FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
UNIT NO. 1

ENVIRONMENTAL REPORT

MAY 20, 1971

DOCKET NO. 50-335

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APPENDICES

1.0 INTRODUCTION

The Florida Power & Light Company hereby submits this Environmental Report for the Hutchinson Island Nuclear Plant, as required under 35 FR 18469 "Implementation of the National Environmental Policy Act of 1969," and in response to the requirements of Appendix D, 10 CFR 50.

The Hutchinson Island Nuclear Plant (AEC Docket No. 50-335) is a nominal 850 Megawatt net electric pressurized water reactor. The nuclear steam supply system is being supplied by Combustion Engineering; Ebasco Services, Inc., is the Engineer-Constructor. At the date of writing the site preparation work is 55% complete, and the total construction is 12% complete. The plant is scheduled for commercial operation in midyear 1974. In selecting the site Florida Power & Light Company has followed its long-established policy under which all new sites are considered for their suitability for more than one unit.

The "Draft Guide to the Preparation of Environmental Reports for Nuclear Power Plants (February 1971)" has been followed in the preparation of the Report, and every effort has been made to be responsive to the suggestions of this Guide, where applicable. For the convenience of the reader the format, organization, and numbering system of the Guide has been followed in this Report.

The information given herein provides as comprehensive a description of the environmental impact of the project as can be made from such existing data as Applicant has been able to obtain from a diligent review of all possible sources of such data, and considering such guidelines for the scope of the inquiry as are available. The various engineering and environmental studies which are continuing are described in detail herein.

2.1 GENERAL

2.1.1 LOCATION OF THE FACILITY

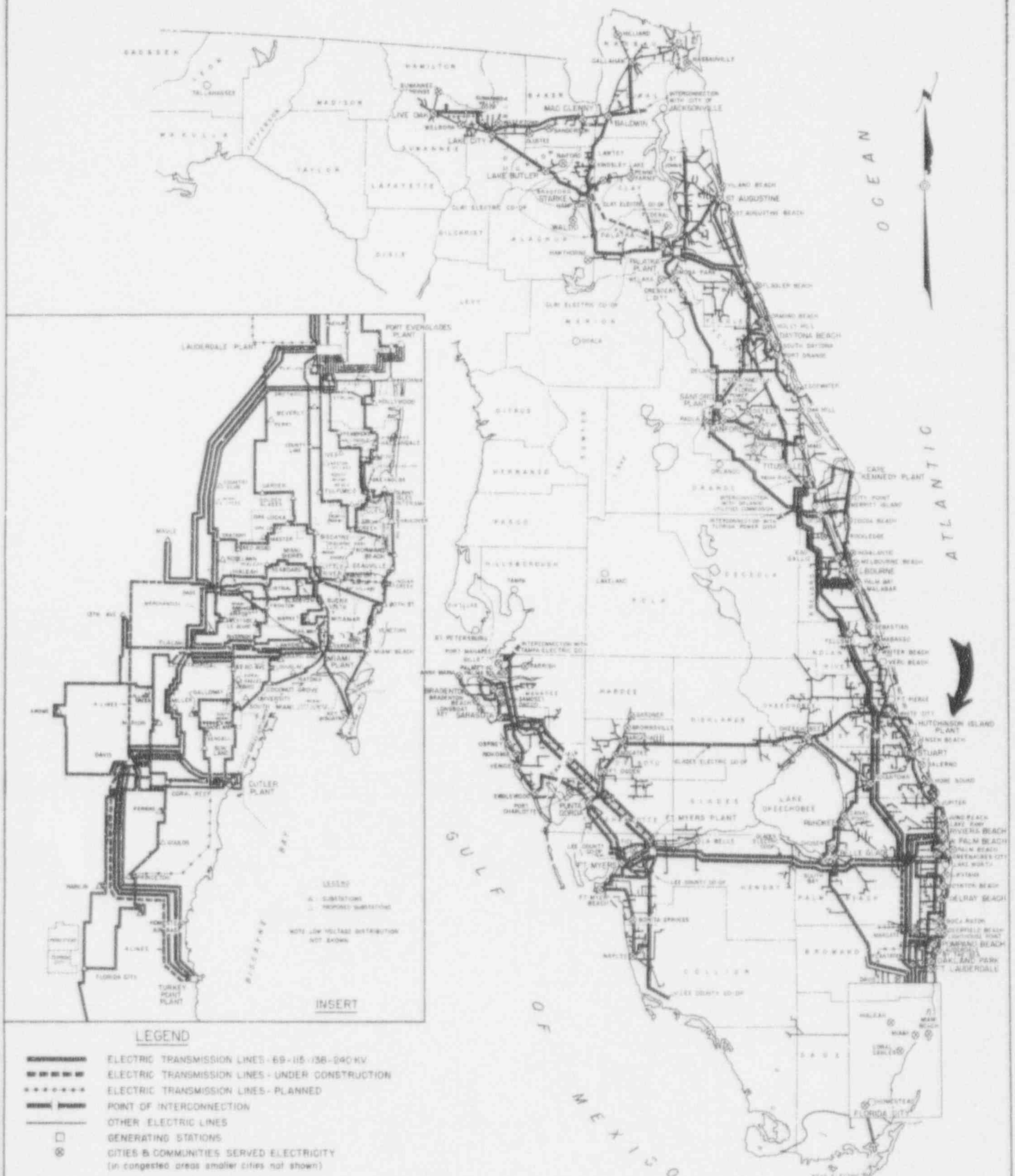
The site for the Hutchinson Island Nuclear Power Plant consists of approximately 1132 acres on Hutchinson Island in St. Lucie County about half way between Fort Pierce and Stuart on the East Coast of Florida. The nearest population center is the City of Fort Pierce which is eight miles from the site across the Indian River. The location of the site is indicated on the map of Florida, Fig. 2.1.1-1, as are the major cities of the State. As an aid in location, the approximate road distances from the site to the principal cities are: Miami 120 miles, Jacksonville 225 miles, Tampa 150 miles, Tallahassee 360 miles, Atlanta, Georgia 550 miles. The Georgia state line is some 260 miles away at the closest point. With the exception of Lake Okeechobee some 35 miles to the southwest, there are no major geographic features or important true rivers in the vicinity.

Figure 2.1.1-2 provides a map of the east-central portion of the State of Florida that locates the plant site relative to the geography of the State within a 100 mile radius. Figure 2.1.1-3, on a larger scale, presents an aerial view of the locale out to a 10-mile radius from the plant site, and identifies natural and improved features and reference points. The Company's property lines are shown in Fig. 2.1.1-4 on a plan of a portion of Hutchinson Island.

The site itself is generally flat. Much of it consists of swamp and, outside the mosquito control areas, the land is covered with a dense vegetation characteristic of Florida coastal mangrove swamps. At the ocean shore the land rises slightly in a dune or ridge to approximately 15 feet above mean low water. The island itself is populated only at the northern and southern ends, the nearest inhabited area being some seven miles north of the reactor site and the closest inhabited area to the south at a distance of around 4.5 miles.

The Hutchinson Island plant then is sited near the center of a long, narrow, offshore island. To the east is the Atlantic Ocean with the north flowing Gulf Stream currents evident only a few miles offshore. Near shore a weak counter-current flowing south is usually felt. To the west, the island is separated from the mainland by the Indian River. It should be noted that the Indian River is not a river in the usually accepted sense but more a long, thin, tidal lagoon stretching down the southeastern coast of Florida between the mainland and a long series of offshore islands. Passes or inlets between the islands connect the Indian River with the ocean while a very limited number of small streams flow into it.

Another fact of importance regarding the site is that there are currently no wells producing fresh water on Hutchinson Island and the many attempts to develop wells, even at considerable depths, have proved unsuccessful. This has limited the development of the island and kept most of the area uninhabited. Development of the northern and southern ends has been possible only because fresh water could be brought from the mainland by pipe lines of limited capacity.

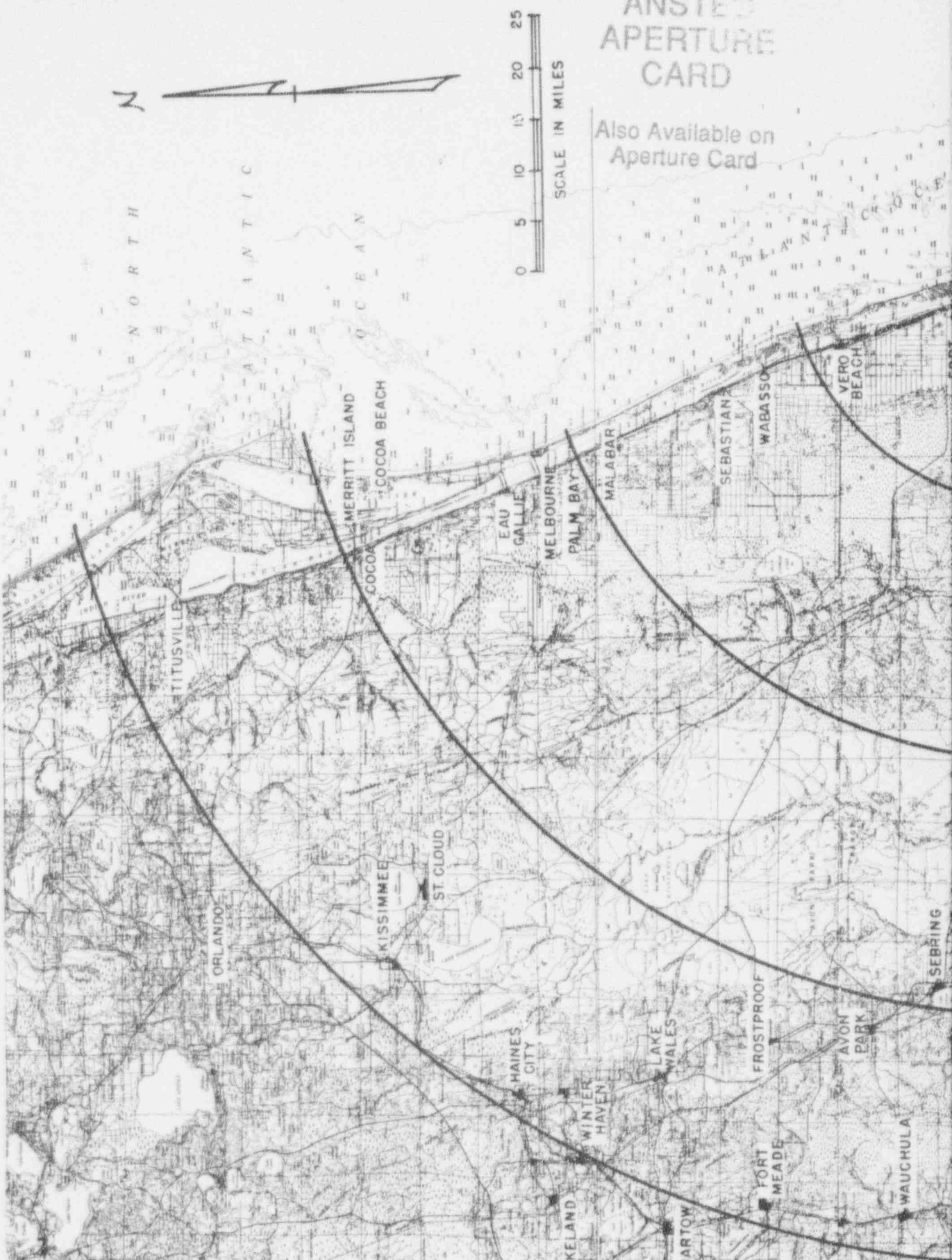


HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
MAP OF FLORIDA LOCATING HUTCHINSON ISLAND PLANT, MAJOR CITIES, AND THE FP&L SERVICE AREA

FIG. 2.1.1-1

ANSTEC
APERTURE
CARD

Also Available on
Aperture Card



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
GENERAL LOCATION MAP
FIG. 2.1.1-2

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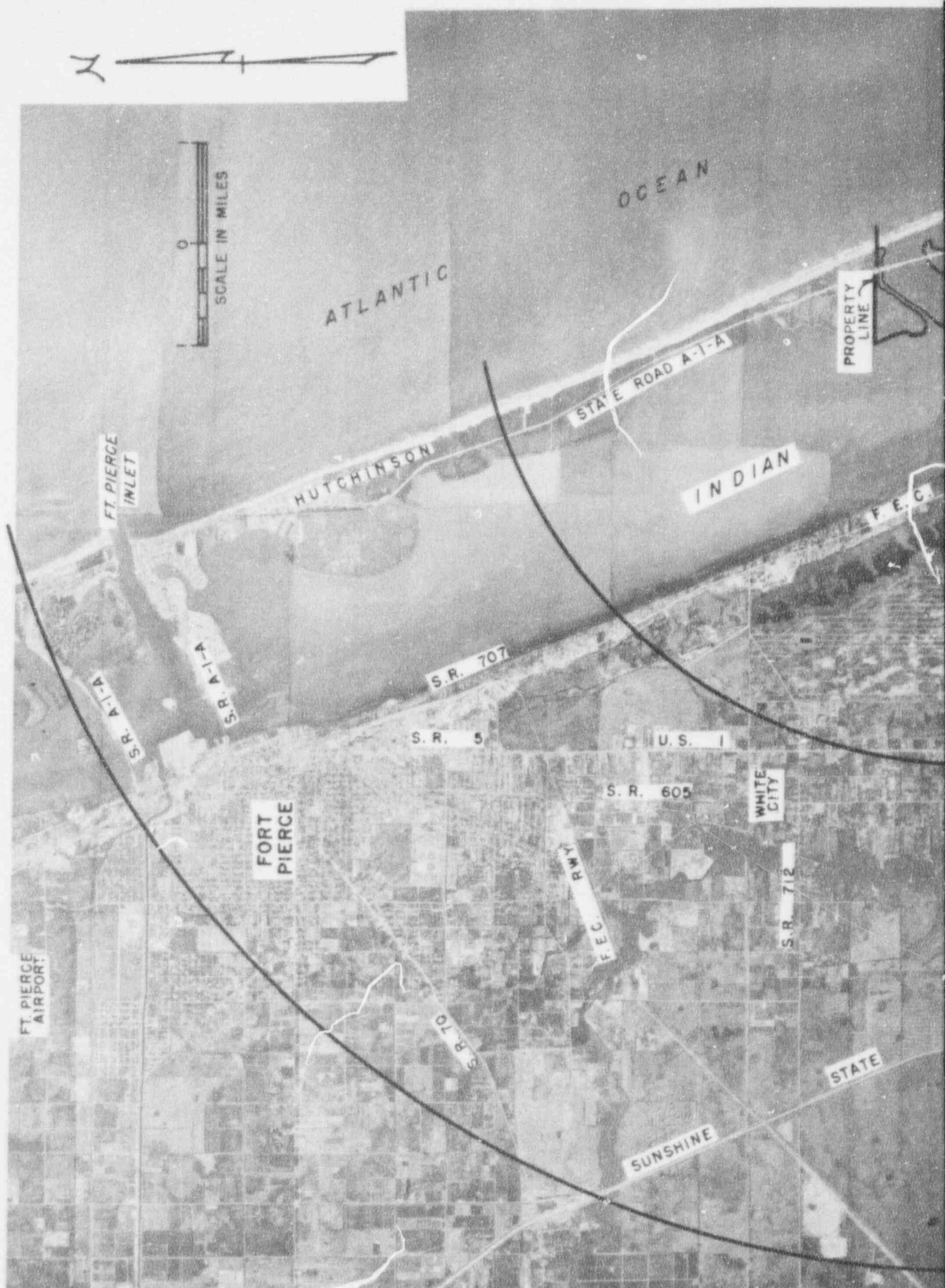

SCALE IN MILES
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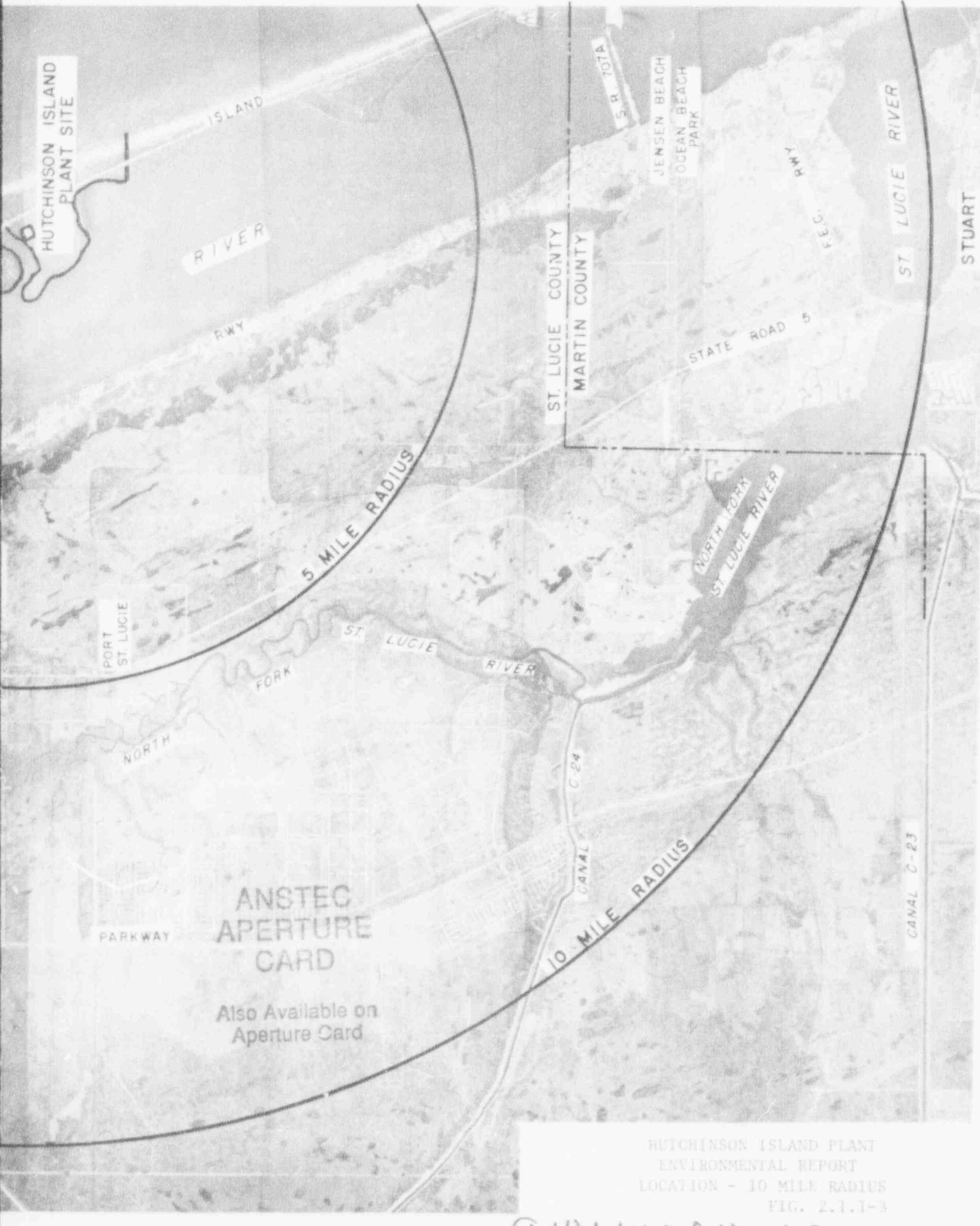
ATLANTIC
OCEAN
INDIAN
PROPERTY LINE
STATE ROAD A-1-A
HUTCHINSON
FT. PIERCE INLET
F.E.C.
S.R. A-1-A
S.R. A-1-A
S.R. 707
S.R. 5
U.S. 1
S.R. 605
WHITE CITY
FORT PIERCE
F.E.C. RWY
S.R. 712
FT. PIERCE AIRPORT
S.R. 70
STATE
SUNSHINE



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HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
LOCATION - 10 MILE RADIUS
FIG. 2.1.1-3

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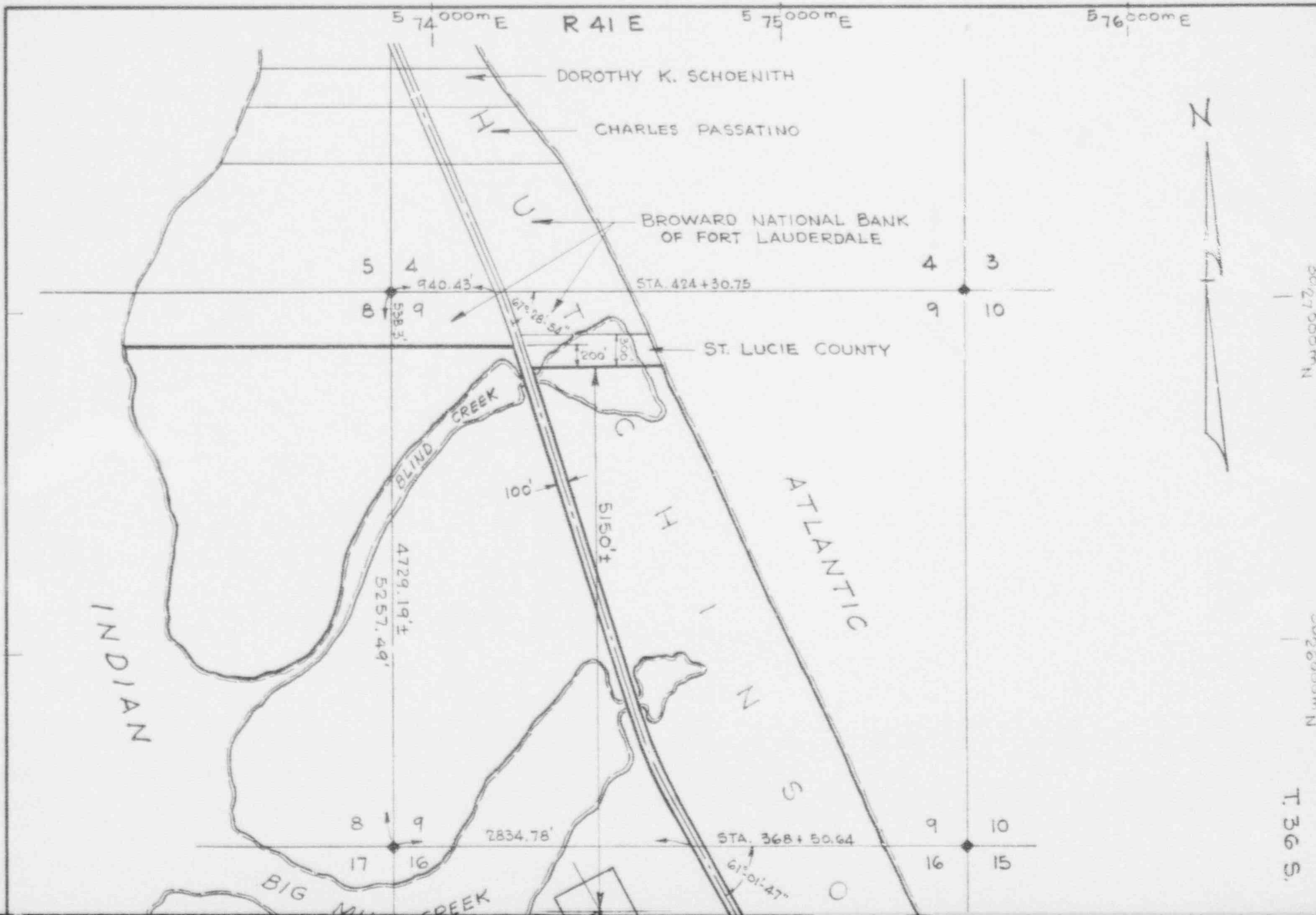

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DOROTHY K. SCHOENITH
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ST. LUCIE COUNTY
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BLIND CREEK
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ATLANTIC
INDIAN
4729.19'±
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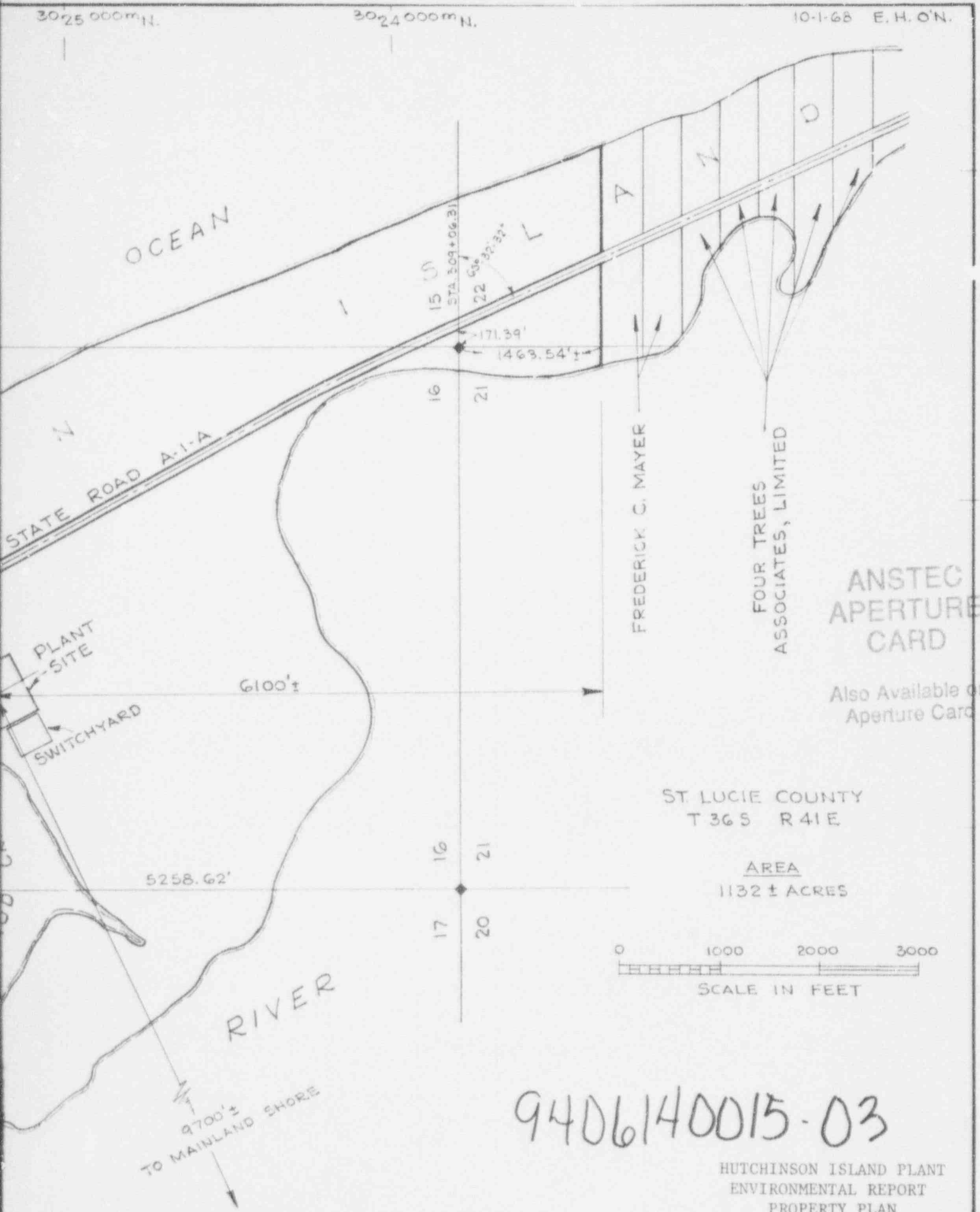

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HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
PROPERTY PLAN
FIG. 2.1.1-4

The mainland to the west of the plant site has a low population density. The heavily populated region begins at the West Palm Beach area 45 miles to the south. As will be discussed in detail in the next section, the immediately surrounding area is agricultural in nature with very limited industrial development.

2.1.2 PHYSICAL CHARACTERISTICS OF THE FACILITY

The reactor facility is described in considerable detail in the Hutchinson Island Plant Preliminary Safety Analysis Report[1] (referred to subsequently in this report as the PSAR). For the convenience of the reader with specialized technical interests, certain portions of this PSAR have been excerpted and included as Appendix 1. A brief description of the facility follows. An artist's concept of the plant when completed is shown in Fig. 2.1.2-1.

The Hutchinson Island plant utilizes a pressurized light water moderated and cooled reactor to extract heat from the fissioning uranium. The rating of the plant is to be 850 megawatts electrical. The reactor coolant system consists of two closed loops connected to the reactor vessel, each loop containing two reactor coolant pumps and a steam generator. The reactor core contains 217 fuel assemblies. Each fuel assembly contains 176 fuel rods fabricated from Zircaloy tubing and containing slightly enriched uranium dioxide fuel pellets. Control and shutdown capability is achieved by 85 control element assemblies containing boron carbide, and by soluble boric acid in the reactor coolant water.

The reactor system will be housed inside a steel containment vessel whose inside diameter is 140 feet. This vessel is in turn surrounded by a reinforced concrete shield building.

Numerous engineered safety features have been included in the design of the plant. Engineered safeguards systems include the safety injection system, the containment spray system, the containment cooling system, and the shield building ventilation system.

All structures and systems important to safety have been designed to withstand without loss of function the most severe environmental conditions which have been postulated for the site, in addition to being designed to meet their performance requirements under the many postulated accident conditions including the effects of missiles. These structures and systems contain redundant components and are designed and will be constructed to the highest industry standards in accordance with applicable codes, and to quality standards commensurate with their importance.

All structures and systems important to safety have been provided with features enabling them to be periodically tested and inspected throughout their operating life.

A variety of postulated accidents have been analyzed to provide the basis for the design and to provide assurance that no credible event would endanger the health and safety of the public. Radioactive waste management systems and operating practices have as their objective the reduction of contained activity in the discharges to the environment to a level as low as practicable.

The interaction of the Hutchinson Island facility with the environment will be discussed in detail in subsequent sections. The following lists these interactions and characterizes them according to their occurrence during the construction phase, during daily or routine operations, and as occurring during routine but infrequent portions of the operating phase. The sections in which these interactions are discussed in detail are given in parenthesis.

1. Construction Phase

Dredging for barge delivery of heavy components	(2.3.1 and 2.3.8.2)
Excavation and dewatering for foundations	(2.3.8.2)
Dredging for foundation fill	(2.3.8.2)
Construction of buildings	(2.3.8.2)
Construction of cooling intake and outfall structures	(2.2.8.2)
Highway traffic effects	(2.3.1)

2. Routine Operations

Intake and discharge of cooling water	(2.3.3)
Release of chemical discharges in the cooling water	(2.3.4)
Release of radioactive liquid effluents in the cooling water	(2.3.7)
Release of radioactive gases	(2.3.7)
Local traffic effects	(2.3.1)
Local population effects from the plant staff	(2.3.1)
Increased use of the area as recreational facilities are made available	(2.3.1)
Limited effects on wildlife as mitigated by the establishment of wildlife preserves	(2.3.1)
Minimal or zero effects on land use as regards future development of agriculture, industry and tourism	(2.3.1)

HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
ARTIST'S CONCEPTION OF COMPLETED PLANT
FIG. 2.1.2-1

3. Infrequent Operations

Shipment of new fuel, spent fuel, and radioactive waste (2.3.1)

As discussed in detail in subsequent sections of this report, no permanent damage or long-term disruption will result from these activities.

References

1. Florida Power & Light Company, Hutchinson Island Preliminary Safety Analysis Report Hutchinson Island Unit No. 1 (three volumes and Appendices), FP&L, Miami, Florida, January 29, 1969. (Docket No. 50-335).

2.1.3 ENVIRONMENT IN THE AREA

2.1.3.1 Climatology and Meteorology

The following summarizes the important factors on site meteorology as reported in Section 2.3 of the PSAR, and as currently being observed and measured in the on-site program.

Figure 2.1.3-1 is a photograph of the Hutchinson Island meteorology station. The tower is located immediately north of Big Mud Creek on the west side of highway A1A. More specifically, the tower is 2,436 feet north of the center of the containment in an area unaffected by the plant construction. The station has been operational since the first week in January 1971. The 200 ft. tower supports an Aerovane transmitter at 50 ft. and another at 190 ft., and temperature sensors at 10 ft., 110 ft., and 200 ft.

The data thus far taken at the site confirms the information given in the PSAR and also indicates a very close similarity to the site data taken at Turkey Point, 135 miles to the south. Briefly, the site is well ventilated with an average wind speed of 10 to 12 mph, and with wind speeds 4 mph or higher more than 95% of the time. Calms occur less than 1% of the time. The diffusion can be characterized as being slightly unstable a larger part of the time with very few occasions that are strongly unstable or strongly stable.

The prevailing meteorology of the coastal site of Hutchinson Island is dominated by the presence of the Azores-Bermuda high pressure system resulting in a subtropical marine type climate. Sporadic penetrations of cooler continental air occur in the winter months. The warm waters of the adjacent Gulf Stream current, located a few miles out in the ocean, tends to inhibit the formation of strong persistent low level inversions. Onshore, intense surface heating during daytime hours provides a deep layer for vertical mixing. Mixing depths vary from a minimum of 3000 ft. in the winter to 5000 ft. or more in the summer.

The average annual rainfall for the area is 62 inches, occurring year round but with the largest amount in the summer time.

The major meteorological hazards are hurricanes and tornadoes. Hurricane activity is limited to the summer and fall months, and the probability of a hurricane affecting Hutchinson Island is about one in fifteen for any given year. Sustained wind speeds associated with hurricanes can be expected in the 150-175 mph class as a nominal maximum. The wind speed and destruction associated with the Florida-type tornadoes are much less than that of a typical mid-western tornado. The wind speeds that have been estimated from the most severe Florida tornadoes is in the 200 mph class. The vital structures of the Hutchinson Island nuclear plant are designed to accommodate 300 mph wind speeds.

2.1.3.2 Geology and Topography *

The Floridan Plateau is the partially submerged southeastern peninsula of the North American Continental Shelf. The peninsula of the State of Florida is the exposed portion above sea level of the Floridan Plateau.

This region of study generally includes the Florida Peninsula and in particular the counties of St. Lucie, Martin, Indian River, and Okeechobee. This region is described as part of the Atlantic Coastal Plain physiographic province.

Within this physiographic province is the Atlantic Coastal Ridge which extends along the Atlantic Ocean shore as an irregularly shaped strip ranging from 5 to 10 miles wide between the Eastern Sandy Flatlands and the Everglades on the west and the Atlantic Ocean on the east. The coastal ridge has a maximum elevation of about (+) 80 feet found at the summits of sand dunes.

The eastern coast of Florida is described as the emergent or building coast, while the western or Gulf Coast is the submergent coast. This means that the Gulf waters are encroaching upon the land and those of the Atlantic are retreating from it. Hutchinson Island was probably formed as an offshore bar during a high stand of the sea. Hutchinson Island today should be considered a part of the Florida mainland even though it is separated by the generally very shallow Indian River. Both fresh water deposits from the internal part of the state and marine deposits from the ocean are now being deposited in the area of these offshore islands.

The topography of the site area is of a bar and swale type. There is a low bar near elevation (+) 14 feet on the ocean side of the island. The surface of the island then slopes downward toward the Indian River to about elevation (+) 4 feet, generally forming a swale. To the north and west of the site, both Big Mud Creek and the Indian River are continuations of the swale and are very shallow, 5 to 10 feet deep. There is a dredged channel in the Indian River for the inland waterway. To the east, the Atlantic Ocean bottom dips very slightly to the east to a depth of about 120 feet at a distance of about 15 to 20 miles from Hutchinson Island. To the west, on the mainland, there is another bar with a maximum elevation of about (+) 40 feet parallel to the coast.

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* The geology and topography of the area is described in considerable detail in Section 2.4 of the PSAR from which this material is taken. Some 49 sources are referenced therein.

The site is covered by a mangrove swamp. There is 4 to 6 feet of peat immediately beneath the surface. This material is a dark brown or black residuum produced by the partial decomposition and disintegration of trees, mangrove roots, and other vegetation. This peat was probably formed during the past several thousand years. Beneath the peat are about 13,000 feet of sedimentary rock formations overlying the crystalline basement in this region. Generally speaking, the upper 600 feet of sediments are soft rock formations consisting of partially cemented and indurated sands and clays. Beneath these materials are moderately hard and hard formations of limestone, dolomite, sandstone, shale and anhydrite.

