

FLORIDA POWER & LIGHT

**TURTLE POINT WATER QUALITY IMPROVEMENT
PROJECT BIOLOGICAL EVALUATION AND
RESTORATION PLAN**

MIAMI-DADE COUNTY, FLORIDA

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July 2016

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Acronyms and Abbreviations

AP	Aquatic Preserve
CCS	Cooling Canal System
cy	Cubic yard
DGPS	Differential Global Positioning System
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FLUCCS	Florida Land Use and Cover Classification System
FPL	Florida Power & Light
fsw	Feet of seawater
ft	foot/feet
ft ²	square feet
FWC	Florida Fish and Wildlife Conservation Commission
FWS	U.S. Fish & Wildlife Service
in.	inch/inches
Kg	kilogram
m	Meter
m ²	square meters
NAVD	North American Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity unit
Project	Turtle Point Water Quality Improvement Project
SAV	Submerged Aquatic Vegetation
TPC	Turtle Point Canal
WGS84	World Geodetic System 1984

1. INTRODUCTION

Tetra Tech Inc., (Tetra Tech) was contracted by Florida Power & Light (FPL) to provide a restoration alternative that would provide additional ecological benefits to the Turtle Point Water Quality Improvement Project (Project), located at the Turkey Point Nuclear Power Plant in Homestead, Miami-Dade County. Per the Florida Department of Environmental Protection (FDEP) issued Consent Order (OGC No. 16-0241) FPL committed to the objective of restoring the Turtle Point Canal (TPC). The Project is intended to improve hydrology and water quality within the TPC by backfilling to -7 NAVD, and create mangrove habitat by backfilling a portion of the canal to approximately +1 NAVD. Figure 1-1 presents the project location graphically.

FPL Turkey Point Power Plant utilizes a closed loop shallow radiant cooling canal system (CCS) in the operation of a fossil fuel and two nuclear (Units 3 and 4) generating systems. In addition to cooling, the CCS is an industrial wastewater facility receiving runoff from the Plant site, processing water backwash/concentrate and boiler blowdown from a natural gas combined cycle generation system (Unit 5).

Tetra Tech performed a site survey on May 23, 2016. The purpose of the survey was to conduct a biological evaluation of the TPC and the surrounding areas to assist in the development of the restoration plan. The survey identified protected species and sensitive biological resources within the Project area. The findings presented herein will supply the regulatory agencies with the most up-to-date resource data for the project site. Further, data collected from this survey were used in the restoration design and planning phase to minimize and avoid impacts to resources during project implementation. This report provides a biological evaluation of the project area as well as restoration planning for implementation of the proposed restoration.

1.1 Purpose and Need

The purpose of the proposed Project is to fill (restore) the historic Turtle Point discharge canal that is no longer in use, and to improve habitat and water quality adjacent to the plant. The TPC was previously the discharge point from the Grand Canal for the Turkey Point Fossil Plant Units 1 & 2. The canal was dredged to approximately -20 to -28 feet NAVD during the initial construction of the Plant in order to allow once thru cooling water to be discharged into Biscayne Bay. The canal has since been plugged and is no longer in use or necessary due to the construction of the CCS system. The remnant canal and adjacent area of scour from outflows is proposed to be backfilled in order to provide for water quality and habitat restoration within Biscayne Bay.

Water quality parameters within the historic discharge canal adjacent to the CCS berm have been monitored as a condition of Miami-Dade County Department of Environmental Resource Management (MDC DERM) Class I permit No. CLI-2014-0312 since May 2015. A sample collected on September 14, 2015 contained ammonia at a level which exceeded the County's water quality standard of 0.5 mg/L (Standard). Ammonia concentrations have intermittently been above MDC DERM standards. FPL performed a feasibility study and has determined that restoration of the remnant canal to a depth of -7ft NAVD will effectively improve the water quality within TPC and subsequently Biscayne Bay.

FPL will be backfilling the TPC to -7 NAVD in order to provide for water quality improvements to Biscayne Bay. Additionally, FPL has requested an analysis of obtaining additional environmental lift by restoring a portion of the TPC footprint to mangrove and American crocodile habitat. This habitat creation would be accomplished by backfilling a portion of the canal (western one-third of the TPC) to approximately +1 ft. NAVD. The following provides a detailed description of the restoration being proposed.

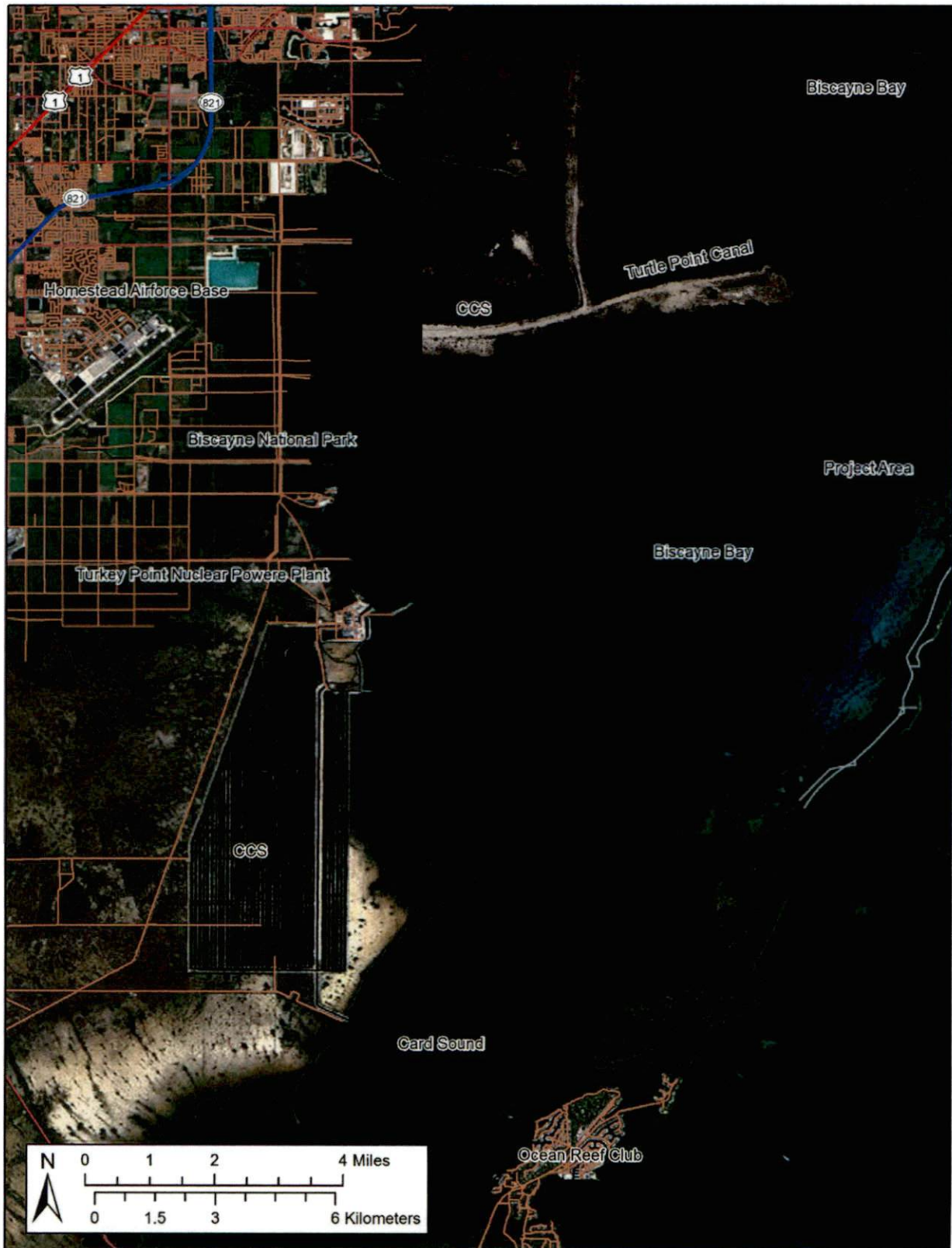


Figure 1-1. Project vicinity map

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2. BIOLOGICAL EVALUATION

A biological evaluation (survey) was conducted of the TPC to document on-site and surrounding ecological communities, identify environmental concerns, define restoration goals and objectives, and to make specific recommendations concerning construction activities associated with the restoration actions. The survey reviewed access routes and environmental precautions. Data gathered during the survey provided the information to develop the restoration prescription and design criteria.

A land and submerged water survey was conducted by a professional land surveyor. The topographic survey provided by FPL was used to assist the restoration team in planning, conceptual design, and assessing restoration actions, as well as providing a basis for volumetric calculations of the TPC to yield an estimate of fill quantities.

2.1 Methods

Tetra Tech biologists with experience in benthic and mangrove habitat assessments performed a biological evaluation of the TPC and surrounding areas. Figure 2-1 provides the extent of the assessment area. The evaluation included reconnaissance of the TPC and the confluence of the TPC and Biscayne Bay. Submerged aquatic vegetation (SAV) communities were mapped and presence of marine fauna were noted. Mangrove and terrestrial communities were assessed and an inventory of common species and wildlife utilization were documented. Representative images of resources were captured during the assessment.

SAV survey activities were performed using scientific divers, Trimble® DGPS, and Hypack® 2013 to catalog the distribution and abundance of SAV. The survey was conducted by Tetra Tech scientific divers trained in marine biological resource identification and quantification. Seagrass species and coverage data were collected along evenly-spaced transects. Divers cataloged each transect at a rate of less than 1 knot. Mapping data were transmitted back to the work platform via Pacific Crest® Environmental Data Link® (EDL II) telemetry. Positioning data were collected in WGS84 (World Geodetic System 1984) datum and transmitted back to the work platform at a rate of 1 data point per second. The Trimble® DGPS receives differential corrections from U.S. Coast Guard Continuously Operating Reference Stations and provides sub-meter horizontal accuracy.

Data were processed with Hypack® Target Editor and subsequently exported in a .txt format. The raw data were imported into ArcGIS® 9 (ArcMap™ 9.3) where shapefiles were created and analyzed. Georeferenced maps of seagrass species distribution and abundance were produced. Seagrass cover was interpolated using the 3D Analyst, Spatial Analyst extensions in ArcMap™ and Xtools Pro (independent [Data East, LLC.] ArcGIS extension). Planar area calculations were performed using Xtools Pro.

Percent coverage was estimated by visually assessing the benthos at regular intervals (approximately every meter) along each transect and assigning a cover value from 0-5. The cover values were assigned based on the observed seagrass/macroalgae percent cover. Greater than 1,000 data points were recorded during field operations and used in the analysis. The SAV cover scale with respective cover ranges is presented in Table 2-1, below.

Table 2-1. SAV Cover Scale

Cover Scale Value	Percent Coverage
0	0%
1	<5%
2	5-25%
3	25-50%
4	50-75%
5	75-100%

2.2 Findings

Underwater visibility during dive operations was variable, ranging from 5 to 20 feet (ft.) (1.5 to 6 meters). Currents within the survey areas were minimal and generally wind driven. Surface water depths ranged from approximately 4 to 10 ft.

Bottom topography is relatively flat outside of the TPC. The interior of the TPC can be characterized as a steep slope from top of bank to the dredge depth of approximately 28 ft. The bottom of the TPC can be classified as barren mud and detritus with no vegetative cover. The sediment outside of the TPC is characterized as a calcareous mixture of silt, sand, shell fragments, and organic material.

In general, the in-water survey area was characterized by three benthic community types; barren mud and detritus, macroalgae, and seagrass. Epibenthic functional groups such as stony corals, sponges, and gorgonians were not encountered during the survey. Other community types within the greater project area include mangrove and upland levees and roadways. A list of marine and terrestrial species observed during the survey is presented in Table 2-2.

2.2.1 Submerged Aquatic Vegetation

No SAV cover was documented within the TPC. In general, barren substrate or epibenthic cover (macroalgae) of less than 1% was encountered deeper than -7-ft. Macroalgae cover was persistent in the -5 to -7-ft. elevation range, while seagrasses were generally encountered in -5-ft. or less elevation.

Two species of seagrass (*Thalassia testudinum* and *Halodule wrightii*) were recorded during the survey. *Thalassia testudinum* is the dominant seagrass species within the survey area; percent cover ranged from <5 to >75%. Minimal coverage of *Halodule wrightii* (<5% cover) was recorded along the fringe of the seagrass community. Figures 2-1 and 2-2 provide SAV coverage by species and percent cover (seagrass by species and macroalgae as a functional group) within the survey area. Table 2-2 provides a list of SAV documented during the survey.