There was no evidence found in the field or in boring to suggest any significant geologic structure within a two mile radius of the site.

2.1.3.3 Hydrology

The surface hydrologic boundaries of the site are the Atlantic Ocean to the east and Indian River to the west. The climate of the site area is humid, sub-tropical. The average annual temperature is 75°F; the average annual precipitation at Fort Pierce is about 62 inches. The average annual water loss due to evaporation in the area is estimated to be 40 to 45 inches.[1]

Rainfall is seasonal and about 65 percent of the annual amount occurs during the rainy season from June through October. During this period the rain usually occurs in the form of localized heavy showers. High soil permeability provides significant ground water recharge from local precipitation, with little runoff.

According to the information obtained from the Mosquito Control Commission at Fort Pierce, some areas of Hutchinson Island, including the site, were flooded by means of a five foot high road-dike, and culverts with flap-valves were provided through the dike. Between the months of September and March the high tide automatically provided the necessary water cover. However, during the remaining months of the year water from the Indian River had to be pumped into the areas. During field investigations, the water level at the site was approximately one foot above the ground surface. A continuous body of water was found at the site down to the depths investigated.

The United States Coast and Geodetic Survey maps indicate the average range of ocean tide in this area to be approximately 3 feet, and that the Indian River tidal range is approximately 1 foot.

The region under study is the area of St. Lucie, Martin, Indian River, and Okeechobee Counties. Two main aquifers are found in this region: a shallow non-artesian or locally artesian aquifer, and a deep artesian aquifer.

The shallow aquifer is the principal source of fresh water supplies in the region. It consists of the Anastasia formation and extends to a depth of about 150 feet below the land surface. It is composed principally of sand but contains thin lenses of shell, limestone, or sandstone which are generally more permeable than the sand.[2]

The shallow aquifer receives most of its recharge from rainfall in the immediate area. In general, surface water runoff is small. A small amount of recharge to the shallow aquifer comes from downward seepage of artesian water used for irrigation.

The discharge of the shallow aquifer is by flow into streams, or lakes, by direct flow into the ocean, by evapotranspiration, and by pumping from wells. Canals and ditches in the area carry some ground water away. The transmissibility of this aquifer in Martin County has been measured to be approximately 20,000 gallons per day per foot.[2]

The deep aquifer of the area and principal artesian aquifer of the region is the Floridan aquifer which underlies all of Florida and southern Georgia and consists mainly of permeable limestone beds. The top of the Floridan aquifer in Martin County is usually between 600 and 800 feet below the ground surface and underlies the Hawthorne formation which is an aquiclude. The thickness of the Floridan aquifer in this immediate vicinity is unknown, since no well has completely penetrated it. It is estimated to be about 2000 feet thick. The artesian pressure head (piezometric surface) in the area of the site is estimated to be about 45 feet.

The principal recharge area for the Floridan aquifer in this region is in and around Polk County where the limestone of the aquifer is overlain by semi-confining beds of the Hawthorne formation which are not impermeable and may permit downward leakage.

The points of discharge of the Floridan aquifer are springs and wells and where upward leakage occurs through the confining beds. There are no known natural springs in the region.

Underlying the 4 to 6 feet of surface peat is the Anastasia formation which extends to about elevations (-) 135 to (-) 155 feet and consists of grey, slightly silty fine to medium sand with varying amounts of fragmented shells. It also contains discontinuous pockets of cemented sand with shells and sandy limestone. Occasionally, discontinuous thin plastic clay lenses are found in the upper part of the formation. The Anastasia formation is an unconfined or non-artesian aquifer.

Below the Anastasia, the upper 100 feet of the Hawthorne formation at the site consists of a green slightly clayey and silty very fine sand. Indications are that the top of this zone is a semi-confined aquifer. Below about 250 feet and extending to the 400 foot depth of boring termination were sandy clayey silts which form the principal aquiclude for the underlying Floridan artesian aquifer.

All public and most domestic supplies of water on the mainland are obtained from ground water sources. Ground water is also used extensively for irrigation, stock watering and industry.

The cities of Fort Pierce and Stuart have public water supplies from wells developed in the shallow aquifer (see Table 2.1..-1, below). The City of Fort Pierce water supply wells are 10 miles northwest of the site and

Stuart wells are 11 miles southwest of the site. No large industrial water usage exists in the area. Irrigation and stock watering account for the largest withdrawals of ground water. Water from the shallow aquifer is used for irrigation by farmers growing vegetables and citrus fruits, by ranchers for pastureland, stock watering, and feed crops. Many of the artesian wells were originally drilled for irrigating vegetable crops.

TABLE 2.1.3-1

City	No. of Wells	Average Ground Surface Elevation	Average Depth of Wells	Average Gal. Per Day Per Well
Ft. Pierce	17	+20	110 ft.	500,000
Stuart	12	+15	105 ft.	170,000

The total use of artesian water for irrigation may be about 10 million gallons per day during the dry season. During the rainy season most of these wells are not used.

Despite the adequate, or more than adequate, supplies of well water on the mainland, no successful fresh water wells have been found on Hutchinson Island.

Field permeability tests made during this investigation have indicated a seepage rate of flow of about 15,000 feet per year in the top 30 feet of the sand deposits at the site. Taking the highest permeability coefficient obtained and a hydraulic gradient of 100% any discharge introduced into the ground at the reactor site would reach the Indian River in about a day.

The discharge would be greatly diluted immediately. Because of the proximity and width of the Indian River and the presence of slight flow of ground water toward the coast line, there is no possibility of subsurface flow from the site to the mainlands. Hence the possibility of any intrusion of accidental releases of radioactivity into mainland ground water supplies is extremely remote.

2.1.3.4 Population and Land Use

Aside from the power produced, the construction and operation of the Hutchinson Island plant will have a discernible effect, if any, only on the population of St. Lucie County directly to the west and on Martin and Indian River Counties which border St. Lucie County to the north and south. No inhabited land exists in the Atlantic within a radius of 100 miles to the east. The characteristics of the area within a radius of 40 miles or more can be summarized as follows:

a. An expanding area of the East Coast of southern Florida, having four principal concentrations of population - around the cities of Vero Beach, Fort Pierce, Stuart and West Palm Beach - all located in the coastal region;

b. An area of low, mostly flat land with elevations running from 50 feet in the western portion to sea level on the east. The central sections are about 20 ft. to 25 ft. above sea level. Swampy areas such as the St. Johns Marsh, Loxahatchee Slough, Allapattah Flats and a portion of Big Cypress Swamp occupy large parts of the study area;

c. Agri-business is the dominant contributor to the commercial economy. Citrus, vegetable and flower culture; cattle raising, including dairying; and related enterprises such as packing houses, processing plants, farm equipment and fertilizer sales, etc., are spread throughout the area;

d. The tourist attractions, and hence heavier seasonal concentrations of population, are found along the Intracoastal Waterway.

e. The general impression is that of an area which will expand its activities and population generally in the coastal regions with more gradual expansion of the agricultural economy to the westward as more land is suitably reclaimed.

Population

Data from the 1970 census[3] has only recently become available for major political subdivisions. The data given for counties are from this source. A population density diagram by sectors for a ten-mile radius from the plant is given as Fig. 2.1.3-2 and provides projected population densities by sectors for 1968, 1978, and 1990 based on the 1960 census. Until the more detailed breakdown of the 1970 census data is available this figure may serve to indicate the expected population growth in the various sectors. Projections from the more recent data are not expected to vary greatly from the information given in the figure.

Land Use

A narrative description of generalized land use patterns in the various subject counties follows. Further information describing agricultural activities and their location within the county is provided in this narrative analysis.

St. Lucie County

a. Location

St. Lucie County, with its 540 square miles of land area, is located on the Atlantic seaboard about 230 miles south of Jacksonville and 120 miles north of Miami. It contains the proposed site for the planned reactor on Hutchinson Island. It is bordered on the north by Indian River County, on the west by Okeechobee County and on the south by Martin County. Almost all of its area lies within 25 miles of the plant site and its northwestern corner, the most distant point, is about 31 miles distant.

b. General Description

Like its neighbors, St. Lucie County is also flat. The western three-fifths of its area is largely covered by St. Johns Marsh in the northern portion and the Allapattah Flats to the south. The remaining two-fifth, paralleling the coast, is flatwoods country but much of the area has been put to productive use for cattle and citrus operations. The swampy area varies in elevation from about 50 feet at the western limits to 25 feet on the east. The flatwoods run east from there to sea level at the Intracoastal Waterway.

Long, narrow, sandy keys known as Hutchinson Island and Sprang Island lie along the entire mainland between the Intracoastal Waterway and the Atlantic Ocean. They are separated from each other by Fort Pierce Inlet, opposite the city of the same name.

The area near the proposed plant site is not populated nor is most of Hutchinson Island. The portion near Fort Pierce Inlet, however, does have resort developments on it.

c. Principal Population Concentration

Fort Pierce, the county seat of St. Lucie County, is located on the west shore of the Indian River, a little north of the center of the county, and a distance of 8 miles from the site. Its 40,330 inhabitants in the City and surroundings in 1970[3] account for over 60% of the entire county's population.

Port St. Lucie is located in the southeastern corner of the county a distance of 8 miles from the site. It has an area of more than 51 square miles, about five times as large as Fort Pierce. It too is an incorporated city and has a population of 330 persons.[3]

Other population clusters are located in the north at Lakewood Park; adjoining Fort Pierce at Sunland Gardens, Harmony Heights and Paradise Park; and in the east-central section at Collins Park Estates.

d. Basic Land Uses

The Agri-business Committee of the Fort Pierce-St. Lucie County Chamber of Commerce reports that two-thirds of the land area of the county is given over to the general agricultural industry; 41% pasture land; 23% citrus; and 1% vegetables. The citrus figures are somewhat higher than those given in estimates by the Florida Department of Agriculture but are considered acceptable.

The citrus groves are, in general, located in two major areas in the northern and central sections of the county and generally west of Fort Pierce. The first area is longitudinal in direction and about three or four miles inland from Indian River, and extends about ten miles south of the Indian River - St. Lucie

County line. The second is connected to the first at its southern extremity and turns west of the first area. The nearest of the major grove concentrations are eight or nine miles removed from the site.

The cattle-raising region is largely in the western half of the county but not limited to that area, with 41% of the county's land area given to this use. Small beef and dairy cattle herds can be found between the citrus areas west of Fort Pierce and west of Port St. Lucie.

Vegetable growing is a much smaller part of the county's agribusiness. Among the crops produced are tomatoes, squash, cabbage and dandelions. Of these, tomatoes represent the major money crop. The 2,103 crates reported sold in the year ending June 30, 1967, represent 99.6% of the entire reported vegetable crop.

The beekeeping industry produces well over 600,000 pounds of honey a year. Horse breeding, swine production, poultry farms and a number of ornamental nursery farms are also part of the county's agricultural production.

Industrial employers of St. Lucie County are mainly centered around Fort Pierce. Some of these and their employed-force brackets are:

Bell Division of Ward Baking Company	200 + Employees
10 Packing houses with seasonal employment	101-200 Employees
6 Packing houses with seasonal employment	51-100 Employees
Sherold of Florida, Inc. - Quartz Crystals (Electronics)	51-100 Employees
Plastic Specialties - Plastic Pipe Fittings	26-50 Employees
Rinker Materials Corp. - Concrete Products	26-50 Employees
Wilson-Toomer Fertilizer Co. - Fertilizer	26-50 Employees
12 Miscellaneous Employers	11-25 Employees

e. Special Features

St. Lucie County Airport is located about two miles northwest of Fort Pierce and is owned and operated by the Fort Pierce Port and Airport Authority. It has four 5,000 foot runways 200 feet wide. The east-west runway is equipped with lighting facilities. The airport is approximately 12 miles from the plant site. Two small, private airports - Godwin and Sunrise - are three and a half miles west and two and a half miles southwest, respectively, of Fort Pierce. Godwin is 12 miles from the plant site and Sunrise is 10 miles from the plant site. None of the airports in St. Lucie County are served by commercial airlines. The deepwater port of Fort Pierce is federally maintained but owned and operated by the Fort Pierce Authority. It is located at Fort Pierce Inlet and the Intracoastal Waterway, 18 miles north of the eastern terminus of the cross-state canal running from Stuart to Fort Myers. The port is served by the Florida East Coast Railway. A coast guard station is located on the causeway just inside the Fort Pierce Inlet. The publicly owned utilities of the City of Fort Pierce include an electrical power generating plant and a 6 million gallon per day water treatment plant.

f. Probable Future Land Uses

It is probable that some 15,000 additional acres will be added to the citrus production land resources inventory by 1974. Another 30,000 acres are estimated to be added by the year 2000. It is further estimated that 25,000 to 30,000 acres of pasture land will be added during the next 30 years. These changes will come about as the result of the reclamation of swampy lands in the western portion of the county.

Martin County

a. Location

Martin County is on the East Coast of Florida, with its northern limits near St. Lucie Inlet. Its county seat, Stuart, is located about 25 miles north of the City of West Palm Beach and 18 miles south of Fort Pierce. It is bordered on the north by St. Lucie County; on the west by the Lake and County of Okeechobee; and on the south by Palm Beach County. The land area of the county is within 35 miles of the plant site and its northern border, north of Jensen Beach, is within six miles of the site.

b. General Description

The topography of this county differs somewhat from its northerly neighbors. The swampy area of the Allapattah Flats and the Loxahatchee Slough, part of the northern reaches of the Everglades, do not extend fully to the county's western boundaries.

In the western third of the county, the flats are interspersed with large patches of flatwoods. The flats, slough and glades regions have more open water areas observable.

Agricultural activities in Martin County include cut-flower production. The St. Lucie River, with its connections to the Intracoastal Waterway, the St. Lucie Canal and the ocean, provide boating and fishing activity.

c. Principal Population Concentrations

Of the 28,035 persons living in Martin County in 1970,[3] more than one-half live in Stuart. Another population cluster, some 2,283 persons, is at the small city of Indiantown which is located in the south-central portion of the county, about 26 or 27 miles southwest of the plant site. Small concentrations will be found at Port Sewall, Salerno, Gomez and Hobe Sound. These small communities are along the Waterway south and east of Stuart, ranging from 11 to 22 miles from plant site.

d. Basic Land Uses

Agriculture is the primary use of land in this county. As of December 1967, the Florida Department of Agriculture reported that over 39,000 acres of Martin County were in developed groves. This is almost 11% of its total land area.

The County Agent estimates that:

The citrus groves may be the end of 1968 cover almost 50,000 acres;

There are about 500 acres in the ornamental horticultural category planted to supply the cut flower trade in chrysanthemums, roses, Easter lilies, and miscellaneous varieties;

There are about 20,000 head of beef cattle and a minor number of cattle in dairy herds;

The row crops, planted on 2,500 acres, include tomatoes, cucumbers, peppers, and watermelons.

The County Agent states that the agricultural activities are located west of the Florida Turnpike; the cut-flower operations are west of and close to the Stuart area because of the climatic advantages provided by the St. Lucie River. Residential and commercial uses are east of the Parkway and, in general, east of U.S. #1. Some industry is found in Stuart and also clustered near the airport.

e. Special Features

Stuart Airport, Witham Field, a county-owned airport having mile-long paved runways, is located just outside the city limits of Stuart and at its southeastern corner. It is 11-1/2 miles from the plant site. No commercial airlines serve this airport.

Stuart owns and operates its own water system, supplied by deep wells. The water is subsequently treated.

Five small municipal parks are within the city. Jonathan Dickinson State Park is located in the southeastern corner of the county, south of Jupiter. It covers some 16 or 17 square miles and lies within 29 miles of the plant site. Its facilities include picnic tables, refreshments, boat ramps and camp sites.

The largest industrial employer is Grumman Aircraft Engineering Corporation, located at the airport and employing about 300 people. Smaller industries are: Hoosier Metal Fabricators; R&H Fittings; Outboard Marine Corporation; and Southeastern Printing Company.

Stuart is a boating and fishing resort, and boatmen and fishermen increase the transient population on both a year-round and seasonal basis.

g. Probable Future Uses

Based upon the information supplied by such authorities as the City Manager of Stuart, the County Agricultural Agent and local real estate brokers, it is believed that future expansion of industry will be mainly in the Stuart area and probably near the airport's present industrial cluster.

The residential expansion will be eastward toward the Waterway and southward toward Salerno. Some westward expansion is anticipated between Palm City and the Florida Turnpike. A very large housing development, which will site astride the Martin-Palm Beach Counties boundary, is in the "talking" and promotional stage. It is reported to be some 5,400 acres in size and is intended to serve as the development center for a 17,000 acre improvement. Plans are vague at this time.

Commercial development of the Stuart area is now taking place and will be expanded.

Indian River County

a. Location

All but a few square miles in the northwest corner of Indian River County lie within the study area. Its most southeasterly point is about 15 miles from the plant site. Its north line, at its junction with the ocean, is 37 miles north-northwest of the proposed plant site. Its eastern boundary is the Atlantic Ocean and on the west is Osceola County. Its two southern neighbors are St. Lucie and Okeechobee Counties.

b. General Description

A generally flat expanse of land, somewhat poorly drained and having the western three-quarters of its area covered by the St. Johns Marsh, this county is one of the major citrus producers of Florida. The general land cover is flatwoods. Major development has been confined to the eastern one-quarter, along the coast. Agriculture is dominant in the central section of the county, with cattle raising spotted in several areas but noticeably in the southwestern corner of the county, some 30 miles northwest of the plant site.

c. Principal Population Concentrations

Of the 1970 population[3] of 35,992, about 60% are concentrated in and around the county seat of Vero Beach. Approximately 10,000 people live in the northeastern eighth of the county and the remaining 2,000 are spread very sparsely around the western two-thirds to three-fourths of the county.

d. Basic Land Uses

Crop use accounts for about 15% of the total county land area. Pasture and range lands cover about one-third of the county. The largest concentration of citrus groves is along the coastal region in the southern three-quarters of the county and lying between Interstate #95 and the Intracoastal Waterway. Another large, but not so extensive, grove area lies along the St. Lucie-Indian River Counties boundary and west of I-95.

The vegetable and other row crop area is mainly concentrated in the northern part of the county, midway between I-95 and the Osceola-Indian River Counties boundary and it covers some 35 to 40 square miles of area.

Cattle raising has previously been commented upon. In this connection, it should be noted that the directions of expansion are west and north, and mainly in the western third of the county.

Some 29,000 acres, about 9% of the county, can be designated as developing urban area and, with the exception of the Fellsmere community, about 37 miles northwest of the plant, is along the Waterway and the ocean.

There has been recent and appreciable industrial buildup on the mainland around the City of Vero Beach. Among the important employers are:

Piper Aircraft Company, Airplanes	1,835 Employees
Verogrand Corporation, Machinery	100 Employees
Crosby Builders, Building Supplies	57 Employees
Hobart Brothers, Electrode Coatings	35 Employees
Templin Fabricators, Trusses	30 Employees
Karnish Instruments, Aircraft Parts	30 Employees
Airlite Processing, Permalite	16 Employees
Miscellaneous Service Employers	100 Employees

e. Special Features

The Pelican Island National Wildlife Refuge is located along the Intracoastal Waterway at Sebastian, about 35 miles from the plant site.

There are two airports in the county - Sebastian Municipal located 35 miles from the plant site at the City of Sebastian and Vero Beach Municipal - located at Vero Beach 20 miles from the plant site. Vero Beach Municipal is served by commercial airlines. Sebastian is not.

f. Other

A scenic attraction, McKee Jungle Gardens, about three miles south of Vero Beach on U.S. #1 and a horse breeding farm at Fellsmere bring visitors to those areas.

The City of Vero Beach operates its own water system, having deep wells as its source. Its water plant has a capacity of 6 million gallons per day.

The municipality also has its own electrical power generating and distribution facilities.

g. Probable Future Land Uses

There is little to indicate any major changes in the types of land use in the future. The extent of use will increase, especially in the coastal region where further urbanization will take place. It is probable that strip development along the route of Interstate 95 will occur in the next few years and that such change will be related to the agricultural expansion in the middle and western parts of the county.

2.1.3.5 Environmental Baseline

The Hutchinson Island site is bordered on the east by the Atlantic Ocean and on the west by the Indian River, a brackish body of water. On the north side of the site is Big Mud Creek, an inlet off the Indian River. The Island itself was covered by mangroves. The perimeter included primarily red and white mangroves and the interior was primarily black mangroves. Mosquito control practices, which started back in the 1930's resulted in the destruction of most of the black mangroves. The destruction of the mangroves resulted in much of the Island being virtually barren (See Appendix 2 and Figure 2.3.8-1).

The Indian River, including Big Mud Creek, was surveyed by FP&L during the initial site evaluation (see Appendices 3 and 4). It was found that the river supports an enormous amount of manatee grass and several species of macroscopic algae. This forest contains large numbers of gammorids, shrimp, isopods, small crabs and juvenile fish. Egg masses and single eggs of various invertebrates are also found. Branches and leaves of plants support large numbers of small worms, attaching algae, diatoms, and protazoa. The benthic population is large, containing many shellfish, tube dwelling worms and crustaceans. The Indian River supports the nursery concept very well. It affords protection and an abundance of food to a great many animals. It is a place where the recycling of nutrients - organic matter to inorganic matter to organic matter - is a normal process.

The growth of plants and animals in the River is heaviest toward the western shore; possibly because of addition of nutrients, in the form of sewage and agricultural run-off, from the mainland.

The Intercoastal Waterway channel in the Indian River is not nearly as heavily populated as the normal river bottom. Big Mud Creek, which was given its name years ago because it always appeared to be muddy, has been dredged to a depth of about 55 feet. Dredging in Big Mud Creek is by no means a new practice as a great deal of the fill for Highway A1A was dredged from it. This creek area has been altered and in the future can be expected to develop its own unique biological system.

The Indian River in the vicinity of Hutchinson Island supports speckled trout, channel bass, snook, sheepshead, and mangrove snapper. Commercially, black mullet and blue crabs are caught and some bait shrimp are taken. Shellfish, oysters and clams, were harvested in fair quantities until July 1970, when this practice was banned because of pollution from sewage discharges (see Section 2.3.6.1.2).

Short term ecological investigations of the ocean off-shore from the site were conducted in February and June 1969, and in April 1970. (The findings of these studies are presented as Appendix 3). These studies, which included investigations at a total of 62 sites covering the area in a six mile radius from the plant site, showed the ocean bottom to be devoid of any important sessile marine resources. The species observed included some scallops at one station about six miles off-shore, sand dollars, tube worms, anemones, starfish, sea urchins, and hermit crabs. No grasses, attached vegetation, or reef outcroppings were in evidence.

Hutchinson Island, and Jupiter Island immediately to the south, are significant as nesting areas for sea turtles. In 1968, it was reported that 5,265 turtles nested on Hutchinson Island. Nearly all of these were loggerhead; only 15 nests were those of the now rare green sea turtle.

Commercial fishing in St. Lucie County was a $593,000 business in 1970. The amount of fish taken that year was representative of the fishing prevalent over the past six years. About 74 percent of the fish taken are pelagic and were caught during migration in Florida waters. These include the bluefish and king and spanish mackerel. Twenty-three percent of the fish were taken from the Indian River. Black mullet comprised most of this catch. In the past few years extensive scallop beds have been developed off-shore from Cape Kennedy and southward to Fort Pierce. These beds are primarily in 10 to 40 fathom water. In 1970, 154,300 pounds of scallops with a dock-side value of $146,500 were harvested by St. Lucie County fishermen.

The mangroves which covered Hutchinson Island plant site and much of the other area on the off-shore island prior to the initiation of the mosquito control program in the 1930's and 1940's provided a very effective breeding and refuge area for many different species. The shallow pools around the roots of the mangroves provided a habitat well suited for many species. from plankton through juvenile forms of crustacean and fish. Insects and some reptiles and small mammals inhabited the higher areas and birds used the trees for rookeries and fed in the pools. Some larger animals, such as racoons, cougars, otters, and deer, would also frequent the mangrove areas.

With the destruction of the mangroves, from mosquito control operations, this ecological community dissolved and the area became barren. This was the case at the plant site prior to construction activities and is the case in many areas of the off-shore island at the present time.

2.1.3.5.1 Air Quality

The air quality of the site has never been studied. However, considering the limited sources of air pollution in the area and the distances from the site, the air quality is expected to be very high.

Because of the distances from possible sources of pollution to Hutchinson Island and the fact that the predominant wind is from the easterly sector, there is expected to be an insignificant effect on the air quality at the site.

The background suspended particulate concentration at the site, due to dust, pollen, etc., is expected to be in the range of 20-30 ug/m^3.

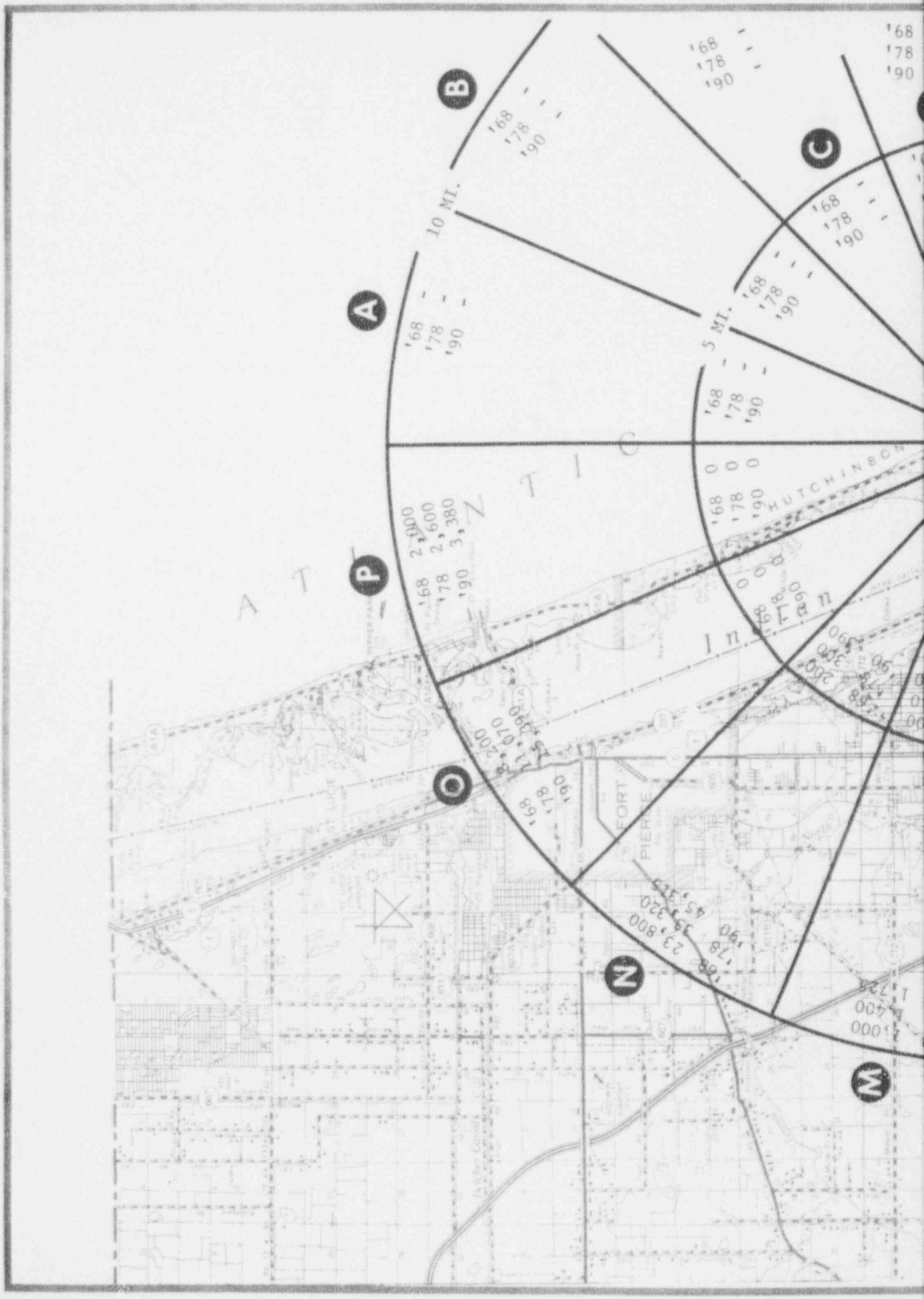
References

1. Barraclough, Jack T., Ground Water Resources of Seminole County, Florida, U.S.G.S. and Florida Geological Survey, Report of Investigations No. 27. 1962.

2. Bermes, Boris J., Interim Report on Geology and Ground Water Resources of Indian River County, Florida, Florida Geological Survey, Information Circular No. 18, 1958.

3. 1970 Census of Population PC(VI)-11 Florida (Advance Report), December 1970, U.S. Department of Commerce, Bureau of the Census, Washington, D.C.

HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
METEOROLOGICAL STATION
FIG. 2.1.3-1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HUTCHINSON
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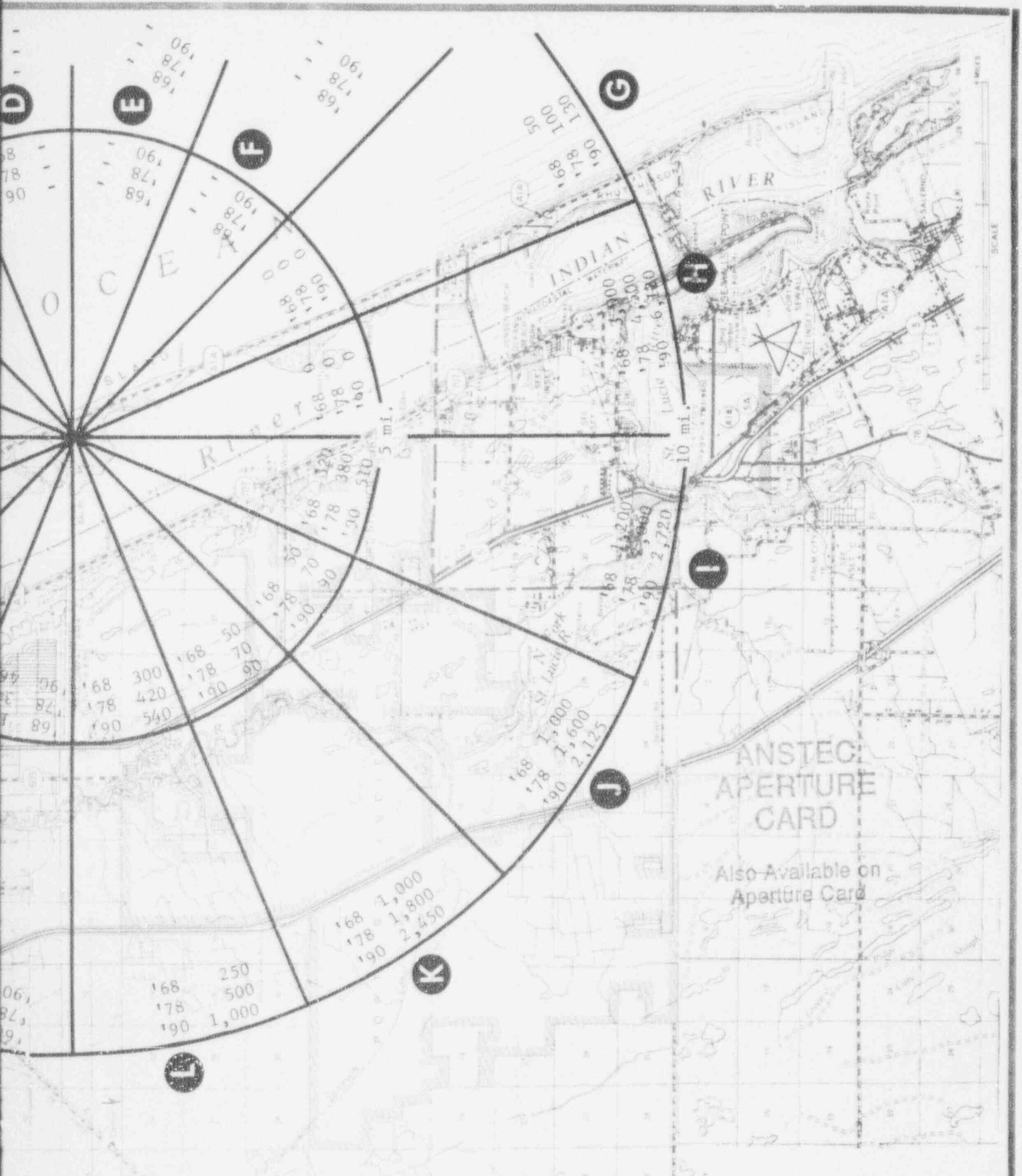

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HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
POPULATION DENSITY
FIG. 2.1.3-2

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2.1.4 ELECTRICAL POWER SUPPLY AND DEMAND

The requirement for new generating capacity from Hutchinson Island is best understood in the light of the historical growth of power requirements on Florida Power & Light's system together with projections of this growth into the future. The FP&L system is one of the most rapidly growing in the country. In 1970, electric sales increased 13% during the year for a total increase since 1960 of 233%.[1] This can be compared with a growth of 104% since 1960 for the nation. In terms of generating capacity this increase was 213% since 1960 against an increase for the nation of only 101%. This tremendous increase in demand is, of course, due to the population growth in the State of Florida and increased per capita use of electricity. The 1970 census figures show that Florida's growth was second only to that of California when the total number of new residents is considered, and second only to that of Nevada on a percentage basis. This influx of people has since the end of World War II resulted in continually increasing demands for power. As will be seen on Figure 2.1.1-1, the Florida Power & Light's system covers a large portion of the State and especially those areas in which population growth is most intense.

In order to meet the continually increasing demand, generating units of increasing size have been added at least annually to the system, and in several years two units per year have been added. Committments for equipment and construction services are made as a result of a continuous study of area load, growth patterns and forecasts of market and regulatory conditions affecting unit economics and delivery and construction schedules. For example, Hutchinson Island plant equipment was committed in the fall of 1967 and construction contracts were finalized in the summer of 1968, some five years in advance of the then scheduled completion date of spring 1973. Since that time construction difficulties and regulatory delays have extended the schedule to 1974.

Table 2.1.4-1 portrays the growth of the FP&L system load and generating capability for the years from 1961 to 1970, inclusive. The projected load for the period 1971 - 1975, and the presently planned program of expansion of generating capability are set forth in Table 2.1.4-2.

The excess of generating capability over peak load is called "reserve". Adequate reserve capability is necessary to cover a variety of contingencies such as actual load being greater than forecast, and equipment, plant and transmission line outages for maintenance. If adequate reserve were not provided, loss of service continuity and reliability would occur which in turn would result in great hardship on our energy-dependent society.

Adequate reserve is generally considered to be 15-25% of the peak load.

The generation addition program set forth in Table 2.1.4-2 was planned to cover not only the annual growth in customer load but in addition to provide at all times an adequate reserve.

If forecasts of time required for regulatory approval, equipment delivery and construction are correct and the units planned come in on schedule, then

TABLE 2.1.4-1

FLORIDA POWER & LIGHT COMPANY
SUMMER PEAK LOADS AND SYSTEM CAPABILITY
1961 - 1970

Year	Peak Load 15-Min Gross - MW	Capability MW
1961	1636	1963
1962	1874	2263
1963	2163	2538
1964	2419	2938
1965	2693	3597
1966	3038	3498
1967	3338	3898
1968	4004	4298
1969	4563	5125
1970	5230	5569

TABLE 2.1.4-2

FLORIDA POWER & LIGHT COMPANY
PROJECTED SUMMER PEAK LOAD & PLANNED GENERATION EXPANSION
1971 - 1975

Year	Projected 15-Min Peak Load-MW	Capability Addition-MW	Total Capability-MW	% Reserve
1971	5910	1172	6741	14.1
1972	6670	1128	7869	18.0
1973	7530	400	8269	9.8
1974	8500	1650	9919	16.7
1975	9600	800	10719	11.7

load increases are met, and reserve margins are adequate. If, after commitments are made, regulatory processes lengthen or equipment or construction is delayed, then schedules are not met, reserve margins shrink or disappear entirely, and the system's ability to meet load increases and maintain reliable continuity of service, is jeopardized. If such delays become apparent early in the schedule, actions can be taken to supplement the expansion program to mitigate the consequences of the delay. If, however, delay occurs after construction is far advanced, as is the case with Hutchinson Island plant, very few steps can be taken to offset the delay.

Because of the extremely long period of time to bring generating capability into being, it is of critical importance that delays in construction schedules be minimized.

All other systems are characterized by the same expansion and generation addition patterns, and all are beset by the same contingencies which could result in delay. All systems have experienced delays and reserve margins are low throughout Peninsular Florida and the entire southeast. The report of the Southeastern Electric Reliability Council[2] reports reserves of only 13% for the summer of 1971, and the adequacy of reserves in ensuing years depends on dozens of generating projects remaining on schedule and entering service as planned. FP&L cannot, however, practically depend on electric generating capability outside Florida. The long transmission lines that would be required are subject to normal transmission losses and to natural hazards such as hurricanes and tornados. Sound engineering planning for system reliability requires the siting of adequate generation near each load center, and then interconnecting generation sites with strong transmission inter-ties. When backed up by emergency inter-ties with other Florida systems, maximum reliability and continuity of service to customers is achieved.

References

1. Florida Power & Light Company Annual Report for 1970, FP&L, Miami, Florida.

2. Southeastern Electric Reliability Council, Coordinated Bulk Power Supply Program, Report to: The Federal Power Commission and Cognizant State Public Service Commissions, in Response to Federal Power Commission Order No. 383-2, 1971-1980, April 1, 1971.

2.2 ENVIRONMENTAL APPROVALS AND CONSULTATION

The following discusses the zoning, planning, water quality, air quality, dredging, fish diversion, and construction effects with respect to the consultations held and the approvals and licenses secured.

Zoning

After discussion with the St. Lucie County Planning and Zoning Commission, an application for a zoning classification change for the Hutchinson Island site was filed with them on February 6, 1968. After an advertised public hearing was held, the creation of a public service district was recommended by the Planning and Zoning Commission to the St. Lucie County Commission. Advertised public hearings were held on May 21, 1968, June 13, 1968, and July 2, 1968. The St. Lucie County Commission approved the rezoning as a Public Service District by letter of July 9, 1968. A copy of this letter is enclosed as Exhibit A in Appendix 5.

Planning

Discussions were held with the St. Lucie County Regional Planning Council in mid-1968. This council which is concerned with economics and land use planning is to be distinguished from the St. Lucie County Planning and Zoning Commission which is concerned only with zoning matters. Discussions have also been held with the Director of the Florida State Department of Community Affairs at Tallahassee and with Homer E. Still, Chief of the Bureau of Planning of the Florida Department of Administration. Informal discussions have been held with the Director of Planning of the Atlantic office of the Department of Housing and Urban Development. These organizations do not issue permits and licenses.

Water Quality

Certification has been obtained from the State of Florida. To establish the statutory background for this certification, a copy of Chapter 28-5 of the Florida statutes - "Rules of the Florida Air and Water Pollution Control Commission" is included as Exhibit B in Appendix 5. The Florida water quality standards were approved by the United States Department of the Interior by letter of January 17, 1969, to Governor Kirk of Florida, included as Exhibit C in Appendix 5. The certification of the Department of Air and Water Pollution Control of the State of Florida was conveyed in the Department's letter of February 12, 1971, to Florida Power and Light Company. A copy of this letter is enclosed as Exhibit D in Appendix 5. Relevant statutory authority is cited in the above and subsequent attachments.

Dredging

Approvals were required from the Corps of Engineers, Department of the Army, and from the Trustees of the Internal Improvement Fund of the State of Florida for the dredging of the access channel into Big Mud Creek and for fill dredging. The Internal Improvement Fund was established as early as 1854 for the purpose of administering Florida State owned lands and for protecting the interests of the public in such lands. Under Florida statutes, Chapter 253, Title 17, Public Lands and Property, the Fund has title to submerged lands throughout the state and must approve all dredging permits on navigable waters. Amendments in 1967 to Section 253.123 and related subsections require biological and ecological studies before dredging permits can be issued. Attachments E and F are approvals from the Corps of Engineers for the Hutchinson Island dredging. Attachments G, H, and I are permits from the Trustees of the Internal Improvement Fund of the State of Florida for the barge access channel and the removal of fill.

No permit is required from the National Center for Air Pollution Control for this installation, nor is a permit concerning air pollution required from the Florida Air and Water Pollution Control Commission.

2.3 ENVIRONMENTAL IMPACT OF THE PROPOSED FACILITY

2.3.1 LAND USE COMPATIBILITY

The impact of the plant construction and operation on land use will be minimal. Neither the present nor future use of the land in the vicinity will be affected and nearly two miles of beach will be preserved in its natural state for the enjoyment of the public.

The present use of land within a 25-mile radius has been discussed in detail in Section 2.1.3. The construction and operation of the plant is expected to have effects as follows:

a. Industrial Operations

No industrial operations of any size are now carried out in the vicinity of the site. Small concerns in the area are, to a large extent. associated with the building and citrus industries, and it is difficult to see that they would be in any way affected by the plant.

b. Transportation

During the construction of the plant, some of the heavier components will be shipped to the site through the inland waterway and Big Mud Creek. There will be increased truck traffic on State Road A1A and probably on State Road 70, connecting to the Florida turnpike. Route A1A will, of course, be used by the employees at the plant during its operating life. With less than 75 employees at the site, the passenger car traffic in the area will not be noticeably affected. Trucks will be required for the transport of new fuel. Their route will probably be over the south bridge on the island and then directly to the Florida turnpike. The possibility of using barge transport for spent fuel is presently being considered.

c. Recreational Uses

The site has no developed recreational areas. The beach is used by the public for bathing and fishing and the Big Mud Creek and Blind Creek areas are used for fishing. There is casual use of other areas for camping and hunting. FP&L does not anticipate that the project will result in change in these uses.

d. Wildlife Preserves

Since most of the site area will be preserved in its natural state, it will continue to serve as a refuge for migratory water fowl and other water birds.

e. Population Distribution

The only direct effect will be a slight increase in permanent residents in the area as a result of the operating staff of the plant. The less than one hundred or so families involved will have a proportionally limited effect on the growing population of St. Lucie County.

f. Waterways

There will be some use of the inland waterway as mentioned above, but there will otherwise be no effect on either the Indian River waterway or the Atlantic.

g. Military Installations and Concentrations of Hazardous Materials

There are no military installations in the nearby area. The closest installation is Patrick Air Force Base approximately 60 miles to the north. No small installations at closer distances are known. There are no known concentrations of hazardous materials such as explosive stores, chemical warehouses, or ammunition depots within the area.

2.3.1.1 Impact of the Facility

Regarding the future use of the land, it seems reasonably safe to predict that Hutchinson Island will follow the pattern of other similar Florida beaches and the precedent set by the developments now present at both ends of the island. If and when water supplies become available to the as yet uninhabited center portion of the island, it can be expected that housing developments will appear and the area will be occupied, possible to a large extent by retirees, by summer and winter visitors, and by a transient tourist population. It is difficult to conceive any way in which such a development would be affected by the Hutchinson Island plant, particularly as the FP&L property will provide a buffer zone between the nearest privately held land, both to the south and north, and the plant area itself. It is believed that keeping this nearly two miles of beach in its natural state for the convenience of visitors will serve as a considerable attraction, both to the permanent residents of Hutchinson Island and to the tourists on which so much of Florida's economy depends.

2.3.1.2 Preservation of the Environment

As discussed above, plans are under development which will both preserve the natural ecology and protect the indigenous wildlife while at the same time provide some access to the beach for the public for swimming, fishing, picnicking, etc. FP&L's intentions and concepts were first discussed with representatives of the National Park Service, Bureau of Sport Fisheries and Wildl'fe, the Bureau of Recreation and others on April 16, 1969.

2.3.1.3 Historic Sites

There are no sites or locations either in the plant site or on Hutchinson Island of any known historic significance. There is a local tradition that there may be Indian mounds within the site area and a few have been identified. It is doubtful that any will be encountered during construction but appropriate steps will be taken through the proper State agencies to properly preserve anything of archaeological or other importance, if found. A few fossils of possible interest have been found during excavation and brought to the attention of Florida State geologists. "The National Register of Historic Places"[1] and the Federal Register[2] have been consulted and the only two sites listed as being even close to the area are the Pelican Island National Wildlife Refuge and the Site of Salvors Camp for Spanish Wrecks. Both sites are near the town of Sebastian in upper Indian River County and are more than 30 miles from the site. At this distance, no effect from the plant is considered possible. A letter from the Advisory Council on Historic Preservation of the Department of Interior (copy enclosed in Appendix 6) states that "no properties are affected which are listed on the National Register" and raises no comment. Letters from the State of Florida Board of Archives and History and a map of the area are also enclosed in Appendix 6. The map shows the location of middens and mounds of possible interest all away from the plant area. FP&L cooperation in preserving sites of historic significance is acknowledged.

References

1. The National Register of Historic Places 1969, United States Department of the Interior-National Park Service, Washington, D.C.

2. Federal Register, Vol. 36, No. 35, p. 3316, Feb. 20, 1971, and for March 2, 1971, p. 3931.

2.3.2 WATER USE COMPATIBILITY

The only cooling water employed will be that taken from and returned to the Atlantic Ocean. The procurement of the necessary permits for the use and discharge of this water is discussed in detail in Section 2.3.3.6. The fresh water requirements are relatively small, and this water will be procured from the City of Fort Pierce Municipal System. Any water rights necessary will be part of the contract now being negotiated with the City. The fresh water resources available to the City of Fort Pierce are considered to be more than adequate for all foreseeable future demands.

2.3.2.1 Seawater Temperatures and Currents

Seawater temperatures are now being measured and continuously recorded from a point offshore roughly corresponding to the intake and discharge locations. Table 2.3.2-1 shows the temperatures at five-day sample intervals, the daily maximum and minimum values for the surface and bottom levels during the first six months for which the continuous calibrated recording station has been operated.

During the period July 12 to July 20, 1969, a series of current measurements was conducted at a location approximately 1500 ft. offshore in a water depth of approximately 25 ft. The current meter was located approximately 9 ft. below the water surface. Continuous measurements of speed and direction were obtained.

The currents were generally oriented parallel to the shoreline. The predominant currents were directed south; however, reversal of currents to the north and slack currents occur for short periods of time. The threshold of the current meter (propeller type) is estimated at 0.1 ft./sec. There seemed to be some correlation in current direction with the 24.8 hr. tidal period; however, the correlation was very weak. The predominantly southerly current direction may be due to a reported weak counter current of the Gulf Stream. The maximum south and north currents are 1.2 ft./sec. and 0.6 ft./sec., respectively. Periods of apparent slackwater were observed to occur for durations up to eight hours. A histogram of the measured currents for this 8-day period is presented in Fig. 2.3.2-1.

There are no known water quality standards, either State or Federal, concerned with the gas concentrations and chemical composition of the seawater. The shape of the warm water plumes and the isopleth characteristics are discussed in Section 2.3.3.

2.3.2.2 Impact of Water Use

Except for biological and ecological effects, as discussed in Section 2.3.6, there is believed to be no other impact of importance due to the use and discharge of the seawater. As previously stated, fresh water supplies are of such an extent and the amount used by the plant is so comparatively small that no effect on municipal or industrial uses can be foreseen. The intake and discharge structures will not significantly affect use of the beach.

2.3.2.3 Temperature Effects

The Atlantic Ocean can be considered the world's second largest heat sink and the over-all effect on it of the heat released is almost infinitely small. The only effects of importance to be considered are those thermal changes in the immediate vicinity of the discharge. These are discussed in Section 2.3.3.4. It may be of general interest to consider the volume of cooling water discharged in a year by the plant as compared with the total volume of the Atlantic Ocean. The Atlantic Ocean, as given by one reference,[1] has an area of 33,420,000 square miles and an average depth of 12,257 ft. Using these presumably rather approximate figures, the Atlantic would contain some 8.55×10^{19} gallons. The cooling water discharged is approximately 530,000 gpm so that in one year approximately 2.5×10^{11} gallons will have been discharged. The total amount of water pumped through the plant in one year is then roughly one one-hundred-millionth of that of the volume of the heat sink into which it is discharged.

It also may be of interest in considering manmade versus natural heat sources to consider the heat released by the plant as compared with the heat absorbed by the ocean water from sunlight. There are considerable differences in the values given by different sources for the heat intensity of solar radiation. However, a standard handbook[2] gives values between 75 (7 AM) and 296 Btu/hr/sq ft at noon for the latitude of Hutchinson Island. From the referenced table a value of 100 Btu/hr/sq ft would be quite conservative. The plant, when operating at capacity, releases 1640 Mw of thermal energy to the sea. This is equivalent to 5.6×10^{9} Btu/hr. At the 100 Btu rate given above, this same number of Btu's is received by 2.02 square miles of the ocean's surface after exposure to sunlight for only one hour. It will be seen then that the plant release is minute in comparison to the energy received by the ocean from natural sources.

References

1. The World Almanac, Newspaper Enterprise Association, Inc., 1969, p. 713.

2. Strock Clifford (Ed.), Handbook of Air Conditioning, Heating and Ventilating, The Industrial Press, New York, N. Y., 1959, pp. 1-183.

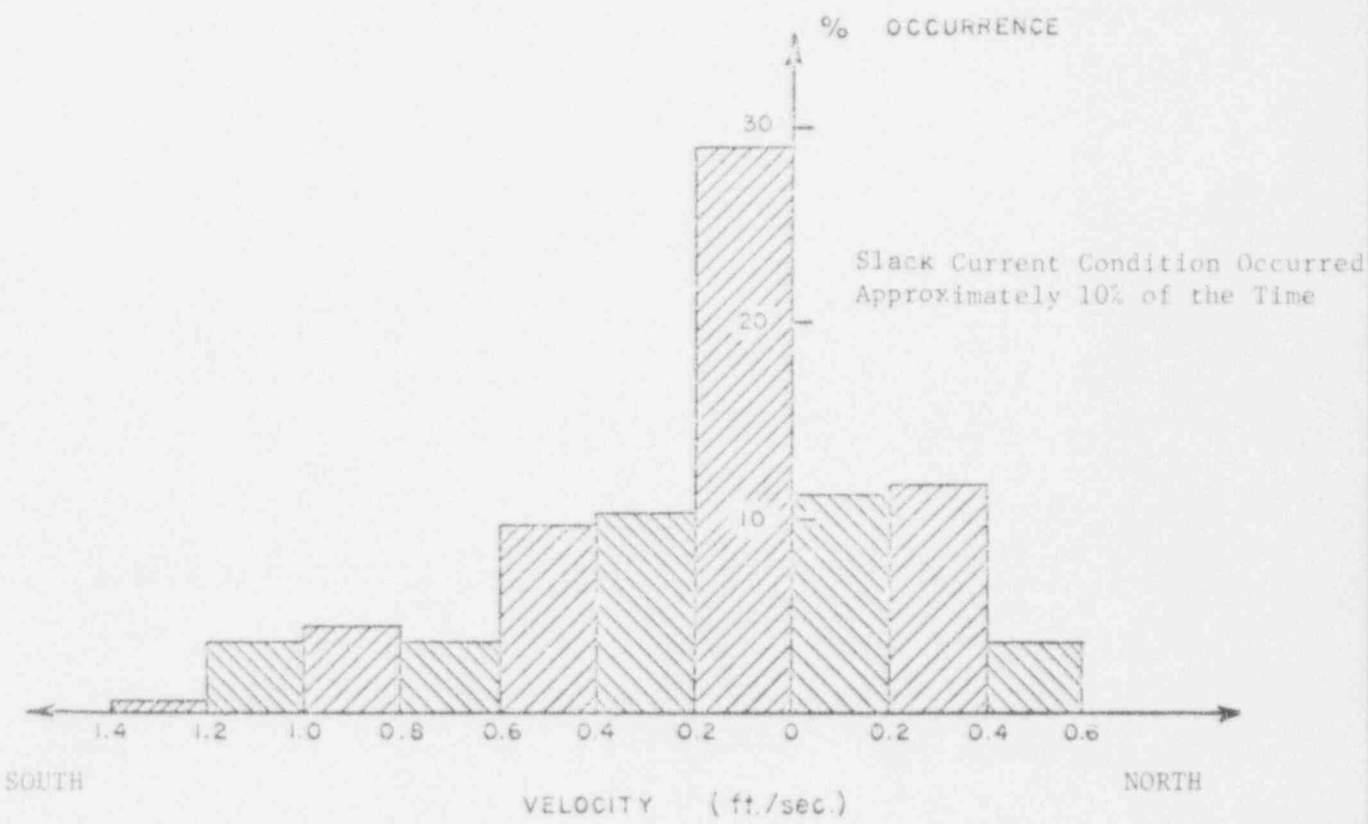
TABLE 2.3.2-1

REPRESENTATIVE SEA WATER TEMPERATURE DATA

As taken near surface (two feet below MLW) and two feet above sea floor, (approx. 30 ft. depth) and 2000 ft. offshore. Condensed by listing data for every fifth day.

			Temperature °F			
			Surface		Bottom	
Year	Month	Date	Max.	Min.	Max.	Min.
1970	Sept.	1	84	82	81	79
		6	86	84	78	77
		11	86	85	83	81
		16	84	83	84	84
		21	84	83	83	83
		26	81	81	82	81
1970	Oct.	1	82	82	81	80
		6	81	81	81	81
		11	81	81	80	80
		16	82	81	80	80
		21	81	81	78	78
		26	-	-	79	78
1970	Nov.	1	-	-	-	-
		6	-	-	-	-
		11	-	-	-	-
		16	75	71	76	73
		21	77	72	72	71
		26	67	67	67	66
1970	Dec.	1	76	75	75	71
		6	76	75	75	74
		11	72	72	71	71
		16	74	73	75	74
		21	73	73	73	73
		26	73	72	74	73
1971	Jan.	1	67	67	68	68
		6	72	71	73	73
		11	74	73	75	73
		16	72	69	73	73
		21	62	61	69	65
		26	71	70	69	68
1971	Feb.	1	72	69	69	67
		6	72	71	70	70
		11	-	-	66	65
		16	70	69	69	68
		21	74	72	73	72
		26	75	73	74	72

FREQUENCY OF OCCURRENCE OF OCEAN CURRENTS
OFFSHORE OF BIG MUD CREEK, BASED ON AN
EIGHT DAY MEASUREMENT PERIOD: SUMMER 1969



HUTCHINSON ISLAND PLANNT
ENVIRONMENTAL REPORT
OFFSHORE OCEAN CURRENTS
FIG. 2.3.2-1

2.3.3 HEAT DISSIPATION

2.3.3.1 Condenser Cooling Water System

The condenser cooling water is provided by the circulating water system which consists of intake and discharge pipes in the ocean with canals to the plant. Pumps at the intake structure provide 530,000 gpm of flow. The system is shown in Figure 2.3.3-1. The maximum design temperature rise at 850 Mwe of the water passing through the condenser will be approximately 24°F. However, the temperature rise for normal full load operation will be 21°F. The temperature rise averaged over a day will be less than 21°F because of daily plant loading.

2.3.3.1.1 Intake System

The water will be taken from the Atlantic Ocean through two 10.5 ft.-ID reinforced concrete pipes originating about 1200 ft. offshore of the beach. The intake pipelines will be buried until the (-18) ft. mean low water (MLW) contour is reached because any obstructions along the ocean bottom inshore of the 18 ft. depth could interfere with natural littoral processes. Because each intake pipe requires a vertical section to prevent sanding and a "velocity cap" to minimize fish entrapment, there would be about 8 ft. of water over the top of each velocity cap. The velocity caps insure a horizontal direction of approach in the near vicinity of the pipes' inlets and also limit the velocity to about 1 fps.

The intake pipes will be located approximately 2300 ft. south of the discharge pipe. They will be buried from the intake points for a distance of about 1600 ft. beneath the ocean bottom and under the beach, terminating in a canal on the west side of the sand dunes. After passing through the inlet pipes at about 6 fps., the circulating water will be conveyed in the canal about 900 ft. to State Road A1A and will pass under this road through culverts. After passing under the road, the water will be conveyed in a canal at 0.3-0.5 fps. for approximately 4000 ft. to the plant intake structure. The intake structure is shown on Figure 2.3.3-2. This reinforced concrete structure consists of four bays. Each bay has a coarse screen, a traveling screen, a circulating water pump and is provided with auxiliary equipment. The approach velocity to each bay is less than 1 fps. From the intake structure, the water is conveyed through a buried pipeline to the condenser. The water then flows at a velocity of less than 7 fps. through the tubes of the condenser, located in the turbine building, into the discharge water boxes.

2.3.3.1.2 Discharge Systems

The circulating water discharge system is shown on Figure 2.3.3-1. From the seal well, the discharged condenser cooling water will be transported approximately 500 ft. in a buried pipeline and then about 580 ft. in a canal to State Road A1A. The water will be carried under the road in culverts. Once past A1A, the cooling water will travel about 1155 ft. in a canal to an outfall structure, located on the western side of the sand dune line. From the canal outfall structure, the cooling water discharge will be carried about 1425 ft. in a 12 ft. diameter pipeline buried under the beach and under the ocean. The pipeline will terminate at a depth of 18 ft. (MLW) and at a distance of about 1200 ft. from shore. At its termination, the 12 ft. diameter pipe will be modified with a short transition section and a two port, Y-type high velocity jet discharge will be added. Both ports in the Y will be 7.5 ft. in diameter and will result in a horizontal discharge of about 13 fps. A short sloping trench will be excavated from the inverts of the ports, daylighting at the natural ocean bottom. The trench will be lined to prevent scour from the jets' discharges.

Preliminary temperature data collected offshore of the site of surface and bottom water of the Atlantic Ocean are given in Table 2.3.2-1. Temperature data collected by the United States Coast and Geodetic Survey (USCGA) at Canova Beach, some fifty miles to the north are given in Table 2.3.2-2. The maximum temperature recorded at the FP&L monitoring station is 86 F. The maximum temperature recorded over an eighteen year period at Canova Beach, is 87 F although there is no thermocline, bottom temperatures are frequently a few degrees cooler than surface temperatures. The temperature of the released water will be rapidly reduced as the discharge water mixes with the surrounding cooler ocean water.

2.3.3.1.3 Main Condenser System

The main condenser system consists of two 50 percent capacity, divided water box surface condensers, of the single pass type, with 7/8 inch OD tubes arranged perpendicular to the turbine shaft. The condenser is of the deaerating type and is sized to condense exhaust steam from the main turbine under full load conditions.

2.3.3.2 Facilities or Techniques

As discussed above, heat removal from the condenser at Hutchinson Island will be accomplished by a circulating water system which receives water from, and discharges water into, the Atlantic Ocean through Y-type jets at the end of the subaqueous discharge pipe. The discharged cooling water will be carried well away from the shoreline for a distance of approximately 1200 ft. The method used for discharge - high velocity subaqueous Y-type jets - will result in rapid dilution and decreased temperature at the water surface. This is accomplished by discharging the heated water at a depth of about 18 ft. through the two port diffuser with an exit velocity of about 13 fps. Discharging the water as a subsursurface jet produces a reduction in temperature of the discharged water as the heated liquid travels to the surface. The horizontal discharge proposed, with both mementum and buoyancy effects, is effective in causing the induced dilution[1] and also carries the discharged water further offshore. The favorable location of the Hutchinson Island near the edge of the ocean permits the use of the highly effective method of heat dissipation, precluding the necessity of any additional heat facilities.

2.3.3.3 Environmental Impact of Heat Removal Facilities

There will be no adverse effects such as icing, fogging, drift and noise, amo g others, resulting from the methods used for waste heat removal at the Hutchinson Island Plant.

2.3.3.4 Characteristics of Thermal Discharge

The location of the Hutchinson Island Plant was heavily influenced by the ability to use the subaqueous Y-type high velocity jet discharging into the ocean as the means of dissipating the heat released from the plant. This system is a very effective method for removing heat with a minimum effect on the environment.

After the heated water is discharged near the ocean bottom, it will rise to the surface (because it is warmer and, therefore, lighter than the surrounding water) and will spread out, establishing a temperature field in an upper layer. For a given temperature at the discharge, the temperature at the point where the water reaches the surface will be significantly reduced by mixing with surrounding water of ambient temperature. As the water reaches the surface, it will spread out and be carried away from the discharge by natural currents and secondarily by the flow pattern produced by the discharge itself. As the water flows away from shore, the temperature will decrease due to heat loss to the atmosphere, diffusion and entrainment of adjacent waters.

In order to calculate temperature fields due to a discharge of heater water, it is necessary to have measurements or estimates of (1) currents, (2) mixing characteristics of the receiving waters, and (3) the climatological factors (primarily wind speed) affecting heat losses to the atmosphere.

In July of 1968, the Florida Power and Light Company entered into a contract with the Engineering and Industrial Experiment Station, College of Engineering, University of Florida, for a preliminary study to evaluate the hydrographic effects of the Hutchinson Island Plant. A report[2] was prepared after completion of this program which indicated that the site location was suitable for a once through cooling system. Based on these favorable preliminary findings, FP&L contracted with the University of Florida in May 1970 for a detailed hydraulic model study of the subaqueous Y-type high velocity jet. The study was initiated in the summer of 1970, using a 1 to 30 scale factor. In addition, Ebasco was authorized by FP&L in July 1970 to evaluate alternative intake and discharge systems. The selected schemes have already been discussed in Section 2.3.3.1.

Results obtained from the parametric study conducted as part of the hydraulic model study have been used to obtain the differential between surface and ambient temperatures for the selected system. The results of the model studies indicate that the maximum surface temperature rise above ambient with the selected scheme is 5.5°F at normal full load operation. Using this result and the temperature data published by USCGS, the maximum absolute surface water temperature will be less than 93 F at the discharge point.

In order to determine the areas enclosed by specific isotherms of temperature rise, analytical methods presented by Dr. Pritchard in Ref. 1 were utilized. These isotherms for 3°F and 1.5°F are shown on Figure 2.3.3-3. The corresponding areas enclosed by these isotherms are approximately 25 acres and 400 acres, respectively. These calculated areas are conservative since heat dissipation to the atmosphere has not been included. In addition the formula presented by Dr. Pritchard has been applied in a conservative manner.

Based on a dye release program conducted during the summer of 1970,[3] it was found that the heated discharge would probably be confined to the upper 8 ft. in the water column. With the geometry of the intake pipes, water will be withdrawn from below the 8 ft. depth. In addition, because of the large separation between the intake and discharge, no measurable recirculation will occur.

The model studies referred to above are being continued in order to provide detailed thermal profiles which will result from the Y-type high velocity jet. A final report will be issued on the analysis, testing, and final design of the discharge system.

2.3.3.5 Thermal Standards

The thermal standards applicable to the water discharged from the Hutchinson Island Plant are given in Florida's "Rules of the Department of Air and Water Pollution Control," Chapter 17-3, Pollution of Waters. The criterion relating to temperature reads as follows:

> "Temperature - shall not be increased so as to cause any damage or harm to the aquatic life or vegetation of the receiving waters or interfere with any beneficial use assigned to such waters."

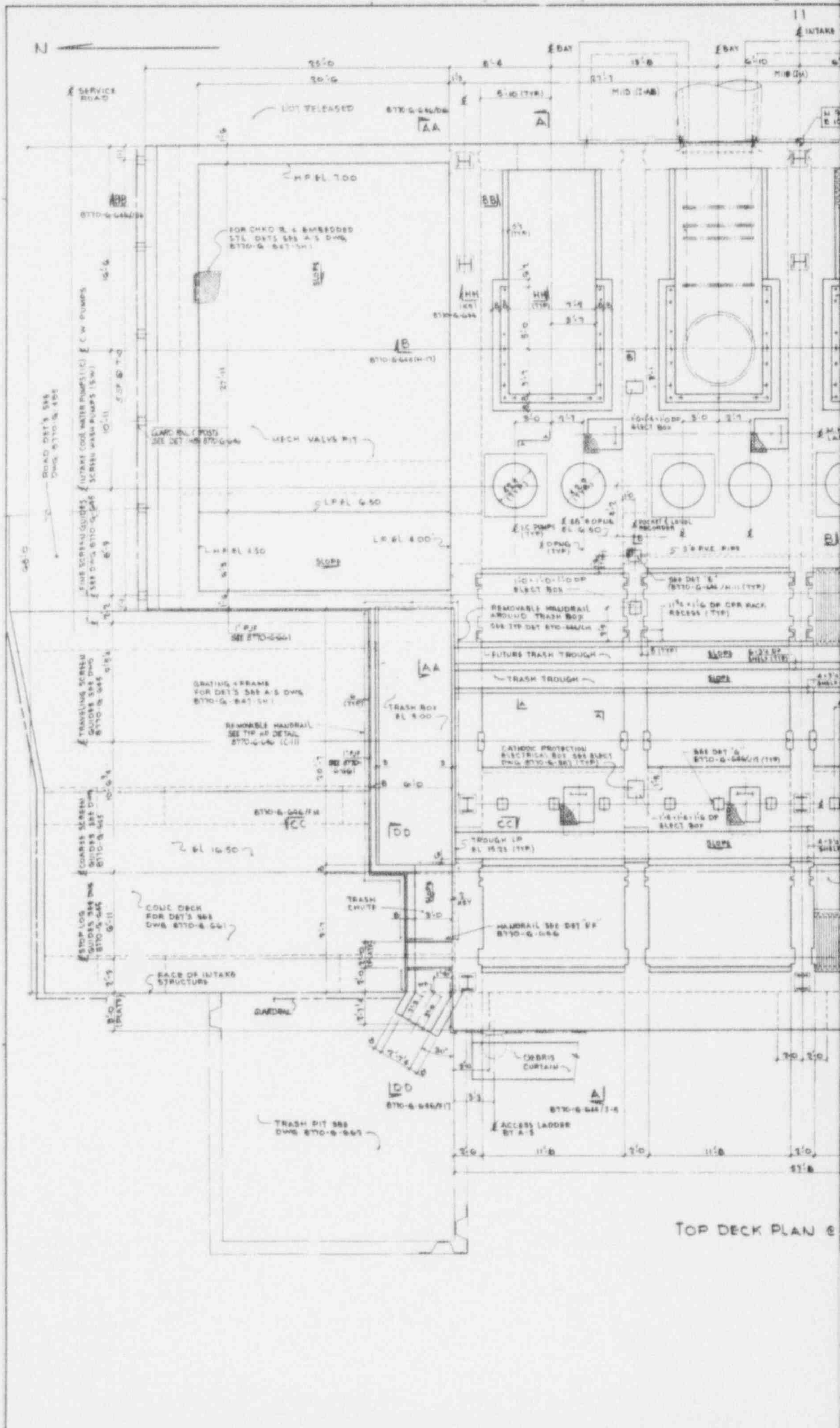
This State standard or criterion has been approved by the Department of the Interior.

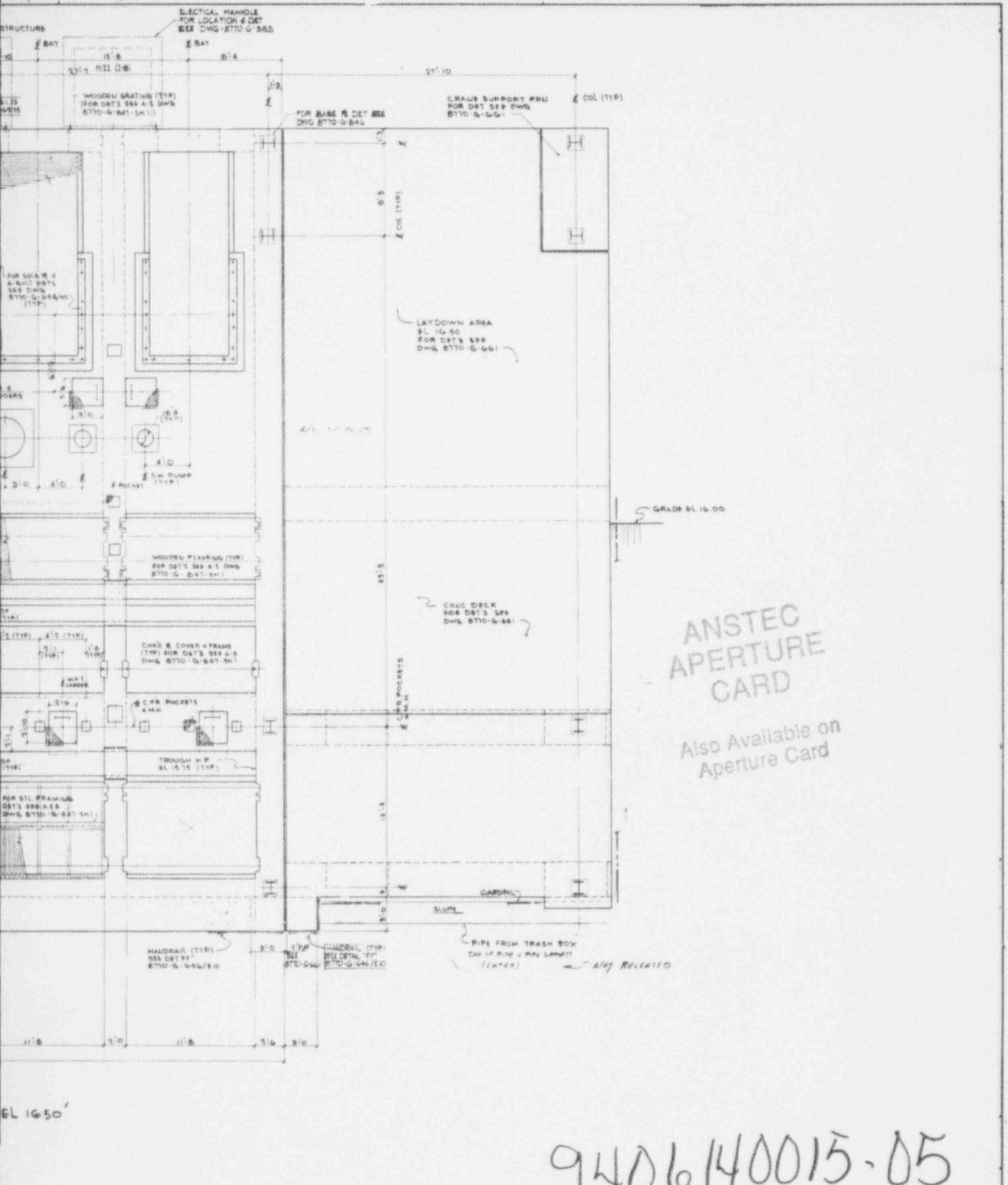
Florida Power and Light will conduct studies during plant operation to determine what effects, if any, heated water will have on the environs offshore of Hutchinson Island. The results of such studies will be compared with similar studies conducted before plant operation to determine what effect, if any, the discharge of heated water has upon the aquatic environment.

2.3.3.6 Water Quality Certification

On April 3, 1970, the Water Quality Improvement Act was enacted, which amends the Federal Water Pollution Control Act. Section 21 (b)(8) of the amended Act requires that applicants for a construction permit or operating license for any nuclear power plant which will discharge effluents into the navigable waters of the United States provides the AEC with certification from the State or interstate pollution control agency, or the Secretary of the Interior, as appropriate, that there is reasonable assurance that the plant will not violate applicable water quality standards. Under Reorganization Plan No. 3 of 1970, the functions and duties of the Secretary of the Interior under this Act have now been transferred to the Administrator of the Environmental Protection Agency.

Since the effluents from the operation of the Hutchinson Island Plant will be into the Atlantic Ocean, which is considered to be a navigable waterway, the water quality certification discussed above is required. Such a certification was issued to the Florida Power and Light Company for the Hutchinson Island facility on February 12, 1971, by Florida's Department of Air and Water Pollution Control. A copy of the certificate is included as Exhibit D in Appendix 5.