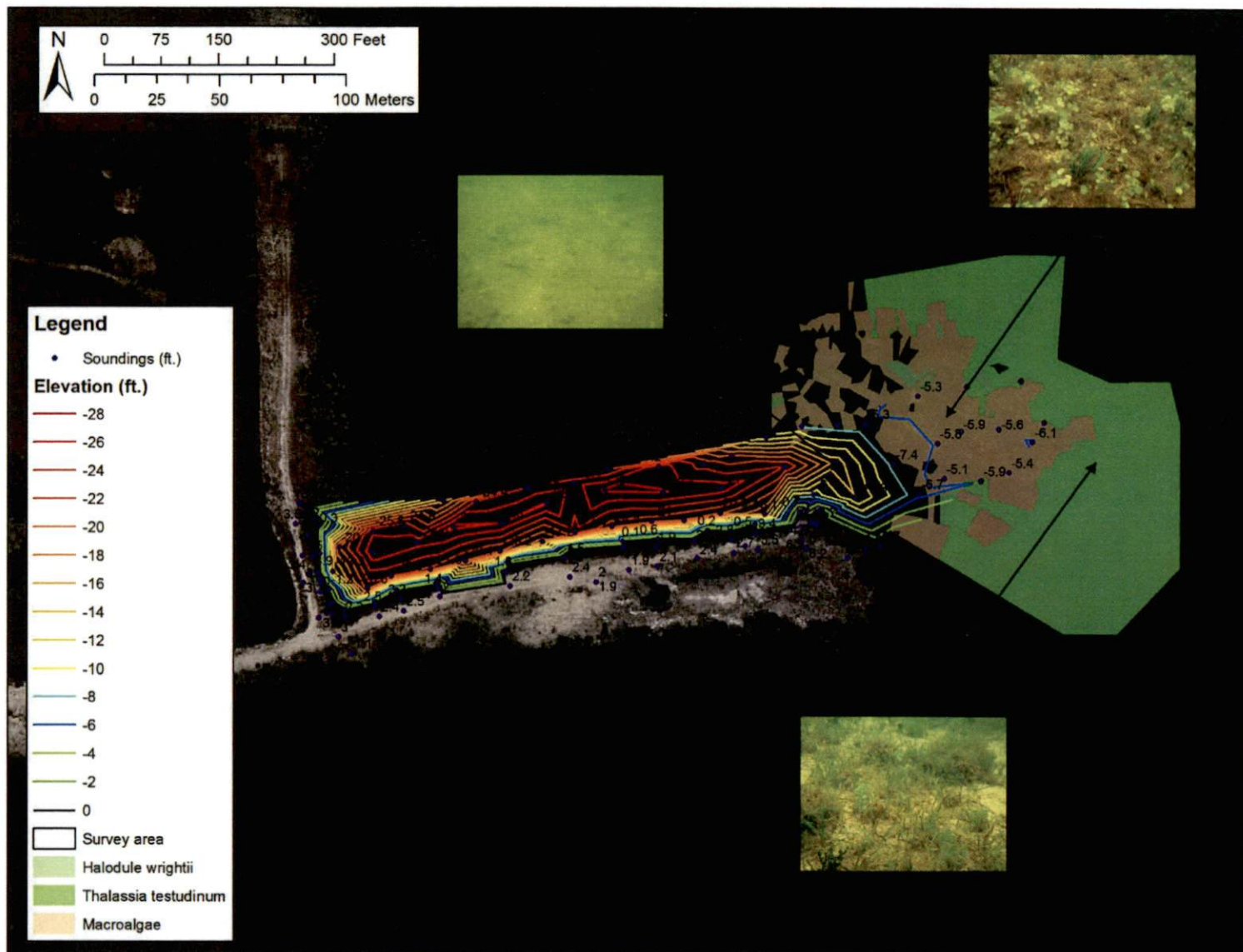


Figure 2-1. SAV cover by species for seagrass and macroalgae as a group

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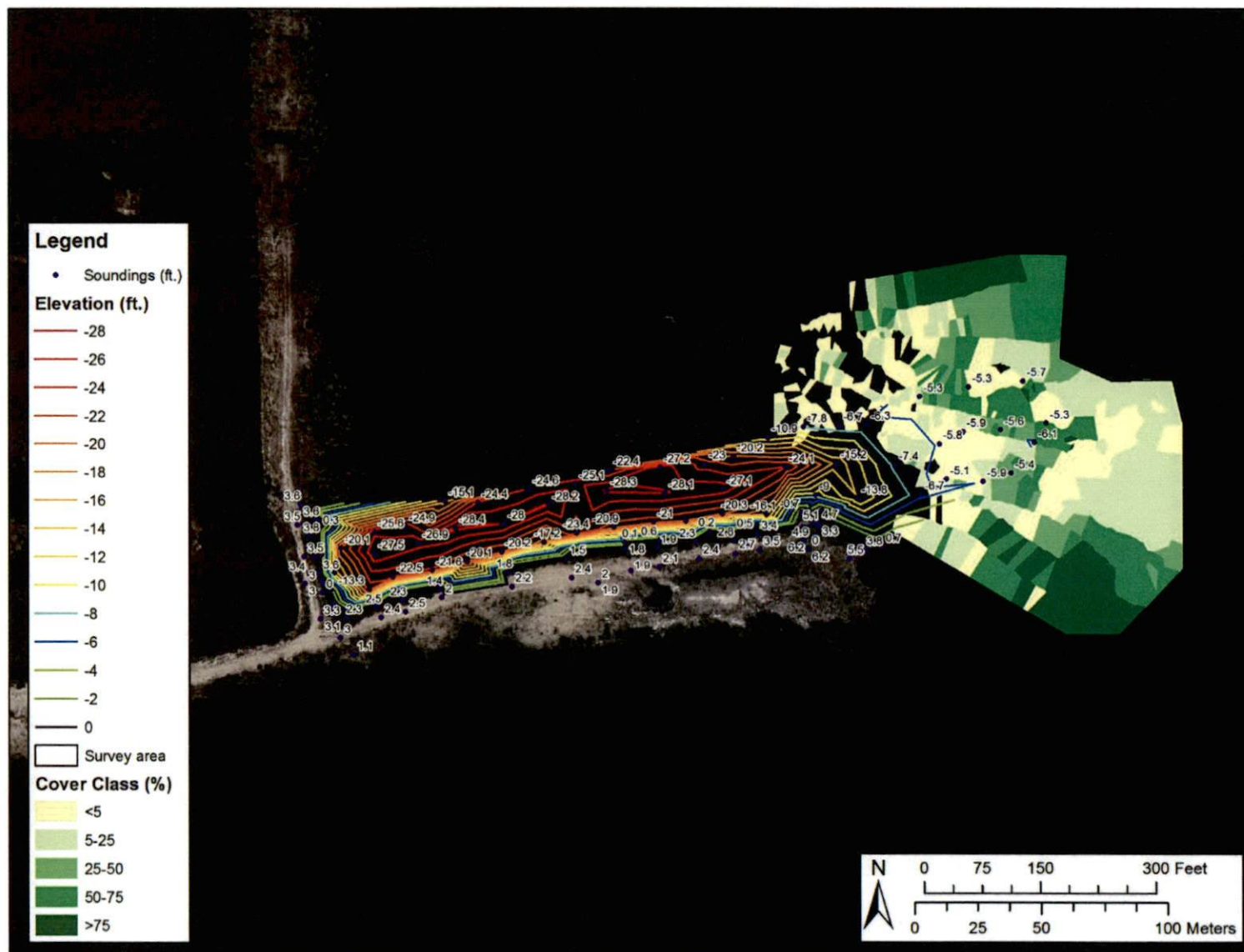


Figure 2-2. SAV cover by percent cover class

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2.2.2 Mangroves

Mature mangroves are present along the three banks of the TPC. Coverage is generally uninterrupted and is characterized by a narrow zone of red mangroves (*Rhizophora mangle*). Several narrow canopy openings were noted along the south and west banks allowing for access to the TPC. White mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and buttonwood (*Conocarpus erectus*) were also noted along the narrow mangrove fringe.

Mangrove habitat provides a detrital base for organic food webs and significant habitat for arboreal, intertidal, and subtidal organisms, including shellfish, crustaceans, fish, and birds. Additionally, red mangrove prop roots can provide substrate for a diverse epifaunal assemblage. Although important habitat for a variety of species, the narrow fringe of available habitat and the steep slope along the seaward edge provide low quality mangrove habitat. Red mangrove prop roots had little to no epifaunal colonization and the detrital base and associated organisms were generally absent due to the narrow fringe and steep slope of the of the TPC. Although the majority of mangroves within the proposed Project construction areas are on lands disturbed and previously impacted by the construction and operation of the Turkey Point complex, it is probable that they still provide structural habitat for mangrove community wildlife.

2.2.3 Uplands

The uplands adjacent to the project site consist of shell rock roads constructed to provide access to the CCS. The uplands are historically filled lands that provide minimal habitat for native species. The roads will provide access to the project site for construction, but will remain unaffected by the project. Table 2-2 provides a list of vegetation noted during the pedestrian survey.

2.3 Land Cover

The FDOT land use, vegetation cover, and landform classification system (FLUCCS) is arranged in hierarchical levels with each level containing information of increasing detail. The system uses four levels (I–IV) within classification categories; however, for the level of detail required for the analysis presented in this report, categories were limited to level III specificity. A total of four categories are represented within the project boundary. Figure 2-3 presents the land use, cover, and forms classification system (FLUCCS) graphically. Below is a description of each land cover category.

Channelized Waterway (512) – This category includes the TPC and the cooling canal system (CCS) associated with the Turkey Point Facility

Embayments Opening D (541) - This category includes the greater Biscayne Bay area.

Mangrove swamp (612) – This Category describes the mangrove communities that fringe the TPC and are adjacent to the project area.

Dikes and levees (747) – This category describes the levees and roadways that surround the CCS and the proposed staging area south of the TPC.

Table 2-2. Marine, Terrestrial, and Avian Species Documented in Turtle Point Canal and Adjacent Upland Area	
Common Name	Scientific Name
Birds	
Common nighthawk	<i>Chordeiles minor</i>
Brown pelican	<i>Pelecanus occidentalis</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>
Anhinga	<i>Anhinga</i>
Mockingbird	<i>Mimus polyglottis</i>
Rusty blackbird	<i>Euphagus carolinus</i>
Fish	
Sheepshead	<i>Archosargus probatocephalus</i>
Flagfin Mojarra	<i>Eucinostomus melanopterus</i>
Tarpon	<i>Megalops atlanticus</i>
Mullet	<i>Mugil</i> sp.
Mangrove snapper	<i>Lutjanus griseus</i>
Reptiles^a	
American crocodile	<i>Crocodylus acutus</i>
Submerged Aquatic Vegetation	
Mermaid's wineglass (green algae)	<i>Acetabularia</i> sp.
Green algae	<i>Batophora</i> sp.
Green algae	<i>Caulerpa</i> sp.
Green algae	<i>Halimeda</i> spp.
Shaving brush alga (green algae)	<i>Penicillus</i> sp.
Turtle grass (seagrass)	<i>Thalassia testudinum</i>
Shoal grass (seagrass)	<i>Halodule wrightii</i>
Terrestrial Vegetation	
Black mangrove	<i>Avicennia germinans</i>
Tree seaside oxeye	<i>Borrchia arborescens</i>
Australian pine	<i>Casuarina equisetifolia</i>
Sea grape	<i>Coccoloba uvifera</i>
Buttonwood	<i>Conocarpus erectus</i>
White mangrove	<i>Laguncularia racemosa</i>
Buttonsage	<i>Lantana involucrata</i>
Red mangrove	<i>Rhizophora mangle</i>
Beach Naupaka	<i>Scaevola taccada</i>
Bay cedar	<i>Suriana maritima</i>
^a . Indirect observation (slide)	

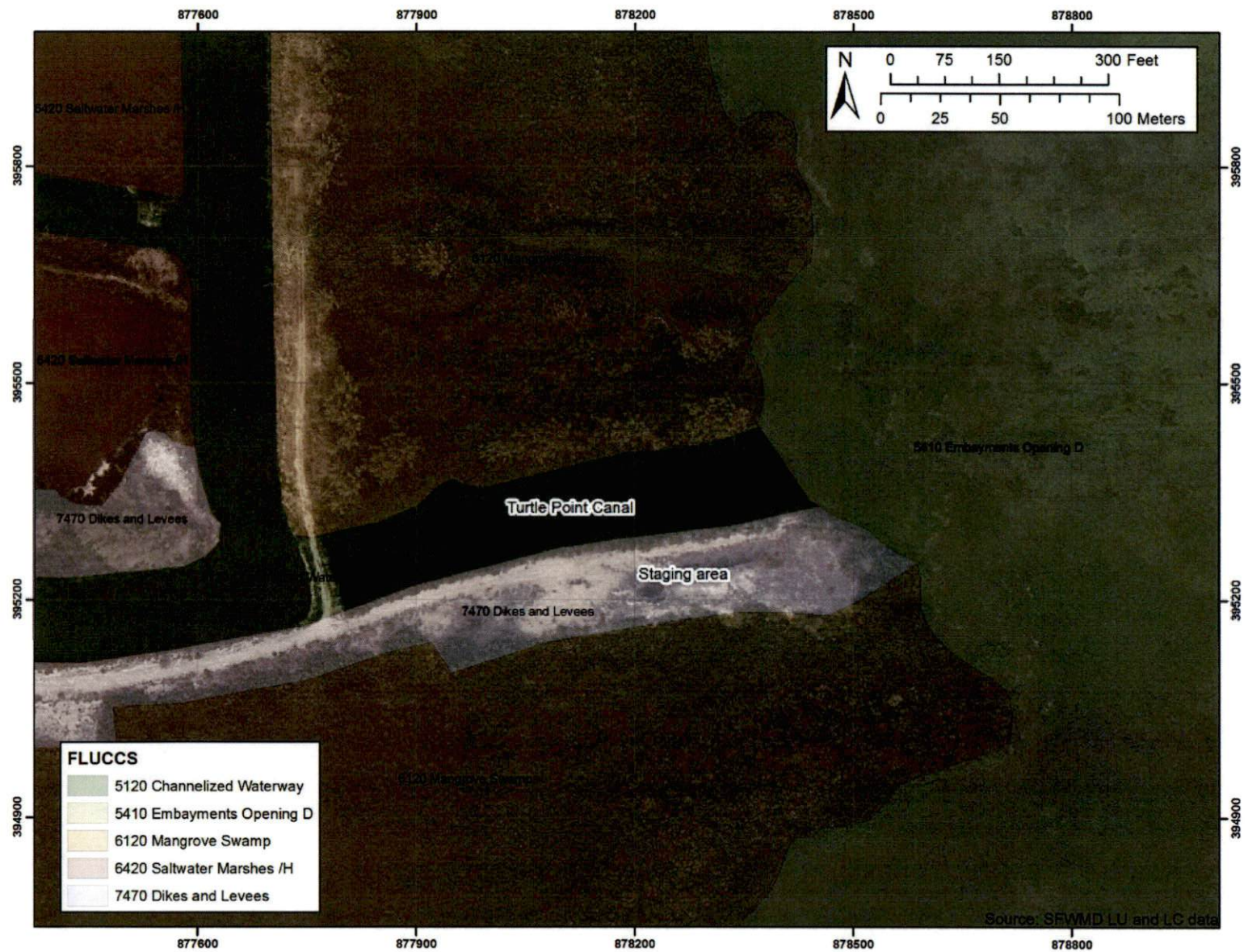


Figure 2-3. Land use and land cover classification

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2.4 Protected Species

The Florida Fish and Wildlife Conservation Commission (FWC) publication Florida's Endangered and Threatened Species (Updated January 2016) was used to determine the status of listed species with the potential to utilize the proposed Project site. Listed species observations during the May 23 site visit resulted in a single Federally listed species observation (indirect) on the property. An American crocodile (*Crocodylus acutus*) slide was observed at the western end of the TPC. No other sightings of or evidence of other listed species were noted during the survey; however, based on geographic range, several listed species have the potential to utilize the TPC area (Table 2-3).

There are 11 aquatic species known to occur within Biscayne Bay that are protected under the Endangered Species Act or are candidates for listing. These are the American crocodile (*Crocodylus acutus*), Johnson's seagrass (*Halophila johnsonii*), the mangrove rivulus (*Rivulus marmoratus*), the small-toothed sawfish (*Pristis pectinata*), five species of sea turtle, the American alligator (*Alligator mississippiensis*), and the Florida manatee (*Trichechus manatus*). Additionally, a variety of protected avian species are known to occur within the southern Biscayne Bay and the Turkey Point Facility. Table 2-3 includes a list of protected avian species that have been known to utilize the TPC area. Although these species were not documented during the survey, brief discussions of potentially occurring protected species are provided below.

American crocodile (Crocodylus acutus)

The American crocodile is federally threatened and state listed as endangered and the TPC is within an area classified by the U.S. Fish & Wildlife Service as critical habitat for the American crocodile. Most crocodile nesting occurs in the southwestern corner of the industrial wastewater facility; however, a limited number of nests have been observed on berms within the northern portion of the return canals. Crocodiles are known to utilize the TPC as evidenced by the well-worn slide mark on the western shore noted during the survey.

Eastern Indigo snake (Drymarchon couperi)

The eastern indigo snake is federally threatened and can be found in almost any habitat throughout the state of Florida. Although eastern indigo snakes were not observed during the survey, they are known to occur on site. These snakes may occur in wetland or uplands and may be seen along the shell rock roads located throughout the CCS area at Turkey Point.

Johnson's seagrass (Halophila johnsonii)

Johnson's seagrass, federally listed as a threatened species, occurs along the Florida coast from Sebastian Inlet to central Biscayne Bay at Virginia Key, Key Biscayne. This seagrass species was not observed during the survey and is not known to occur as far south as the Turkey Point plant property.