N
NOT RELEASED
MECH VALVE PIT
SLOPE
FUTURE TRASH TROUGH
TRASH TROUGH
TRASH BOX
REMOVABLE HANDRAIL AROUND TRASH BOX
CATHODIC PROTECTION ELECTRICAL BOX
TRASH CHUTE
CONC DECK
BACK OF INTAKE STRUCTURE
GUARDRAIL
DEBRIS CURTAIN
ACCESS LADDER BY A-S
TRASH PIT
TOP DECK PLAN



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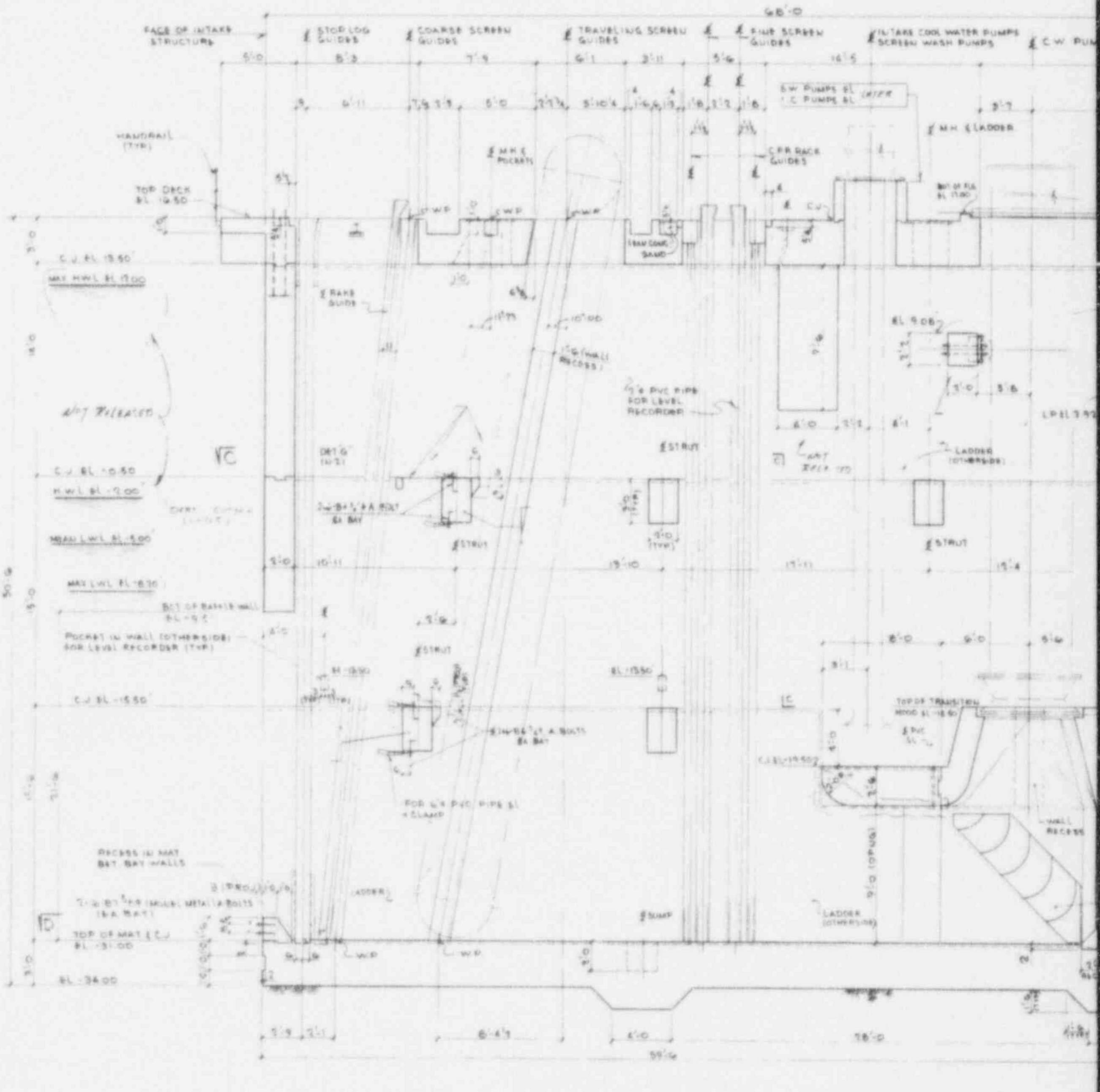
HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
INTAKE STRUCTURE-PLAN
FIG. 2.3.3-1



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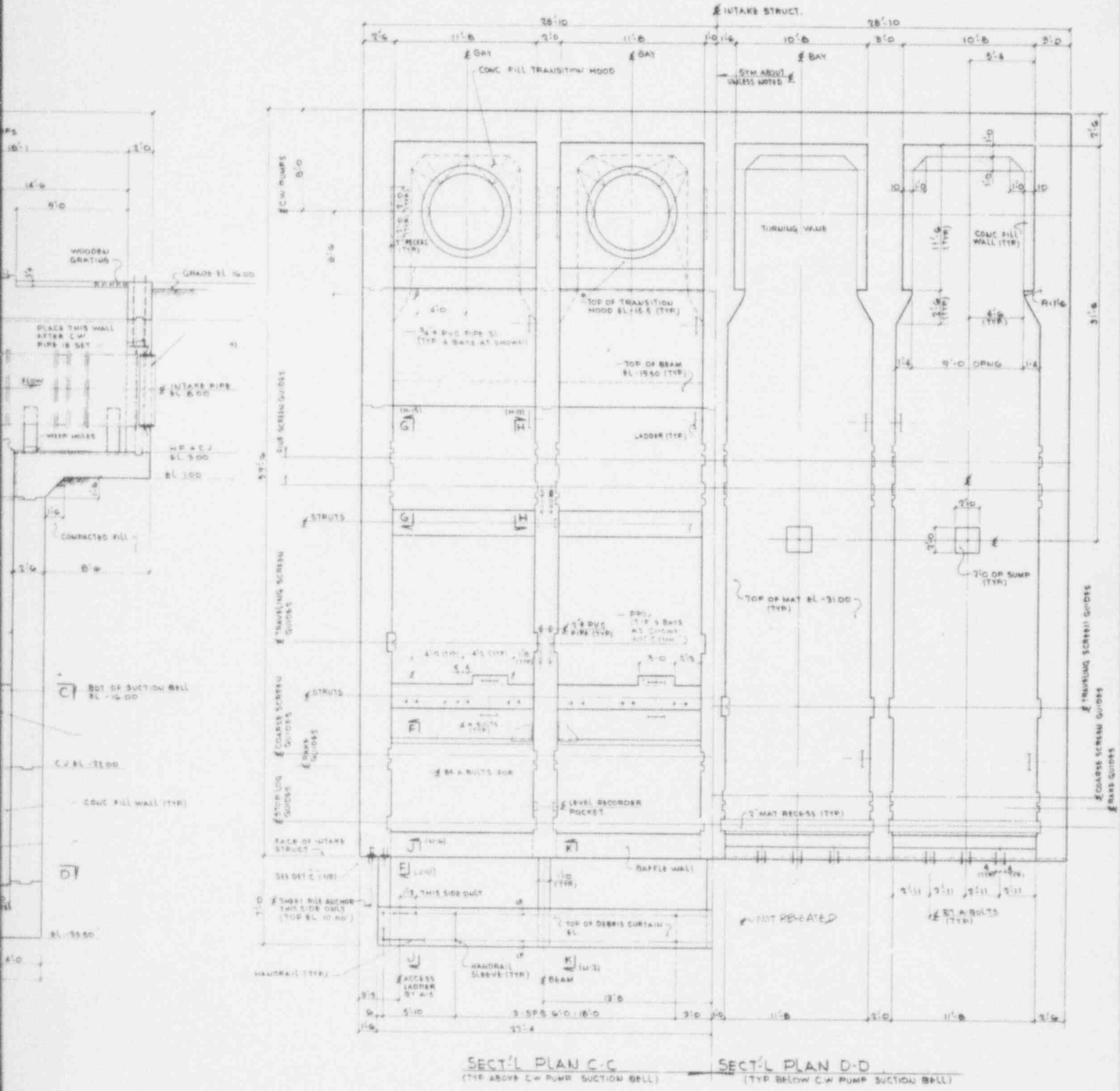

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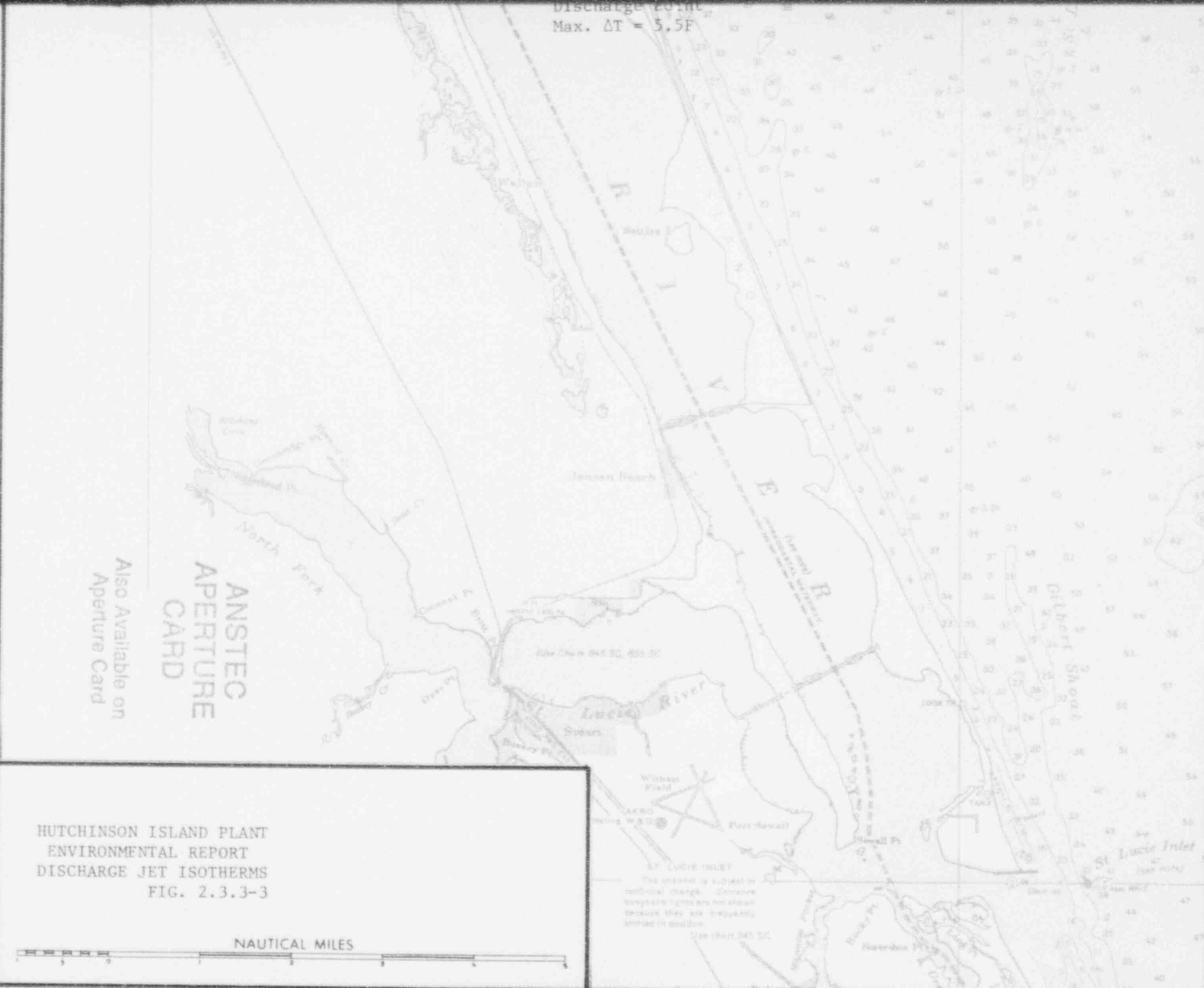
HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
INTAKE STRUCTURE-SECTIONS
FIG. 2.3.3-2

Fort Pierce Inlet
Fort Pierce
White City
White City Sta.
Lucie
N
3.0F
1.5F



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
DISCHARGE JET ISOTHERMS
FIG. 2.3.3-3

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2.3.3.7 Effect of Discharges on Quality of Waters in Other States

The cooling water is released into the ocean at a point where it will have no effect on any bordering states as the distance to the nearest state, Georgia, is approximately 260 miles.

References

1. Pritchard, D. W., "Design and Siting Criteria for Once-Through Cooling Systems", Chesapeake Bay Institute, The Johns Hopkins University (Presented at the American Institute of Chemical Engineers 68th National Meeting, Houston, Texas, March 2, 1971).

2. "Temperature Field Predictions, Hutchinson Island Nuclear Plant Outfall", Department of Coastal and Oceanographic Engineering, Florida Engineering and Industrial Experiment Station, University of Florida, Gainesville, Florida, May 1970.

3. "Drift and Dispersion Study - Hutchinson Island, Florida", April, 1971, Dr. J. H. Carpenter, Chesapeake Bay Institute, Johns Hopkins University, Baltimore, Maryland.

2.3.4 CHEMICAL DISCHARGES

The systems handling chemical discharges are in the early stages of design and processes and quantities are not final. However, at this stage of design the systems can be outlined as follows:

The chemicals used in non-radioactive secondary and auxiliary equipment cleanup will be drained through the floor drain system into one of two diked areas to be retained.

Incorporated in the plant is a water treatment system which refines city water into very high purity water for plant processes. This system utilizes chlorine, sulfuric acid and caustic soda. The spent solutions of these chemicals will be discharged to a retention basin where they will be neutralized and tested for pH. The neutralized solutions containing sodium calcium, salts, magnesium, and trace quantities of other metallic ions extracted from the city water, will be released to the circulating water system with a pH of 6.0 - 8.5.

A chlorine solution will be fed into the sea water ahead of the intake structure for 15 minutes every other day to control slime formation. The solution enters the circulating water and open cooling water system in regulated quantities such that the residual chlorine at the condenser outlet will be nominally one ppm and no greater than 1-1/2 ppm at any time.

There will be times during operation when it will be necessary to discharge highly pure water which will contain small amounts of boric acid (in the order of 1%). After dilution by the circulating water the presence of boric acid will be undetectable.

No other chemical usage which would result in additional chemical discharges is presently contemplated.

2.3.5 SANITARY WASTES

During the early phase of construction, sanitary wastes are retained in portable chemical toilets. During the late phase of construction and throughout the operating phase of the facility, sanitary wastes will be treated through two septic tanks and their associated leaching fields which will be located above the local water table. The sanitary waste treatment system will meet the Florida State Department of Health requirements.

2.3.6 BIOLOGICAL IMPACT

The Florida Power & Light Hutchinson Island nuclear facility presently under construction is expected to go on line in 1974. Both the physical structure and the thermal enrichment of cooling water will impact on the environment in various predictable ways. The over-all ecological effect of this facility will be minimal to the marine and freshwater resources of the area. The details supporting this conclusion are presented as the aquatic biology phase of this report. All existing available information relating to the environment of Hutchinson Island has been examined. Papers of major importance are included as Appendices 2 and 3. Biological and environmental studies to provide the long-term data to substantiate the existing information are discussed.

2.3.6.1 Environmental Evaluation

2.3.6.1.1 Indian River Biological Survey

Beginning in 1968, a study was carried out on the Indian River in the vicinity of the FP&L plant. This investigation formed a part of a report submitted to the State of Florida for a construction permit for the nuclear facility.[1] Nine stations were established from Little Mud Creek south to Herman Bay. Microscopic forms in the sediment as well as an inventory of plankton were made as one phase of the investigation. In addition a survey was completed of the macrophytic grasses and algae serving as nursery areas for juvenile marine invertebrates and fish of commercial and sport value. A census was also made of the species caught in trawls of the river.

The results of this study showed a rich and varied ecological system that would represent a significant loss if disturbed or unbalanced. Dr. James Lackey, principal investigator, summarized as follows:

1. Indian River supports an enormous biomass of manatee grass and several species of macroscopic algae. Turtle grass (Thalassia) was not found. The dominant algae was Gracilaria, but several others are common. Most of them are red algae, although patches of Sphacelaria, a brown alga, were found. This forest, often ten inches high, contains large numbers of gammarids (scud), shrimp, isopods, small crabs and juvenile fish. Egg masses or single eggs of various invertebrates are found here, and the branches and leaves of the plants support large numbers of caprellids, bryozoans, very small worms and very small attaching algae. The leaves of manatee grass are a substrate for the attachment of vast quantities of organisms, mostly diatoms such as Licmophora, but also various protozoa such as the colonial ciliate Zoothamnion.

   Altogether Indian River supports the nursery concept very well indeed. It affords protection to a very large variety and number of animals. It offers an abundance of food for many animals, especially the smaller ones who browse on the attached diatoms and other plants. It is a place where recycling of the nutrients - organic matter to inorganic matter to organic matter - is a normal procedure. Three characteristics of this stretch of estuary should be noted, in view of the discussion which follows:

   a. The growth is heaviest toward the western shore.

   b. The character of the water, especially salinity and turbidity, varies considerably from time to time.

   c. The growths are so thick as to trap and hold free floating particulate matter whether copepods, protozoa, eggs or invertebrates. The growths act much like a sieve such as Purdy long ago ascribed to the macroscopic growths in the Potomac below Washington.

2. Indian River supports an abundant and diverse plankton. It owes its character to a constant raindown of organic matter in the overgrown area, i.e., those from 0.0 to 4.0 feet, sometimes more, of depth. This organic matter undergoes bacterial decomposition on the bottom, and the mineral salts liberated are utilized by the algae, and the bacteria by protozoa, rotifers, copepods, etc., to maintain a high population.

   Samples collected at nine stations showed the plankton populations to range from 200 to 20,000 organisms per milliliter with a median range of 1000 to 8000 organisms per milliliter. Chemical analyses and water samples collected at the same time showed concentrations of orthophosphate to be 0.18-0.26 ppm, nitrate as nitrogen 0.03-0.06 ppm and copper 0.11-0.12 ppm.

3. The sediment water interface is densely populated and it is inferred that it is a place of intense biochemical activity. This conclusion may not be valid for large areas, since only four cores have been examined.

4. The benthic population, as shown by Carr (Appendix 3) is large, containing many shellfish, tube dwelling worms and crustaceans. These either dwell in the mud or in tubes or crawl about in the macroscopic growths or on the bottom. Accordingly they are hardly susceptible to being displaced and swept along by a moderate current.

   Shrimp and juvenile fish are also abundant although not benthic. These are more responsive to current action, but for those which are hatched in the ocean, such as shrimp, it is hardly likely that all of them enter the River on the incoming tides at the two inlets. In fact, both are frequently brought up when scooping up a mass of algae and grass. In other words, many are not readily dislodged from the "forest."

5. Tows in Big Mud Creek and in the channel of the intracoastal waterway revealed very few eggs or larval forms - only calanoid copepods. Certainly there is no vast assemblage of suspended invertebrates, eggs and juvenile forms routinely present in the river.

6. Plankton tows in the two inlets (Ft. Pierce Inlet, 8 miles north of the site and St. Lucie Inlet, 14 miles to the south) show considerable numbers of estuarine organisms being carried out on the outgoing tide, and considerable numbers of oceanic organisms being brought in on the incoming tide. Very few oceanic organisms persist in the River, and few estaurine organisms are found in the samples taken either by net or water bottle, in the ocean stations east of Big Mud Creek. Whether they die in the ocean or whether they are widely scattered is not determined.

7. The only organisms of direct economic importance (aside from an occasional fish) found thus far in the River have been shrimp, young blue crabs and a very few conchs. Normally the River is fine for speckled trout, but in May and June at least, fishermen were far more abundant in both inlets. Channel bass, trout and snook appeared to be most commonly taken, but many other species such as drum, sheephead and mangrove snappers were also caught.

The complete report prepared by Lackey is presented as Appendix 3 of this report.

2.3.6.1.2 State Board of Health Edible Shellfish Program

The Florida State Board of Health has jurisdiction over all coastal waters for the harvesting of edible shellfish and, through representatives in County health departments, maintains a surveillance on the bacteriological quality of water overlying shellfish beds. In the area around Hutchinson Island the commercial shellfish catch is limited and doesn't offer much promise for commercial development for oystering.[2] However, fair quantities of oysters and clams are harvested by sportsmen each year and is a prime recreational activity for many people living in that area.

Unfortunately, urbanization of the mainland has caused a progressive decrease in water quality, and shore areas along the west bank of the Indian River from Middle Cove to St. Lucie Inlet were closed for the taking of shellfish several years ago. Periods of rainfall especially impact on the river as runoff carries heavy bacterial burdens into the shellfish environment. Stormwater runoff as well as domestic waste effluent constitute a health hazard since feeding oysters readily concentrate intestinal pathogens. When raw shellfish are consumed those carrying pathogenic bacteria and viruses can easily cause a serious infection.

During the spring and summer of 1970, a sanitary survey related to these waters was completed by the health department. The results pinpointed sources of pollution from sewage treatment plants, residential septic tanks and boat wastes. The latter source was considered significant, especially during the winter when traffic is high.

In July 1970, the southeast regional engineer recommended that the area of the Indian River extending from Sebastian Inlet at the north to the St. Lucie Inlet at the south no longer be certified for the taking of shellfish. These recommendations were based on his report as follows:

> This area is presently experiencing a very rapid rate of growth with the end result of a predominately urban concentration of population. The open spaces between the principal population centers of Vero Beach, Fort Pierce, and Stuart are being filled in with such large scale developments as Johns Island and The Moorings on the island and Sebastian Highlands, Vero Beach Highlands, and Port St. Lucie of General Development Corporation on the mainland. The storm water runoff from these developments alone is enough to contribute substantial contamination. The sewage effluents from these larger sources are so distributed as to subject the greater part of the Indian River to possible major pollution in case of an accident or breakdown. In addition, numerous smaller developments with sewage treatment plants represent the continuing possible hazard due to lack of continuous supervision and maintenance. This problem is further aggravated by lack of available personnel in this office to provide adequate surveillance. The potential for sewage contamination is further enhanced by thousands of

> septic tank installations in marginal soil conditions which can and do contribute significant pollution during periods of heavy rain.
>
> I wish to also point out that an extensive agricultural drainage system discharges into these waters. It drains areas intensively planted in citrus with consequent potential for pesticide contamination. There is also a significant contribution of waste from the dairy and beef cattle industry.
>
> In addition to the foregoing sources of contamination from the land, there is a significant and increasing contribution from watercraft. The Indian River is the locus of intracoastal waterways and this presents a constant hazard by the contribution of small quantities of fresh sewage.

As a result of the reappraisal the waters in the Indian River essentially from the Indian River County line on the north, south through St. Lucie County and into Martin County were closed to the taking of shellfish in August 1970.

The State Board of Health informed the Directors of the three county health departments that the waters in question can be "reclassified as conditionally approved shellfish harvesting waters provided the following studies are conducted and favorable data is concluded from these studies:

1. An evaluation of each actual or potential source of pollution is made and the pollution sources are eliminated.

2. Flow studies are conducted to determine the dispersal of the waters surrounding the potential pollution sources.

3. Extensive bacteriological sampling, under adverse weather conditions, i.e., unusually high tides and heavy rainfall resulting in runoff from the watershed, is conducted to determine the water quality after these adverse weather conditions.

4. Assurance that constant surveillance, bacteriological, shoreline reconnaissance and domestic-industrial waste treatment facility operation will be provided, if these areas are reclassified as 'conditionally approved'."

2.3.6.1.3 Ecological Investigation Offshore of Hutchinson Island

During February and June, 1969, and April, 1970, studies were conducted offshore from Hutchinson Island in the vicinity of plant site to evaluate the existing marine resources in the area. During these three periods observations were made at a total of 61 locations within a 6 mile radius of the plant. The location of these sites and a summary description of the conditions at each site are included in Appendix 3.

The observations indicated that the ocean floor in this area is a flat, barren, sandy plain. There are two shoals offshore; one about two miles out and another about 6 miles out. The depth of water at both of these locations is about 20 ft. Between shore and the first shoal the bottom is a broad, gently sloping trough with a maximum water depth of about 40 ft. A similar trough exists between the two shoals. The maximum water depth in this area is about 50 ft. Beyond the second shoal - 6 miles offshore - the bottom drops off slowly to a depth of 120 ft. about 12 miles offshore.

In the entire study area the bottom was observed to consist of sand mixed with varying amounts of shell fragments as shown in photographs in Appendix 3. At no place was there mud, silt, or organic matter. Even though the transparency of the water was generally good, bottom growths did not develop because of the lack of nutrients. No rock formations or coral growths were noted within the area, even in the vicinity of the shoals.

The benthic organisms present were representative of a typical array of sublittoral bottom forms. The predominant animals at most bottom stations were polychaete worms, barnacles, amphipods, bryozoans, starfish, sand dollars, chitons, and slipper shell. A total of 63 benthic species were identified in samples collected at 9 sites in June, 1969, but other than the ones listed, they were present in very small numbers. None of the animals collected were of commercial importance.

One of the principal reasons for extending the limits of the study area 6 miles offshore was to determine if there were areas which were attractive for commercial or sport fishing. In particular, an objective was to determine whether the calico scallop beds which are located off Cape Kennedy extended into the area. These beds were only recently discovered and have been worked commercially since early 1969. The primary concentration of scallops is off Cape Kennedy in water 60-240 ft. deep (6-10 miles offshore). The beds of commercial interest reportedly extend southward to about the Ft. Pierce inlet. A dredge tow between Ft. Pierce and Jupiter inlets in 80-300 ft. deep water produced only 0-0.5 bushel of scallops per 30 minute tow whereas further north near Daytona Beach the production was as much as 17 bushels per 30 minute tow.[3] Commercial dredging off Cape Kennedy commonly produces 10-20 bushels of scallops in a 30 minute period.[4]

Observations made during the June, 1969, study further substantiated the fact that the scallop beds do not extend into the Hutchinson Island offshore area. At one station 6 miles offshore the scallop density was about 1 per 2 sq. ft. of bottom. At other sites the density was 1 scallop per 10-50 sq. ft. and at most sites no scallops were observed at all.

The lack of bottom grasses, rock outcropings, and coral reef previously discussed led to the conclusion that nowhere within the 6 mile radius would there be an attractive fishing area.

During February, 1969, water bottle samples were collected from the surface at 8 sites between 3 and 6 miles directly offshore from the plant site.

The total number of nanoplankton species in all the samples was 41. This did, however, include all major groups of algae plankton except the blue green and all major groups of protozoa except rhizopods. Diatoms were the most common species. The number of organisms in the 8 samples ranged from 32-132 per ml with the greatest number occurring 6 miles offshore. This number compares with an average range of 1000-8000 organisms per ml in the Indian River.

In June, 1969, samples were collected at 9 sites within a 2 mile radius of the shore adjacent to the plant and examined for plankton. About 63 species were observed with diatoms accounting for over 50 percent of this number. Again, as in April, the species diversity at each station was high but at all stations the number of organisms was less than 100 per ml.

Another set of samples was collected from 4 stations between 1100 and 5500 ft. offshore in April, 1970. At this time the total number of species was 41 and consisted primarily of diatoms and dinoflagellates. The diversity was good at each station but the number of organisms was again less than 100 per ml at all 4 stations.

The findings of the three surveys indicate that the area has a very low productivity. The water is of good quality as indicated by the high diversity of species but is low in nutrients as indicated by the low numbers of species. Chemical analyses for nutrients in the shelf water showed orthophosphate concentrations to range from 0.02-0.03 mg/l, nitrate nitrogen to be about 0.01 mg/l, and copper to range between 0.004-0.005 mg/l. For comparison, orthophosphate concentrations in the highly productive Indian River range between 0.18-0.26 mg/l and nitrate nitrogen range between 0.03-0.06 mg/l.

The findings of the three offshore surveys were consistent with those of a two year study of the shelf waters by Lackey[5] off Pompano Beach, Florida, an area 75 miles south of Hutchinson Island. In this study samples were collected and examined monthly over the two years. The bottom was similar to that off Hutchinson Island, i.e., devoid of grasses and sessile species, and plankton numbers seldom exceeded 100 per ml although the diversity was again high. The nutrient levels in this area were similar to those observed off Hutchinson Island.

During the February, 1969, survey, observations were made at the Ft. Pierce inlet about 8 miles north of the plant site. The ocean bottom near the inlet did support patchy stands of grasses and the general condition of the area, while not highly productive, showed evidence of nutrient and organic material discharge from the Indian River. Net plankton samples collected in the inlet during flood and ebb tides showed about the same number and diversity of species entering the River on a flood tide as being flushed to the ocean on an ebb tide.

It is interesting to note that even with the discharge of water high enough in nutrients to support the luxurious growths in the Indian River from inlets 8 miles north and 14 miles south of the plant and with northerly or southerly currents 90 percent of the time, the productivity of the area offshore from the plant site is very low and the nutrient levels are in the range expected in ocean water.[3]

In discussing the study Dr. William Carr, a member of the survey team and an assistant professor at the University of Florida, described this offshore area as amenable to receive cooling water due to the absence of any important sessile marine resources. The offshore environment is the direct opposite of the Indian River which is a rich and valuable resource.

2.3.6.1.4 The Beach as Nesting Habitat for Sea Turtles

The beach along Hutchinson Island serves as habitat for nesting sea turtles. Two species mainly are present, the loggerhead turtles (Caretta caretta caretta) and the green sea turtles (Chelonia mydas mydas). Of the two species the loggerhead predominates. Existing information relating to turtle nesting activities on the island is sketchy. R. A. Routa reporting to the Florida Academy of Science[6] estimated 5,265 sea turtle nests for the entire 22.4 miles of beach on Hutchinson Island. Of these he estimated some 15 to be of the green sea turtle. Mr. Frank Lund has actively engaged in turtle research mainly on Jupiter Island to the south. Lund's[7] opinion is that these two areas comprise the most significant loggerhead nesting area within the continental U.S. Lund also feels that Routa's estimates of green sea turtles nesting, which is the only published record of green sea turtles nesting in Florida, is low. Lund's studies of Hutchinson made within the past two years indicate that the green turtle population is at least twice Routa's earlier estimate, or some 30 turtle nests. In this regard, nesting of the green sea turtle is sufficiently limited so that neither Hutchinson Island nor any part of the United States is included as a principal nesting ground of the species as shown in a National Geographic paper.[8]

Presently the main detrimental effect on sea turtles aside from nest destruction by predation or poaching is misorientation of hatchings. Lights such as carbon arc lights will attract the young turtles. Migration of the young toward point light sources has caused mortality mainly from cars as the turtles attempt to cross roads. A situation such as this will not occur in the plant area as a buffer zone of Australian pines, sea grapes, palmetto shrubs and sand dunes which screen the beach from lights at the plant.

No data indicates any reason to believe that the plant will have an effect on turtle nesting.

2.3.6.1.5 Commercial and Sport Fishing

An investigation of available literature revealed no published information on studies related to fish census or behavior patterns in the offshore vicinity of Hutchinson Island. A report prepared by the Bureau of

Commercial Fisheries on the Cape Kennedy area, about 65 miles to the north, indicated the Cape area to be very productive biologically.[9]

At the St. Lucie inlet, 14 miles to the south, large numbers of snook congregate about 600-1000 yards off-shore during the spring of the year.[10] The cooling water discharged from the power plant will not influence this area, however it has also been observed that near the St. Lucie area there appears to be a definite change in the marine ecology[10] attributed to the circulation patterns in the area and climatic regimes. To the north, including the Hutchinson Island area, the ecology is temperate. To the south, the environment takes on several tropical characteristics. Observations made by Lackey during three surveys of the shelf water offshore from the plant site (Appendix 3) revealed no attached grasses, rock outcroppings, or coral reefs that would provide a suitable habitat for a fish population. Scallops were observed at some locations but the populations generally were one scallop per 10-50 sq. ft. of bottom area. At one site, about 6 miles offshore, the scallop density was about 1 per 2 sq. ft. of bottom area. At none of the sites examined were spiny lobster or clams observed.

Fish landings are not, of course, indicative of the catch area. The data are included, however, as an indication of the extent of fishing in the vicinity of Hutchinson Island.

Commercial fishing in the St. Lucie County area can be divided into three geographic subdivisions: the Inside Waters (the Indian River), the Shelf Waters (within the 10 fathom limit of the Atlantic Ocean), and the Off-Shore Waters (beyond the 10 fathom limit). In the shelf waters the bluefish, the king mackerel, and the spanish mackerel are the most heavily fished. They represent about 86 percent of the weight of fish taken from these waters in 1970 and about 81 percent of the annual value. None of these fish spawn in the Hutchinson Island area, however.[4]

Commercial landing of fin fish from St. Lucie County have been quite variable during the 1965-70 period. Catches have ranged from 2,239,038 lbs. to 3,444,608 lbs. The most important species in terms of weight and value are listed in Table 2.3.6-2. These species account for over 90 percent of the fish landed and over 99 percent of the commercial value of fin fish. The 1970 annual dock-side value of these fish was $692,156.

In addition to fin fish, there are, in general, sporadic landings of shell fish. Shrimping has been good during certain past years; however, in the period 1968-70 a total of only 9546 lbs. were landed and over 7800 lbs. of these were landed in January, 1970. This sporadic landing pattern is attributed to the migratory habits of the shrimp in this particular area.[11]

TABLE 2.3.6-2

COMMERCIAL FIN FISH LANDING IN ST. LUCIE COUNTY [12]
1968-70

			1970			
			Atlantic Ocean		Indian River	
Species	1968	1969	Weight(lb)	Value($)	Weight	Value
Bluefish	546,884	541,483	711,644	78,718	13,500	1,612
Red Drum	4,989	7,338	500	84	4,500	762
King Mackerel	883,854	584,483	994,901	302,725	--	--
Spanish Mackerel	541,022	488,057	1,234,589	177,246	7,500	891
King Whiting	85,111	51,851	35,000	6,226	16,900	3,009
Black Mullet	213,917	221,515	25,000	2,295	168,600	15,473
Pompano	80,008	37,731	4,000	3,892	30,418	35,573
Sea Trout	118,436	112,047	4,500	1,558	72,956	10,738
Spot	204,005	194,533	15,000	3,039	189,100	38,315
Total	2,678,226	2,239,038	2,941,134	$575,783	503,474	$106,373

Total Weight	Total Value
3,444,608 lbs.	$692,156

Clams have also been taken somewhat irregularly. In 1970 about 4300 lbs. were reported; mostly during the period January to July. These were taken from the inland waterway which have since been closed to commercial shellfishing because of the potential of sewage pollution.

The blue crab is taken sporadically with monthly catches of up to 9400 lbs. (January, 1969) reported. Over the three year period (1968-70), however, only 17,433 lbs. have been reported. In 1970, 6700 lbs. of blue crab were taken from the Indian River. These crabs had a dock-side value of $711.

The landings of spiny lobster have decreased during the past 5 years. In 1966 landings of 39,049 lbs. were reported whereas in 1970 only 1256 lbs. were reported.

Calico scallops appear to be the only shellfish in the St. Lucie area that are harvested with regularity commercially. The Bureau of Commercial Fisheries has found extensive beds of these scallops off-shore in 10-40 fathoms of water, but the primary concentration of the beds is off the Cape Kennedy area and some six to ten miles offshore. It is reported that 20-40 bushels per hour of scallops are dredged by commercial fishermen.

In St. Lucie County landings of calico scallops began to be reported in May 1969. Since then monthly landings have averaged over 19,000 lbs. with a range from 0 to 51,655 lbs. In 1970, 154,300 lbs. of scallops, with a dock-side value of $146,545, were harvested.

Oysters apparently have not been harvested commercially in St. Lucie County - at least not in the period 1968-70. Since the Indian River is closed to shellfish harvesting due to sewage pollution this trend ill not change for the next few years.

The Hutchinson Island site area is not heavily used for recreational activities, including sport fishing. In the Indian River there is some shore fishing and fishing from private or rental boats.

In the Atlantic Ocean, there is some surf and boat fishing in the vicinity of Hutchinson Island.

2.3.6.1.6 Importance of Locale as Nursery Area

The Indian River is of recognized importance as a marine spawning and nursery area. As a result of this, the original plans for withdrawal of condenser cooling water from the Indian River were changed to a with-drawal from the Atlantic Ocean. This change was done at considerable increase in cost and effort. There are no significant spawning areas near the discharge of the cooling water. Consequently the plant will have no significant effect on spawning or on nursery phenomena.