Mangrove rivulus (Rivulus marmoratus)

The mangrove rivulus, a fish that inhabits crab burrows in mangrove areas, is federally listed as a NOAA Species of Concern and listed by the state as a Florida species of concern. It could be present in mangrove areas fringing the plant site, but is unlikely to be present in the Turtle Point canal due to lack of habitat (no crabs or crab burrows were observed in mangrove habitat during the survey).

Small-toothed sawfish (*Pristis pectinata*)

The small-toothed sawfish is a state and federally endangered species that inhabits inshore bars, seagrass beds, and mangrove areas. Due to its preference for these habitat types, the small-toothed sawfish could potentially utilize the Turtle Point canal; however it is unlikely due to the poor habitat quality of the TPC.

Florida manatee (*Trichechus manatus*)

The manatee is a state and federally endangered species that frequents warm water estuarine habitats including rivers, marshes, bays, and sounds in Florida. They use warm water refuges in the cooler months, including freshwater springs and heated effluent from power plants (No such discharge exists from the CCS). Their critical habitat includes Biscayne Bay and Card Sound adjacent to the Turkey Point plant property and the canals entering these water bodies. Manatees have been observed in the barge turning basin and nearby state canals (NRC 2016), and are likely to utilize the Bay area east of the TPC where seagrasses are prevalent.

American alligator (*Alligator mississippiensis*)

The alligator is federally listed as Threatened due to similarity of appearance and state listed as a Florida species of special concern. The species is federally listed as threatened due to its physical resemblance to the American crocodile, which is endangered. Alligators live in swampy areas, rivers, streams, lakes and ponds. Although they are primarily freshwater animals, alligators will also venture into brackish water. Although alligators have been observed and relocated off site from the Turkey Point facility, there are no reports of alligators utilizing the TPC.

Sea turtles

Sea turtles (4 species with protection status of Endangered or Threatened) are found in marine habitats that open to the sea, such as Biscayne Bay and Card Sound. The Turtle Point canal does not provide suitable habitat, and the shoreline adjacent to the canal lacks the beach habitat preferred by sea turtles for nesting.

Wood stork (*Myctera americana*)

The wood stork is classified as endangered by the FWC and the FWS. This species could potentially use the site as short-term foraging grounds. Wetlands and the perimeter of the TPC could offer limited forage for this species during the wet season. Long term use of the site is limited due to low quantity and quality of the foraging habitat as well the flashy and short duration of inundation on site.

Wading Birds

Several wading birds (herons and egrets) are classified by the FWC as species of special concern. The snowy egret (*Egretta thula*), reddish egret (*Egretta rubescens*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), Roseate spoonbill (*Platalea ajaja*), and white ibis (*Eudocimus albus*) were not observed on site during the survey; however, limited utilization throughout the year is likely to occur. As described for the wood stork, seasonal utilization is likely when the ditches are inundated during the wet season. The ponds offer limited and poor quality year-round forage.

Brown pelican (*Pelecanus occidentalis*)

The brown pelican is a state species of special concern that thrives near coasts and on islands. Brown pelicans rely in part on the actions of marine predators such as large fish, sharks and

dolphins to force schools of fish to the surface where the pelicans can catch them. Pelicans will breed only in areas with enough food to support the breeding colony. Roosting and resting sites where brown pelicans can dry their feathers and rest without disturbance are also important. (USFWS 2016). This is the only listed species to be observed during the May 23, 2016 survey.

Least tern (Sterna antillarum)

The least tern is a state threatened species that inhabits areas along the coasts of Florida including estuaries and bays. The least tern's diet primarily consists of fish, but they will also feed on small invertebrates. They build nests in shallow depressions in bare beach sand and on gravel berms and rooftops (FWC 2016). Seasonal utilization of the berm adjacent to the TPC is possible during nesting season.

White-crowned pigeon (Patagioenas leucocephala)

The white-crowned pigeon is not federally listed however is protected by the U.S. Migratory Bird treaty Act and as a State-designated threatened species. White crowned pigeons inhabit low-lying forest habitats including mangroves around Biscayne Bay, Florida Bay and the Florida Keys. The diet of the white-crowned pigeon consists of tropical hardwood tree fruits. White crowned pigeons were not observed during the survey.

Table 2-3. Federally Listed and Florida-State Listed Species Potentially Existing near Turtle Point Canal

Common Name	Scientific Name	Federal Status ^(a)	State Status ^(a)	Observed during survey
Birds				
Roseate spoonbill	<i>Ajaia ajaja</i>	—	S	N
Little blue heron	<i>Egretta caerulea</i>	—	S	N
Reddish egret	<i>Egretta rufescens</i>	—	S	N
Snowy egret	<i>Egretta thula</i>	—	S	N
Tricolor heron	<i>Egretta tricolor</i>	—	S	N
White ibis	<i>Eudocimus albus</i>	—	S	N
American kestrel	<i>Falco sparverius</i>	—	T	N
Bald eagle	<i>Haliaeetus leucocephalus</i>	DL	T	N
Wood stork	<i>Mycteria americana</i>	E	E	N
Brown pelican	<i>Pelecanus occidentalis</i>	—	S	Y
White-crowned pigeon	<i>Patagioenas leucocephala</i>	—	T	N
Least tern	<i>Sterna antillarum</i>	—	T	N
Fish				
Mangrove rivulus	<i>Rivulus marmoratus</i>	SOC	S	N
Small-toothed sawfish	<i>Pristis pectinata</i>	E	—	N
Common snook	<i>Centropomus undecimalis</i>	—	S	N
Mammals				
Florida manatee	<i>Trichechus latirostris</i>	E	E	N
Plants				
Johnson's seagrass	<i>Halophila johnsonii</i>	T	—	N
Reptiles				
Green sea turtle	<i>Chelonia mydas</i>	E	E	N
Eastern Indigo snake	<i>Drymarchon couperi</i>	T	T	N
Hawksbill sea turtle	<i>Erytmochelys imbricata</i>	E	E	N
Leatherback sea turtle	<i>Dermochelys coriacea</i>	E	E	N
Kemp's ridley sea turtle	<i>Lepidochelys kemp</i>	E	E	N
Loggerhead sea turtle	<i>Caretta</i>	T	T	N
American alligator	<i>Alligator mississippiensis</i>	T (S/A)	S	N
American crocodile	<i>Crocodylus acutus</i>	T	E	N
(a) E = Endangered; T = Threatened; T(S/A) = Threatened due to similarity of appearance; C = Candidate for federal listing; S = Florida species of special concern; SOC = NOAA species of concern; — = No listing				

3. RESTORATION PLAN

This section describes the methods and techniques for restoration implementation of the TPC. The proposed restoration consists of filling approximately one-third the length of the TPC to a grade of +0.7 to +0.9 ft. NAVD for creation of mangrove habitat, then sloping to -7ft. at 3:1 slope, and filling the rest (two-thirds) of the TPC to -7ft. out to the bay bottom. The proposed plan will require placing approximately **57,000 cy** of raw fill material (approximately **17,100 cy** of bottom fill and **39,900 cy** of select top fill) to fill the canal to proposed specification. Figure 3-1 provides an illustration of proposed alternative. A set of conceptual restoration plan drawings have been prepared under a separate cover.

Fill grade elevations for mangrove habitat were determined by similar successful mangrove restoration projects in south Miami/Dade County. The fill volume was calculated using topographic survey data provided by FPL, an estimated boundary (approximately 235 ft.), and a 3:1 slope to a -7ft. final grade elevation. The volume includes an additional 25% of material to account for inadvertent loss due to compaction, material handling, loss of fines, etc.

The proposed restoration plan will meet the project objective of restoring water quality within the TPC with an additional result of habitat creation. The project schedule should avoid periods of extreme high tides, bird and crocodile nesting seasons, and tropical storm systems. Restoration will consist of a combination of specific activities that include material staging, sediment placement, grading, shoreline stabilization, and mangrove planting. The approach for implementation of the proposed plan is presented below.

3.1 Fill Specifications, Transport, and Staging

The fill specification for Turtle Point requires two types of fill: Type – E (bottom fill) and Type – A (select top fill). The bottom fill is a calcium carbonate coarse grain sand with a grain size of less than 10% passing through a range 12 inch to #200 sieve. Bottom fill will be placed from the canal bottom to an elevation of -15.8 ft NAVD along the length of the canal. The select top fill is a calcium carbonate coarse grain sand with a grain size of less than 5% passing through a range #4 to #200 sieve. Top fill will be placed in layer from -15.8 ft to +1 ft NAVD along the western third and to -7 ft NAVD along eastern two thirds of the TPC to the opening at Biscayne Bay (see Figure 3-1).

Select top fill and bottom fill should be obtained from local quarries. Fill material meeting the gradation specifications are readily available from local quarries in the quantity needed to fulfill the project needs. There may also be appropriate available fill from on-site sources.



Photo 3-1. Proposed staging area

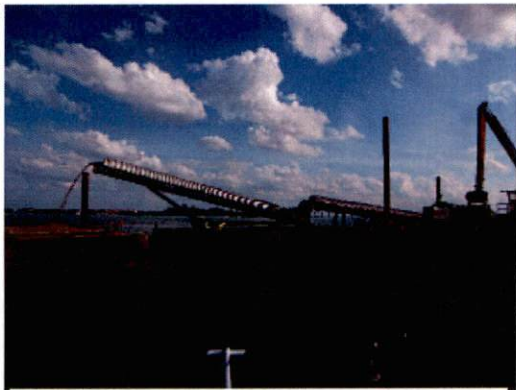


Photo 3-2. Example of covered fill conveyor system

Staging areas are available near the project site. Photo 3-1 provides an example of a potential staging area; however, the staging area will be identified by the contractor. Fill material will be delivered via truck directly to the staging area along existing roads on the project site.. Fill material will be stored on site. Fill material will be staged in a contained environment to avoid loss of material to adjacent aquatic resources. The staging area will be returned to pre-project conditions following project completion, with final cleanup notification provided to the FPL representative.

Loose fill may be transferred using a long-reach excavator and conveyor system or other suitable transfer machinery from the staging area to a material placement barge. Photo 3-2 provides an example of equipment used to efficiently transfer fill material. Typically, the use of a conveyor system (preferred method) provides a low-to no-impact fill material transfer route through the mangroves. Mangrove canopy openings sufficient for installation of the conveyor system were identified during the site assessment. Figure 3-2 identifies a potential location for installation of the conveyor system. All sections of the conveyor system that cross mangrove habitat or any other sensitive habitat will be covered from above and below to limit wind loss of material and to catch any material that may drop from the conveyor system. The covers are generally constructed of half sectioned corrugated style pipe installed above and below the conveyor belt (see Photo 3-2). Once selected the contractor may propose comparable alternative methods.

A turbidity containment system will be installed prior to construction and will remain throughout the fill operations. At no time will the turbidity containment be breached during the fill operations.

3.2 Turbidity Containment

During fill placement activities, turbidity curtains and/or other barriers will enclose the north shoreline and mouth of the TPC to minimize potential siltation and turbidity of surrounding mangrove and seagrass communities. Turbidity curtains at the mouth of the TPC will be placed such that the bottom edge of the material is in contact with the bay bottom. Turbidity curtains will be anchored securely for use in high current/dynamic conditions. Piles (12- in. diameter or greater) will be used across the mouth of the TPC to secure the turbidity curtain. All possible turbidity leak points (seams, bottom of curtain, etc.) will be secured and monitored during filling operations. Turbidity curtains shall be furnished with excess material (flaps) at each end so they may be rolled together to seal the seam created by securing two sections together. Additionally, curtains will have a 3-ft. barrier above the water line to inhibit manatees from entering the fill zone. The turbidity curtains will be highly visible and manufactured from entanglement-free material that is safe to use in the presence of marine mammals, sea turtles, and



Photo 3-3. Fill conveyor loading placement barge

other marine fauna. Curtains will be removed from the TPC post-filling once turbidity within the feature reaches an acceptable level.

3.3 Habitat Grading and Shoreline and Slope Stabilization

As described above, approximately 235 linear ft. of the TPC will be filled to a maximum elevation of +0.73 to +0.93 ft. NAVD. The goal of habitat grading is to create a mosaic of habitat types that may be utilized by reptiles, avifauna, and invertebrates. Additionally, the proposed grading plan will promote drainage of the TPC and will provide access for crocodiles to Biscayne Bay. A conceptual habitat map of the TPC is presented in Figure 3-3.

On-site physical conditions (i.e., high energy environments) may require the use of a temporary and/or permanent protective barrier to protect the slope from erosion and the planted mangroves from wave action and floating debris. The unconsolidated fill shoreline and slope to 7-ft NAVD will be stabilized using natural limerock boulders (30 cm to 90 cm [1 ft. – 3 ft.]). Providing shoreline stabilization in this manner will abate wave action, which will reduce erosion and re-suspension of sediments and related turbidity allowing the red mangroves to establish prop roots that will provide feeding, refuge, and nursery habitat for a variety of attached and motile sub-tidal and inter-tidal marine fauna.

The limestone protective barrier will begin at the toe of slope at -7 ft. NAVD and will extend to an elevation of 60 cm (2 ft.) above mean high water, with a 3:1 slope below the water line and no greater than 2:1 slope for the limestone above mean low water. Filter fabric should be used beneath the lime-rock boulders to limit the loss of unconsolidated fill material. The limestone barrier should be installed in a uniform and interlocking manner so there are voids between the larger pieces. The protective barrier should be placed a minimum of 1 ft. from existing mangrove trunks and prop roots. It is estimated that approximately 400 cy of limestone boulders will be required to provide the shoreline and slope stabilization.

3.4 Mangrove planting

Red mangroves (*Rhizophora mangle*) will be planted in an approximately 0.35 acres (15,449 ft²) of the filled TPC. Figure 3-3 presents the mangrove planting area graphically. The mangrove planting area will be graded flat to an elevation of +0.73 ft. to +0.93 ft. NAVD. Approximately 1,725 Red mangrove plants with a minimum height of 18 inches (in.) will be planted 5-ft. on center.

3.5 Threatened and Endangered Species Signage

All staff involved with filling operations will be instructed and trained as per Florida Fish and Wildlife Conservation Commission (FWC) Standard Manatee Conditions for In-Water Work as well as the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA-NMFS) Marine Sea Turtle and Smalltooth Sawfish Construction Conditions. Idle speed/manatee protection signage will be maintained on board during all restoration activities. One sign which reads Caution: Boaters shall be posted in a location where it is prominently visible to

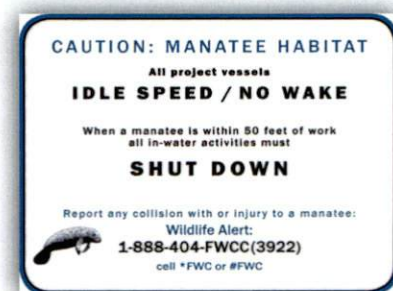


Figure 3-5. FWC manatee signage

all staff. A second sign measuring at least 8.5 by 11-in. explaining the requirements for “Idle Speed/No Wake” and the shutdown of in-water operations (Figure 3-5) will be posted in a location prominently visible to all personnel engaged in water-related activities (www.myfwc.com). Signage will be maintained at both the location of the materials barge and the restoration site. If any Threatened and Endangered Species comes within 50 feet of the work zone, filling operations will cease until the protected species has left the work zone on its own accord.

During the permitting process, the level of observer will be determined: 1) observer approved by Florida Fish & Wildlife Conservation Commission at least 2 weeks prior to starting construction; 2) observer adequately trained and equipped with proper glasses; or 3) all on-site personnel are responsible for observer in-water activities for possible manatee presence. If a dedicated manatee observer will be required, that person(s) is expected to be on-site at all times during in-water construction.

3.6 Water Quality Monitoring

Using a portable turbidimeter (Hach 2100Q), turbidity measurements will be collected at 6-hour intervals from upstream, downstream, and within the work area. Samples will be collected outside the turbidity containment from no further than 50 ft. from the point of discharge within the densest portion of any visible plume if such an event occurs. If the turbidity exceeds the state water quality standards (DEP 62-302.530) for an Outstanding Florida Water (zero NTU's above background) then backfill operations will cease until water quality standards are returned to background levels. If water quality standards are exceeded more than twice a day, the backfill operations will be stopped and then evaluated for implementation of mitigation measures.

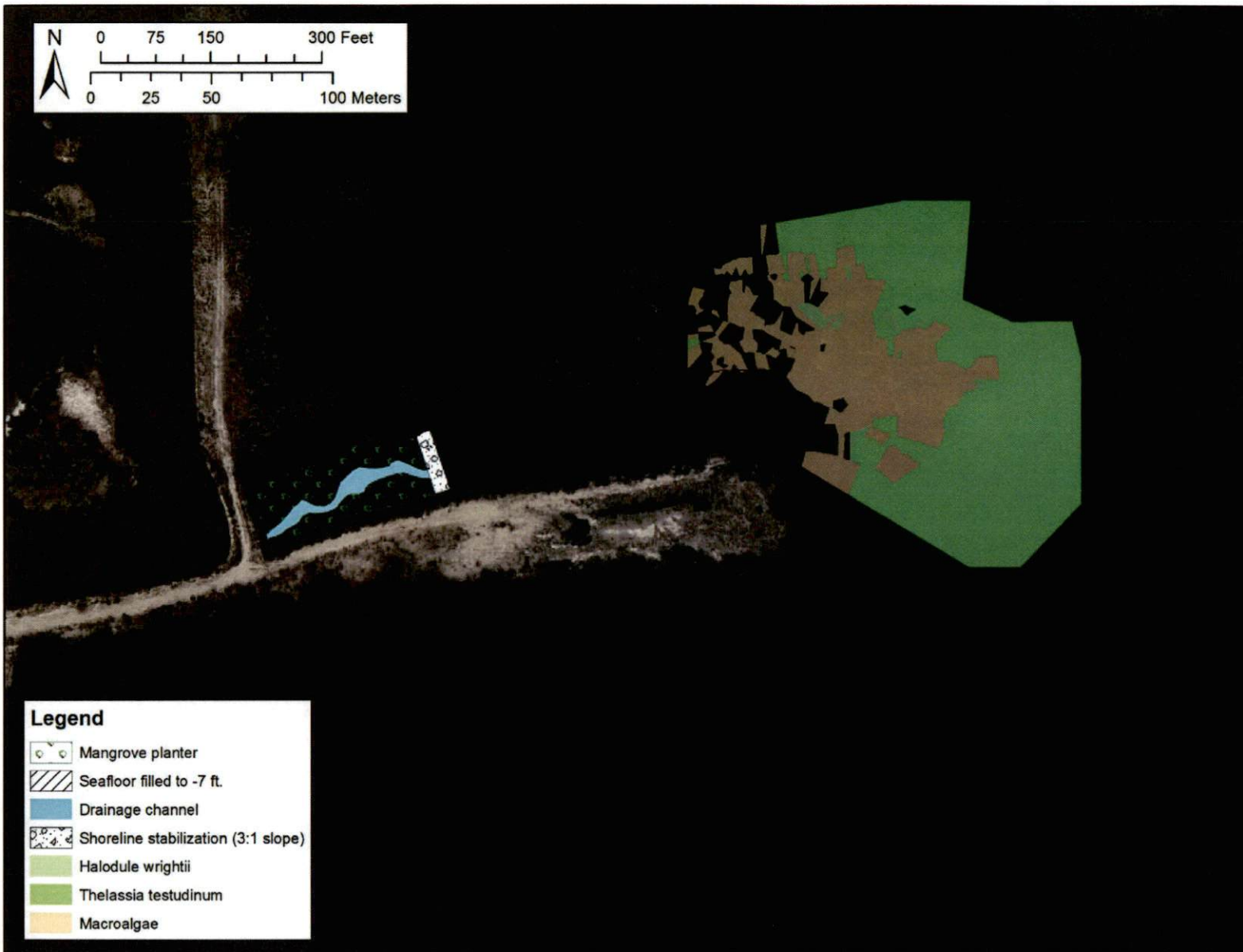


Figure 3-1. Proposed restoration conceptual plan for filling one third of the TPC



Figure 3-2. Proposed staging area and conveyor placement area

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FLORIDA POWER AND LIGHT TURTLE POINT CANAL RESTORATION

MIAMI-DADE COUNTY



INDEX OF SHEETS

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G-002	LIMITS OF CONSTRUCTION	7/29/16	0
P-101	TURTLE POINT PLAN VIEW AND SURVEY	7/29/16	0
P-102	TURTLE POINT ELEVATIONS	7/29/16	0
P-103	TURTLE POINT CROSS-SECTIONS	7/29/16	0
P-104	TURTLE POINT FILL AREA	7/29/16	0

VICINITY MAP

TURTLE POINT CANAL, MIAMI-DADE COUNTY, FLORIDA

FOR PERMITTING ONLY
NOT FOR CONSTRUCTION



FLORIDA POWER AND LIGHT
TURTLE POINT CANAL RESTORATION

COVER SHEET AND VICINITY MAP

MIAMI-DADE COUNTY, FLORIDA



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Drawn By:

Checked By:

Reviewed By:

Design file no:
FPL-TT-TURTLE POINT-01AL010

Scale:
AS SHOWN

Sheet Reference:

G-001

Sheet 1 of 6

4. SUMMARY

Currently the TPC is a channelized waterway with sparse to no epibenthic floral or faunal coverage. The vertically cut banks along with poor water quality currently provides suboptimal marine habitat. Filling of the TPC is expected to improve benthic habitat both within the TPC and adjacent areas. The overall intent of the project is to improve water quality and hydrology by backfilling the TPC to a minimum depth of -7 NGVD and restoring a third of the system to mangrove habitat, thereby, providing ecological improvements to Biscayne Bay. Additionally, indirect benefits to marine habitats are expected as a result of the overall improvements to water quality.

Based on the site survey, direct impacts to benthic resources are not expected as a result of the project. Indirect impacts such as shading, sedimentation, turbidity, and mechanical injury are expected to be negligible. The use of specialized turbidity containment and equipment and the methods specified herein will avoid and minimize both direct and indirect impacts to both sessile and motile biota. Accessing the remnant canal from the land side, with the exception of the construction barge with excavator to be mobilized to the canal, will minimize barge traffic compared to a water based operation and therefore avoid impacts from prop dredging, vessel groundings, and any potential for vessel strikes to protected marine species. All standard construction conditions for manatees and smalltooth sawfish will be abided by during construction to avoid any potential affects. Additionally, an observer will be on-site during all in-water construction to observe for any protected species within the project vicinity and provide awareness so actions to avoid harm or harassment to protected species can be taken.

5. REFERENCES

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FLORIDA POWER & LIGHT

**BARGE CANAL WATER QUALITY IMPROVEMENT
PROJECT BIOLOGICAL EVALUATION AND
RESTORATION PLAN**

MIAMI-DADE COUNTY, FLORIDA

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July 2016

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Acronyms and Abbreviations

AP	Aquatic Preserve
BC	Barge Canal
CCS	Cooling Canal System
cy	Cubic yard
DGPS	Differential Global Positioning System
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FLUCCS	Florida Land Use and Cover Classification System
FPL	Florida Power & Light
fsw	Feet of seawater
ft	foot/feet
ft ²	square feet
FWC	Florida Fish and Wildlife Conservation Commission
FWS	U.S. Fish & Wildlife Service
in.	inch/inches
Kg	kilogram
m	meter
m ²	square meters
NAVD	North American Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity unit
Project	Barge Canal Water Quality Improvement Project
SAV	Submerged Aquatic Vegetation
TPC	Turtle Point Canal
WGS84	World Geodetic System 1984

1. INTRODUCTION

Tetra Tech Inc., (Tetra Tech) was contracted by Florida Power & Light (FPL) to provide an ecological evaluation and restoration plan for the Barge Canal/Basin Water Quality Improvement Project (Project), located at the Turkey Point Nuclear Power Plant in Homestead, Miami-Dade County. The Project is intended to restore water quality within the active Barge Canal/Basin (BC) by backfilling to -15 NAVD. Figure 1-1 presents the project location graphically.

FPL Turkey Point Power Plant utilizes a closed loop shallow radiant cooling canal system in the operation of a fossil fuel and two nuclear (Units 3 and 4) generating systems. In addition to cooling, the CCS is an industrial wastewater facility receiving runoff from the Plant site, processing water backwash/concentrate and boiler blowdown from a natural gas combined cycle generation system (Unit 5).

Per the Florida Department of Environmental Protection issued Consent Order (OGC No. 16-0241) FPL committed to the objective of restoring the BC. Partially backfilling the BC to a level of approximately ~15ft. NAVD will improve hydrology, water quality, and fringe habitat.

Tetra Tech performed a site survey on May 23, 2016. The purpose of the survey was to conduct a biological evaluation of the BC and the surrounding areas (hereinafter cumulatively referred to as Project area) to assist in the development of restoration alternatives. The survey identified protected species and sensitive biological resources within the Project area. The findings presented herein will supply the regulatory agencies with the most up-to-date resource data for the project site. Further, data collected from this survey were used in the restoration design and planning phase to minimize and avoid impacts to resources during project implementation.

1.1 Purpose and Need

The purpose of the proposed Project is fill the BC to elevation -15 ft. NAVD to improve water quality adjacent to the Plant and Biscayne Bay. The BC is an active basin currently used for delivery of fossil fuel for operation of the Turkey Point Plant. The BC was dredged to approximately -30 feet NAVD during the initial construction of the Plant.

Water quality parameters within the BC have been monitored as a condition of Miami-Dade County Department of Environmental Resource Management (MDC DERM) Class I permit No. CLI-2014-0312 since May 2015. A sample collected on September 14, 2015 contained ammonia at a level which exceeded the County's water quality standard of 0.5 mg/L (Standard). Ammonia concentrations have intermittently been above MDC DERM standards since that time. FPL performed a feasibility study and has determined that filling the BC to a depth of -15 ft. NAVD will effectively improve the water quality within the BC and subsequently Biscayne Bay.



Figure 1-1. Project vicinity map

Back of figure

2. BIOLOGICAL EVALUATION

A biological evaluation (survey) was conducted of the BC to document on-site and surrounding ecological communities, identify environmental concerns, and make specific recommendations concerning construction activities associated with the restoration actions. The survey reviewed access routes and environmental precautions. Data gathered during the survey provided the basis for development of the restoration prescription and design criteria.

A land and submerged water survey was conducted by a professional land surveyor. The topographic survey provided by FPL was used to assist the restoration team in planning, conceptual design, and planning for restoration actions, as well as provide a basis for volumetric calculations of the BC to yield an estimate of fill quantities.

2.1 Methods

Tetra Tech biologists with experience in benthic and mangrove habitat assessments performed a biological evaluation of the BC and surrounding areas. Figure 2-1 provides the extent of the assessment area. The evaluation included reconnaissance of the BC, the confluence of the BC and Biscayne Bay, and the immediately adjacent mangrove and terrestrial communities. All observations were made from the surface aboard a vessel. The entire boundary of the BC was surveyed. During the survey submerged aquatic vegetation (SAV) communities and presence of marine fauna were noted. Mangrove and terrestrial communities were also assessed and an inventory of common species and wildlife utilization were documented. Representative images including underwater video of resources were captured during the assessment.

2.2 Findings

With the exception of the barge channel, the bottom topography is relatively flat outside of the BC. The BC can be characterized as hardened shoreline basin with a steep slope from top of bank to the dredge depth of approximately -30 ft. The bottom (seafloor) of the BC can be classified as barren mud and detritus with no vegetative cover. The sediment outside of the BC is characterized as a calcareous mixture of silt, sand, shell fragments, and organic material.

In general, the in-water survey area was characterized by three benthic community types; barren mud and detritus, macroalgae, and hard substrate (bulkhead, rubble, and rip rap). Epibenthic functional groups such as stony corals, sponges, and gorgonians were not encountered during the survey. Other community types within the greater project area include mangrove and upland levees and roadways. A list of marine and terrestrial species observed during the survey is presented in Table 2-2.



Photo 2-1. Hardened shoreline of barge canal

2.2.1 *Submerged Aquatic Vegetation*

No epibenthic cover was documented within the BC at depths greater than 15 fsw. In general, barren substrate or epibenthic cover (macroalgae) of less than <5% was encountered to the proposed fill depth of -15 ft. NAVD. Silt-covered filamentous diatoms makes up the dominant vegetative cover along the hard substrate (wall and rubble and/or concrete). Macroalgae cover was occasionally observed in areas of gently sloping unconsolidated substrate predominantly in the -4 to -7ft. elevation range. Table 2-2 provides a list of SAV documented during the survey.





Figure 2-1. Extent of survey

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2.2.2 Mangroves

Mature mangroves are present along approximately 50 percent of the BC shoreline. The northwest shoreline (see Photo 2-1) is generally uninterrupted and is characterized by a narrow zone of red mangroves (*Rhizophora mangle*). White mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*), and buttonwood (*Conocarpus erectus*) were also noted along the narrow mangrove fringe. The southern shoreline (see Photo 2-2) is characterized by a discontinuous

narrow fringe of mature mangroves and young recruits with small (< 5 ft.) to large (>100 ft.) open areas.

Mangrove habitat provides a detrital base for organic food webs and significant habitat for arboreal, intertidal, and subtidal organisms, including shellfish, crustaceans, fish, and birds. Additionally, red mangrove prop roots can provide substrate for a diverse epifaunal assemblage. Although important habitat for a variety of species, the narrow fringe of available habitat and the steep slope along the edge of the edge of the BC provide marginal mangrove habitat. Red mangrove prop roots had little to no epifaunal colonization and the detrital base and associated organisms were marginal due to the narrow fringe, hard substrate, and steep slope of the BC. Although the mangroves within the BC are on lands disturbed and previously impacted by the construction and operation of the Turkey Point complex, they provide structural habitat for a variety of mangrove habitat associated fauna.



Photo 2-1. Northwest shoreline



Photo 2-2. Southern shoreline

2.2.3 Uplands

The uplands adjacent to the project site consist of the Turkey Point Power Plant facility and pervious (shell rock) roads and levees constructed for operations of the electrical power facility. The uplands are historically filled lands that currently provide minimal habitat for native species. Due to the active use of the uplands, the potential for wildlife utilization is low.

The roadways and levees surrounding the BC will provide access to the staging area and project site during construction. These roadways and levees will be under heavy use during project implementation. Table 2-2 provides a list of vegetation noted during the pedestrian survey.