2.3.6.2 The Impact on the Environment

2.3.6.2.1 Marine Ecology Effects

The studies of the marine environment conducted between 1968 and 1970 were instrumental in the FP&L decision to use the ocean both as a source of cooling water and as a heat sink for disposing of the water. The alternative of using the Indian River as a source of cooling water was eliminated after the area was discovered to be highly productive and a significant nursery area for many species important to the area, while the ocean, on the other hand, was discovered to be very barren.

The offshore area, in general, contains no unique features and it is not a spawning area for any known species of fish or shellfish. It was concluded that the site is an ideal location for an electric power generating station.

Several studies have been undertaken fairly recently to evaluate the effects of calefaction on aquatic and marine systems. Unfortunately, methods of investigation have not been standardized, hence the results reported are not always directly comparable. Furthermore, many of the studies have been conducted under laboratory conditions and there has been criticism of extrapolating these results to natural systems. Another factor which makes the results of this type study difficult to interpret is the extreme natural variability of biological systems. An example of the latter is a statement made by Reeve in describing effects on zooplankton:[13]

> "The natural fluctuations of biomass in the bay from station to station and between successive sampling dates are so large (as are temperatures and salinities) that several years of intensive sampling might fail to correlate these fluctuations with the operations of the power plant under present operating conditions, except perhaps in the very limited path of the inshore thermal plume."

The same problem is faced by every investigator observing effects on mobile species in a natural system.

The effects on benthic organisms and plants is easier to define but there are effects in addition to calefaction which are sometimes overlooked. These include the effects of biocides and the effects of erosion. Taking into consideration the overall effect of cooling water discharges on the benthic population, there is little doubt that some disruption occurs near the mouth of the discharge conduit.[14,15,16]

Another effect to consider in the operation of an electric power generating plant is that of the entrainment of various species in the cooling water system. Several studies are underway to evaluate the effects of thermal shock, the magnitude of temperature rise, the maximum temperature reached, the use of biocides, and mechanical damage due to pumping.[17,18,19] These studies again report conflicting data in part. Some facts are quite clear, however. For example, there is little disagreement on the fact that chlorine used for cleaning the condenser tubes does cause extensive damage to the organisms entrained at the time the chlorine is injected. At Hutchinson Island this will be for about 15 minutes every second day. There is also a trend which indicates that increasing the temperature of the water when the ambient water temperature is in the 16C (61F) range will increase the productivity of the organisms present whereas a similar increase when the ambient water temperature is in the 23-25C (73-77F) range will suppress productivity.[17] The magnitude of the temperature rise which will cause this phenomenon and not result in damage due to thermal shock is not agreed upon. For that matter neither are the 16C (61F) nor the 23-25C (73-77F) ranges. Warinner and Brehmer[14] report that a 5.5C (10F) temperature rise above an ambient temperature of 15C (59F) will depress the productivity while North[18] reports an increase in productivity with a temperature rise of 11C (20F) over an ambient temperature of 16C (61F). The magnitude of the temperature rise, of course, will have to be less to prevent damage as the ambient temperature approaches the maximum critical limit for organisms. Here again, there is no agreement on the maximum critical limit temperature for most organisms. For organisms present in the Hutchinson Island waters this temperature is reported to be in the 23-35C (73-95F) range.[20,21]

There is some general agreement on the fact that some damage to organisms is incurred due to the mechanics of pumping and the transport through the cooling system.[17,22]

2.3.6.2.2 Impact of the Hutchinson Island Nuclear Power Plant on the Marine Ecology

When evaluating the effects of calefaction on a natural system it is almost always necessary to draw upon knowledge developed at another site for a basis of extrapolation. Although necessary, this should be done with great care to avoid unwarranted conclusions which might be detrimental to the environment or to the utility company.

As discussed in previous sections, the Hutchinson Island offshore waters appear to be an ideal place to dispose of thermally enriched water because of the barren nature of the system and because no unique features exist in the area. Furthermore, the system is not confined. Currents, southerly 65 percent of the time and northerly 25 percent of the time, almost continually flush the area with new water. It has been calculated that within two miles of shore, with the average southerly current of 0.6 fps the volume of water flowing past Hutchinson Island is 210,000 cfs. With the average northerly current (0.2 fps) the flow is 70,000 cfs. The flow through the cooling system is 1140 cfs. With a northerly current about 1.7 percent of the water flowing within two miles of Hutchinson Island will be utilized for cooling purposes. This water will be raised in temperature normally 11.6C (21F), maxima[illegible] 3C (24F), and at periods of low load 5.5C (10F).

During the summer months when the ambient water temperatures reach 30C (87F) there is little doubt that a temperature rise of 11.6C (21F) will cause some damage to the entrained organisms. Even a 5.5C (10F) temperature rise on top of this ambient temperature will probably cause some damage. Assuming the worst case, i.e., complete destruction of all entrained organisms, the impact on the environment would be negligible; first, because of the barren nature of the water to begin with and second, because only a small volume of the offshore water will be used for cooling.

Since the low plankton counts in the water are due to nutrient limitations and because there will be species of organisms not affected by entrainment the ecological system will re-establish its equilibrium within a short distance of the end of the outfall. Such recoveries have been observed in several systems.[13,14,15,17,19,22,23,24] From the above considerations, and from the level of radioactivity release from the facility being less than one percent of maximum permissible concentration (10CFR20), no radiological disturbance to the marine ecological system is anticipated.

The discharge system consists of a main conduit with two points of discharge which form jets whose initial velocity is about 13 fps to promote rapid dilution with surrounding water. The computed surface area affected by temperature 1.7C (3F) above ambient is 25 acres and by temperature 0.9C (1.5F) above ambient is 400 acres. The effects on organisms in the outfall water mixing zone are considered secondary to the effects on the entrained organisms which passed through the plant condenser. The effects on the entrained organisms inventory in the area was concluded to be negligible.

The plume of heated water will not result in a thermal block to migrating fish or turtles because of the small area affected in comparison to the open water on the shelf.

2.3.6.2.3 Terrestrial Ecology

Much of the western shore of Hutchinson Island was originally covered with mangrove swamp. Beginning in the 1930's, a mosquito control program was initiated to eradicate several of these insects capable of transmitting disease. The program consisted of eliminating the breeding grounds of the mosquito by flooding the mangrove swamps on the island.

In addition to eliminating mosquitoes, this program resulted in the destruction of much of the black mangroves on the island (Appendix 2). This also destroyed the area as a habitat for birds, small animals, and many of the aquatic species that normally inhabit the protected waters around the mangrove roots.

Photographs taken of Hutchinson Island before construction on the power plant began (Fig. 2.2.8-1) show that most of the mangroves in the interior of the island were dead or damaged. The mangroves around the perimeter of the island, primarily white and red mangroves, were not as badly affected and appear in the pre-construction photograph to be quite healthy.

These perimeter trees still exist, although some have been damaged by the construction of a road around the site perimeter. Plans are to maintain this perimeter of mangroves.

Because of the condition of Hutchinson Island prior to construction work, it is felt that very little adverse disruption to the environment resulted from the activities presently underway and from the use to which the land will be put when the plant is completed and in operation.

2.3.6.3 Studies to Resolve Environmental Impact Questions

Some pre-construction environmental surveys have been conducted in the intercoastal and off-shore waters near Hutchinson Island to provide the bases for development of the site and the nuclear facility. Further studies will be conducted to extend the original studies over several seasons and to investigate in more detail certain aspects of the ecology.

2.3.6.3.1 Off-shore Ecological Study

The studies conducted during the 1968 to 1970 period were of short duration. The findings of the studies were consistent with one another, i.e., there was no seasonal change in the marine ecological system, and the results were consistent with the results of a long term study of the shelf water at Pompano Beach, Florida, 75 miles to the south.

To further substantiate these findings, a study sponsored by FP&L was initiated in April, 1971. The objective of the study is to continue the observations of preoperational conditions offshore from the site. The study will continue throughout the remaining preoperational period and will probably be continued into the post-operational period. The study is being directed by the State of Florida, Department of Natural Resources.

Specifically, the study will continue the monitoring of benthic and plankton species. The latter will include nanoplankton as well as net plankton.

The study is being conducted by two full-time biologists stationed at a laboratory at Jensen Beach, Florida. Approximately 10 sampling sites will be selected to be representative of the marine environment at various distances offshore and along the coast. It is anticipated that each of these sites will be sampled extensively every two months.

Physical information, i.e., water temperature, salinity, currents, and meteorological data, is being routinely collected at this time. These data will continue to be collected and will be correlated with the biological sampling.

2.3.6.3.2 Sea Turtle Nesting Study

The habits of the green and loggerhead turtles have been under study by Frank Lund for quite some time. It is his opinion that Hutchinson Island and Jupiter Island, immediately to the south, is the most significant loggerhead nesting area in continental United States.

A study is planned to further observe the nesting habits of the sea turtles on Hutchinson Island during the remaining pre-operational phases of the plant and during plant operation. The details of this study have not been worked out at this time.

2.3.6.3.3 Fish Diversion Study

A study will be initiated in the near future to investigate the various means of reducing the number of fish and other organisms entrained in the cooling water circulation system. The results of this study will be used in the final design of the cooling water intake system.

Factors considered will include velocity caps at the mouth of the intake conduits, the horizontal and vertical velocities at the point of intake and velocities in the intake conduit and on-shore intake canal. Diversion screens in the on-shore canal with a return to the ocean will also be investigated.

2.3.6.3.4 Terrestrial Ecological Studies

Since the construction of the plant has adversely disrupted little in the way of terrestrial ecology no studies are anticipated in this area.

2.3.6.4 <u>Monitoring Programs</u>

Monitoring programs planned into the overall schedule of the Hutchinson Island nuclear power plant can be divided into three categories; those that monitor:

1. Releases from the plant,

2. Environmental conditions that influence the transport or effect of materials released from the plant, and

3. Environmental systems affected by the plant.

2.3.6.4.1 Monitoring Systems for Releases from the Plant

The releases from the plant include gaseous releases from the containment vessel, liquid wastes from the waste management system, sanitary wastes, and the discharge from the cooling water systems.

The gases from the radwaste system, after up to a 30 day hold-up, are released through a vent at the 140 foot elevation. Means are provided to sample the gases for gross radioactivity in the gas decay tanks prior to discharge. The discharged gas activity is also monitored continuously for gross activity and the release rate controlled.

The liquid wastes from waste management system are monitored in tanks for gross activity prior to discharge and occasionally will be monitored for specific nuclides. The discharge from these tanks is monitored continuously for gross activity as it flows into the cooling water discharge system.

Sanitary wastes will be discharged subsurface through a septic tank system and will not be monitored.

The cooling water system will be continuously monitored for temperature at the inlet to the condensers and for temperature and chlorine at the outlet of the condensers.

A monitoring system is located in the ocean near the anticipated point of discharge for the cooling water. Surface and bottom temperature, salinity and current direction and speed are recorded continuously. This program will continue indefinitely.

2.3.6.4.2 Radiological Monitoring

Two major environmental surveys are included in the operation plans for the plant. One, the off-shore ecological survey, was initiated in April 1971 and will continue in a pre-operational phase until the plant goes on line in 1974. The study will then continue in a post-operational phase until questions regarding the environmental impact of the plant are resolved. The other major environmental monitoring program is the radiological program. This is being conducted by the State of Florida Department of Health and is presently underway in the pre-operational phase.

The surveillance program is designed to demonstrate and monitor radionuclide pathways to man. In the pre-operational phase of the surveillance measurements are also being made to establish the radiological characteristics of the area so that trends which might develop in the operating phase may be differentiated from normal background radiation.

The pathways which are being investigated are:

1. External exposure

   a. Exposure to radionuclides resulting from release of gaseous waste.

      1. Particulate material in air

      2. Immersion in a cloud of radioactivity in gaseous form.

   b. Exposure to radionuclides in seawater.

2. Internal Exposure

   Exposure to radionuclides in food chain

   1. Drinking water

   2. Milk

   3. Seafood

   4. Food crops

To accomplish this program the following media will be sampled:

1. Particulates in air

2. Background gamma exposure (external)

3. Seawater

4. Beach sand, silt, and soil

5. Drinking water

6. Milk

7. Beef grown on local pasture

8. Citrus fruit

9. Other food crops as available

10. Fish and crustacea from Indian River. Shellfish will be sampled as available.

Radionuclide concentration analysis of these samples in whole or in part will consist of:

1. Tritium (H-3) in water.

2. Radiochemical separation of strontium 89 and strontium 90 in milk.

3. Gamma spectroscopy of milk for cesium 137, iodine 131, barium 140, and potassium 40.

4. Radiochemical separation of cobalt 58, cobalt 60 and iron 55.

5. Strontium 90 and phosphorous 32 in selected seafood samples by liquid scintillation counting.

6. A gamma analysis by spectroscopy of all media including the following nuclides.

   a. Cerium 144
   b. Iodine 131
   c. Ruthenium 106
   d. Cesium 137
   e. Zirconium 95
   f. Manganese 54
   g. Zinc 65
   h. Barium 140
   i. Potassium 40

Determination of external gamma exposure is made utilizing thermoluminescent dosimetry. Particulates in air are sampled utilizing air movers and filters with a weekly determination of gross beta activity and an analysis of monthly composites for gamma activity as outlined above.

Sampling locations have been established on the basis of calculated dilution factors adjusted for population density in sectors and the wind direction frequencies.

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2.3.7 RADIOACTIVE DISCHARGES

The Florida Power and Light Company has always reviewed, from the initiation of the Hutchinson Island project, the design and proposed operating procedures to assure that every effort will be made to maintain radiation releases to levels "as low as practicable." The applicant believes that the radwaste system's design meets the definition of "as low as practicable" as given in Part 10, Section 50.34a of the Code of Federal Regulations in which it is stated that such term means "as low as practicably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety and in relation to the utilization of atomic energy in the public interest."

The radwaste system's equipment installed will be capable, by virtue of successive process components and/or recycling features and the appropriate storage facilities, of reducing the contained activity in discharged liquids to, or nearly equal to, natural background levels, with the possible exception of tritium. However, even the tritium releases will be kept well below the permissible limits. Storage facilities are provided to reduce the gaseous activity levels by decay before their release. Nevertheless, in spite of the strong belief that the presently designed radwaste system is most adequate, Florida Power and Light will stay informed of developments in this area of radiation control and, if necessary, would consider the incorporation of advanced treatment equipment into the present waste management system as such systems are demonstrated to be practical and necessary.

The effects of any radioactive releases on the aquatic and terrestrial ecosystems will be measured in the radiological monitoring program. It is believed that the monitoring program will show no adverse effects because of the extremely low amounts of radioactivity released from the plant. On the basis of the information given in the following subsections, it is concluded that there will be no measurable radiological impact on the environs as a result of the operation of the Hutchinson Island Plant.

2.3.7.1 Description of the Waste Management System

The waste management system, located in the auxiliary building, is composed of tanks, process equipment and piping necessary for handling radioactive wastes within the confines of the plant and for preparing these wastes for reuse or for offsite disposal. The waste management system includes two subsystems; (1) the boric acid recovery system for normally recoverable liquids, and (2) the waste treatment system for nonrecoverable liquid, gaseous and solid wastes.

The boron recovery system treats the recoverable hydrogen bearing liquid effluent from the reactor coolant system. The design of the system is based on the requirements for processing both the fission products which may be released while operating with 1 percent defective fuel and the radioactive corrosion products carried in the effluent. It should be noted that 1 percent defective fuel is a design number only and affords protection in the event of either transient or long time increases in the amount of failed fuel. The anticipated percent of defective fuel is expected to be at least an order of magnitude lower. The activity level of the liquid effluent is substantially reduced by decay during holdup and by filtration, ion exchange and degasification before it is concentrated and then monitored for either discharge or for reuse in the plant. Normally this treated liquid will be reused.

The waste treatment system treats all nonrecoverable radioactive liquid wastes, solid wastes and gaseous waste mixtures. The system is also designed to process effluent with an activity level based on plant operation with 1 percent defective fuel although, as indicated above, the anticipated percent of defective fuel is expected to be well below this. The basic processing methods used are storage, filtration and concentration. Radioactive solid wastes are compacted in drums for offsite disposal. Any releases of gaseous and liquid effluent from the waste treatment processes shall be in accordance with the provisions of Part 20 of Title 10 of the Code of Federal Regulations. Means are provided to sample potentially radioactive liquid and gaseous wastes in storage tanks prior to their release.

The waste management system is designed to provide controlled treatment and disposal of gaseous and solid wastes and either disposal or reuse of liquid wastes. The principal design criterion concerning disposal is to insure that the general public is protected by maintaining all releases of radioactive materials well within the limits of 10 CFR 20. Releases of radioactivity will be via the batch process after the stored liquid or gas to be released has been sampled. Liquid will be released to its circulating water discharge canal, which has an 1140 cfs (~510,000 gpm) flow. Gases will be discharged to the plant vent which is located on the side of the shield building and is released to the atmosphere at an elevation of 140 ft. Filters are located in the gaseous discharge line.

The waste management system flow diagrams are shown in Figs. 2.3.7-1, 2.3.7-2, 2.3.7-3, and 2.3.7-4. A description of the subsystems follows:

Boron Recovery System

This portion of the system is shown in Figs. 2.3.7-1 and 2.3.7-2. The major source of liquid waste containing hydrogen is reactor coolant letdown that occurs during plant startups and dilution operations. These are transient situations which the system can readily accommodate. Minor sources inside the containment are accumulated in the reactor drain tank during normal operation. These minor sources include leakoff, drain and relief flows from valves and equipment inside the containment which contain reactor coolant.

The liquid wastes either pumped from the reactor drain tank or released from the chemical and volume control system are sprayed into the flash tank. The dissolved hydrogen and any fission gases released from solution are purged to the gas surge header by nitrogen. The nitrogen is maintained in the flash tank at a pressure slightly above atmospheric to prevent air in-leakage and the formation of an explosive hydrogen-oxygen mixture. The flash tank pump operation is controlled automatically by a signal from the tank level. Pressure and level instrumentation with alarms inform the operator of any malfunction.

The liquid is pumped from the flash tank to one of the four holdup tanks where it may be stored until a sufficient volume has accumulated for efficient operation of the boric acid concentrators. The gross activity of the liquid is significantly reduced during storage by the decay of radionuclides. A nitrogen gas blanket in the tanks is automatically maintained above atmospheric pressure to prevent air in-leakage. The nitrogen cover gas is released to the gas collection header or displaced into other holdup tanks as liquid fills the tank. Any further transfer of hydrogen or fission gases from the liquid to the cover gas takes place by molecular diffusion.

Pressure and level instrumentation with alarms are provided on each holdup tank. Should the flash tank equipment malfunction, the letdown flow is automatically diverted to the holdup tanks where it can be stored until the flash tank is back in service. At such time, the holdup tank liquid can be recirculated via the flash tank to remove the dissolved gases.

Flexibility is provided in processing the holdup tank liquid before it enters the boric acid concentrators. Flow paths are provided to recirculate the holdup tank contents through the flash tank or through a filter and/or an ion exchanger. Filters remove particulate matter and strainers serve as a backup to the ion exchanger retention elements. Differential pressure instrumentation is provided for the filters and ion exchangers. In this way, the activity level of the liquid is further reduced before being processed in the boric acid concentrators.

The boric acid concentrator piping located in the system is shown in Fig. 2.3.7-2. The liquid is processed in one or both of the boric acid concentrators and the concentrate is collected in the boric acid holding tank. The capacity of a concentrator is 20 gpm. The recovered boric acid is sampled; it may be diluted or reconcentrated as required before it is pumped to the boric acid tanks in the chemical and volume control system. The distillate, after flowing through one of the ion exchangers, is collected in the condensate tanks and sampled and analyzed for both radioactivity and solids content. The water can then be pumped either to the primary makeup water tank for reuse, recirculated to the holdup tanks or the condensate ion exchanger for further processing, or released to the circulating water discharge. It is anticipated that most of this liquid, approximately 780,000 gallons annually, will be reused in the plant. Any liquid that is released will be monitored for radioactivity and automatic valve closure would be initiated if the activity exceeds a preset level. Level instrumentation with alarms is provided on the boric acid holding and concentrator condensate tanks, and the boric acid holding tank is equipped with a heater and with temperature instrumentation and alarms. The bottoms from the boric acid concentrators will be pumped to the drumming station for ultimate offsite disposal in government approved containers.

Waste Treatment System

Liquid Wastes

Liquid wastes which are normally not reusable, approximately 156,000 gallons annually, include such sources as laboratory sink drains, decontamination area drains, equipment drains, building sumps, laundry effluent and contaminated showers (Fig. 2.3.7-3). These wastes are collected in the equipment, chemical and laundry drain tanks.

Contaminated, aerated and dirty liquid drains and building sumps discharge to the equipment drain tank. Drains from the sampling system, decontamination drains and chemical laboratory drains flow to the chemical drain tank. When a sufficient volume is collected in the drain tanks, the effluent is pumped through a filter to the waste concentrator. The capacity of the concentrator is 2 gpm. The bottoms from the waste concentrator are pumped to the drumming station, and the distillate is collected and monitored in the waste concentrator condensate tanks. After the distillate has been sampled and analyzed, it may be released to the circulating water discharge or, if necessary, it can be retreated as required. The activity of the effluent in the line to the circulating water discharge is monitored and, should the concentration exceed preset limits, the discharge is automatically stopped. The liquid would then receive further treatment before its release via the same line. All tanks are provided with level instrumentation and alarms.

The laundry wastes are collected in the laundry drain tanks and are normally pumped through a filter directly to the circulating water discharge. Should the concentration exceed the preset limits, the discharge is automatically stopped and additional processing commenced. The activity level is closely monitored and, should the need arise, the laundry wastes can be processed using the waste concentrator.

Gaseous Wastes

This portion of the system is shown in Fig. 2.3.7-4. The gaseous waste system processes potentially radioactive mixtures of waste gases which are either aerated or contain hydrogen. Gaseous effluents satisfying the concentration limits are discharged to the plant vent.

The majority of the gaseous waste is nitrogen cover gas that is displaced by liquid accumulation in the holdup tanks. Sources of radioactive waste gas mixtures containing hydrogen include the reactor drain tank, flash tank, volume control tank in the chemical and volume control system, and the pressurizer quench tank. Aerated radioactive waste gas sources include the equipment drain tank, chemical drain tank, laundry drain tanks, and concentrator condensate tanks. The aerated gases are processed separately from the gases containing hydrogen to prevent the possibility of explosive mixtures. Aerated waste gas mixtures are vented to the gas collection header and then to the plant vent.

Hydrogen and fission gases stripped in the flash tank and vented from other tanks flow to the gas surge header and then to the gas surge tank. A nitrogen blanket in the gas surge tank automatically maintains a slight positive pressure in the system. The gases are compressed into the gas decay tanks by means of the waste gas compressors.

The gases are retained in the tanks until the activity level has been reduced by decay so that, when controlled release to the plant vent occurs, the concentrations at the site boundary will be well below the concentration limits of 10 CFR 20. Storage capacity is sufficient for 30-day holdup. Means are provided to sample the radioactive gases in the gas decay tanks prior to discharge. The discharged gas activity level is monitored and controlled. The interconnection of the holdup tanks provides a large volume for dilution of any fission gases or hydrogen which may diffuse out of the liquid effluent thereby assuring that discharge will be within the limits of 10 CFR 20.

The holdup tank nitrogen cover gas and aerated waste gases are vented to the gas collection header and then to the vent.

The gas system also includes the nitrogen and hydrogen controls, consisting of relief valves, pressure regulators, pressure instrumentation with alarms and valving to allow safe and flexible operation.

A gas analyzer provides the means to automatically sample at frequent intervals the components that may contain mixtures of hydrogen and air. Provisions are made to purge these components with nitrogen.

Solid Wastes

Radioactive solid wastes consist mainly of dewatered ion exchanger resins, the waste solidified from the concentrator bottoms, filter elements, and contaminated disposable solids such as plastic bags and protective clothing.

The spent resins may be stored in the spent resin tank for decay before being sluiced to the drumming station. The contaminated disposable solids are collected in suitable containers and removed from the site by licensed contractors in accordance with Department of Transportation and other applicable regulations.

2.3.7.2 Released Activity

An estimate of the quantity of each of the principal radionuclides expected to be released in liquid and gaseous effluents during normal reactor operation has been calculated and is given in Table 2.3.7-1. The quantities are given as fractions of their maximum permissible concentrations (MPC) as given in Appendix B of 10 CFR 20. It is believed that presenting the results in such a way is more meaningful than listing the total curies of a discharged radionuclide. The curie amount by itself is not really indicative of its effect on the environs. The fractions given in the table are then compared with actual measured fractions for operating pressurized water reactors as given in Ref. 1.

The values given in Table 2.3.7-1 assume that plant operation takes place with 0.1% failed fuel and that the gaseous activity is held up for the full thirty days before its release. The full delay time is consistent with keeping releases as low as practicable. The results indicate that the yearly average concentrations of the released liquid activity will be about one half of one percent of the 10 CFR 20 limits and for the released

TABLE 2.3.7-1

ESTIMATED YEARLY AVERAGE RADIONUCLIDE RELEASES

A. Liquid Releases

Radionuclide	MPC(μCi/ml)	Average Concentration in Circulating Water Discharge, μCi/ml	Fraction of MPC in Circulating Water Discharge
H-3	3×10^{-3}	23.1×10^{-7}	7.7×10^{-4}
Cr-51	2×10^{-3}	2.8×10^{-9}	1.4×10^{-6}
Mn-54	1×10^{-4}	2.3×10^{-11}	2.3×10^{-7}
Co-58	9×10^{-5}	88.2×10^{-10}	9.8×10^{-5}
Co-60	3×10^{-5}	12.3×10^{-10}	4.1×10^{-5}
Fe-59	5×10^{-5}	8.5×10^{-12}	1.7×10^{-7}
Sr-89	3×10^{-6}	7.8×10^{-13}	2.6×10^{-7}
Sr-90	3×10^{-7}	3.9×10^{-14}	1.3×10^{-7}
Y-91	3×10^{-5}	3.3×10^{-10}	1.1×10^{-5}
Zr-95	3×10^{-5}	21.6×10^{-12}	7.2×10^{-7}
Mo-99	2×10^{-4}	2.6×10^{-9}	1.3×10^{-5}
Ru-103	8×10^{-5}	63.2×10^{-14}	7.9×10^{-9}
Ru-106	1×10^{-5}	3.7×10^{-14}	3.7×10^{-9}
I-131	3×10^{-7}	6.0×10^{-10}	2.0×10^{-3}
I-133	1×10^{-6}	8.3×10^{-10}	8.3×10^{-4}
Cs-134	9×10^{-6}	52.2×10^{-10}	5.8×10^{-4}
Cs-137	2×10^{-5}	2.6×10^{-8}	1.3×10^{-3}
Ce-144	1×10^{-5}	5.9×10^{-13}	5.9×10^{-8}

$\Sigma = 0.49 \times 10^{-2}$
(not including tritium)

$\Sigma = 0.57 \times 10^{-2}$
(including tritium)

TABLE 2.3.7-1 (Continued)

B. Gaseous Releases

Radionuclide	MPC(μCi)/(ml)	Fraction of MPC at Boundary of Restricted Area*
Kr-85	3×10^{-7}	5.1×10^{-4}
Xe-133	3×10^{-7}	5.8×10^{-4}
		$\Sigma = 10.9 \times 10^{-4}$

* This assumes an atmospheric dispersion factor (χ/Q) of 2.4×10^{-6} sec/m^3 at the site boundary of approximately 5000 ft. Actual measurements of dispersion are being made and it is believed that the χ/Q value will be of the order of 1×10^{-6}.

gaseous activity, slightly greater than one tenth of one percent of the limits. The average concentration of the released tritium is expected to be less than one tenth of one percent of its permissible limit.

Reference 1 presents results for both gaseous and liquid discharges for operating reactors in the United States. Although pressurized water, boiling water, and the one gas cooled reactor are listed, the most meaningful information is obtained by comparing the calculated results with the results given in the tables for pressurized water reactors. The most significant tables are 4, 7, 9, and 10 of the reference. These tables clearly show that there is a fairly wide range in the percent of allowable limits that have been released, although all releases are well below the 10 CFR 20 limits. For liquids, exclusive of tritium, the percents range from less than one tenth to slightly above five. For tritium, the percents range from 0.005 to 0.15, and for gases all the releases are below one percent, with most being below one tenth of a percent. The estimated releases are thus seen to fall within the range of actual releases that have occurred during the operation of other pressurized water facilities.

2.3.7.3 Pathways to Man and Annual Radiation Doses

A number of potential pathways of radiation exposure to man exist from operation of the Hutchinson Island Plant. These include both external and internal exposure paths. The external exposure pathway is via the release of gaseous waste from the facility and possibly also directly from radionuclides in the seawater. The internal exposure pathway is via the food chain. This would include seafood, milk, food crops, and drinking water.

While some estimates of the effects of the pathways to man can be made, reliance for detailed information must really be placed on the surveillance program (refer to Section 2.3.6.3). In the pre-operational phase of the program, measurements will be made to establish the radiological characteristics of the area so that trends which might develop during the operating phase may be differentiated from normal background radiation.

External Exposure

During normal operation of the facility, external exposure from released gaseous activity (essentially only Kr-85 and Xe-133) is expected to have hardly any effect. Based on the gaseous releases listed in Table 2.3.7-1, the dose to a person standing at the plant boundary for year would be slightly greater than a half of a mrem. Such a dose is less than a person would receive from cosmic rays during a one way flight across the United States in a jet plane. The annual dose from released gaseous activity to a person standing on the west bank of the Indian River for a year would be even lower, about a quarter of a mrem per year. This is completely insignificant when compared with the total yearly dose of 120 mrem from natural sources. Population groups, further inland, would, of course, receive even lower doses.

Direct external radiation exposure from discharged activity in the ocean is expected to be insignificant due to the fact that the very low level activity discharge takes place well away from the shore line and also because it undergoes good dilution. Water that is already low in activity precludes any concern from this potential pathway.

Internal Exposure

Since liquid effluents from Hutchinson Island will be discharged directly into the Atlantic Ocean, the marine food chains will be monitored as possible pathways to man. For fin fish, Cs-134 and Cs-137 are the critical nuclides because they are "reconcentrated" in the edible flesh of fish. Thus, while the fish might be in water containing a certain concentration of cesium, the flesh of the fish will contain a higher concentration because of the reconcentration effect. Other radionuclides which are reconcentrated in fin fish include Co-58, Co-60, Sr-89, and Sr-90. However, these radionuclides are, in general, not as significant as radiocesium from a population dose standpoint because they tend to concentrate in the non-edible portions of fish, i.e., strontium in the bone, and cobalt in the liver and kidney.[2]

For shellfish, such as lobsters, shrimp, crabs, etc., the effluent radionuclides, Cr-51, Mn-54, Co-58, Fe-59, Co-60, Zr-95, Ru-103, Ru-106, I-131, I-133 and Ce-144, are reconcentrated in the edible tissues. Strontium is concentrated in the shell and is not expected to be of public health significance, unless the shell is employed in animal feed.[2]

A conservative calculation of the amount of seafood that would have to be eaten daily to reach the general population limits has been made. Reconcentration factors, as given in References 3 and 4, have been applied to the average concentration of nuclides in the circulating water discharge. No dilution of the effluent was assumed and the fish were assumed exposed to this activity for the time required to reach their maximum activity concentrations. Even with these extremely conservative assumptions, the results indicate that a member of the general public could eat about 2.0 lb. of seafood every day of the year and still not be exposed to an internal dose exceeding the permissible limits. Reference 3 refers to a report that says the annual fish consumption of commercial fishermen is 37 lb., or only about 0.1 lb. per day. Thus, even assuming that the diet of the general population is similar to the diet of commercial fishermen, which is unlikely, the amount of seafood that would be needed to be consumed is much larger than is reasonable. As such, it is concluded that the internal dose from the consumption of fish caught in the ocean offshore from the Hutchinson Island Plant would be negligible. Of course, the fish living in the Indian River would be unaffected by any plant releases.

The existence of commercial dairy and crop farms in St. Lucie and surrounding counties suggests two other possible routes to man for radionuclides in effluents discharged to the atmosphere: (1) the air-grass-milk-child and (2) air-soil-food crop-man pathways. The critical radionuclides for the first route are I-131, Sr-89, and Sr-90, which are readily concentrated in milk. Cs-134 and Cs-137 may also contribute to this pathway. For the food crop pathway, Cs-134, Cs-137, Sr-89 and Sr-90 are the critical nuclides. Sr-89 and Sr-90 enter the food crop chain either through absorption by plant roots or direct plant contamination, while Cs-134 and Cs-137 enter the chain by direct contamination. However, as stated in Ref. 2, experience at operating pressurized water reactors which utilize gaseous waste treatment facilities has not indicated a measurable exposure hazard via these routes.

The final pathway to man that has been considered is from drinking water. Obviously there need be no concern from water in the Atlantic Ocean, because its salt content precludes its use as a supply of drinking water. The only sources of drinking water that could be potentially affected by the plant's operation would be wells or other drinking water systems in the general area of the facility. While it is believed that such waters on the mainland will not be contaminated from reactor effluents, the surveillance program will assure that this is, in fact, correct.

In summary, it is concluded that the released radionuclides will have an insignificant effect on the environs. An evaluation of the Hutchinson Island Plant by the Public Health Service[2] did not reveal any information that the plant could not be operated without any undue risk to the surrounding population. In addition, radiological surveillance studies at the Dresden Nuclear Power Station for Dresden I concluded that the "exposure to the surrounding population through consumption of food and water from radionuclides released at Dresden was not measurable."[5] Even though Dresden I is a boiling water reactor, the conclusions are nevertheless relevant. A similar study on a pressurized water reactor (Yankee Rowe) has been completed, but the report has not yet been released. However, referring to this study, Ref. 6 states the following: "Preliminary data indicate that exposure in the environs from the discharge to the atmosphere of gaseous radioactive wastes from this reactor was not detectable. In addition, sampling of the aquatic environment did not reveal radioactivity levels that would produce measurable exposure to the public."

2.3.7.4 Radiological Effects on Important Species

As discussed in Section 2.3.7.2, the amount of activity released during plant operations is expected to be quite low, less than one percent of the 10 CFR 20 limits. While it is true that radiation standards for safeguarding aquatic organisms and wildlife are more difficult to establish than those prescribed for man because of the many species involved, the following statement was made by Dr. Raymond Johnson, Assistant Director, Bureau of Sport Fisheries and Wildlife, Department of the Interior:[7]

> "However, in spite of this problem (numerous species involved),* virtually all published data show that concentration of radionuclides required to injure fish and wildlife are much higher than the maximum permissible concentrations prescribed in title 10, part 20, of the Code of Federal Regulations."

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* Parentheses added for clarification.

Dr. Johnson went on to say that the cushion provided by the 10 CFR 20 limits appears to be adequate for acute toxicities or effects on aquatic organisms.

On the basis of the above, it is believed that the anticipated releases of radioactivity from the facility will have a minimal radiological effect on the important species in the environs. Verification of this tentative conclusion will, of course, have to wait on the results of the preoperational and operational radiological monitoring programs.

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2. Pliner, G., "Public Health Evaluation - Hutchinson Island Plant, Unit No. 1," U. S. Public Health Service, Bureau of Radiological Health, April 1970.

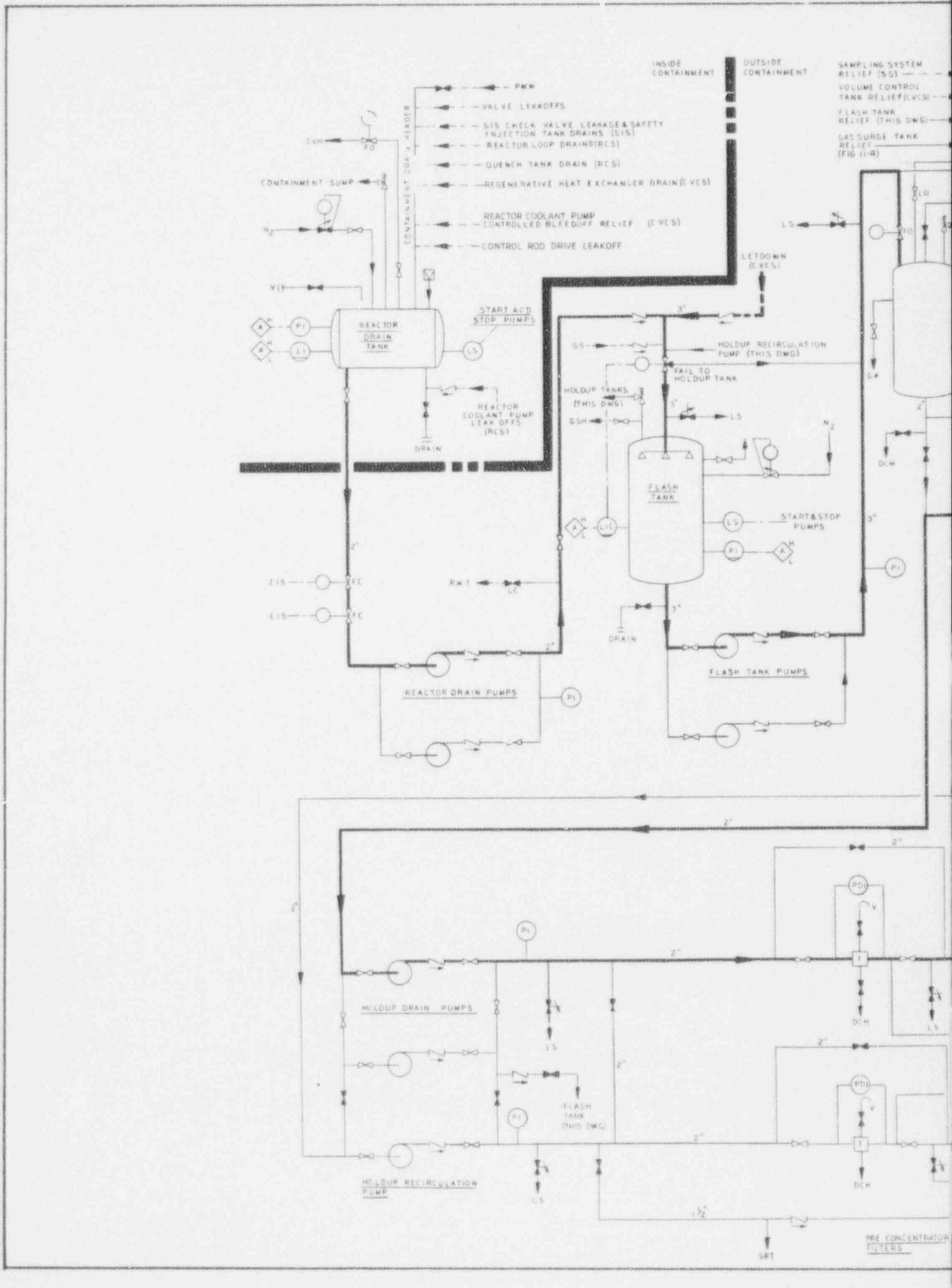
3. Weaver, C. L., "A Proposed Radioactivity Concentration Guide for Shellfish," U. S. Public Health Service, September 1967.

4. Freke, A. M., "A Model for the Approximate Calculation of Safe Rates of Discharge of Radioactive Wastes into Marine Environments," Health Physics, 13, November 1966.

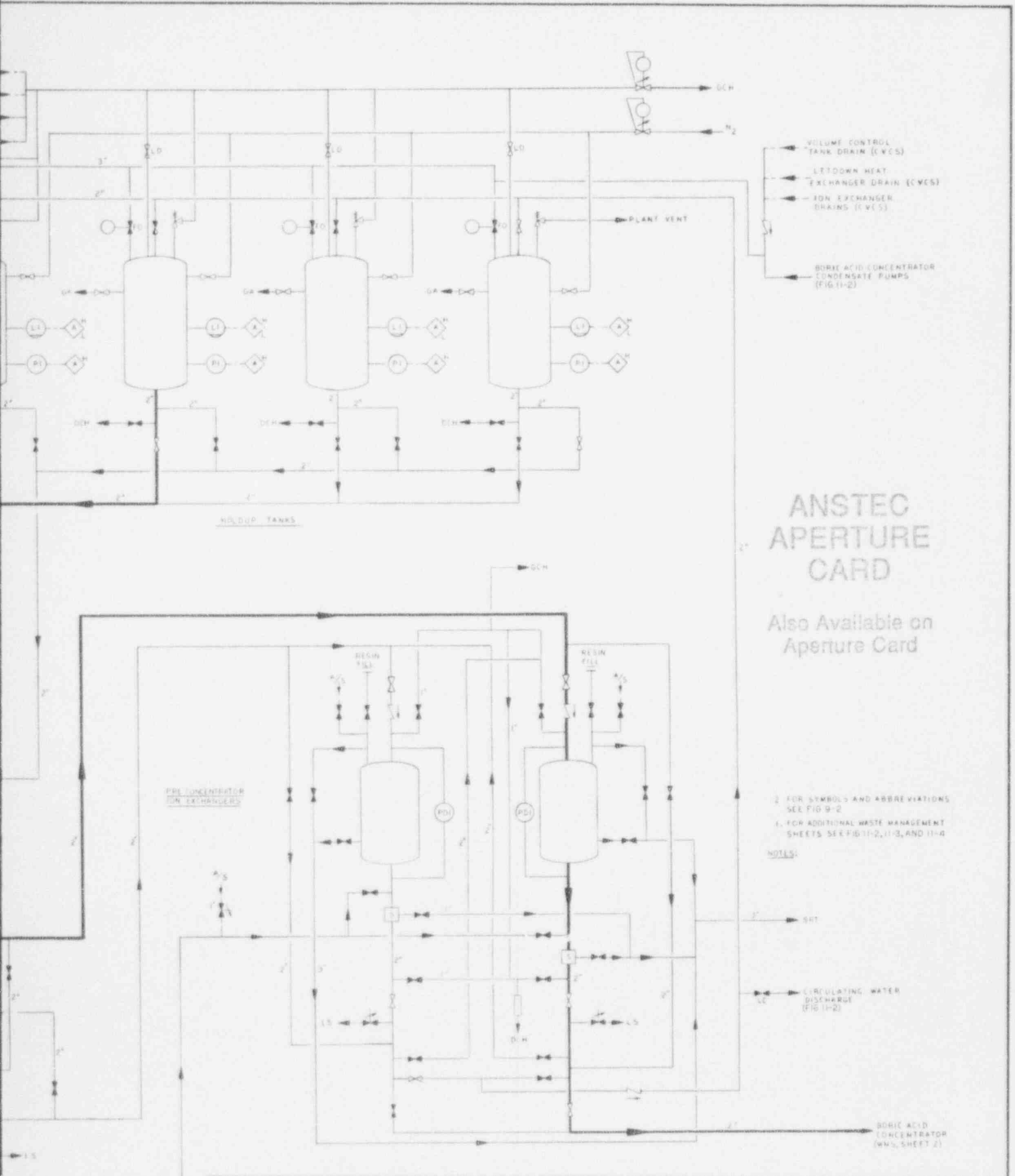
5. Kahn, B., et al, "Radiological Surveillance Studies at a Boiling Water Nuclear Power Reactor," BRH/DER 70-1 March 1970.

6. Radiological Health Data and Reports, Vol. II, Number 7, July 1970.

7. Statement made on November 5, 1969 at the Hearings before the Joint Committee on Atomic Energy, Congress of the United States, Ninety-First Congress, First Session on "Environmental Effects of Producing Electric Power."



INSIDE CONTAINMENT
OUTSIDE CONTAINMENT
SAMPLING SYSTEM RELIEF (SS)
VOLUME CONTROL TANK RELIEF (CVCS)
FLASH TANK RELIEF (THIS DWG)
GAS SURGE TANK RELIEF (FIG 11-4)
PMW
VALVE LEAKOFFS
SIS CHECK VALVE LEAKAGE & SAFETY INJECTION TANK DRAINS (SIS)
REACTOR LOOP DRAINS (RCS)
QUENCH TANK DRAIN (RCS)
REGENERATIVE HEAT EXCHANGER DRAIN (CVCS)
REACTOR COOLANT PUMP CONTROLLED BLEEDOFF RELIEF (CVCS)
CONTROL ROD DRIVE LEAKOFF
CONTAINMENT DRAIN HEADER
CONTAINMENT SUMP
CVH
N2
VH
REACTOR DRAIN TANK
START AND STOP PUMPS
LETDOWN (CVCS)
HOLDUP RECIRCULATION PUMP (THIS DWG)
FAIL TO HOLDUP TANK
HOLDUP TANKS (THIS DWG)
GSH
REACTOR COOLANT PUMP LEAK OFFS (RCS)
DRAIN
FLASH TANK
START & STOP PUMPS
CIS
RWT
REACTOR DRAIN PUMPS
FLASH TANK PUMPS
HOLDUP DRAIN PUMPS
FLASH TANK (THIS DWG)
HOLDUP RECIRCULATION PUMP
PRE CONCENTRATOR FILTERS
SRT
DCH
LS
PI
PDI



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Waste Management System - Flow Diagram	HUTCHINSON ISLAND PLANT ENVIRONMENTAL REPORT	FIGURE 2.3.7-1

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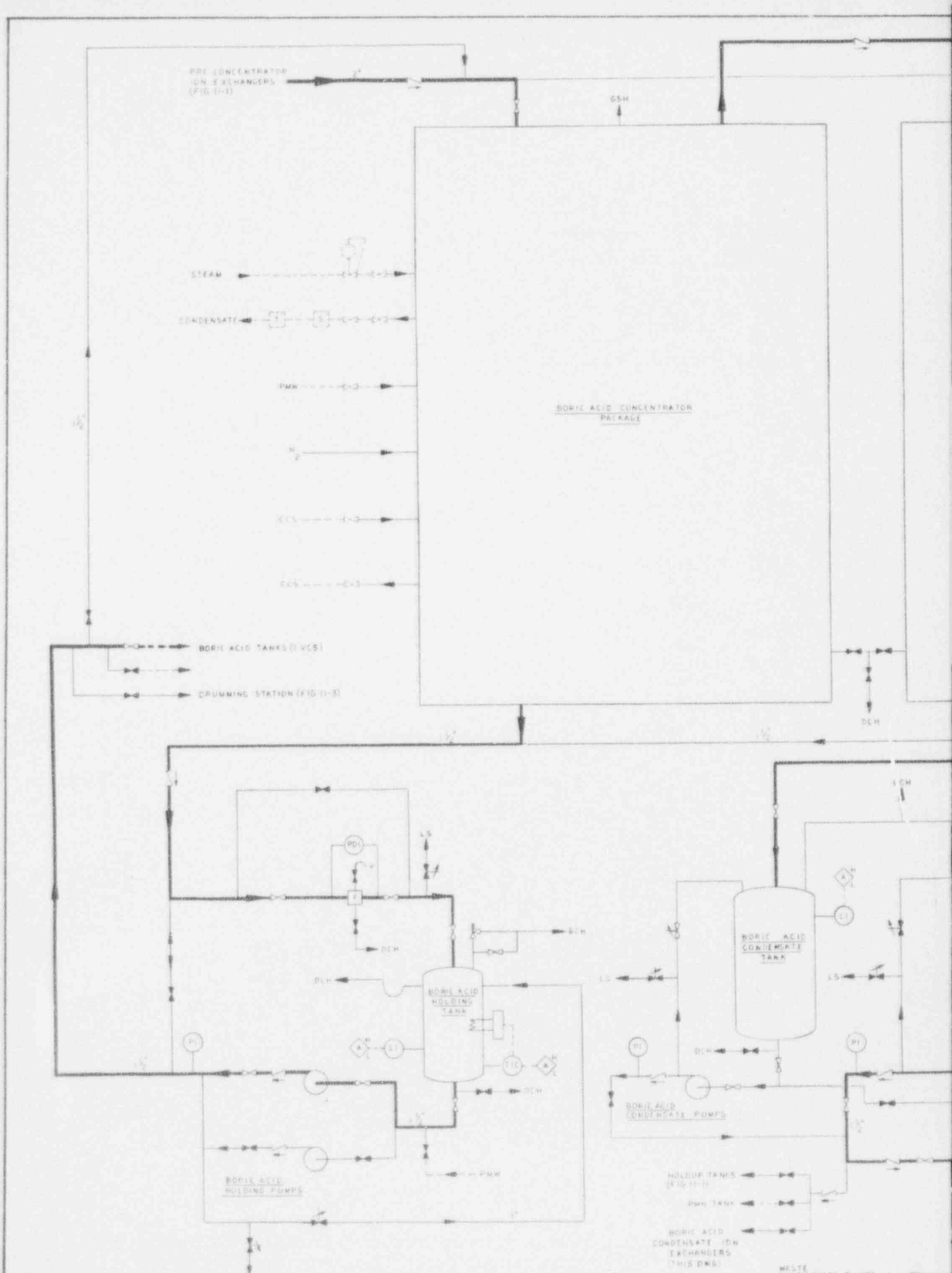
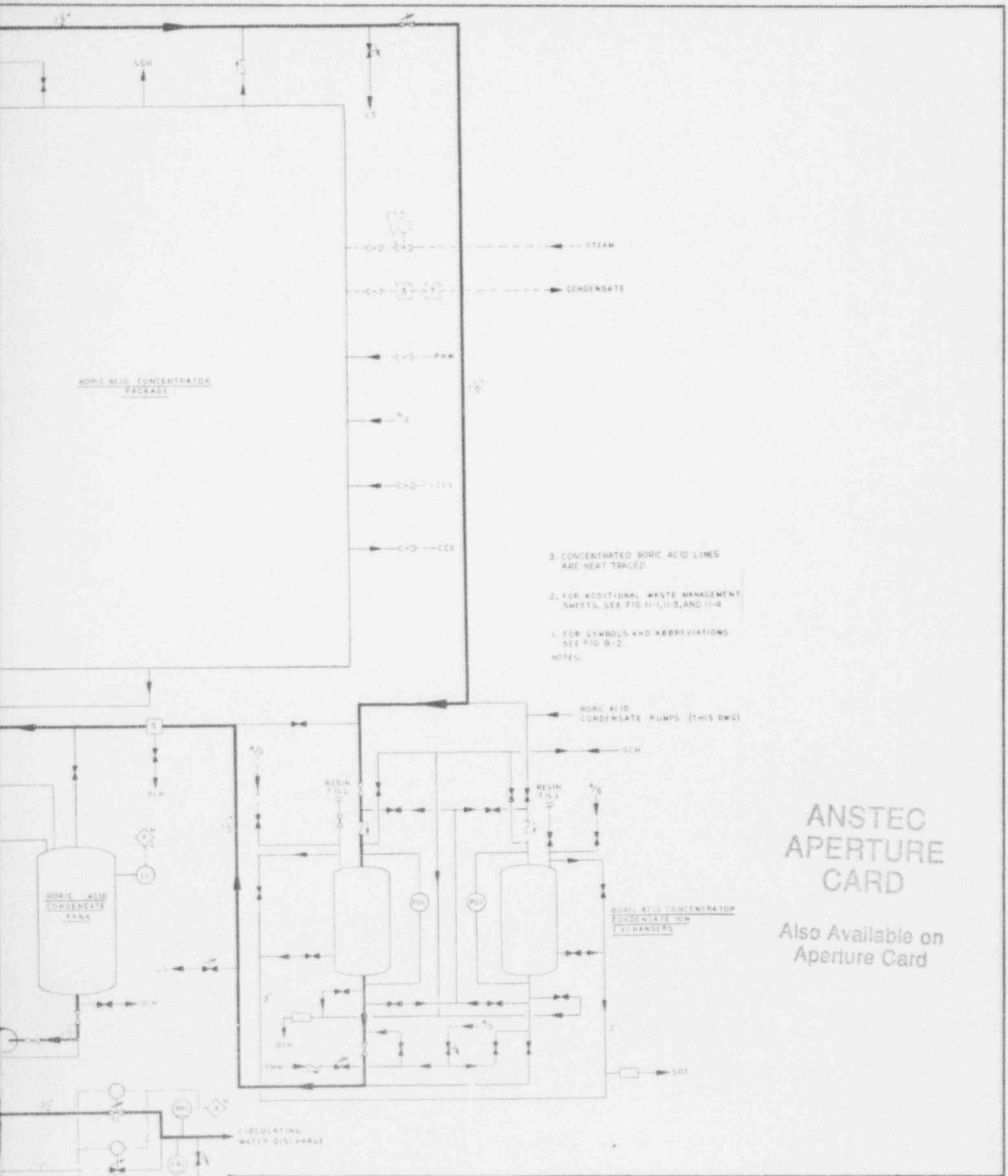


PRE CONCENTRATOR ION EXCHANGERS (FIG 11-1)
GSH
STEAM
CONDENSATE
PMW
CCS
CCS
BORIC ACID CONCENTRATOR PACKAGE
BORIC ACID TANKS (CVCS)
DRUMMING STATION (FIG 11-3)
DCH
PDI
LS
BORIC ACID HOLDING TANK
PI
LI
TIC
BORIC ACID HOLDING PUMPS
BORIC ACID CONDENSATE TANK
BORIC ACID CONDENSATE PUMPS
HOLDUP TANKS (FIG 11-1)
PMW TANK
BORIC ACID CONDENSATE ION EXCHANGERS (THIS DWG)
WASTE CONDENSATE PUMPS (FIG 11-3)



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Waste Management System - Flow Diagram	HUTCHINSON ISLAND PLANT ENVIRONMENTAL REPORT	FIGURE 2.3.7-2

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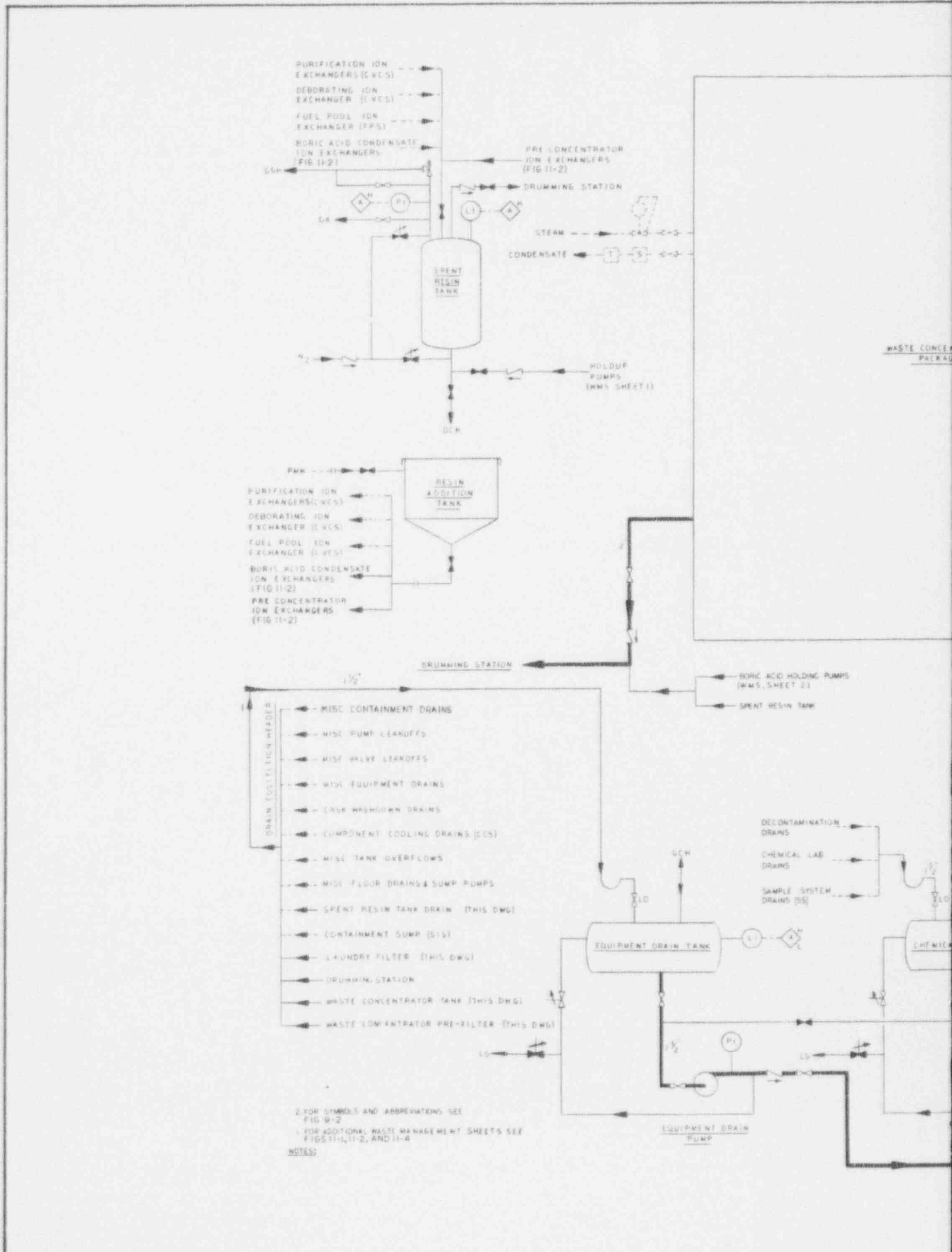
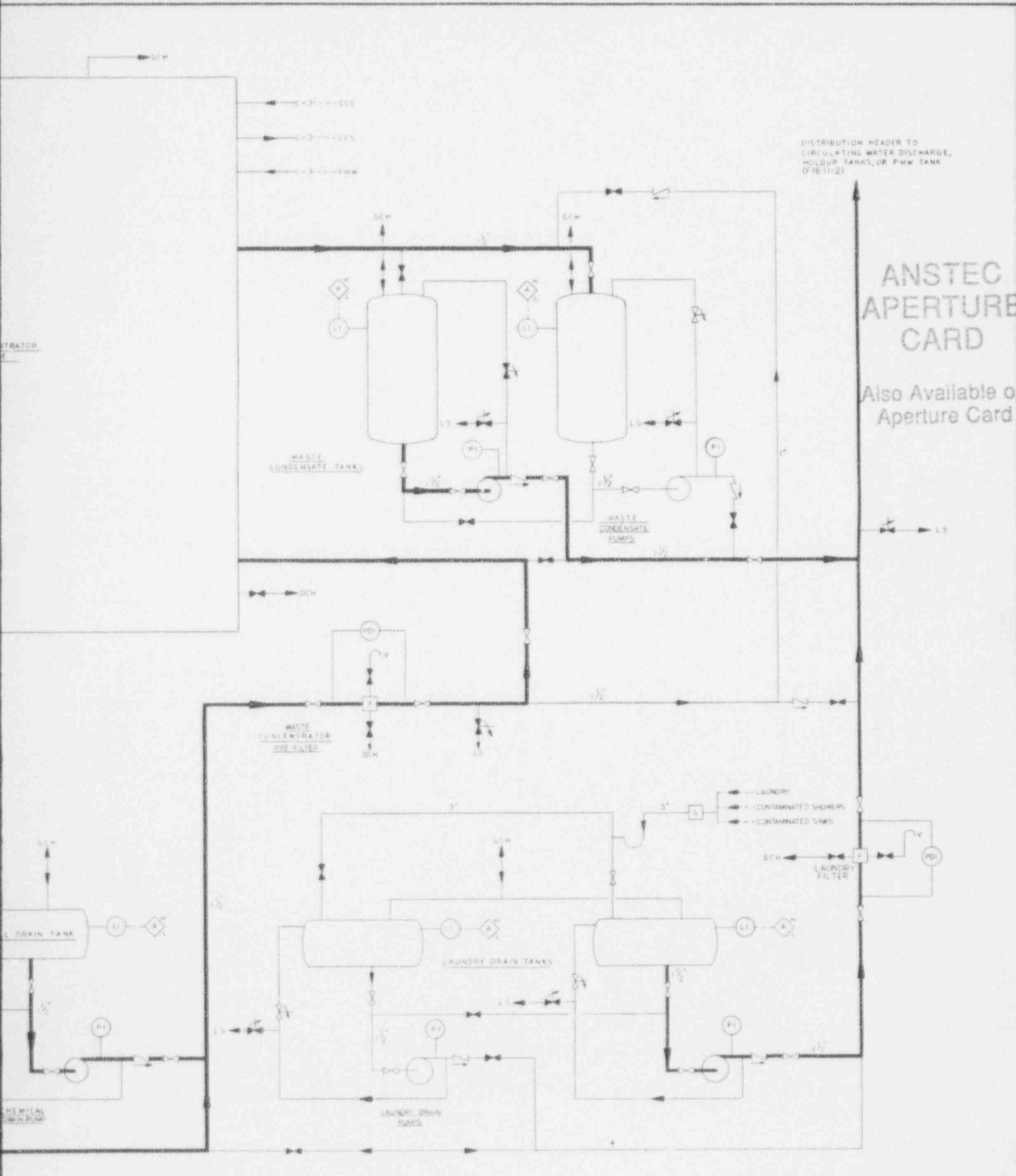

PURIFICATION ION EXCHANGERS (CVCS)
DEBORATING ION EXCHANGER (CVCS)
FUEL POOL ION EXCHANGER (FPS)
BORIC ACID CONDENSATE ION EXCHANGERS (FIG 11-2)
PRE CONCENTRATOR ION EXCHANGERS (FIG 11-2)
DRUMMING STATION
STEAM
CONDENSATE
SPENT RESIN TANK
HOLDUP PUMPS (WMS SHEET 1)
GCH
PMW
RESIN ADDITION TANK
PURIFICATION ION EXCHANGERS (CVCS)
DEBORATING ION EXCHANGER (CVCS)
FUEL POOL ION EXCHANGER (CVCS)
BORIC ACID CONDENSATE ION EXCHANGERS (FIG 11-2)
PRE CONCENTRATOR ION EXCHANGERS (FIG 11-2)
WASTE CONCEN... PACKAG...
DRUMMING STATION
BORIC ACID HOLDING PUMPS (WMS, SHEET 2)
SPENT RESIN TANK
DRAIN COLLECTION HEADER
MISC CONTAINMENT DRAINS
MISC PUMP LEAKOFFS
MISC VALVE LEAKOFFS
MISC EQUIPMENT DRAINS
CASK WASHDOWN DRAINS
COMPONENT COOLING DRAINS (CCS)
MISC TANK OVERFLOWS
MISC FLOOR DRAINS & SUMP PUMPS
SPENT RESIN TANK DRAIN (THIS DWG)
CONTAINMENT SUMP (SIS)
LAUNDRY FILTER (THIS DWG)
DRUMMING STATION
WASTE CONCENTRATOR TANK (THIS DWG)
WASTE CONCENTRATOR PRE-FILTER (THIS DWG)
DECONTAMINATION DRAINS
CHEMICAL LAB DRAINS
SAMPLE SYSTEM DRAINS (SS)
EQUIPMENT DRAIN TANK
CHEMICA...
EQUIPMENT DRAIN PUMP
NOTES:
1. FOR ADDITIONAL WASTE MANAGEMENT SHEETS SEE FIGS 11-1, 11-2, AND 11-4
2. FOR SYMBOLS AND ABBREVIATIONS SEE FIG 9-2

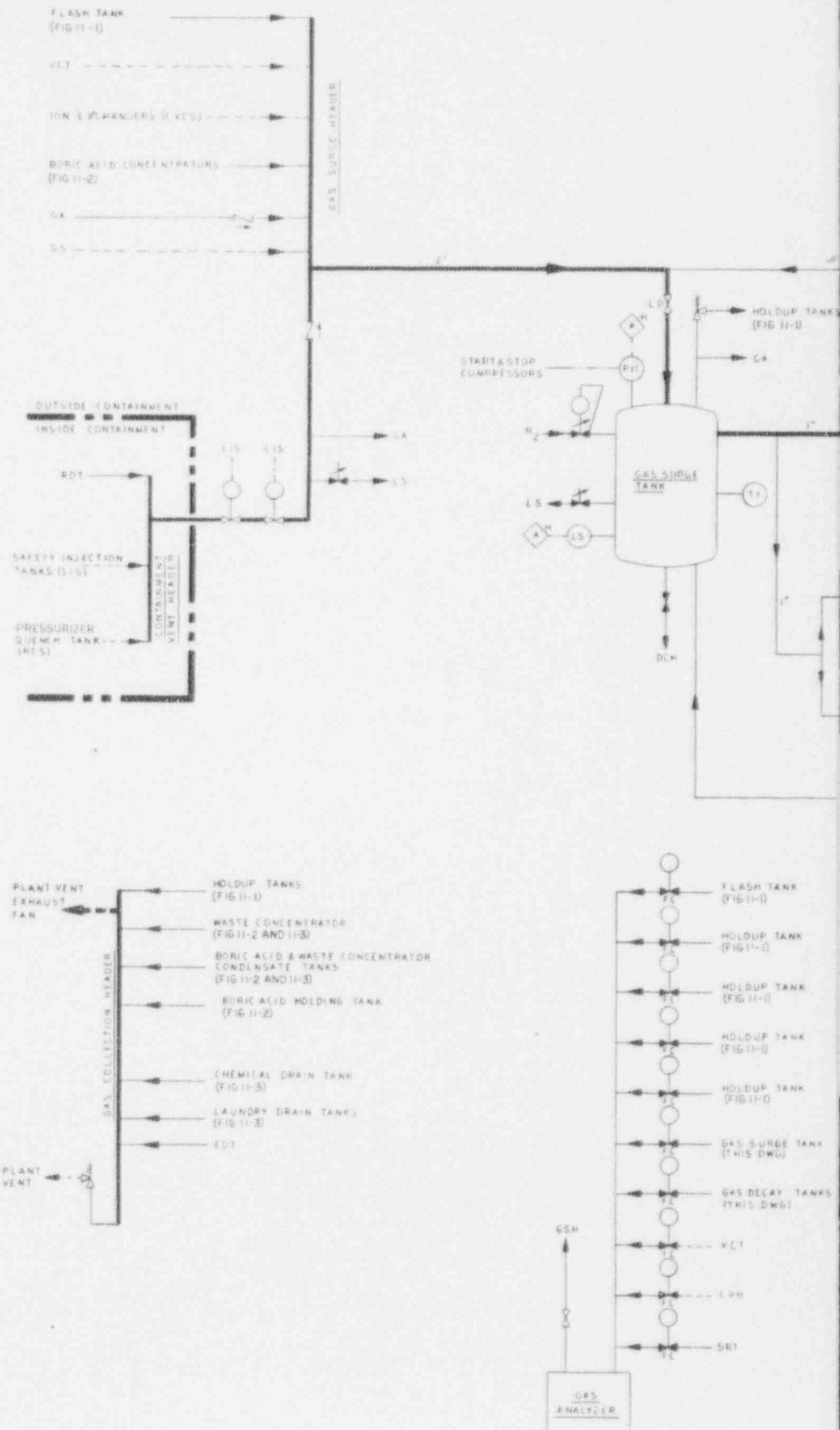


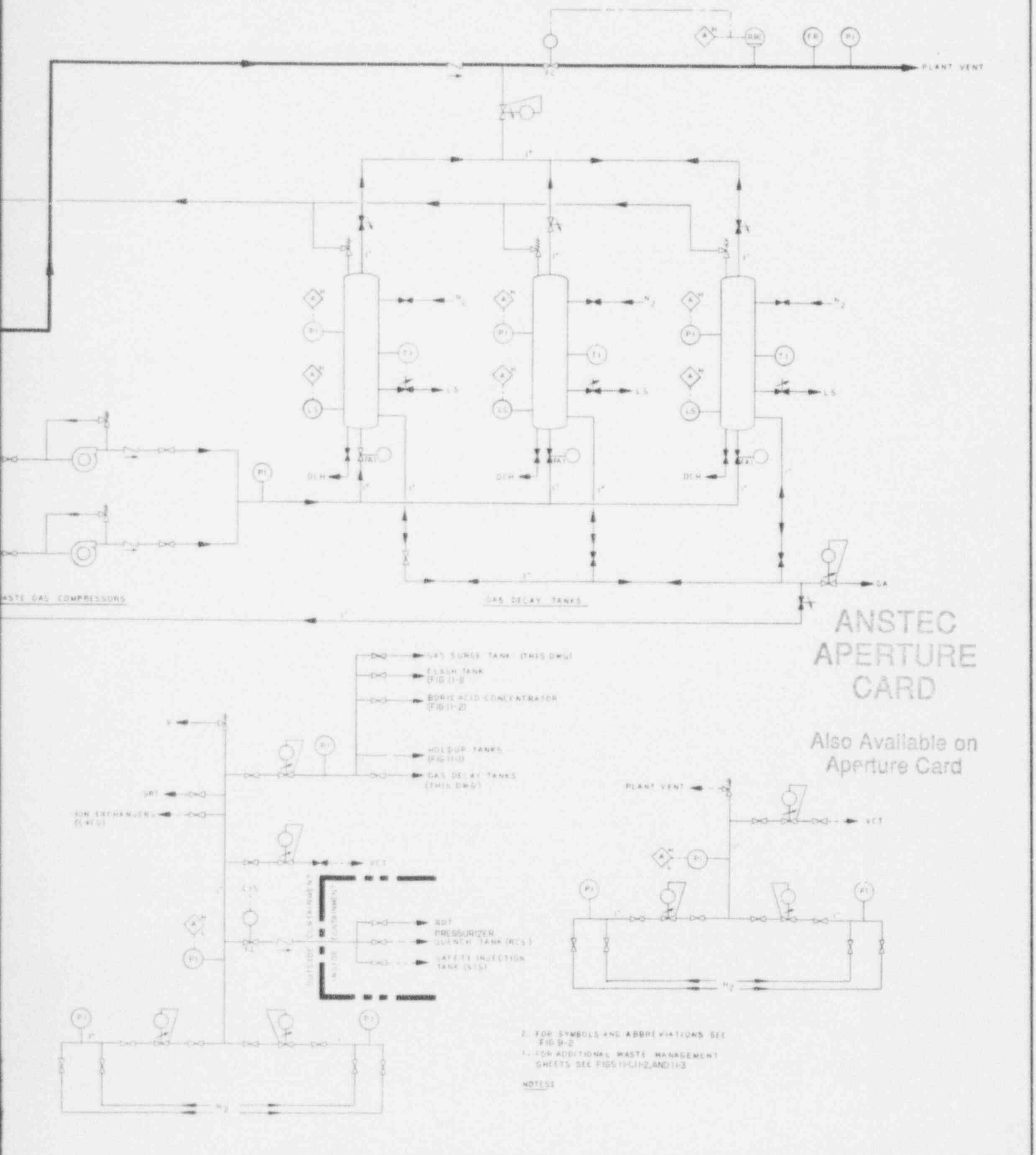
ANSTEC APERTURE CARD

Also Available on Aperture Card

Waste Management System - Flow Diagram	HUTCHINSON ISLAND PLANT ENVIRONMENTAL REPORT	FIGURE 2.3.7-3

9406140015-10


FLASH TANK (FIG 11-1)
VCT
ION EXCHANGERS (CVCS)
BORIC ACID CONCENTRATORS (FIG 11-2)
GA
SS
GAS SURGE HEADER
OUTSIDE CONTAINMENT
INSIDE CONTAINMENT
RDT
SAFETY INJECTION TANKS (SIS)
PRESSURIZER QUENCH TANK (RCS)
CONTAINMENT VENT HEADER
GA
LS
START & STOP COMPRESSORS
PIC
HOLDUP TANKS (FIG 11-1)
GA
GAS SURGE TANK
TI
LS
DCH
PLANT VENT EXHAUST FAN
HOLDUP TANKS (FIG 11-1)
WASTE CONCENTRATOR (FIG 11-2 AND 11-3)
BORIC ACID & WASTE CONCENTRATOR CONDENSATE TANKS (FIG 11-2 AND 11-3)
BORIC ACID HOLDING TANK (FIG 11-2)
CHEMICAL DRAIN TANK (FIG 11-3)
LAUNDRY DRAIN TANKS (FIG 11-3)
EDT
PLANT VENT
GAS COLLECTION HEADER
FLASH TANK (FIG 11-1)
HOLDUP TANK (FIG 11-1)
HOLDUP TANK (FIG 11-1)
HOLDUP TANK (FIG 11-1)
HOLDUP TANK (FIG 11-1)
GAS SURGE TANK (THIS DWG)
GAS DECAY TANKS (THIS DWG)
VCT
CVH
SRT
GSH
GAS ANALYZER



ANSTEC APERTURE CARD

Also Available on Aperture Card

Waste Management System - Flow Diagram	HUTCHINSON ISLAND PLANT ENVIRONMENTAL REPORT	FIGURE 2.3.7-4

9406140015-11

2.3.8 CONSTRUCTION EFFECTS

The preliminary site preparation efforts which commenced on April 10, 1969, and the start of construction which began with the receipt of the Construction Permit on July 1, 1970, were designed to stringently control the effects on the environment and to keep such effects below the threshold at which any harm could occur. Fortunately, the care with which this construction was planned anticipated the spirit of the National Environmental Policy Act of 1969. By the time the Act had become law (January 1, 1970) approximately 80% of the construction work which would have an effect on the environment had been completed. In addition to the Construction Permit received from the Atomic Energy Commission, permits affecting construction had also been received from the Corps of Engineers and The Trustees of the Internal Improvement Fund of the State of Florida (see Section 2.2).