2.3 Land Cover

The FDOT land use, vegetation cover, and landform classification system (FLUCCS) is arranged in hierarchical levels with each level containing information of increasing detail. The system uses four levels (I–IV) within classification categories; however, for the level of detail required for the analysis presented in this report, categories were limited to level III specificity. Five categories are

represented within the project boundary. Figure 2-2 presents the land use, cover, and forms classification system (FLUCCS) graphically. Below is a description of each land cover category.

Channelized Waterway (512) – This category includes the TPC and the cooling canal system (CCS) associated with the Turkey Point Facility

Embayments Opening D (541) - This category includes the greater Biscayne Bay area.

Mangrove swamp (612) – This Category describes the mangrove communities that fringe the TPC and are adjacent to the project area.

Dikes and levees (747) – This category describes the levees and roadways that surround the CCS and the proposed staging area south of the TPC.

Electrical Power Facility (931) – This category describes the grounds associated with the Turkey Point Power Plant facility.

Table 2-2. Marine, Terrestrial, and Avian Species Documented in Barge Canal and Adjacent Upland Area	
Common Name	Scientific Name
Birds	
Common nighthawk	<i>Chordeiles minor</i>
Brown pelican	<i>Pelecanus occidentalis</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>
Anhinga	<i>Anhinga anhinga</i>
Mockingbird	<i>Mimus polyglottis</i>
Great White Heron	<i>Ardea herodias occidentalis</i>
Common grackle	<i>Quiscalus quiscula</i>
Fish	
Sheepshead	<i>Archosargus probatocephalus</i>
Flagfin Mojarra	<i>Eucinostomus melanopterus</i>
Tarpon	<i>Megalops atlanticus</i>
Common snook	<i>Centropomus undecimalis</i>
Parrot fish	<i>Scarus spp.</i>
Sergeant major	<i>Abudefduf saxatilis</i>
Mullet	<i>Mugil sp.</i>
Mangrove snapper	<i>Lutjanus griseus</i>
Silversides	<i>Menidia</i>
Submerged Aquatic Vegetation	
Mermaid's wineglass (green algae)	<i>Acetabularia sp.</i>
Green algae	<i>Caulerpa sp.</i>
Shaving brush alga (green algae)	<i>Penicillus sp.</i>
Turtle grass (seagrass)	<i>Thalassia testudinum</i>
Shoal grass (seagrass)	<i>Halodule wrightii</i>
Manatee grass	<i>Syringodium filiforme</i>
Terrestrial Vegetation	
Black mangrove	<i>Avicennia germinans</i>
Tree seaside oxeye	<i>Borrchia arborescens</i>
Australian pine	<i>Casuarina equisetifolia</i>
Sea grape	<i>Coccoloba uvifera</i>
Buttonwood	<i>Conocarpus erectus</i>
White mangrove	<i>Laguncularia racemosa</i>
Red mangrove	<i>Rhizophora mangle</i>
Beach Naupaka	<i>Scaevola taccada</i>
Bay cedar	<i>Suriana maritima</i>
Brazilian pepper	<i>Schinus terebinthifolius</i>

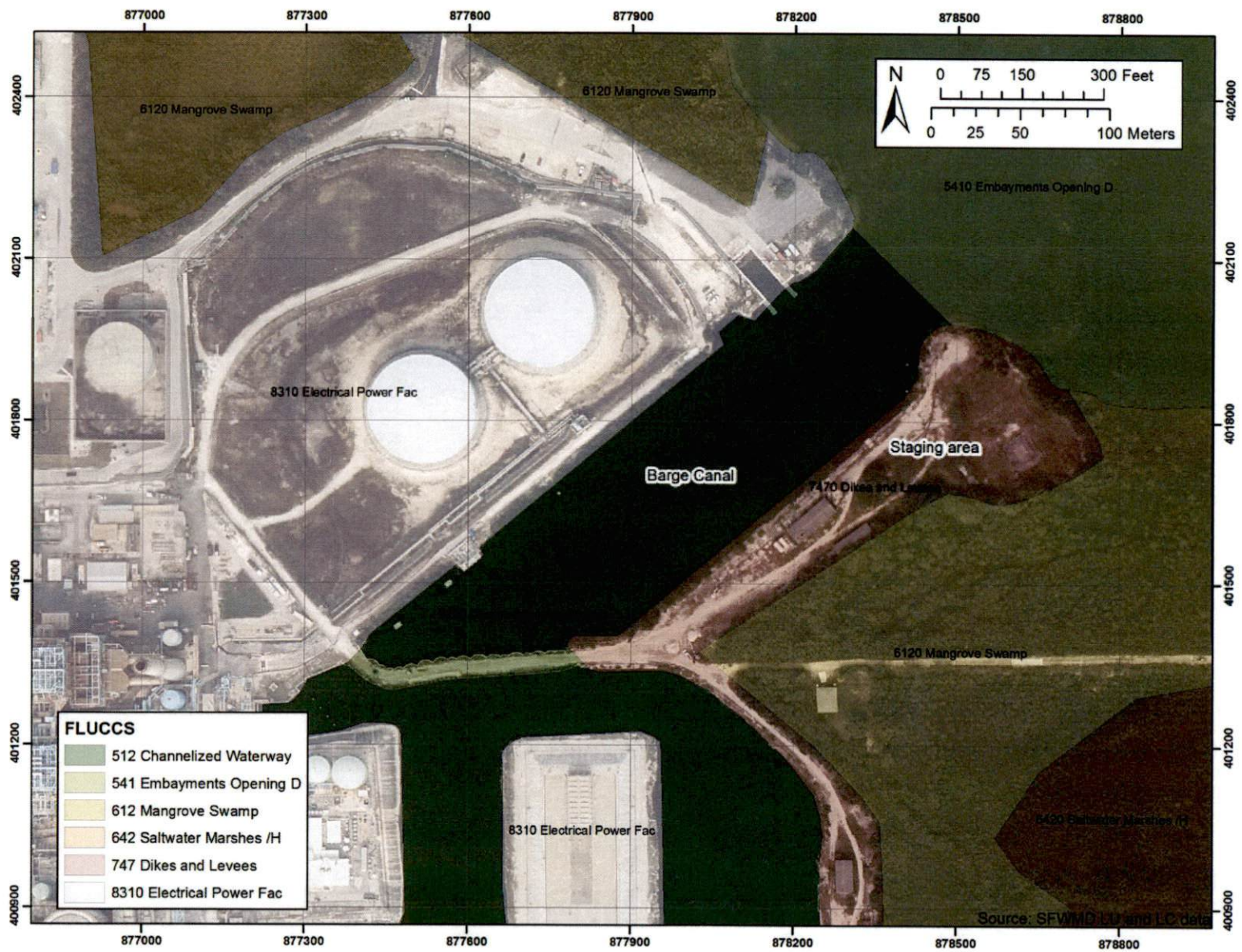


Figure 2-2. Land use and land cover classification

Back of figure

2.4 Protected Species

The Florida Fish and Wildlife Conservation Commission (FWC) publication Florida's Endangered and Threatened Species (Updated January 2016) was used to determine the status of listed species with the potential to utilize the proposed Project site. No sightings of or evidence of listed species were noted during the survey; however, based on geographic range, several listed species have the potential to utilize the TPC area (Table 2-3).

There are 11 aquatic species known to occur within Biscayne Bay that are protected under the Endangered Species Act or are candidates for listing. These are the American crocodile (*Crocodylus acutus*), Johnson's seagrass (*Halophila johnsonii*), the mangrove rivulus (*Rivulus marmoratus*), the small-toothed sawfish (*Pristis pectinata*), five species of sea turtle, the American alligator (*Alligator mississippiensis*), and the Florida manatee (*Trichechus manatus*). Additionally, a variety of protected avian species are known to occur within the southern Biscayne Bay and the Turkey Point Facility. Table 2-3 includes a list of protected avian species that have been known to utilize the BC area. Although these species were not documented during the survey, brief discussions of potentially occurring protected species are provided below.

American crocodile (Crocodylus acutus)

The American crocodile is federally threatened and state listed as endangered. Most crocodile nesting occurs in the southwestern corner of the industrial wastewater facility; however, a limited number of nests have been observed on berms within the northern portion of the return canals.

Johnson's seagrass (Halophila johnsonii)

Johnson's seagrass, federally listed as a threatened species, occurs along the Florida coast from Sebastian Inlet to central Biscayne Bay at Virginia Key, Key Biscayne. This seagrass species was not observed during the survey and is not known to occur as far south as the Turkey Point plant property.

Mangrove rivulus (Rivulus marmoratus)

The mangrove rivulus, a fish that inhabits crab burrows in mangrove areas, is federally listed as a NOAA Species of Concern and listed by the state as a Florida species of concern. It could be present in mangrove areas fringing the plant site, but is unlikely to be present in the BC due to lack of habitat (no crabs or crab burrows were observed in mangrove habitat during the survey).

Small-toothed sawfish (Pristis pectinata)

The small-toothed sawfish is a state and federally endangered species that inhabits inshore bars, seagrass beds, and mangrove areas. Due to its preference for these habitat types, the small-toothed sawfish could potentially utilize the BC.

Florida manatee (Trichechus manatus)

The manatee is a state and federally endangered species that frequents warm water estuarine habitats including rivers, marshes, bays, and sounds in Florida. They use warm water refuges in the cooler months, including freshwater springs and heated effluent from power plants. Manatees are federal- and state-listed as endangered, and their critical habitat includes Biscayne Bay and Card Sound adjacent to the Turkey Point plant property and the canals entering these water bodies. Manatees have been observed in the barge turning basin and nearby state canals (NRC 2016).

American alligator (Alligator mississippiensis)

The alligator is federally listed as Threatened due to similarity of appearance and state listed as a Florida species of special concern. The species is federally listed as threatened due to its physical resemblance to the American crocodile, which is endangered. Alligators live in swampy areas, rivers, streams, lakes and ponds. Although they are primarily freshwater animals, alligators will also venture into brackish salt water. Although alligators have been observed and relocated off site from the Turkey Point facility, there are no reports of alligators utilizing the BC.

Eastern Indigo snake (Drymarchon couperi)

The eastern indigo snake is federally threatened and can be found in almost any habitat throughout the state of Florida. Although eastern indigo snakes were not observed during the survey, they are known to occur on site. These snakes may occur in wetland or uplands and may be seen along the shell rock roads located throughout the CCS area at Turkey Point.

Sea turtles

Sea turtles (4 species with protection status of Endangered or Threatened) are found in marine habitats that open to the sea, such as Biscayne Bay and Card Sound. The BC does not provide suitable habitat, and the shoreline adjacent to the canal lacks the beach habitat preferred by sea turtles for nesting.

Wood stork

The wood stork (*Myctera americana*) is classified as endangered by the FWC and the FWS. This species could potentially use the site as short-term foraging grounds. Wetlands and the perimeter of the TPC could offer limited forage for this species during the wet season. Long term use of the site is limited due to low quantity and quality of the foraging habitat as well the flashy and short duration of inundation on site.

Wading Birds

Several wading birds (herons and egrets) are classified by the FWC as species of special concern. The snowy egret (*Egretta thula*), reddish egret (*Egretta rubescens*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), Roseate spoonbill (*Platalea ajaja*), and white ibis (*Eudocimus albus*) were not observed on site during the survey; however, limited utilization throughout the year is likely to occur. As described for the wood stork, seasonal utilization is likely when the ditches are inundated during the wet season. The ponds offer limited and poor quality year-round forage.

Brown pelican

The brown pelican is a state species of special concern that thrives near coasts and on islands. Brown pelicans rely in part on the actions of marine predators such as large fish, sharks and dolphins to force schools of fish to the surface where the pelicans can catch them. Pelicans will breed only in areas with enough food to support the breeding colony. Roosting and resting sites where brown pelicans can dry their feathers and rest without disturbance are also important. (USFWS 2016). This is the only listed species to be observed during the May 23, 2016 survey.

White-crowned pigeon (Patagioenas leucocephala)

The white-crowned pigeon is not federally listed however is protected by the U.S. Migratory Bird treaty Act and as a State-designated threatened species. White crowned pigeons inhabit low-lying forest habitats including mangroves around Biscayne Bay, Florida Bay and the Florida Keys. The

diet of the white-crowned pigeon consists of tropical hardwood tree fruits. White crowned pigeons were not observed during the survey.

Least tern

The least tern is a state threatened species that inhabits areas along the coasts of Florida including estuaries and bays. The least tern's diet primarily consists of fish, but they will also feed on small invertebrates. They build nests in shallow depressions in bare beach sand and on gravel berms and rooftops (FWC 2016).

Table 2-3. Federally Listed and Florida-State Listed Species Potentially Existing near Barge Canal				
Common Name	Scientific Name	Federal Status ^(a)	State Status ^(a)	Observed during survey
Birds				
Roseate spoonbill	<i>Ajaia ajaja</i>	—	S	N
Little blue heron	<i>Egretta caerulea</i>	—	S	N
Reddish egret	<i>Egretta rufescens</i>	—	S	N
Snowy egret	<i>Egretta thula</i>	—	S	N
Tricolor heron	<i>Egretta tricolor</i>	—	S	N
White ibis	<i>Eudocimus albus</i>	—	S	N
American kestrel	<i>Falco sparverius</i>	—	T	N
Bald eagle	<i>Haliaeetus leucocephalus</i>	DL	T	N
Wood stork	<i>Mycteria americana</i>	E	E	N
Brown pelican	<i>Pelecanus occidentalis</i>	—	S	Y
Least tern	<i>Sterna antillarum</i>	—	T	N
White-crowned Pigeon	<i>Patagioenas leucocephala</i>	—	T	N
Fish				
Mangrove rivulus	<i>Rivulus marmoratus</i>	SOC	S	N
Small-toothed sawfish	<i>Pristis pectinata</i>	E	—	N
Common snook	<i>Centropomus undecimalis</i>	—	S	N
Mammals				
Florida manatee	<i>Trichechus latirostris</i>	E	E	N
Plants				
Johnson's seagrass	<i>Halophila johnsonii</i>	T	—	N
Reptiles				
Green sea turtle	<i>Chelonia mydas</i>	E	E	N
Hawksbill sea turtle	<i>Erytmochelys imbricata</i>	E	E	N
Leatherback sea turtle	<i>Dermochelys coriacea</i>	E	E	N
Kemp's ridley sea turtle	<i>Lepidochelys kemp</i>	E	E	N
Loggerhead sea turtle	<i>Caretta</i>	T	T	N
American alligator	<i>Alligator mississippiensis</i>	T (S/A)	S	N
American crocodile	<i>Crocodylus acutus</i>	T	E	N
Eastern Indigo snake	<i>Drymarchon couperi</i>	T	T	N
(a) E = Endangered; T = Threatened; T(S/A) = Threatened due to similarity of appearance; C = Candidate for federal listing; S = Florida species of special concern; SOC = NOAA species of concern; — = No listing				

3. RESTORATION PLAN

This section describes the methods and techniques planned for restoration implementation of the BC. The proposed restoration action involves topographically restoring the BC to an elevation of -15 ft. NAVD. The proposed restoration will consist of a combination of specific activities that include material staging, sediment placement, and grading. The approach to restoration activities is presented below.