2.3.8.1 Schedule

A schedule of construction activities is given in Table 2.3.8-1. The table has been arranged to categorize those preparational activities which took place prior to receipt of the Construction Permit; those carried out between the receipt of this permit and the preparation of this Report; and the scheduled completion dates.

2.3.8.2 Construction Effects on Indian River

It is necessary to consider the previous condition of the plant area to evaluate the effects of construction. Figure 2.3.8-1 is a photograph of the plant area taken in August, 1968, previous to the start of any work whatever at the site. It will be seen that this entire area at that time was a mangrove swamp in which most of the mangrove and related plant life was dead, due to the flooding and ditching necessary for mosquito control. The drainage work which had such a serious effect on the vegetation had been started for mosquito control in the early 1930's under Works Progress Administration support. [More recently, the St. Lucie County Mosquito Control District had, as will be seen from the photograph, devoted considerable effort to this particular area. From the rather impressive amount of work which was necessary for mosquito control, it would seem that the local residents may have had a rather negative view of the swamp on which the plant is now being erected. A report on the past and present condition of the plant site vegetation by Dr. John H. Davis is included as Appendix 4. As given in this report, Dr. Davis concluded that the site area had become "almost a biological desert" before the start of construction, a conclusion borne out by the color photograph. [As will be seen from another photograph, Fig. 2.3.8-2, taken on January 27, 1971, when construction was well along, a belt dike has been completed around the plant area (visible near the perimeter road and the belt of trees) to prevent erosion and the contamination of the Indian River from runoff.] Dewatering operations have been necessary before placing the foundation fill, and this rather limited volume of water has been discharged to Big Mud Creek and the Indian River. This limited quantity of ground water is negligible in its effects. Because of the nature of the earth, little or no blasting has been required during construction. While noise levels are those common for any major construction effort, the distance to inhabited areas is so great that they are not heard. The effects of construction are apparent only on the Indian River side. These effects, from such operations as the initial dredging of Big Mud Creek, are well within the limits set by the dredging permit as issued by the State of Florida Internal Improvement Fund. There will be no effects of construction on local water supplies as no useable aquifers exist below the site (see Section 2.3.2). As discussed elsewhere, the development of Hutchinson Island has been limited by the lack of water supply, and the water for the plant will be obtained from the City of Ft. Pierce Municipal System. The city's water resources are considered to be more than adequate for considerable growth in the area.

2.3.8.3 Construction Effects on the Atlantic

On the completion of construction at the plant site, all discharges to the Indian River will cease. A minor amount of work will then be required on the Atlantic side for the construction of the intake and discharge systems. The major effort here will be a limited amount of excavation and dredging and the building of the intake and discharge structures (see Section 2.3.3). Some silt will be disturbed at the beach during this time but the time during which silt will be evident in the waters will be relatively brief so that the total effect should be considerably less than found in the dredging for beach restoration of the type which is now being carried out at Ft. Pierce Beach, a few miles to the north. No fill will be placed on the Atlantic side of the Island.

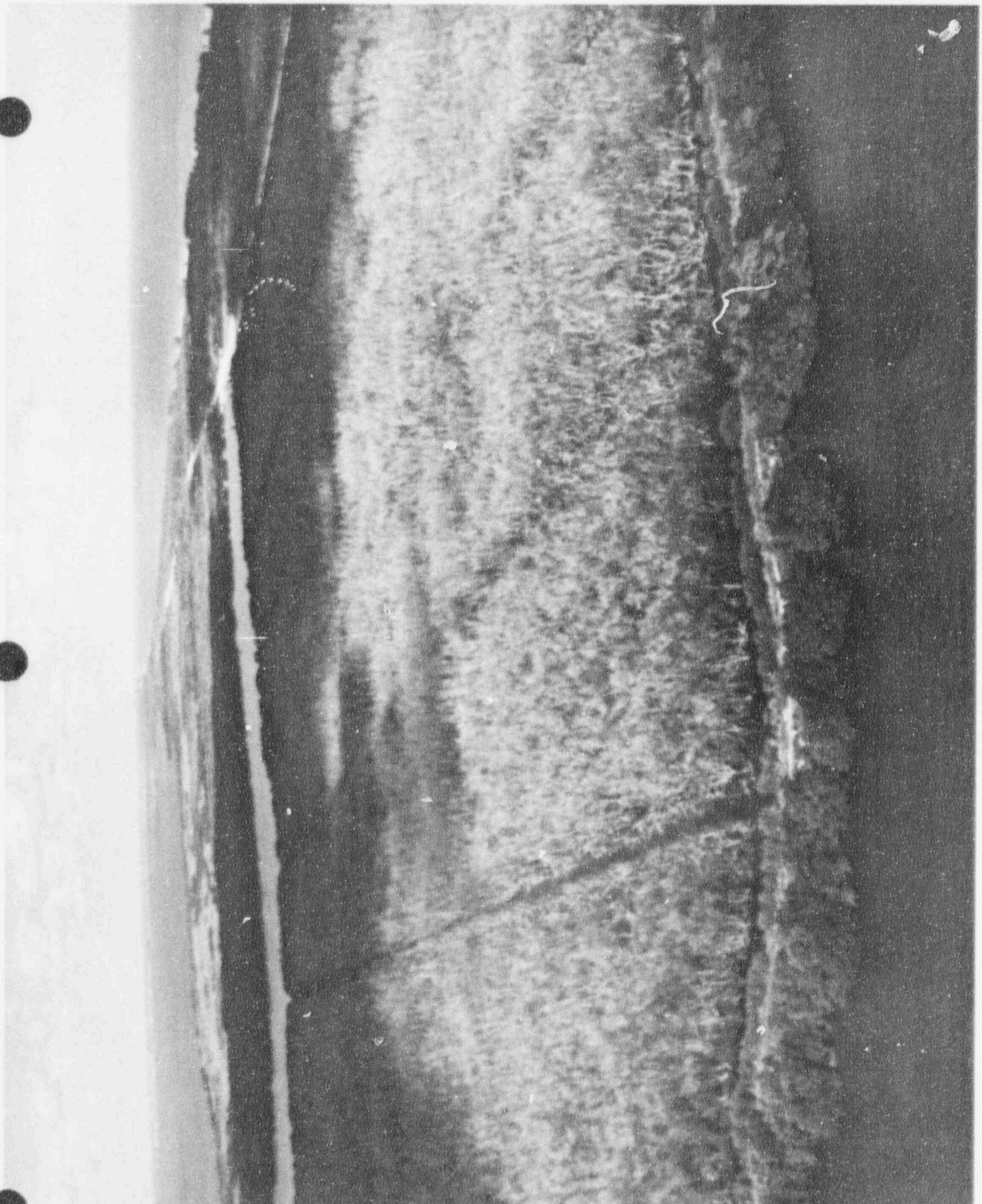
When all construction is completed, the whole area will be intensively landscaped and plantings will be made, as discussed in Section 2.3.9, of a type which will be effective in controlling erosion. Landscaping, when completed, will result in an aesthetically pleasing appearance for the whole area.

TABLE 2.3.8-1

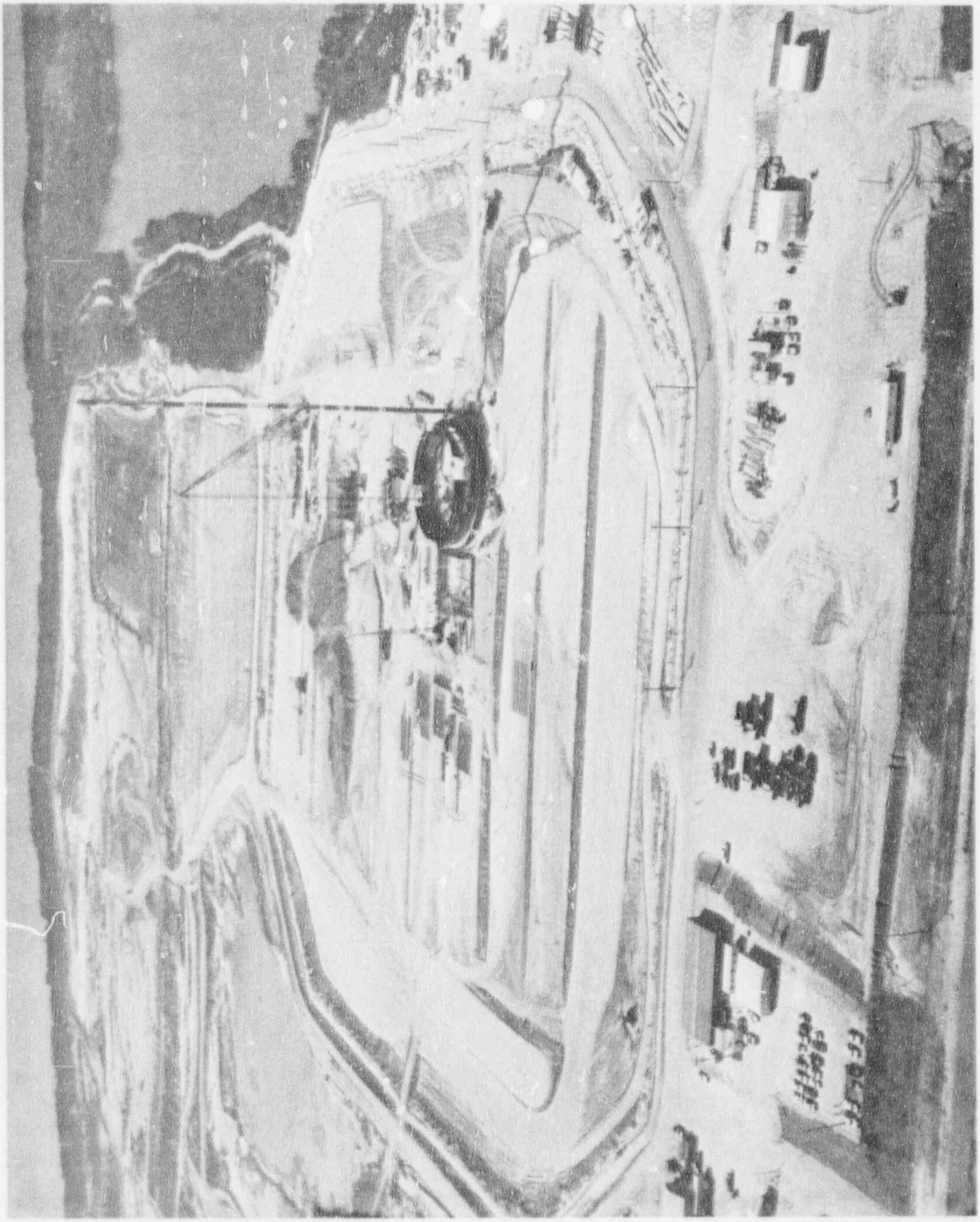
CHRONOLOGY OF HUTCHINSON ISLAND PLANT
SITE PREPARATION AND CONSTRUCTION EVENTS

19 January 1968	-	After comprehensive survey of suitable sites for a steam-electric plant along the mid-state east coast of Florida, the Hutchinson Island site was selected and land purchase negotiated.
6 February 1968	-	Application for zoning classification change filed with the St. Lucie County Planning and Zoning Commission.
21 May 1968	-	Advertised public hearing held by the County Commission at which the creation of a Public Service District was approved.
August 1968	-	Ecological survey of Hutchinson Island property and adjacent waters performed by Dr. William Carr and Dr. Joseph Davis, University of Florida; and Mr. Terry Davis, and Dr. James Lackey, Consultants.
29 January 1969	-	Application for a construction permit filed with the U.S. Atomic Energy Commission.
10 April 1969	-	First preparatory work at the site.
16 April 1969	-	Upon reference by the Corps of Engineers to the U.S. Department of Interior, a conference was held at the Atlanta regional office with representatives of the National Park Service Bureau of Sport Fisheries and Wildlife, Bureau of Outdoor Recreation and the Federal Water Pollution Control Administration, following which the dredging permit (69-55) was approved.
15 May 1969	-	Permits (69-55) issued by U.S. Army Corps of Engineers to dredge access channel in Indian River and Big Mud Creek.
2 July 1969	-	Meeting held at Atlanta regional office with representatives of U. S. Department of Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Outdoor Recreation, Natural Resources and Air and Water Pollution Control.
12 March 1970	-	Approval letter issued on the construction permit application by the Advisory Committee on Reactor Safeguards.

17 April 1970	-	Meeting held at Tallahassee with representatives of the U.S. Army Corps of Engineers, Florida Department of Air and Water Pollution Control and Florida Trustees of the Internal Improvement Fund concerning the intake and discharge system.
7 May 1970	-	Permit application for the circulating water system discharge was filed with the Florida Department of Air and Water Pollution Control.
12 May 1970	-	Advertised public hearing was held by the Atomic Safety Licensing Board at Fort Pierce, Florida, to consider approval of construction permit application to the U.S. Atomic Energy Commission.
1 July 1970	-	Construction permit issued by the U.S. Atomic Energy Commission.
22 February 1971	-	Marine biological study authorized at the site in co-operation with Florida Department of Natural Resources.
1 February 1974	-	Scheduled initiation of fuel loading.
1 June 1974	-	Scheduled initiation of commercial operation.



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
PLANT AREA PRIOR TO START OF CONSTRUCTION
FIG. 2.3.8-1



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
STATUS OF PLANT CONSTRUCTION
JANUARY 27, 1971
FIG. 2.3.8-2

2.3.9 AESTHETICS

The plant structures, in themselves unobtrusive, when seen through the intensively landscaped site area, will produce a minimum visual impact. The over-all appearance of the plant will not be out of harmony with its surroundings. The absence of the dirt and pollution, as well as the continuously moving transport usually associated with industrial plants, will minimize the visual conflict between the natural and the manmade. An artist's rendering of how the plant will appear upon completion is shown on Fig. 2.1.2-1.

The flat terrain of Hutchinson Island does not permit hiding the plant. The Victorian approach of attempting to disguise it as something which it is not could hardly be considered. The approach then has been to build honest, functional, and unobtrusive structures screened by attractive plantings. Only the upper parts of the higher buildings will be visible to an observer on the Island as the switchyards and other low structures will be totally or partially concealed. The absence of noise audible to the public even at the highway at the plant gate will also help to fit the plant into its surroundings.

The over-all appearance, depending on the observer, is expected to be at worst, unobtrusive, and at best, attractive, with careful landscaping preventing any conflict with the surroundings.

Florida Power and Light has always shown concern for the appearance of its necessary structures and, as a matter of policy, strives to preserve both the environment and the amenities. That its efforts in these directions have achieved some degree of success is shown in the award of the Electrical World magazine's 1970 Environmental Action Award to FP&L.[1] The Company was one of the five electrical utilities in the country so honored. The award cited the Company for "effectively blending beauty and function in its production, distribution, and other facilities, particularly as expressed in harmonious architecture, tasteful landscaping and provision for recreational facilities."

Reference

1. Florida Power and Light Company Annual Report for 1970, FP&L Miami, Florida.

2.4 ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

The effects of the construction of the Hutchinson Island unit have been minimal, and this construction is well along towards completion. As discussed in other sections, the only important result of this construction has been the conversion of a few acres of tidal marsh which may have served as a breeding ground for some of the life forms of the Indian River. There have been minor discharges resulting from the dewatering of the site, but these have been minimal and well within the limits established by State permits. Regarding sociological effects, there has, of course, been an influx of construction workers into the area but the total number of people involved will seldom reach one thousand. Because of the heavy dependence of the Florida economy on tourists and winter visitors, these people could be absorbed with considerably less impact than would have been apparent in other parts of the country.

The construction and operation activities have been reviewed in the light of Section 101 (b) of The National Environmental Policy Act of 1969. Referring to the subparagraphs of this section, the following statements can be made:

1. By preserving two miles of beach in its natural state, the Florida Power and Light Company has accepted its responsibility for preserving the environment for succeeding generations.

2. The facility will operate safely, will be aesthetically acceptable, and will provide a useful and essential commodity - electric power.

3. The construction and operation of the plant will not degrade the environment nor will it present any risks to the health and safety of the public as evaluated by the Atomic Energy Commission, the Advisory Committee on Reactor Safeguards, and the Atomic Safety and Licensing Board.

4. The location of the plant will not affect historic and cultural aspects of our national heritage and will maintain an undegraded environment.

5. Adequate supplies of electric energy are essential to preserve and expand our high standards of living and the wide sharing of life's amenities. The construction of the Hutchinson Island plant will provide such power with a minimal, efficient use of resources.

It is believed that the construction and operation of the Hutchinson Island plant will be carried out in full conformance with both the spirit and the specific provisions of the above Act.

2.5 ALTERNATIVES

Before deciding on the Hutchinson Island unit, the many alternatives for securing the power needed were thoroughly investigated and alternate sites given very serious study. The various possibilities included:

1. The possibility of securing an adequate supply of power from other systems was clearly not feasible. FP&L has been for many years a member of the Florida Interconnected Group of Electric Utilities which keeps current their reviews of the electric power requirements in the State of Florida as a whole and the generating capacity needed to meet these requirements. The evidence was clear, as born out by the Southeastern Reliability Reports (see Section 2.1.4), that there is not now, and will not be in the foreseeable future, excess generating capacity in Florida which could be purchased to meet our system needs. Florida is a peninsula so that its only neighboring states are Georgia and Alabama, both a considerable distance to the north of the heavy FP&L load centers. In neither state will power be available for purchase as shown by these Reliability Reports. Even if such power were available, present transmission capacity from Georgia and Alabama is incapable of supplying even a small faction of the states power needs.

   It is ethically questionable whether a utility has the right to transfer the inevitable environmental effects resulting from the generation of electricity from the territory it serves to a distant territory it does not serve.

2. In comparing candidate sites so as to select one for the new nuclear unit, the following criteria were employed:

   a. The distance of the site from population centers.

   b. The availability of a large area of land at the site.

   c. Natural characteristics of the site such that the impact on the environmental would be minimal.

   d. Proximity to load centers.

   e. Convenient access to navigable water for the transport of the neavy system components.

   f. Provision for a cooling system with a minimum environmental effect.

   FP&L has attained an intimate familiarity with its service area and with the rest of Florida. Considerable knowledge was therefore available regarding all possible sites. It was found that Hutchinson Island met all the above requirements and was unique as regards the distance from population centers and in the quantity of land available. The most competitive sites were Port Salerno and a location on Lake Okeechobee. While Lake Okeechobee was attractive from the standpoint of low population density and land availability, there are presently serious questions regarding the availability of water in view of recent drought situations and the possible danger to wildlife in the Everglades. While these questions may well be resolved in the future, they ruled against the Lake site at the time of decision. While Port Salerno had several attractive attributes, it was basically too close to heavily populated areas. The growth of demand in the West Palm Beach area and the necessity of providing adequate reliability dictated the siting of a plant in this locale so that dependence would not have to be placed on long transmission lines.

3. Regarding the selection of a nuclear unit, FP&L's policy on generation is to build a balanced system in which generation capacity will be divided between fossil, nuclear and gas turbine plants. It is believed that a properly balanced system of this type can best meet the rapidly growing demands with which the Company is faced. Fossil plants have the advantage of more rapid construction, which is extremely important in a quickly expanding system, while nuclear units provide minimum effluents to the atmosphere. Gas turbines are, of course, uniquely suitable for peaking requirements. Until some technical and economic problems are resolved as the nuclear industry matures and until construction schedules are shortened, a total commitment to nuclear is inadvisable. On the other hand, a total fossil system is not acceptable in view of the limited but, at the present state of technology, unavoidable air pollution associated with such plants. Practical methods for sulfur dioxide removal for oil fired units may possibly be developed, and FP&L is actively following such developments. The supply of low sulfur fuel oils is limited and obtaining assured supplies is a present difficulty. In addition, political difficulties in the Mideast cast considerable doubt on any over-commitment to oil fired units. While natural gas would provide an extremely attractive solution, FP&L is presently unable to expand their gas supplies and the increase in such supplies would depend not only on the construction of new transmission facilities but also on the rather improbable development of new sources of natural gas. Florida, because of its extremely flat terrain, is probably the least suited of all the states for hydroelectric power, and even though two small hydroelectric stations have been successfully operated, this method of generation is not a possibility. Therefore, in considering the necessity of minimizing air pollution, the availability of fuels, the state of the art of nuclear power technology and the growth rate of the system, a balanced approach in selecting power generation methods has been selected.

4. Concerning heat dissipation methods, the once-through ocean water cooled method was selected in preference to wet or dry cooling towers, spray ponds, or other methods. A thorough study of the feasibility of salt water cooling towers has been made in connection with the Turkey Point Plant.[1] The major question and one that appears insoluble in the immediate future regards the drift of salt water from mechanical draft cooling towers. Although Hutchinson Island is relatively remote, the possibility of spraying the environs with excessive quantities of salt did not seem acceptable. Natural draft towers minimize the salt drift problem but do so at a considerable additional cost. Because of their great height, these towers would probably be aesthetically unacceptable on Hutchinson Island. Both of these types of towers, because of their capital cost, would add to the cost of generation. The so-called dry cooling tower in which the coolant does not come in contact with the air to which its heat is transferred has never been built in sufficiently large sizes to demonstrate practicality. Further, the use of such cooling towers would require turbine designs not presently available. In a Florida location where ambient air temperatures are always relatively high, the use of dry cooling towers could only result in a considerable and ex-expensive drop in the unit's output. Cooling ponds require hundreds of acres of surface to supply the required capacity. While spray ponds which employ p[illegible] jets of water from the pond surface require considerab[illegible] area, both types of ponds are of such large size that they could not be fitted onto Hutchinson Island. Hutchinson Island provides ready access to the Atlantic Ocean, a heat sink of such tremendous size that no conceivable thermal effect can be expected more than several hundred feet from the discharge diffusers (Section 2.3.2).

<u>Reference</u>

1. An Evaluation of the Feasibility of Salt Water Cooling Towers for Turkey Point, Southern Nuclear Engineering, Inc., Dunedin, Fla., Feb. 1970.

2.6 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

Regarding the effects on the land on which the plant and its related structures are situated, a dead mangrove swamp will have been converted into filled land attractively landscaped. The area occupied was never farmed or at any time had any economic importance. From the amount of effort that was evidently required to control mosquitoes in this swamp area, the local people may have taken a negative view of its value. Beyond the plant area itself, the other Company property on the island will be preserved in its natural state. Since this will protect it from the future encroachment of the usual Florida beach type of development, it should be of considerable value in preserving the amenities. Should it be desired to decommission the reactor at the end of its expected life, the land itself could be returned to a natural state as a filled area rather than a swamp, or employed for other purposes. Only a low mound would remain, and the radioactivity levels would be negligible and not prevent normal use of the land.

Since there will be no discharge into Indian River, the only effect here will be felt during the construction period, now approaching an end. The only long-term effect on the River side is removal of a few acres of tidal swamp by filling. The mosquito control works constructed on the site prior to its acquisition by FP&L had substantially diminished any geological significance it may have had, and the loss although permanent will be extremely small. It should be mentioned that the red mangroves which are the principal contributors to estuarine productivity have been preserved.

On the Atlantic side, as discussed in previous sections, no short or long-term effects on the biota are expected. The chemical and radiological discharges are so small as to have neither short nor long-term effects.

The Hutchinson Island site will produce power which is needed for a rapidly growing area at a minimal cost in both short-term and long-term effects. This and such benefits as preserving the beach outweigh by far any of the limited permanent effects.

2.7 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The construction of the Hutchinson Island nuclear plant has a very small permanent effect on such natural resources as submerged land, as discussed in the preceding section. Present thinking on the decommissioning of nuclear plants is that techniques can be developed which will remove the hazards of radioactivity from the area to the extent that its utilization for other purposes will not be limited. Therefore, the land itself cannot be considered as irretrievably committed. The construction materials and the operating supplies are so small in total as to have no significant effect. The only mineral resource whose depletion will be seriously affected is the natural uranium required for fuel. Some 33 metric tons of uranium dioxide, equivalent to several thousand tons of uranium ore, will be required each year. The adoption of plutonium recycle processes may greatly reduce this requirement. There is no apparent future shortage of uranium as new ore supplies are continuously being found; the depletion of this natural resource is not considered serious. In view of recent discoveries such as Nabarlek in Australia, nuclear fuel may well be the most abundant fuel supply available in nature for energy conversion purposes, with the current technology of electric energy production.

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
UNIT NO. 1

ENVIRONMENTAL REPORT SUPPLEMENT

JANUARY 6, 1972

DOCKET NO. 50-335

TABLE OF CONTENTS

APPENDICES

TABLES

FIGURES

I. INTRODUCTION

As required by Appendix D, 10 CFR 50, the Florida Power and Light Company hereby submits this Supplement to the original Environmental Report (May 20, 1971) for Hutchinson Island Unit No. 1. As the Application for Hutchinson Island Unit No. 2 has since been tabled, this Supplement refers only to Unit No. 1.

The Hutchinson Island Nuclear Plant (AEC Docket No. 50-335) is a nominal 850 Megawatt net electric unit utilizing a pressurized water reactor. The nuclear steam supply system is being supplied by Combustion Engineering; Ebasco Services, Inc., is the Engineer-Constructor. At the date of writing, the site preparation work is 70% complete, and the total construction is 20% complete. The plant is scheduled for commercial operation in midyear 1974.

The original Environmental Report was prepared in accordance with the Guide to the Preparation of Environmental Reports for Nuclear Power Plants of February, 1971. Since it was submitted, several new guides have appeared and this Supplement has been prepared in accordance with:

-- the Interim Guidance on Modification in Applicants' Environmental Reports and AEC Statements under NEPA of August 4, 1971;

-- the Scope of Applicants' Environmental Reports with Respect to Transportation, Transmission Lines, and Accidents of September 1, 1971;

-- Appendix D, 10 CFR 50 of September 9, 1971.

A draft Guide to the Preparation of Benefit-Cost Analysis to be Included in Applicant's Environmental Reports has recently been released for comment. While the available version of this Guide applies to nuclear plants which are approaching completion and not to plants at earlier stages of construction, such as Hutchinson Island Unit 1, it has been used for guidance where applicable in the preparation of this Supplement, even though the Guide is in preliminary form.

The contents of this Supplement are limited to those matters required by guides and directives issued subsequent to May 20, 1971, as no changes have occurred which would significantly affect the material submitted in the Environmental Report of that date.

The material previously submitted has been reviewed by the applicant, as directed in the Interim Guidance on Modification in Applicant's Environmental Reports and AEC Statements under NEPA, to assure that the required material will be fully reported. This reporting is as follows:

1. Full information on thermal and other effects with respect to water quality was provided in Sections 2.3.2 through 2.3.6 of the original Report. Marine ecological effects were discussed in detail in Section 2.3.6.2.2.

2. Alternative methods of heat dissipation were discussed in Section 2.5.4 of the original Report. Cost data and further information are provided in Section V of this Supplement.

3. The original Report includes all relevant available information known to the applicant on the environmental effects of the facility as regards land use compatibility (Section 2.3.1), aesthetics (Section 2.3.9), and recreation (Section 2.3.1).

4. The need for the power to be generated by the Hutchinson Island plant and alternative methods for generating this power were discussed in Sections 2.1.4 and 2.5.3 of the original Report. This discussion is amplified in Section V of this Supplement.

5. The benefit-ccst aspects of the plant are discussed and analyzed in Section VI of this Supplement.

II. TRANSPORTATION

Under the terms of the agreement with the fuel supplier, Combustion Engineering, FP&L will take title to the fuel after its receipt at the plant. Title to the spent fuel, via a buy-back agreement, will return to C-E when the irradiated fuel has been transferred to the transporting conveyances after storage. Fuel transportation both to and from the reactor will be the responsibility of C-E.

A. Transportation of Fuel Assemblies from the Fabrication Facility to the Plant Site

The environmental effects of the transportation of fuel assemblies from the fuel fabrication facility in Windsor, Connecticut to the plant site will be no greater than the environmental effects of any normal material shipment.

Combustion Engineering's containers for transferring unirradiated zircaloy clad fuel assemblies containing special nuclear material are identified as Models 927A, 927B and 927C. The Atomic Energy Commission has authorized the use of these shipping containers for the delivery of special nuclear material to a carrier (Amendment 71-3 to Special Nuclear Material License SNM-1067) and the United States Department of Transportation (USDOT) has issued Special Permit No. 6078, including First Revision, authorizing the shipment of special nuclear material in these containers.

The above mentioned shipping container(s) consist of a lower and upper shell. These steel shells have a positive closure which prevents inadvertent opening. The outer diameter of the assembled container is 43 inches. Each container houses two unirradiated Zircaloy clad fuel bundles that are individually protected by a polyethylene covering. Internal structures and a clamping assembly secure the fuel bundles within the individual containers. The gross weights of model 927A, 927B and 927C containers are 6200 lbs., 6200 lbs. and 7200 lbs. respectively. Each container has a maximum radioactivity limit of 1.4 curies.

The containers used for the shipment of fuel assemblies from the C-E fuel fabrication plant to the Hutchinson Island plant are designed, constructed, and their contents limited by design, to meet stringent safety criteria during normal conditions of transport. Satisfaction of these criteria assures that the contents would remain subcritical even under hypothetical accident conditions which are assumed to result in the fuel occupying its most reactive credible configuration with full water moderation and reflection on all sides.

Qualification tests have also been performed to insure withstanding the conditions expected during normal and accident transport conditions. During these tests a shipping container prototype has been subjected to severe conditions of heat and cold, pressure and vibration. In addition, free drop, penetration and compression tests for both normal and hypothetical accident conditions have been performed. The container prototype has passed all of the qualification tests performed.

Maximum radiation dose rates and removable radioactive contamination levels for shipments are specified in 49 CFR 173.393 (j), 173.389 (f), and 173.397 (a) as follows:

a. 1,000 millirem per hour at 3 feet from the external surface of the package when transportation is by closed vehicle;

b. 200 millirem per hour at any point on the external surface of the car or vehicle when transportation is by closed vehicle;

c. 10 millirem per hour at 6 feet from the external surface of the car or vehicle;

d. 2 millirem per hour in any normally occupied position in the car or vehicle; and

e. 10^{-11} curies of beta-gamma per square centimeter and 10^{-12} curies of alpha per square centimeter as measured on the wiping material used to wipe the external surface of packaged radioactivity.

Experience on past new fuel shipments demonstrates that radiation dose rates for shipments of fuel elements from the fuel fabrication plant to the Hutchinson Island plant easily meet all of the above limits with normal radiation levels seldom exceeding 5 mrem/hr on contact with the external surface of the shipping container and dose rates in the vehicle not measurable.

The above mentioned new fuel shipping containers will be transported in motor vehicles for the sole use of Combustion Engineering, Inc. These containers are authorized for shipment up to a total of 16 fuel assemblies per vehicle load. The containers are secured by chains in protective covering and shored by wooden blocks.

It is planned that the initial core fuel bundles will be transported from the fabrication facility to the plant site in approximately fifteen (15) shipments over a period of about one (1) month. Thereafter, a fraction of the reactor core will be renewed approximately annually which should result in approximately five (5) shipments over a period of about one (1) month.

It is concluded that the environmental impact of the transportation of new fuel from the fuel fabrication facility to the plant site will be nil.

B. <u>Transportation of Spent Fuel Assemblies from the Plant Site to the Fuel Reprocessing Plant</u>

In the course of power generation the fissionable isotopes in the fuel will be partially depleted and about annually some of the fuel must be discharged and replaced with fresh fuel. At this point, the depleted, or "spent fuel", still contains some of the original fissionable uranium and also plutonium; both of sufficient value to warrant recovery. This operation can most safely and economically be carried out at a separate fuel recovery facility serving many individual reactors. Therefore, such fuel must be transported to the recovery facility where valuable uranium and plutonium are recovered and residual radioactive wastes are packaged for safe disposal.

The Hutchinson Island Unit 1 will discharge approximately 72 spent fuel assemblies containing approximately 28 metric tons of uranium and 240 Kg of plutonium about once a year after the first 20 months of operation. The spent fuel will be cooled in the spent fuel pool for a minimum of 4 months prior to shipment to reduce the radioactivity and heat generation in the spent fuel. During this period, the fuel assemblies will be monitored to determine whether there are any "leakers" which will require canning prior to insertion in shipping casks to further ensure against activity leakage.

After the cooling period, the spent fuel will be loaded into shipping casks designed and constructed to meet the rigorous requirements of the AEC and USDOT. These requirements provide for cooling, radiation shielding and containment of radioactivity for protection of the public in the event of abnormal and accident conditions as well as for normal conditions of transport. Prior to use, each cask design and its transport system will be reviewed and approved by AEC and USDOT, and transportation will be authorized by license issued by the AEC. License provisions will include adequate quality assurance, testing programs and operating procedures to assure equipment is constructed and used in accordance with approved designs and procedures. When loaded, the casks will be carefully surveyed for leak tightness and surface radioactivity contamination and inspected to assure that they have been properly prepared for shipment and fully comply with license provisions governing transportation. Shipments will also be placarded in accordance with federal regulations.

The applicant has entered into an agreement with Combustion Engineering, Inc. whereby C-E will buy back irradiated fuel from the applicant and will then have responsibility for the transportation of the spent fuel from the plant site to the fuel reprocessing plant. In turn, C-E has contracted with Allied-Gulf Nuclear Services for the shipment and processing of the spent fuel. Casks used for the shipment of spent fuel assemblies are designed, constructed and the contents limited in accordance with stringent safety criteria which help to assure that there will be no release of radioactive material from the cask during loading and shipping. A cask used for the shipment of irradiated fuel is constructed and its contents limited by design such that, under hypothetical accident conditions (10 CFR 71):

a. The reduction of shielding would not be sufficient to increase the external radiation dose rate to more than 1,000 millirems per hour at 3 feet from the external surface of the package.

b. No radioactive material would be released from the cask except for gases and contaminated coolant containing total radioactivity exceeding neither 0.1 percent of the total radioactivity of the cask contents nor 0.01 curie of Group I radionuclides, 0.5 curie of Group II radionuclides, 10 curies of Group III radionuclides, 10 curies of Group IV radionuclides and not more than 1,000 curies of inert gases irrespective of transport group.

In addition to the above the cask is designed such that its contents will remain subcritical under hypothetical accident conditions which result in the fissile material occupying its most reactive credible configuration with complete water moderation and reflection on all sides.

The cask is also designed to meet structural standards for load resistance and external pressure which will assure that the containment vessel will suffer no loss of contents if subjected to static loads equal to five times its fully loaded weight or external pressures of 25 psig.

During normal conditions of transport, there will be no release of radioactive material from the shipping cask and radiation emitted from the containers will be within established limits. Furthermore, in the event of a shipping accident whereby maximum hypothetical conditions are assumed to exist, the environmental release of radioactivity is limited to inert gas, which would pose no radiation hazard, and coolant, that could readily be contained and disposed of. This assessment is made in light of the rigorous safety criteria which have been employed during the design and construction of the shipping casks.

It is planned that spent fuel will be transported by barge and/or exclusive use truck. Based on this plan, approximately three barge shipments or 36 truck shipments will be made each year. Destination during the period 1976 to 1982 will be Allied-Gulf Nuclear Services in Barnwell, South Carolina.