3.1 Topographic Restoration

Topographic restoration will be achieved by placing approximately **124,000** cubic yards (cy) of loose (raw) sediment fill material (approximately **55,779** cy of bottom fill and **68,175** cy of select top fill), within the BC. The fill volume was calculated using topographic survey data provided by FPL. The volume includes an additional 25% of material to account for inadvertent loss due to compaction, material handling, loss of fines, etc. The 25% factor is an estimate based on past experience with similar projects.

The BC was evaluated to determine the work zone, vessel access corridor, the appropriate methods for delivery and transfer of fill material, placement of the fill material, and turbidity containment. The proposed fill elevation was determined by a separate study for water quality improvement planning. Figure 3-1 illustrates the fill area planned to -15 NAVD. The proposed approach and methods for topographic restoration are described below. A set of conceptual restoration plan drawings have been prepared under a separate cover.

3.1.1 *Fill Specifications, Transport, and Staging*

The fill specification for the Barge Canal requires two types of fill: Type – E (bottom fill) and Type – A (select top fill). The bottom fill is a calcium carbonate coarse grain sand with a grain size of less than 10% passing through a range 12 inch to #200 sieve. Bottom fill will be placed from the canal bottom to an elevation of -22 NAVD along the length of the canal. The select top fill is a calcium carbonate coarse grain sand with a grain size of less than 5% passing through a range #4 to #200 sieve. The top fill will be placed from -22 to -15 NAVD.

Select top fill and bottom fill should be obtained from local quarries. Fill material meeting the gradation specifications are readily available from local quarries in the quantity needed to fulfill the project needs.

Staging areas are available near the project site. The staging area will be identified by the contractor. Fill material will be delivered via truck directly to the staging area along existing roads on the project site. Fill material will be stored on site. Fill material will be staged in a contained environment to avoid loss of material to adjacent aquatic resources. The staging area will be returned to pre-project conditions following project completion, with final cleanup notification provided to the FPL representative.



Photo 3-1. Example of covered fill conveyor system

Loose fill may be transferred using a long-reach excavator and conveyor system or other suitable transfer machinery from the staging area to a material placement barge. Photo 3-2 provides an example of equipment used to efficiently transfer fill material. Typically, the use of a conveyor system provides a low-to no-impact fill material transfer route through the mangroves. Mangrove canopy openings sufficient for installation of the conveyor system were identified during the site assessment. Figure 3-2 identifies a potential location for installation of the conveyor system. All sections of the conveyor system that cross mangrove habitat or any other sensitive habitat will be covered from above and below to limit wind loss of material and to catch any material that may drop from the conveyor system. The covers are generally constructed of half sectioned corrugated style pipe installed above and below the conveyor belt (see Photo 3-2). Once selected the contractor may propose comparable alternative methods.

A turbidity containment system will be installed prior to construction and will remain throughout the fill operations. At no time will the turbidity containment be breached during the fill operations.

3.2 Turbidity Containment

During fill placement activities, turbidity curtains and/or other barriers will enclose the mouth of the BC to minimize potential siltation and turbidity of surrounding mangrove and seagrass communities. Turbidity curtains at the mouth of the BC will be placed such that the bottom edge of the material is in contact with the bay bottom. Turbidity curtains will be anchored securely for use in high current/dynamic conditions. Piles (12- in. diameter or greater) will be used across the mouth of the BC to secure the turbidity curtain. All possible turbidity leak points (seams, bottom of curtain, etc.) will be secured and monitored during filling operations. Turbidity curtains shall be furnished with excess material (flaps) at each end so they may be rolled together to seal the seam created by securing two sections together. Additionally, curtains will have a 3-ft. barrier above the water line to inhibit manatees from entering the fill zone. The turbidity curtains will be highly visible and manufactured from entanglement-free material that is safe to use in the presence of marine mammals, sea turtles, and other marine fauna. Curtains will be removed from the BC post-filling once turbidity within the feature reaches an acceptable level



Photo 3-2. Fill conveyor loading placement barge



Figure 3-1. Fill area and proposed staging area and conveyor placement area

Back of figure

3.3 Threatened and Endangered Species Signage

All staff involved with filling operations will be instructed and trained as per Florida Fish and Wildlife Conservation Commission (FWC) Standard Manatee Conditions for In-Water Work as well as the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA-NMFS) Marine Sea Turtle and Smalltooth Sawfish Construction Conditions. Idle speed/manatee protection signage will be maintained on board during all restoration activities. One sign which reads Caution: Boaters shall be posted in a location where it is prominently visible to all staff. A second sign measuring at least 8.5 by 11-in. explaining the requirements for "Idle Speed/No Wake" and the shutdown of in-water operations (Figure 3-3) will be posted in a location prominently visible to all personnel engaged in water-related activities (www.myfwc.com). Signage will be maintained at both the location of the materials barge and the restoration site. If any Threatened and Endangered Species comes within 50 feet of the work zone, filling operations will cease until the protected species has left the work zone on its own accord.



Figure 3-3. FWC manatee signage

During the permitting process, the level of observer will be determined: 1) observer approved by Florida Fish & Wildlife Conservation Commission at least 2 weeks prior to starting construction; 2) observer adequately trained and equipped with proper glasses; or 3) all on-site personnel are responsible for observer in-water activities for possible manatee presence. If a dedicated manatee observer will be required, that person(s) is expected to be on-site at all times during in-water construction.

3.4 Water Quality Monitoring

Using a portable turbidimeter (Hach 2100Q), turbidity measurements will be collected at 6-hour intervals from upstream, downstream, and within the work area. Samples will be collected outside the turbidity containment from no further than 50 ft. from the point of discharge within the densest portion of any visible plume. If the turbidity exceeds the state water quality standards (DEP 62-302.530) for an Outstanding Florida Water (zero NTU's above background) then backfill operations will cease until water quality standards are returned to background levels. If water quality standards are exceeded more than twice a day, the backfill operations will be stopped and then evaluated for implementation of mitigation measures.

4. SUMMARY

Currently the BC is a channelized waterway with sparse to no epibenthic floral or faunal coverage. The vertically cut banks along with poor water quality currently provides suboptimal marine habitat. Filling of the BC to a minimum depth of -15 NGVD, is expected to improve benthic habitat and hydrology, thereby, providing water quality improvements to Biscayne Bay. Additionally, indirect benefits to marine habitats are expected as a result of the overall improvements to water quality.

Based on the site survey, direct impacts to benthic resources are not expected as a result of the project. Indirect impacts such as shading, sedimentation, turbidity, and mechanical injury are expected to be negligible. The use of specialized turbidity containment and equipment and the methods specified in herein will avoid and minimize both direct and indirect impacts to both sessile and motile biota. Accessing the BC from the land side, with the exception of the placement barge, will minimize barge traffic compared to a water based operation and therefore avoid impacts from prop dredging, vessel groundings, and any potential for vessel strikes to protected marine species. All standard construction conditions for manatees and smalltooth sawfish will be abided by during construction to avoid any potential affects. Additionally, an observer will be on-site during all construction to observe any protected species within the project vicinity and advise any additional measures needed to avoid harm or harassment to protected species.

5. REFERENCES

US Fish and Wildlife Service. <http://www.fws.gov/oregonfwo/Species/Data/BrownPelican/>. Accessed May 25, 2016.

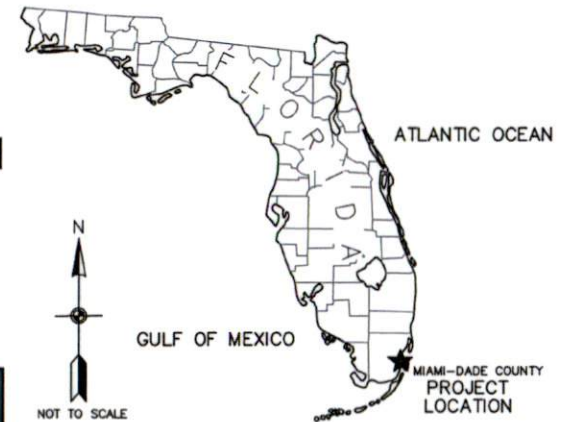
Florida Fish and Wildlife Conservation Commission. <http://myfwc.com/wildlifehabitats/imperiled/profiles/birds/least-tern/>. Accessed May 25, 2016.

United States Nuclear Regulatory Commission. <http://www.nrc.gov/docs/ML1036/ML103630163.pdf>. Accessed May 25, 2016.



FLORIDA POWER AND LIGHT BARGE SLIP CANAL RESTORATION

MIAMI-DADE COUNTY



INDEX OF SHEETS

SHEET #	TITLE	LATEST UPDATE	REV.
G-001	COVER SHEET AND VICINITY MAP	7/26/16	0
G-002	LIMITS OF CONSTRUCTION	7/26/16	0
P-101	BARGE SLIP PLAN VIEW AND SURVEY	7/26/16	0
P-102	BARGE SLIP FILL CROSS-SECTIONS	7/26/16	0
P-103	BARGE SLIP ELEVATIONS	7/26/16	0

VICINITY MAP

BARGE SLIP CANAL, MIAMI-DADE COUNTY, FLORIDA

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FLORIDA POWER AND LIGHT
BARGE SLIP CANAL RESTORATION

COVER SHEET AND VICINITY MAP

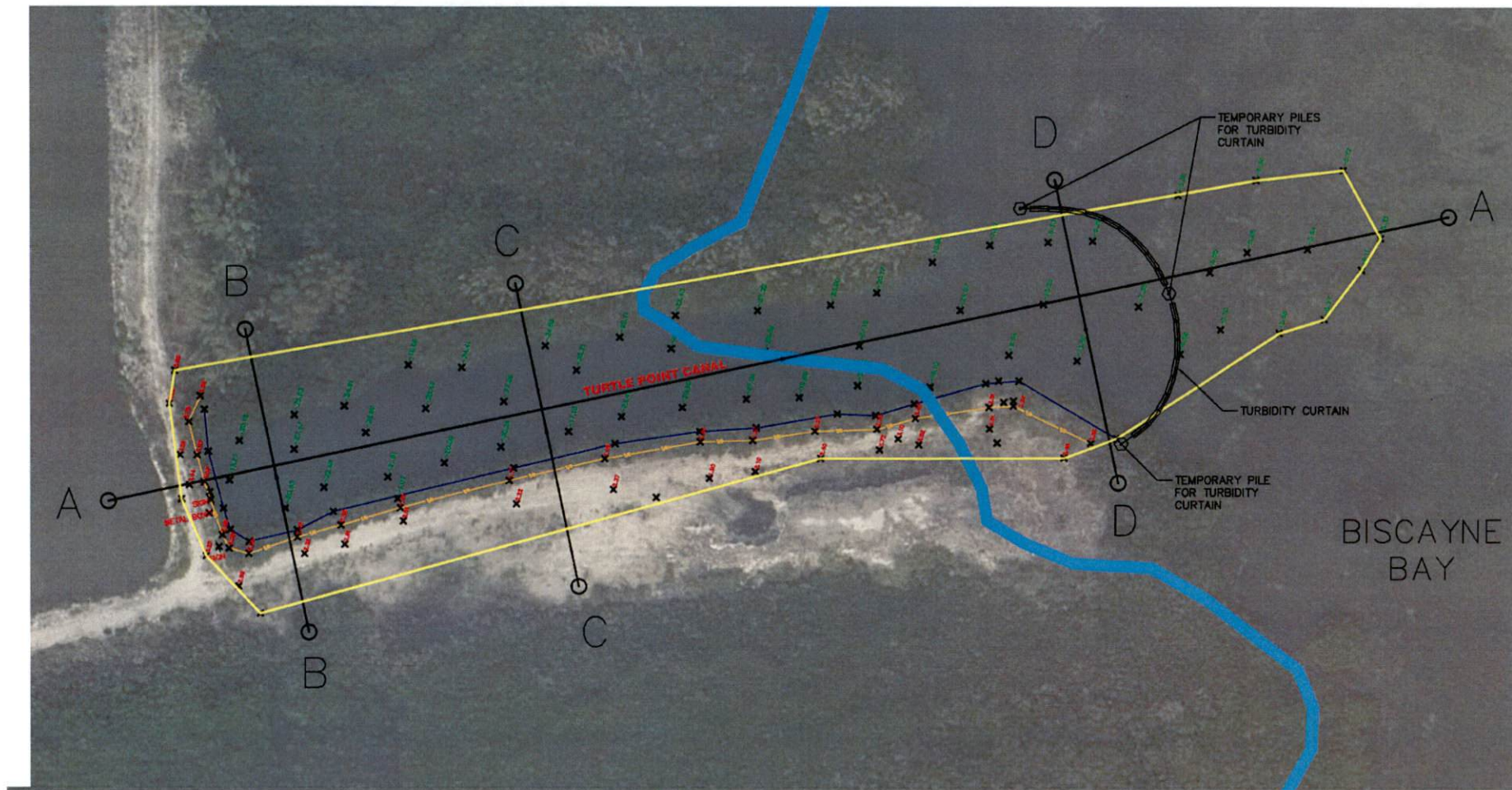
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G-001
Sheet 1 of 5



NOTES:

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4. A TURBIDITY CURTAIN SHALL BE UTILIZED TO PREVENT ANY SUSPENDED MATERIAL FROM ESCAPING OUTSIDE OF THE CONSTRUCTION ZONE. THREE TEMPORARY PILES SHALL BE DRIVEN AT THE LOCATIONS SHOWN TO ANCHOR THE TURBIDITY CURTAIN.
5. CROSS-SECTIONS A-A THROUGH D-D ARE SHOWN ON SHEET P-103.

LEGEND:

- × SURVEY POINT
- SURVEY BOUNDARY
- CROSS-SECTION
- ⊙ TEMPORARY PILES
- TURBIDITY CURTAIN
- APPROX. PROPERTY LINE

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**FLORIDA POWER AND LIGHT
TURTLE POINT CANAL RESTORATION**

TURTLE POINT PLAN VIEW AND SURVEY

MIAMI-DADE COUNTY, FLORIDA



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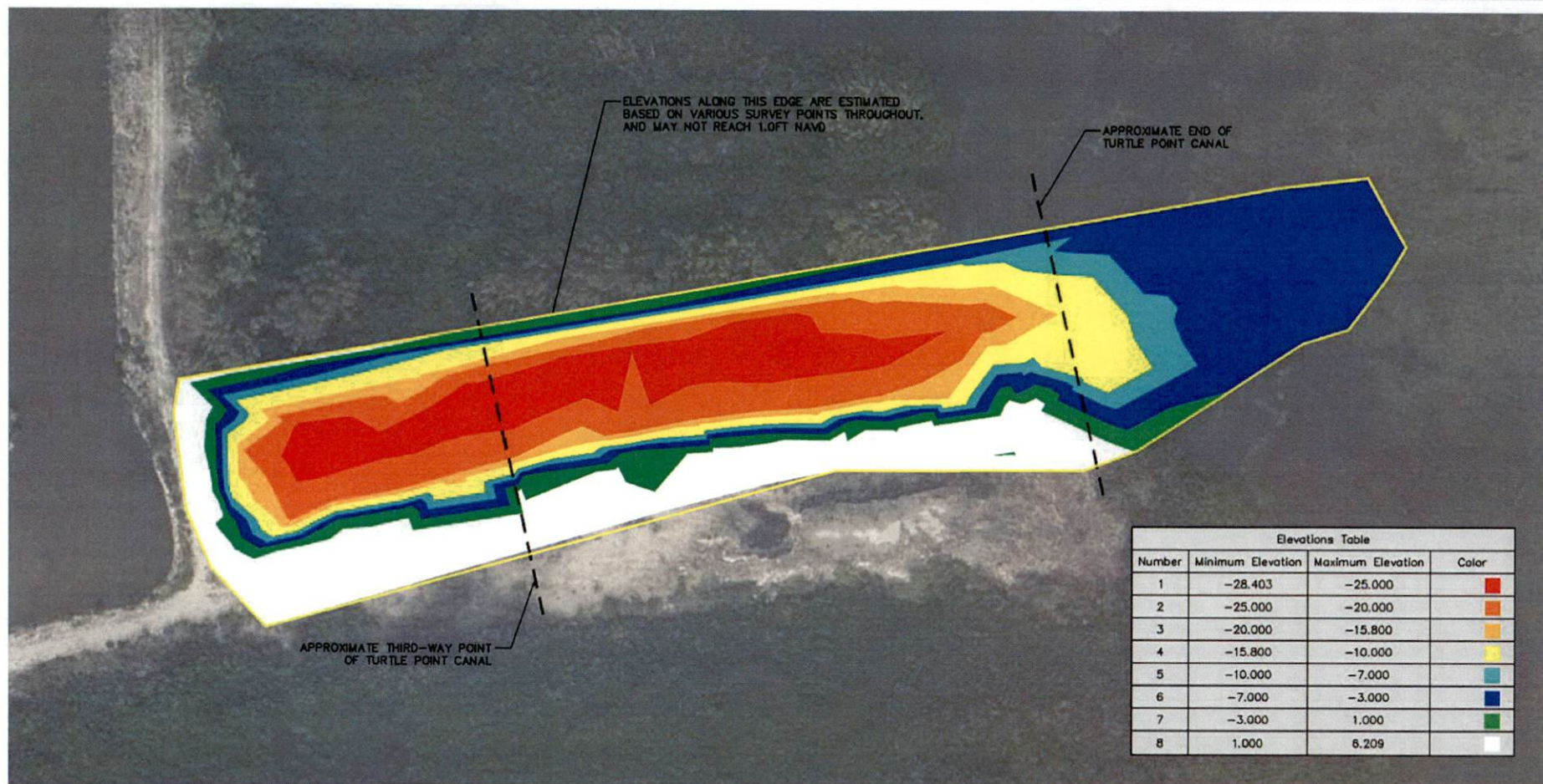
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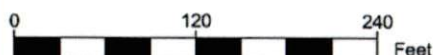
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P-101

Sheet 3 of 6



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	-28.403	-25.000	Red
2	-25.000	-20.000	Orange
3	-20.000	-15.800	Yellow
4	-15.800	-10.000	Light Green
5	-10.000	-7.000	Dark Green
6	-7.000	-3.000	Blue
7	-3.000	1.000	Light Blue
8	1.000	6.209	White



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4. THE RESTORATION PLAN INVOLVES FILLING THE FIRST THIRD OF THE TURTLE POINT CANAL TO EL. 1.0FT NAVD, THEN THE BASIN WILL SLOPE DOWN (AT 3H:1V SLOPE) TO -7.0FT NAVD ALL THE WAY TO THE END OF THE CANAL.

LEGEND:

- SURVEY BOUNDARY
- - - - - APPROX. CANAL BOUNDARIES

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**FLORIDA POWER AND LIGHT
TURTLE POINT CANAL RESTORATION**

TURTLE POINT ELEVATIONS

MIAMI-DADE COUNTY, FLORIDA

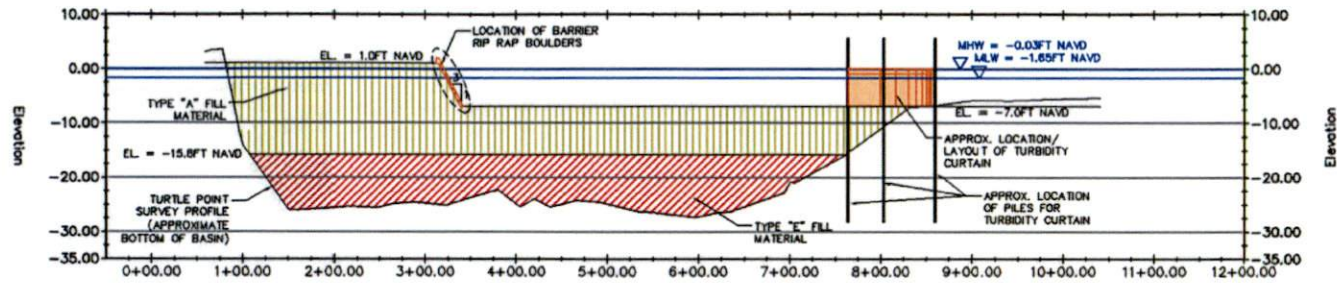


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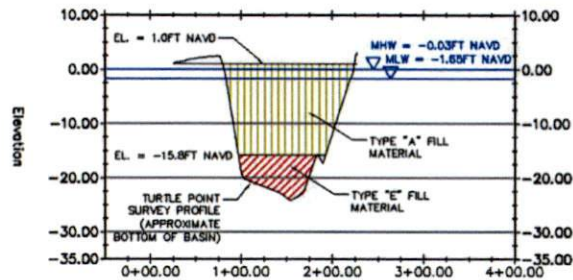
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P-102
Sheet 4 of 6

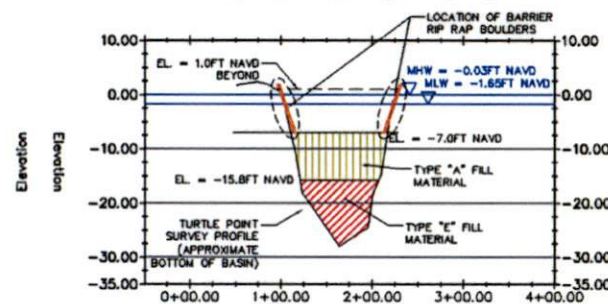
Profile View of A-A



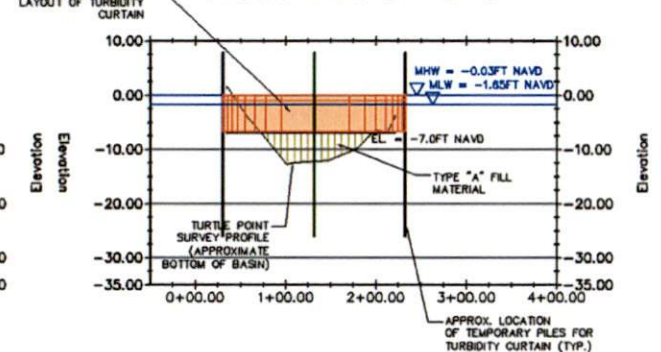
Profile View of B-B



Profile View of C-C



Profile View of D-D

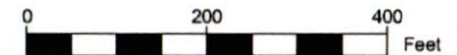


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4. RESTORATION PLAN: ONE-THIRD OF TURTLE POINT CANAL WILL BE FILLED TO EL. 1.0FT NAVD, THEN THE BASIN WILL SLOPE DOWN (AT 3H:1V SLOPE) TO -7.0FT NAVD DOWN TO THE END OF THE CANAL.
5. APPROXIMATE FILL VOLUME TO RESTORE CANAL: 57,000 C.Y. OVER AN AREA OF 2.1 ACRES (NOTE: VOLUMES INCLUDE AN ADDITIONAL 25% OF MATERIAL TO ACCOUNT FOR INADVERTENT LOSS OF MATERIAL). TWO TYPES OF FILL WILL BE USED:
 - 5.1. FILL TYPE "A": CALCIUM CARBONATE COARSE GRAIN SAND WITH A GRAIN SIZE OF LESS THAN 5% PASSING THROUGH A RANGE #4 TO #200 SIEVE IS UTILIZED FOR THE FILL. TYPE "A" FILL QUANTITY IS 39,900 CY IN LAYER +1FT TO -15.8FT NAVD TO OPENING AT BISCAYNE BAY.
 - 5.2. FILL TYPE "E": CALCIUM CARBONATE COARSE GRAIN SAND WITH A GRAIN SIZE OF LESS THAN 10% PASSING THROUGH A RANGE 12 INCH TO #200 SIEVE IS UTILIZED FOR THE FILL. TYPE "E" FILL QUANTITY IS 17,100 CY IN LAYER -15.8FT NAVD TO CANAL BOTTOM FULL LENGTH OF CANAL.
6. A RIP RAP BARRIER WITH APPROXIMATELY 2FT. DIAMETER LIMESTONE BOULDERS IS TO BE PLACED ALONG THE FILL SLOPE TO PROTECT MANGROVE PLANTINGS ON THE 1.0FT NAVD RESTORATION FILL AREA.
7. MEAN HIGH WATER (MHW) ELEVATION AND MEAN LOW WATER ELEVATION (MLW) WERE DETERMINED FROM NOAA TIDAL STATION 8723423, TURKEY POINT, BISCAYNE BAY, FL.

LEGEND:

- TYPE "A" FILL
- TYPE "E" FILL
- LOCATION OF RIP RAP



HORIZONTAL SCALE: 1" = 200'

VERTICAL EXAGGERATION: 6.0
VERTICAL SCALE: 1" = 33.3'

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FLORIDA POWER AND LIGHT
TURTLE POINT CANAL RESTORATION

TURTLE POINT FILL CROSS-SECTIONS

MIAMI-DADE COUNTY, FLORIDA



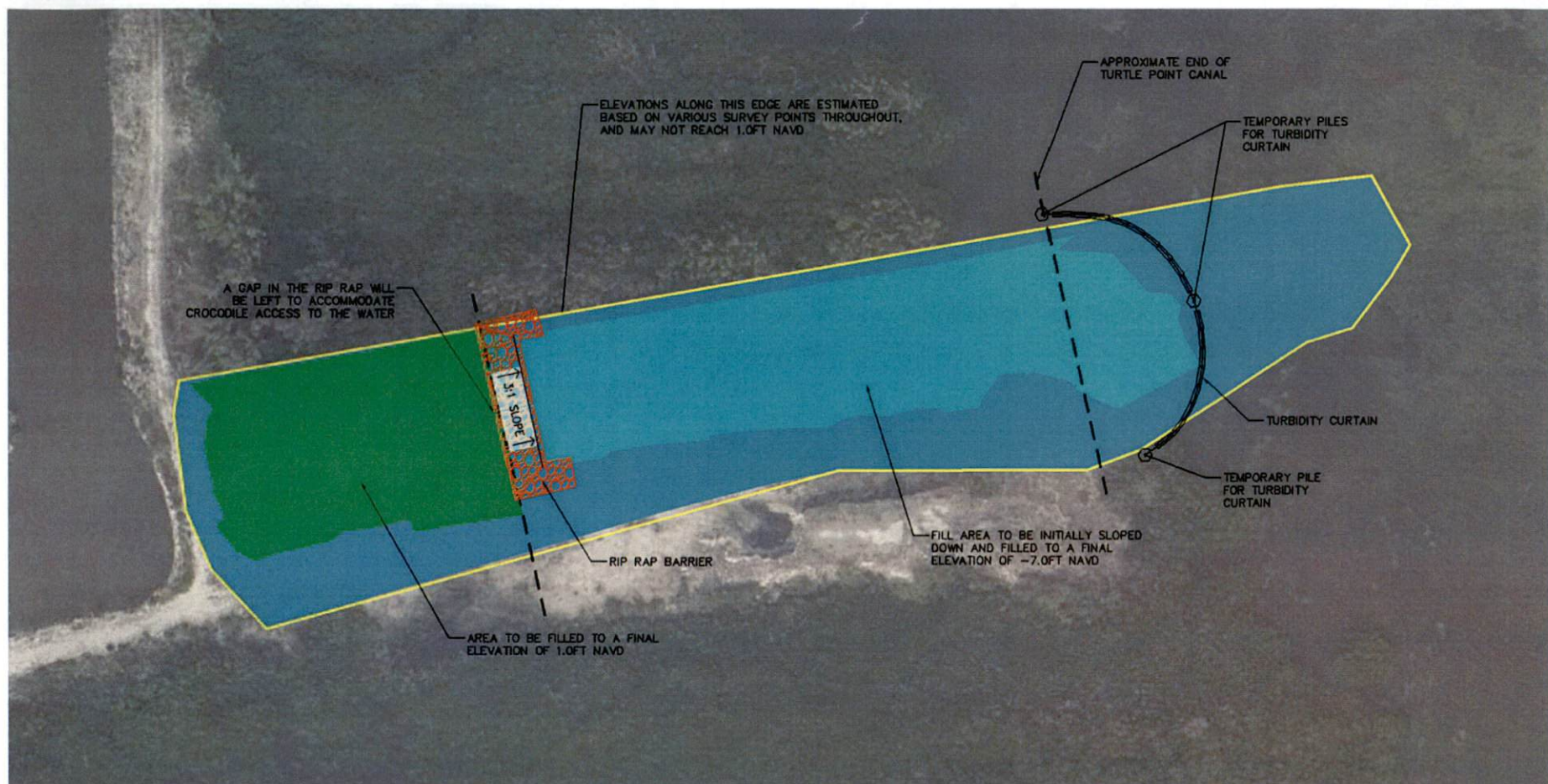
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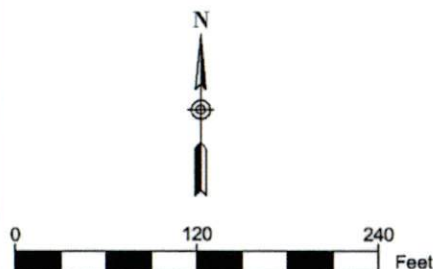
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LEGEND:

- SURVEY BOUNDARY
- - - - - APPROX. CANAL BOUNDARIES
- 1.0FT NAVD FILL AREA
- -7.0FT NAVD FILL AREA
- EXISTING GROUND ELEVATION
- LOCATION OF RIP RAP

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**FLORIDA POWER AND LIGHT
TURTLE POINT CANAL RESTORATION**

TURTLE POINT FILL AREA

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Sheet 6 of 6



**FLORIDA POWER AND LIGHT
TURTLE POINT CANAL RESTORATION**

LIMITS OF CONSTRUCTION

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Sheet 2 of 6



FLORIDA POWER AND LIGHT
BARGE SLIP CANAL RESTORATION

LIMITS OF CONSTRUCTION

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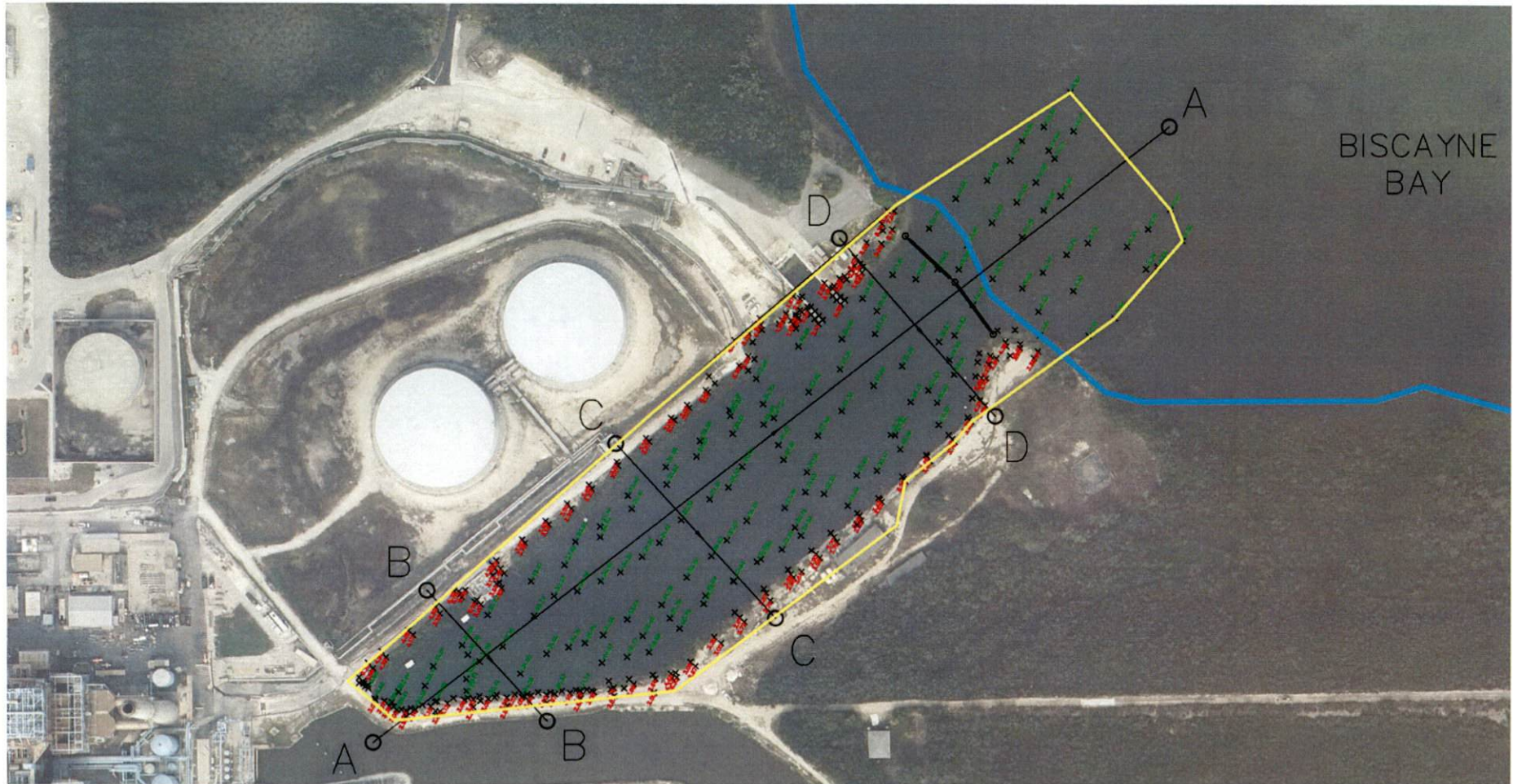
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Sheet 2 of 5



0 240 480 Feet

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4. A TURBIDITY CURTAIN SHALL BE UTILIZED TO PREVENT ANY SUSPENDED MATERIAL FROM ESCAPING OUTSIDE OF THE CONSTRUCTION ZONE. THREE TEMPORARY PILES SHALL BE DRIVEN AT THE LOCATIONS SHOWN TO ANCHOR THE TURBIDITY CURTAIN.
5. CROSS-SECTIONS A-A THROUGH D-D ARE SHOWN ON SHEET P-102.

LEGEND:

- x SURVEY POINT
- SURVEY BOUNDARY
- CROSS-SECTION
- o TEMPORARY PILES
- TURBIDITY CURTAIN
- APPROX. PROPERTY LINE

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**FLORIDA POWER AND LIGHT
TURTLE POINT CANAL RESTORATION**

BARGE SLIP PLAN VIEW AND SURVEY

MIAMI-DADE COUNTY, FLORIDA



TETRA TECH, INC.
759 SOUTH FEDERAL HWY
SUITE 314
STUART, FL 34994-2936
TEL: (772) 781-3400
FAX: (772) 781-3411
CERTIFICATE OF AUTHORIZATION
NO. 2429

Designed by:

Drawn By:

Checked By:

Reviewed By:

Design file no:
FPL-TT_BSC_FINAL.DWG

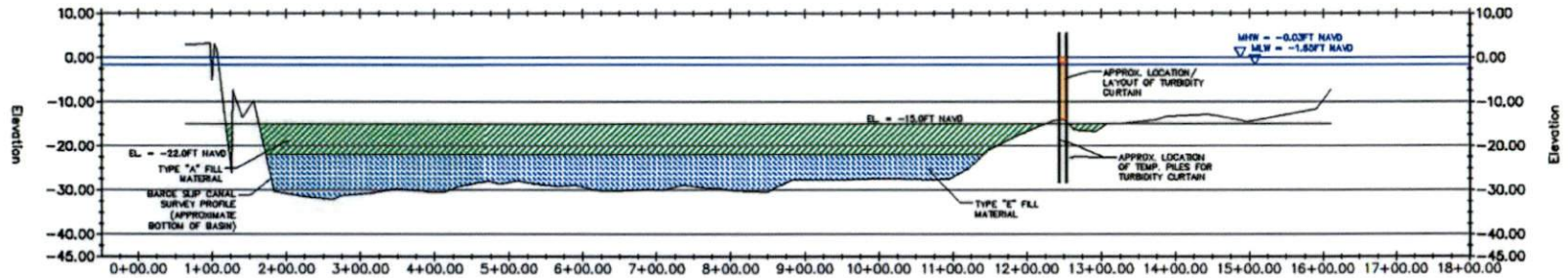
Scale:
AS SHOWN

Sheet Reference:

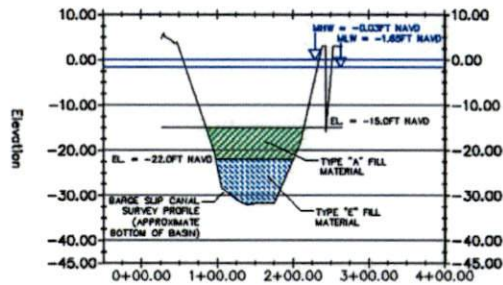
P-101

Sheet 3 of 5

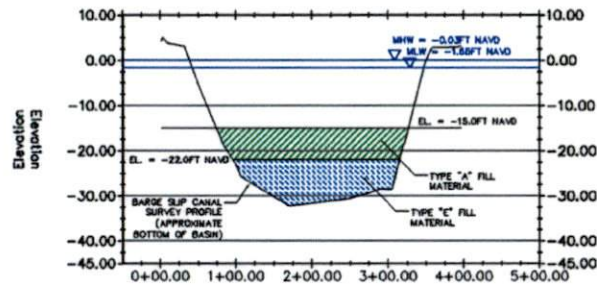
Profile View of BSC-A



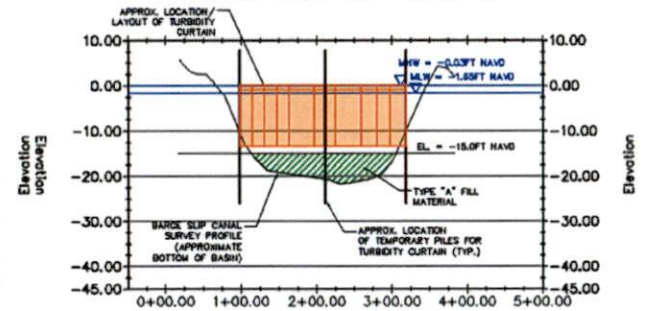
Profile View of BSC-B



Profile View of BSC-C



Profile View of BSC-D

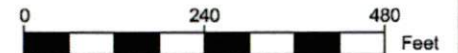


NOTES:

- ALL SURVEY DATA WAS PROVIDED BY FORD, ARMENTEROS & FERNANDEZ, INC. AND SURVEYED ON 4/15/16.
- ALL ELEVATIONS SHOWN HEREON ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
- THE SURFACES USED FOR ANALYSIS WERE DEVELOPED FROM THE LIMITED SURVEY DATA, WITH SOME ELEVATIONS INTERPOLATED BASED ON SURROUNDING SURVEY POINTS. CONTRACTOR IS RESPONSIBLE FOR DETERMINING ACTUAL FILL VOLUMES REQUIRED FOR COMPLETION OF THIS PROJECT.
- APPROXIMATE FILL VOLUME TO RESTORE BASIN TO -15.0FT NAVD = 124,000 C.Y. (NOTE: VOLUMES INCLUDE AN ADDITIONAL 25% OF MATERIAL TO ACCOUNT FOR INADVERTENT LOSS OF MATERIAL. TWO TYPES OF FILL WILL BE USED:
 - FILL TYPE "A": CALCIUM CARBONATE COARSE GRAIN SAND WITH A GRAIN SIZE OF LESS THAN 5% PASSING THROUGH A RANGE #4 TO #200 SIEVE IS UTILIZED FOR THE FILL. TYPE "A" FILL QUANTITY IS 68,175 CY IN LAYER -22FT TO -15FT NAVD FULL LENGTH OF CANAL.
 - FILL TYPE "E": CALCIUM CARBONATE COARSE GRAIN SAND WITH A GRAIN SIZE OF LESS THAN 10% PASSING THROUGH A RANGE 12 INCH TO #200 SIEVE IS UTILIZED FOR THE FILL. TYPE "E" FILL QUANTITY IS 55,779 CY IN LAYER -22FT NAVD TO CANAL BOTTOM FULL LENGTH OF CANAL.
- APPROXIMATE AREA OF BASIN TO BE FILLED = 5.6 ACRES
- MEAN HIGH WATER (MHW) ELEVATION AND MEAN LOW WATER ELEVATION (MLW) WERE DETERMINED FROM NOAA TIDAL STATION 8723423, TURKEY POINT, BISCAYNE BAY, FL.

LEGEND:

- TYPE "A" FILL
- TYPE "E" FILL



HORIZONTAL SCALE: 1" = 240'

VERTICAL EXAGGERATION: 6.0

VERTICAL SCALE: 1" = 40'

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FLORIDA POWER AND LIGHT
TURTLE POINT CANAL RESTORATION

BARGE SLIP FILL CROSS-SECTIONS

MIAMI-DADE COUNTY, FLORIDA



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759 SOUTH FEDERAL HWY
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STUART, FL 34994-2936
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Designed by:

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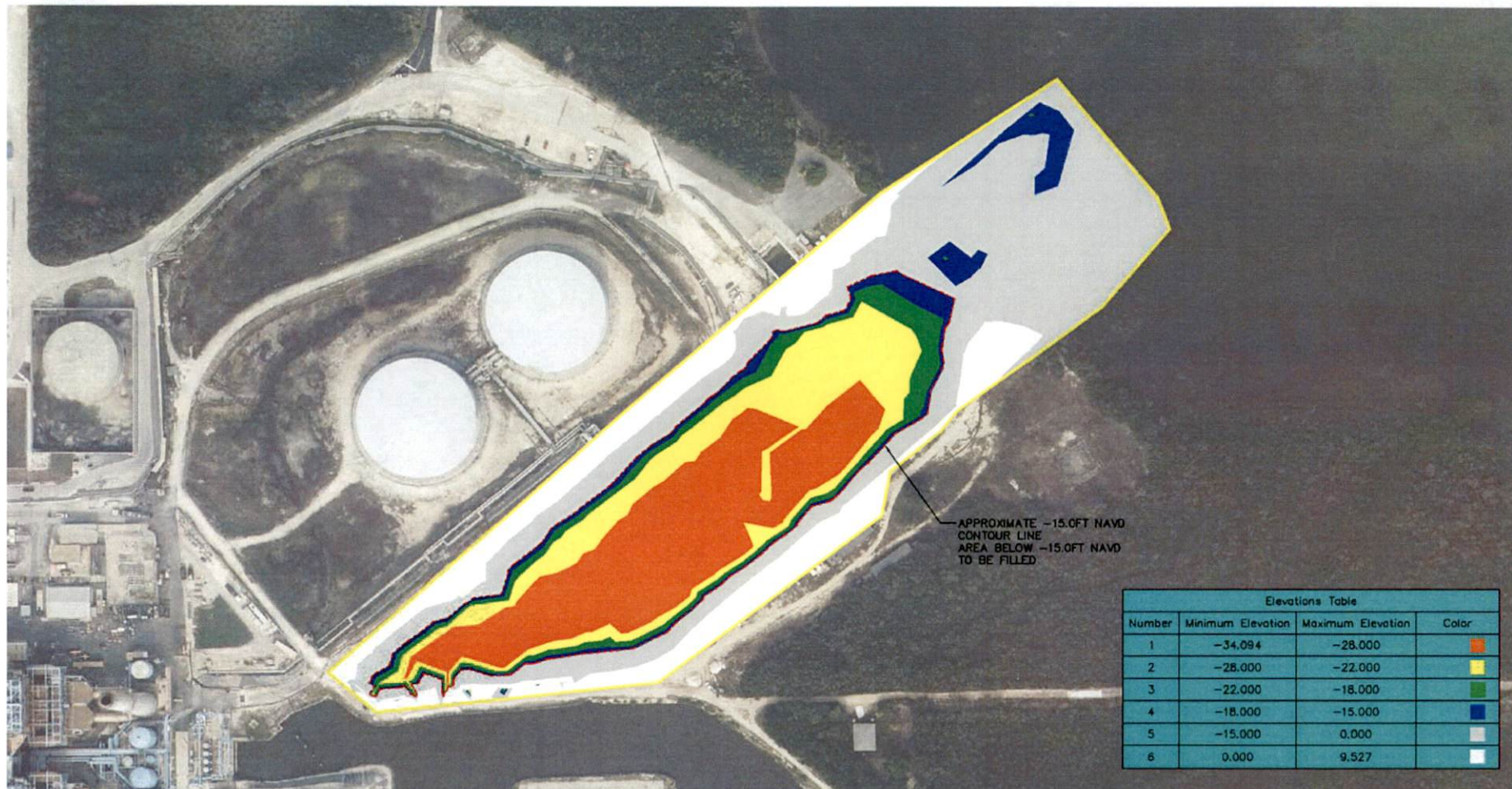
Scale:

AS SHOWN

Sheet Reference:

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Sheet 4 of 5



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	-34.094	-28.000	Orange
2	-28.000	-22.000	Yellow
3	-22.000	-18.000	Green
4	-18.000	-15.000	Blue
5	-15.000	0.000	White
6	0.000	9.527	White

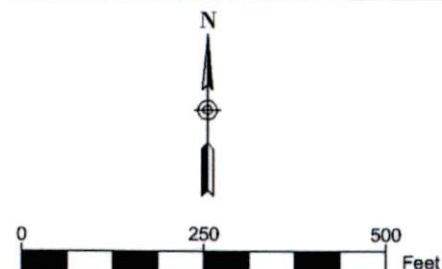
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5. APPROXIMATE AREA OF BASIN TO BE FILLED = 5.6 ACRES

LEGEND:

- SURVEY BOUNDARY
 APPROX. FILL BOUNDARY

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**FLORIDA POWER AND LIGHT
 BARGE SLIP CANAL RESTORATION**

BARGE SLIP ELEVATIONS

MIAMI-DADE COUNTY, FLORIDA



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P-103

Sheet 5 of 5