The total yearly spent fuel shipping program will be carried out in approximately one month by barge or 2 - 3 months by truck. In all cases, truck shipments will be routed to avoid heavily populated and congested areas as well as tunnels, bridges or toll roads which prohibit such shipments. Each truck will be manned by two specially trained drivers and progress will be frequently reported enroute. Instruments for detection of abnormal conditions and instructions for immediate action will accompany all shipments.

A formal Accident Control and Recovery Plan will be developed prior to first shipment which will provide for rapid and orderly utilization of Applicant, carrier, Allied-Gulf, state and municipal emergency personnel, and AEC radiological assistance teams as required in case that any abnormal condition or accident is encountered. Even though the probability of an accident is remote, the plan will include control of contamination and of exposure to the public. The plan will also include salvage and recovery as well as control of bodily injury and property damage.

In view of the plans for packaging and transportation outlined above, it is believed that there will be no adverse environmental effects associated with the transportation of spent fuel from the Hutchinson Island Plant. This conclusion is based on the following:

a. The volume of barge and truck traffic added in the region of interest is an insignificant part of existing traffic.

b. Both the packaging and the vehicle will be designed to withstand normal and accident conditions without harmful radiation exposure of the public or release of the radioactive spent fuel.

c. The hazards associated with accidents are largely those associated with conventional heavy object shipments, not radiological hazards.

d. The probability of such accidents is lower than comparably heavy object shipments because of the additional equipment design and operational safety requirements as well as personnel screening and training.

C. Transportation of Packaged Waste Radioactive Materials

Detailed plans for the shipment of solid and liquid radioactive waste have not as yet been developed as such shipments will not be necessary until 1975. Possible contractors for radwaste transportation and burial are being investigated. When plans are finalized, all pertinent laws and regulations will be determined and rigorously complied with.

III. TRANSMISSION LINES

The Hutchinson Island plant is scheduled for startup in 1974 and operable transmission lines will not be required until roughly a year in advance of this date. The transmission lines are not scheduled to be energized until June 1973 so that designs are not as yet complete and only one-half of the right-of-way on the mainland has been secured. No construction is scheduled to begin until after October 1, 1972. The entire transmission system will cross the Indian River west of the plant site and then continue overland for some 11 1/2 miles to the present St. Lucie substation. There will be three circuits of 240 kv in this system. The present transmission lines out of the St. Lucie substation are adequate to handle the Hutchinson Island output in addition to their present loads.

A. Indian River Crossing

The transmission lines consist of two portions; one crossing the Indian River and the second from the River overland to the St. Lucie substation. The Indian River crossing, as shown on Figure III-1, will consist of three circuits, each of which will consist of three structures in the River plus two sets of land structures at each end. The lines of the three circuits will be spaced parallel with their centerlines 100 feet apart. Starting at the Hutchinson Island switchyard, the lines will proceed almost directly west with the first structure at 612 feet and the second at 1751 feet farther, both on land. The third structure is the first with foundations in the River and is at an interval of 2005 feet. The fourth tower is 2005 feet to the west, the fifth, 1648 feet, and the sixth tower is on the mainland at an interval of 2005 feet, with the final tower of the River crossing section at 1180 feet.

The three towers in the River rise 173 feet above mean high water so that the conductors will clear the surface by 90 feet at the intersection with the Intercoastal Waterway. With this clearance and with the spacing between the towers, there will be no interference with navigation or pleasure craft or fishing. On the west side of the Indian River a small bluff rises from the water and the final tower of the River crossing system is near the top of this bluff. The 104 feet height of this tower will hold the conductors approximately 76 feet above the ground so that they will clear the trees. Nearly all of the trees will be preserved so that the landscape will remain undisturbed and the towers will be less obtrusive. A plan and profile of this crossing is shown on Figure III-1.

River Crossing Permits. Permits for the transmission lines across the Indian River have been received from the U. S. Army Corps of Engineers and from the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida (I I Board). The Internal Improvement Fund was established in 1854 for the purpose of administering lands owned by the State of Florida and for the protection of the interest of the public of such lands. Under Florida Statutes, Chapter 253, Title 17, the Fund has title to submerged land throughout the State and is, therefore, concerned with such matters as this River crossing. The Central and South Florida Flood Control District has also issued a permit for this crossing. The U.S. Coast Guard has stated that no lighting on the towers for aid to navigation purposes will be required for the River crossing.

Machine copies of the above permits are included in the Appendices as is a copy of the Coast Guard letter.

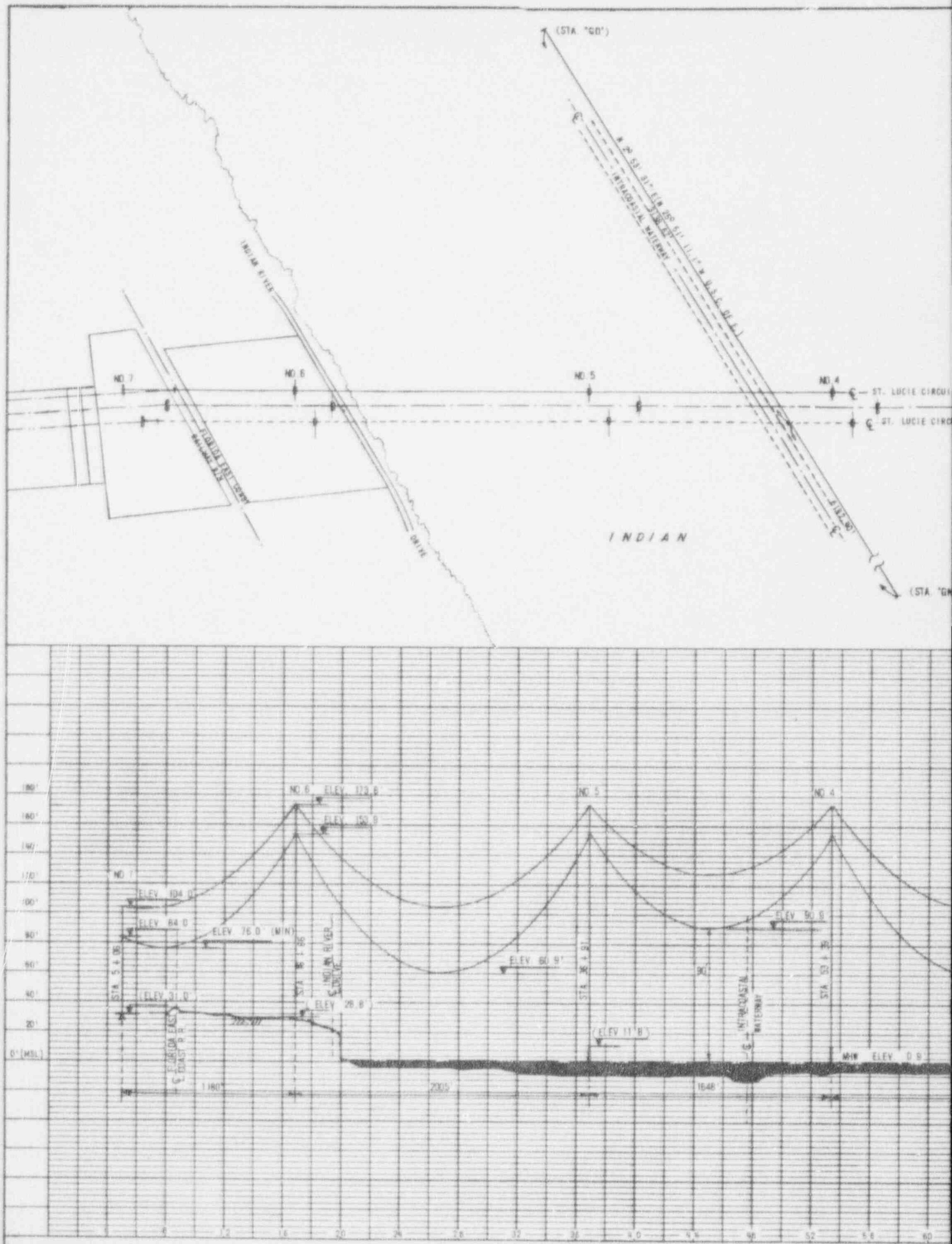
B. Mainland Transmission Lines

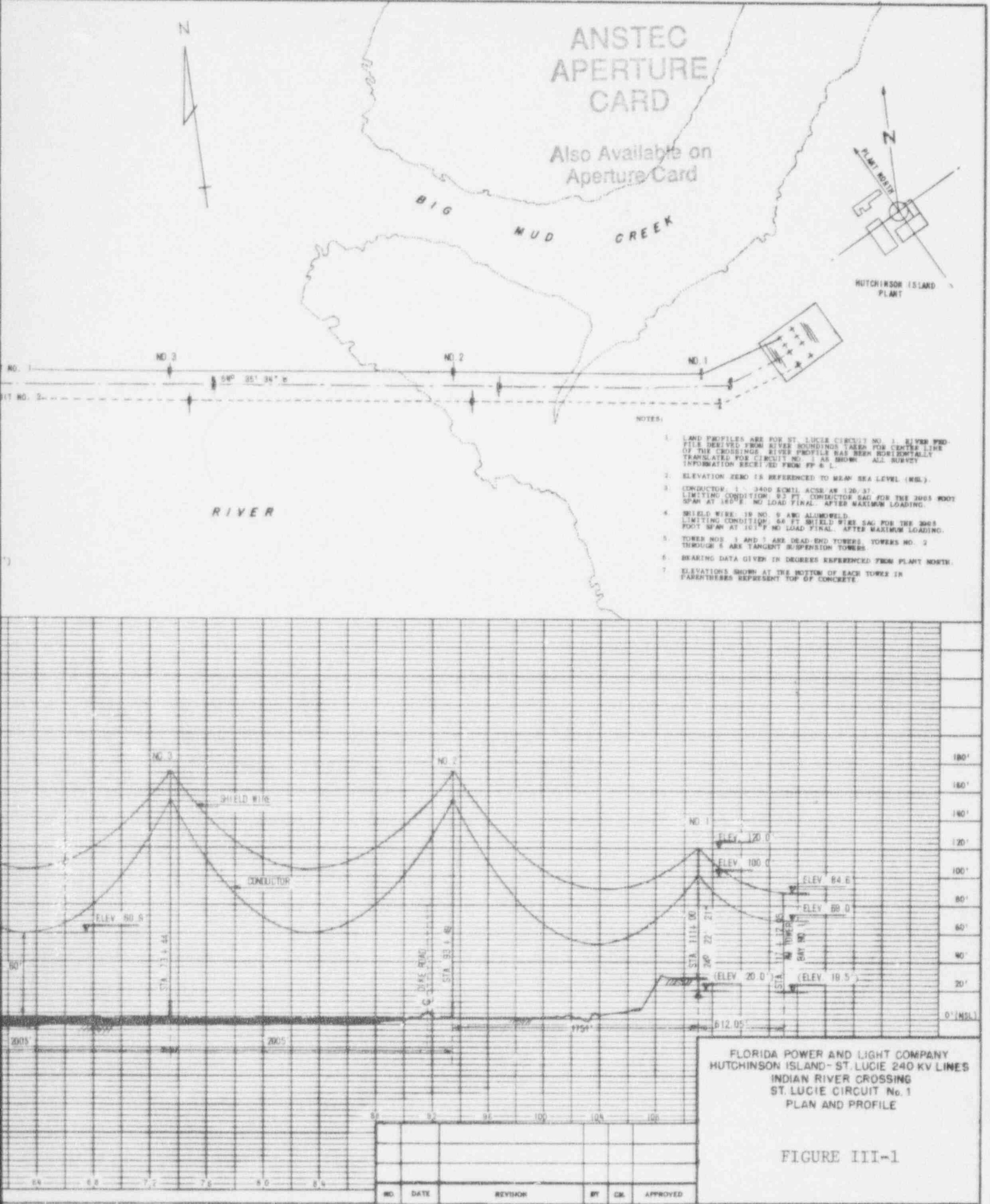
The design of this system is as yet incomplete but the characteristics of the right-of-way can be described at least generally. From the last tower of the River crossing system, the lines will proceed westerly for approximately 10 miles. The first quarter mile from the bluff will be through a rather open bluff area with the next 2 1/4 miles being an open, level savanna. For the next mile the lines will proceed through orange groves. In this area U.S. 1 will be crossed. After the orange groves, the lines will run through the St. Lucie River basin, a swampy area, for 3/4 of a mile. The rest of the line will be built in an area of open field now used for pasturing and grazing. This area is of the type sometimes referred to as "Palmetto Flats" and is being acquired from a large land development company. The right-of-way will create a natural 'green belt' that can be used for parks and other recreational uses. The last 1 3/4 miles of the line will depart from the westerly direction of the line and run almost due north to the St. Lucie substation. The right-of-way will be 660 feet wide and it is expected that the circuits will be supported on two-pole structures.

Mainland Transmission Line Permits. Permits will be required from the Florida State Department of Transportation to cross State Roads 707, 5 (US 1), 605 and the Florida Turnpike. Applications for these permits have not as yet been made as the design of the mainland portion of the transmission lines is incomplete. It is believed that none of these road crossing permits are concerned with environmental effects.

C. Environmental Impact

Those structures west of the River crossing are expected to be 80 feet high with an average 650 feet span. While the type and the height of the mainland towers has not been decided, it is intended to keep these structures as unobtrusive as possible. The major impact on the environment is expected to be visual, as the types of lands which will be crossed, as listed, are not of a type which will be damaged by the construction of the transmission line or by its presence when operating. Since there are no woody areas along this right-of-way, the removal of trees will be negligible. The savanna and palmetto flat will be in no way affected as regards land use by the presence of the transmission structures. Only those orange trees will have to be removed in the grove area where there is a direct conflict with a structure. The Indian River structures will be visible from the mainland shore but this is at present a lightly populated area which contains no major roads. Since the nearest bridges north and south of this crossing are approximately eight miles distant, the visual impact will be negligible. Special emphasis was placed on the engineering design of the Indian River Crossing structures to create an esthetic appearance and to minimize the number of structures in the water. A sketch of one of these structures is given on Figure III-2. The construction of the transmission line will have a negligible environmental impact as the placement of structures on the mainland side is a conventional operation quickly completed. The construction of the piers for the towers in the River is not expected to interfere with marine life, navigation or recreation because of the relatively small size of the piers and the great distance between them.


(STA "GO")
INDIAN RIVER
INTRACOASTAL WATERWAY
NO. 7
NO. 6
NO. 5
NO. 4
ST. LUCIE CIRCUI
ST. LUCIE CIRC
INDIAN
DRIVE
NO. 6 ELEV. 173.8
ELEV. 150.9
NO. 5
NO. 4
NO. 7
ELEV. 104.0
ELEV. 84.0
ELEV. 76.0' (MIN)
ELEV. 60.9'
ELEV. 90.9
ELEV. 31.0
ELEV. 28.8'
ELEV. 11.8
MHW ELEV. 0.9
INTRACOASTAL WATERWAY
FLORIDA EAST COAST R.R.
0' (MSL)
1180'
2005'
1648'



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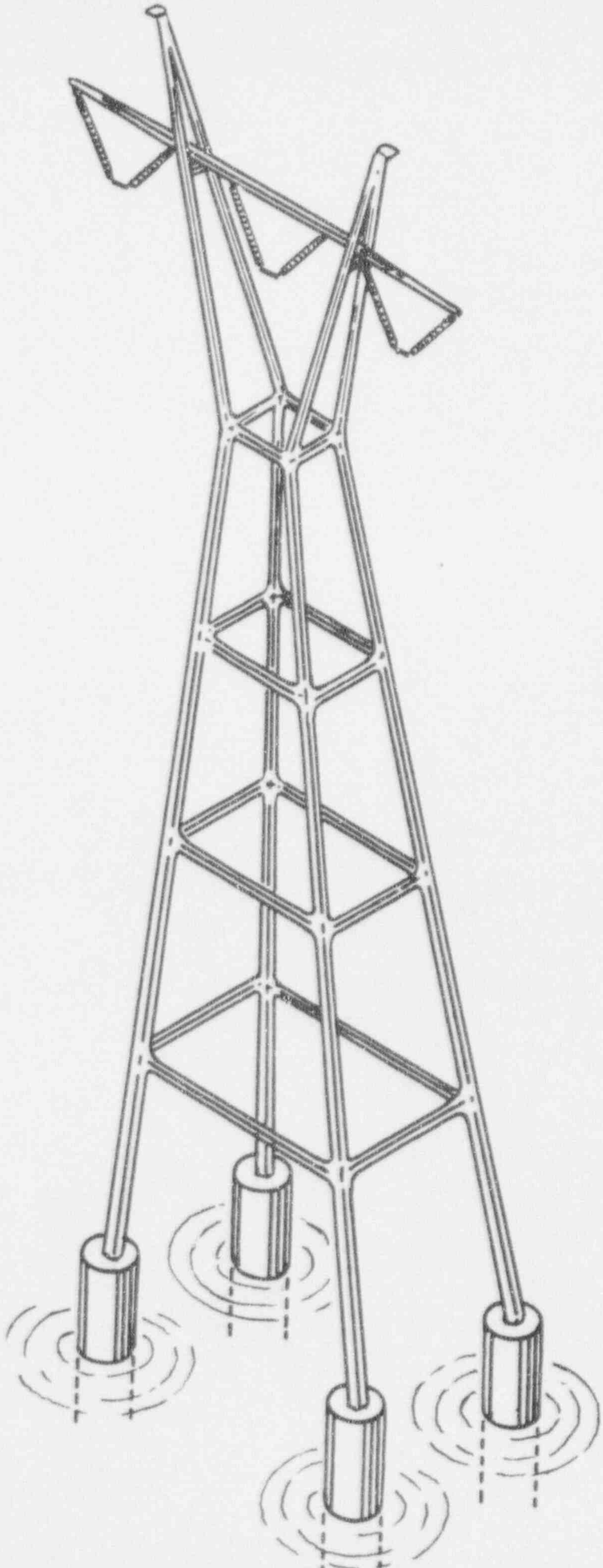

Typical River
Crossing Structure

FIGURE III-2

IV. ACCIDENTS

The accidents which are of concern from the environmental protection standpoint are those which might result in an uncontrolled release of radioactive materials to the environment. Viewed in this context, the design and construction of the facility are basic to safety. Numerous barriers and features are provided which guard against accidental or uncontrolled releases of radioactive materials from the plant. These barriers are (1) the uranium oxide fuel pellets, (2) the sealed metal tubes which contain the pellets, (3) the reactor coolant system which encloses the reactor, (4) the containment which houses the reactor coolant system, and (5) the shield building which encloses the containment. Additional protection of the public is provided by the engineered safeguards which control the release of radioactivity in the event of an accident, and the remote site location, which was chosen to further reduce the effects to the general public of an accidental release of radioactivity.

Various postulated incidents and accidents have been analyzed as reported in the Preliminary Safety Analysis Report (PSAR). These analyses were made for the purpose of demonstrating that the plant can be operated safely and that maximum radiation exposures from credible accidents would be within the guidelines of 10CFR100.[1] To provide a high degree of assurance that the radiation doses will be within these guidelines under any credible circumstances, the analyses have been performed in a highly conservative way. Because of the degree of conservatism built into the analyses reported in the PSAR, the resulting doses are far in excess of what would be realistically expected.

To facilitate the assessment of the impact of possible incidents and accidents in a realistic and timely manner, and therefore to allow a judgment as to the environmental risk inherent to operation of the facility, further analyses have been made. As compared to the PSAR analyses, the environmental risk analyses are more realistic and less conservative due to the use of experimental data not previously available, consistent assessments of the events resulting from an incident or accident, and a diminution of the degree of conservatism applied to the analyses, with a corresponding enhancement of the degree of realism.

Analysis of Environmental Impact of Accidents

A variety of accidents and incidents have been analyzed covering a wide range of severity, in order to facilitate a realistic assessment of risk. Table IV-1 shows the events which were considered. These events were chosen to represent a spectrum of events from relatively minor to the most severe which could credibly be postulated. Calculated results of these events are shown in Table IV-2 in terms of site boundary whole body dose, site boundary thyroid dose, and average integrated population dose (man-rem). The site boundary doses should be regarded as typical doses that would be expected from a particular event. The man-rem exposures were calculated in a similar fashion, the results being "average expected" exposures. In calculating these doses, realism was adhered to as closely as possible. Engineered safeguards operation at 100% design value was assumed as appropriate. Details of the parameters used are given in a later section.

Almost all of the whole-body and thyroid doses and the man-rem values given in Table IV-2 are insignificant and can be dismissed from further discussion. The doses and man-rem values for the loss-of-coolant accident are also small, but further consideration is focused on them because they do, in fact, represent the largest values resulting from the various accidents considered. Any other accident would then obviously have a less significant radiological effect.

The following paragraphs briefly discuss the whole-body dose, the thyroid dose, and the man-rem value resulting from the loss-of-coolant accident. Comparisons are made with guideline values, 10CFR20 limits[2], and exposures that people are subjected to in everyday life.

Whole-Body Dose

The whole-body dose resulting from the loss-of-coolant accident is approximately 3 millirem. This is less than three percent of the background radiation received annually from natural phenomena by a person living in the South Florida area. These phenomena include cosmic rays, radioactivity emanating from the ground and building materials, and radioactive nuclides found in human tissues. The dose is approximately the same as that which would be delivered to a person from cosmic rays during a jet round trip between Florida and California. It is less than the estimated annual average dose received by a person watching color television[3]. It is also less than the annual difference in dose received by a person living in Brooklyn compared with a resident of the Bronx, which is about 5 millirems.[4]

The whole-body dose resulting from the postulated loss-of-coolant accident is about a factor of 8,300 below the guideline value of 25 rem given in TID-14844[5] for such an accident, and a factor of 167 below the 10CFR20 annual limit of 0.5 rem to any individual member of the general public.

Thyroid Dose

The thyroid dose resulting from the loss-of-coolant accident is approximately 6×10^{-3} rems, or 6 millirems. While it would be difficult to compare such a dose with that received from natural sources since the dose is essentially all due to radioactive iodine, it can readily be compared with guideline and dose limit values. The 6 millirems is a factor of 50,000 below the once-in-a-lifetime guideline value of 300 rems given in TID-14844 for such an accident. It is also a factor of approximately 250 less than the annual thyroid dose that would be received from a person exposed to the iodine concentrations given in Table II, column 1 of Appendix B of 10CFR20.

Based on the allowable concentration values given in the above mentioned Appendix B, it can be determined approximately that a thyroid dose of 1.5 rem is "equivalent" to a whole-body dose of 0.5 rem. Using this approximation, 6 millirems to the thyroid would be about the same as 2 millirems to the whole body. While such a comparison must be used very cautiously, the result should be "in the ball park" and, as such, the thyroid dose can be compared with the whole-body dose previously discussed. The whole-body dose was only 3 millirem, while the "equivalent" thyroid dose is about 2 millirems. This would indicate then that the whole-body dose is the more limiting of the two, but both are extremely low.

Man-Rem

The integrated gamma dose to the population is commonly called the man-rem. The man-rem is a comparative measure of the total exposure of a large number of persons and is one way to assess the relative genetic significance of released radiation. A value of about 20 man-rems results from the loss-of-coolant accident.

An indication of how small 20 man-rems really is can be illustrated by assuming that the annual exposure from an average black and white television set is one millirem. Here a value of one is conservatively used instead of the five used for the color television exposure in the earlier discussion of the whole-body dose. Since the population within 50 miles of the site exceeds 300,000, the man-rems from watching television over a one-year period exceeds 300. This represents a value much greater than the man-rem value predicted from the postulated accident. Also, the 20 man-rems can be compared with the approximate integrated dose exposure to airline passengers using the West Palm Beach Airport. In 1970, more than 800,000 domestic and international passengers, total, either arrived or departed from this airport. Assuming an average whole-body exposure of 0.25 millirems per flight, this would result in a man-rem value of 200, or a factor of about 10 times the value expected from the postulated loss-of-coolant accident.

Conclusions

The above discussion of activity releases from postulated accidents at the Hutchinson Island plant should in no way be interpreted as downgrading the potential effects of radiation. However, one should compare the extremely low activity levels predicted for such accidents with radiation from other sources to which man is exposed and also with the guidelines and limits set by experts in the field of radiation protection. Such a comparison has been made and it is concluded that radiation from postulated accidents at the plant will have no discernable adverse effect on the public.

In the light of the above discussion, none of the classes of accidents listed was found to have significant adverse environmental effects. Therefore, we do not believe that the probabilities of such accidents need be evaluated.

Details of Dose Calculations

Throughout the dose calculations, parameters were based on expected or normal operation of the plant. Typical parameters are as follows:

Fuel defects - Accident calculations reported herein have been based on a value of 0.1% defected fuel. Although the plant is designed for operation with coolant levels corresponding to 1% fuel defects, a typical expected value is 0.1%. The primary system inventory is 8400 equivalent curies Xe-133 and 170 equivalent curies I-131.

Meteorology - The annual average dilution multiplier, $\frac{\chi}{Q}$, at the site boundary was assumed to be 2.4×10^{-6}, the PSAR 30 day estimated value, which is greater than the annual average value expected for the Hutchinson Island site. The value of 2.4×10^{-6} is consistent with the value used in Section 2.3.7 of the original Report, and in Section 14.15 of the PSAR. Actually, including expected variations in stabilities, wind speed, and wind direction, the value is probably conservative. Further discussion of the climatology and meteorolo[illegible] the site is given in Section 2.1.3.1 of the Environmental Report, and [illegible]ion 2.3 of the PSAR.

Events

Minor release - A release of the gaseous activity contained in 1000 gallons of primary system fluid was postulated for this event. All noble gas activity and a fraction of [illegible] iodine activity, assuming a typical liquid-gas partition factor, was [illegible]lated to be released. A release of this magnitude might be postul[illegible] to result from leakage in the Chemical and Volume Control System or the Waste Disposal System.

Release from gas decay tank - The waste disposal systems are described in Section 2.3.7 of the Environmental Report and in Chapter 11 of the PSAR. Fission product activity is removed from the reactor coolant during reactor operation and transferred to the gas decay tanks. Activity in the tanks was assumed to be inadvertently released at the completion of filling, which is the time of maximum [illegible]ity. Inventory of noble gases is based on 0.1% failed fuel. Iodine act[illegible]y is negligible due to removal in the ion exchangers, and the partition which is expected to occur in the flash tank.

Two accidents were assumed; the release of 10% of the contents of a tank and the release of the entire contents.

Fuel failures in normal operation - As described previously, the plant is designed with multiple barriers which prevent the escape of radioactive fission products. Any which escape from the fuel rod gap during normal operation are contained in the reactor coolant system and their escape to the environment is prevented. The fission products are removed from the reactor coolant and collected in the Waste Disposal System. The dose to the environment is negligible.

Fuel failures and steam generator leakage - Operation is permissible with a small leakage from the primary coolant system to the secondary system. A leak rate of 0.1 gpm was chosen as a typical value. Small amounts of noble gases would be transported to the secondary system, through the turbine, and out the air ejector. Iodine and other fission products reaching the secondary system would tend to remain in the steam generator water, and be scrubbed out of the condenser. No significant amount would be released to the environment under normal operating conditions. Operation under the above conditions was assumed to continue for 30 days, with the failed fuel value of 0.1%. A loss-of-load, resulting in a loss of off-site power, was assumed at the end of the period. This necessitates use of the atmospheric steam dump valves for reactor cooldown, providing a direct path for release of iodine from the steam generator secondary.

Refueling accident inside containment - It was assumed that 14 rods (one row) in the hottest fuel assembly are broken 3 days after reactor shutdown, releasing their entire gap inventory of fission products. Refueling takes place with the fuel under water at all times. All noble gas activity was assumed to reach the water surface and mix with the containment air, while the iodine inventory was assumed to be reduced by a factor of 1000. Containment building purge was assumed to continue for 2 minutes following the accident, being terminated by the automatic shutoff on high purge activity (the actual time is expected to be shorter). Half the iodine reaching the containment atmosphere was assumed to plate out inside the containment.

Refueling accident outside containment - This event is the same as the preceding, except that all noble gas fission products are assumed to be transported through the auxiliary building ventilation system and released to the environment. Of the iodine leaving the spent fuel pool, one-half was assumed to plate out on the surface and ductwork of the fuel handling building.

Steam line break - The steam line break has been analyzed extensively as reported in the PSAR. This analysis shows that, even under adverse and highly improbable conditions, the reactor coolant system and the reactor core remain intact and adequate core cooling is maintained. The activity released is limited to that already in the steam generator secondary side at the time of the accident, which could have entered only through tube leaks. As discussed previously, noble gases entering the steam generator during operation pass continuously out of the system while iodine tends to be held in the water. Upon occurrence of the steam break, the entire contents of the steam generator was assumed to be ejected as a steam-water mixture. A factor of one-half was assumed for iodine plate-out. Other conditions assumed were 0.1% failed fuel, 0.1 gpm steam generator leakage, and 1 gpm blowdown.

Steam generator tube rupture - The sequence of events following a steam generator tube rupture is discussed in the PSAR. Briefly, it begins with an assumed double ended rupture of a steam generator tube, allowing reactor coolant to flow into the steam generator. Steam is assumed to flow through the atomospheric dump valves to the condenser or to the atmosphere from the faulty steam generator. During this time the pressure and temperature of the primary system are reduced below the steam generator secondary design pressure. At this point the affected generator is isolated, terminating the releases. A failed fuel fraction of 0.1%, a release to the steam generator of about 15% of the primary system activity, and a decontamination factor for iodine of 500 were assumed.

Control element assembly - CEA ejection is a rupture of the primary system, resulting in rapid removal of a control rod from the core. This incident has been extensively analyzed in the PSAR. This analysis shows that less than 4.5% of the fuel rods reach an enthalpy at which clad damage might occur. For this analysis, the assumptions are the same as those used in the loss-of-coolant accident, except that the activity release is the gap activity from only the fuel rods which reach conditions which could cause clad damage.

Loss-of-coolant accident - Previous analyses of this accident show that the Safety Injection System, operating with only partial effectiveness, will limit the clad temperature and assure that the core will remain in place and substantially intact with its essential heat transfer geometry preserved. Therefore, the uranium oxide barrier to fission product release is preserved, and the release to the containment is only the gap activity from part of the core. The fraction of the fuel rods which overheat and release their activity depends primarily on the size of the break, varying from zero for small breaks to a large fraction for large breaks. All of the rods were assumed to release the fission products contained in the gap. Half the iodine released was assumed to be removed from the containment atmosphere by plateout. The Containment Spray System and the Containment Ventilation System both serve to mitigate the consequences of the accident by removing elemental iodine from the containment atmosphere and by reducing the containment pressure, which causes the leak rate to decrease. The filtering system is effective both for elemental and methyl iodine. An initial spray cleanup rate of 10/hr was assumed, with a maximum decontamination factor of 100 for both systems operating together. A containment leakage rate of 0.25%/day was used for the initial time period when containment pressure was high. After this period a leak rate of 0.125%/day was assumed. A filter efficiency of 0.99 was assumed for the Shield Building Ventilation System filter.

Spent fuel transportation accident on-site - Although not listed in the classes of accidents in Tables IV-1 and IV-2, a spent fuel transportation accident on-site has been considered. Spent fuel is stored underwater in the spent fuel pit before being shipped off-site for reprocessing. This storage period allows the decay of most of the radioactive noble gas and iodine isotopes to insignificant levels. (Krypton-85 is the exception to this). Additionally, the cask in which spent fuel is shipped must meet stringent requirements to assure that significant quantities of radioactivity will not be released in the event of an accident during shipment.

During shipment of spent fuel the UO_2 pellets serve as a barrier to the release of activity just as they do during normal operation of the reactor. Thus only the small amounts of fission products in the gap between the fuel pellets and the clad can be released in an accident. The following conditions were assumed:

- Release of the entire gap inventory of noble gases from two fuel assemblies;

- One-half of the gap inventory of iodine is released from the two fuel assemblies, and one-half of the iodine released from the fuel leaves the fuel cask;

- The accident occurs in the spent fuel building so that the dilution multiplier of 2.4×10^{-6} is applicable.

- Spent fuel is shipped 120 days after cessation of power operation.

Assuming the gap activity is 1% of the total xenon inventory plus 1000 Ci Kr-85.

and considering only the gammas, the whole body site boundary dose is about .003 mrem. The integrated exposure is about 0.019 man-rem from this accident.

Considering the beta's, the site boundary dose is less than 0.3 mrem. This dose is primarily from long-lived Kr-85.

The site boundary thyroid dose is less than 0.2 mrem, again assuming the gap inventory of I-131 is 1% of the total activity in the assembly.

Since these values are much less than those resulting from the loss-of-coolant accident, as discussed elsewhere, the environmental radiological effects are also of less importance as compared to that accident, and are judged to be insignificant.

REFERENCES

1. Code of Federal Regulations, Title 10, Part 100, revised as of January 1, 1971.

2. Code of Federal Regulations, Title 10, Part 20, revised as of January 1, 1971.

3. Information derived from testimony given before the Joint Committee on Atomic Energy by Dr. Victor Bond, Brookhaven National Laboratory, January 28, 1970.

4. From testimony before the Joint Committee on Atomic Energy by Dr. John Totter, Director, Division of Biology and Medicine, October 29, 1969.

5. Di Nunno, J. J., Anderson, F. D., et al, "Calculation of Distance Factors for Power and Test Reactor Sites," TID-14844, March 1962.

Table IV-1 ACCIDENTS ANALYZED

	Event	Type of Failure	Activity Release	Systems Operating to Minimize Release
1.	Minor release of primary fluid	Leak; operator error	Activity contained in 1000 gallons of reactor coolant	None
2.	Release from gas decay tank	Pipe or valve failure	Partial release of contents	None
3.	Fuel failures normal operation	Manufacturing defects	Activity from 0.1% failures	Waste Disposal System
4.	Fuel failures and steam generator leakage	Item 3 plus steam generator tube leakage	Item 3 plus 0.1 gpm leakage for 1 month plus atmospheric release from loss-of-load	None
5.	Fuel handling accident inside containment	Dropped fuel assembly	Gap activity from 14 rods	Containment
6.	Fuel handling accident outside containment	Same as Item 5	Same as Item 5	None
7.	Release from gas decay tank	Pipe or valve failure	Complete release of contents	None
8.	Item 4 above plus steam break	Pipe or valve failure	Activity in steam generator	None
9.	Item 3 above plus steam generator tube rupture	Double-ended break of one tube	Activity in primary coolant steam generator	Steam Generator Isolation
10.	Control element assembly ejection	Rupture of control rod mechanism housing	5% of activity not contained by uranium dioxide	Containment, Safety Injection, Containment Spray, Containment Cooling, Containment Ventilation, Shield Building, Shield Building Ventilation
11.	Loss-of-coolant	Break of large pipe in Reactor Coolant System	Activity not contained by uranium dioxide	Same as 10

Table IV-2
RESULTS OF ACCIDENT ANALYSIS

Event	Class	Accident or Release	Site Boundary Doses, Millirem Thyroid	Site Boundary Doses, Millirem Whole Body	Man-Rem
1	2	Minor release of primary fluid	$3x10^{-4}$	$5x10^{-3}$	0.03
2	3	Gas decay tank - 10% contents	$\sim 10^{-5}$	$1x10^{-3}$	$8x10^{-3}$
3	4	Failed fuel	No Direct Release		--
4	5	Failed fuel and steam generator tube leak	$2x10^{-2}$	$3x10^{-2}$	0.2
5	6	Fuel handling accident in containment	$3x10^{-2}$	$2.5x10^{-3}$	0.02
6	7	Fuel handling accident - fuel building	$8x10^{-1}$	$6x10^{-2}$	0.5
7	8	Gas decay tank - 100% contents	$\sim 10^{-4}$	$1x10^{2}$	$8x10^{-2}$
8	8	Steam line break	$6x10^{-1}$	$2x10^{-4}$	$1x10^{-3}$
9	8	Steam generator tube break	$6x10^{-2}$	$6x10^{-2}$	0.5
10	8	Control rod ejection - 5% gap release	$3x10^{-1}$	$2x10^{-1}$	1
11	8	Loss of coolant-large pipe break	6	3	20

V. ALTERNATIVES

A. Power Requirements and Alternate Methods of Providing Power

1. The Need for Power

Section 2.1.4 of the original Environmental Report described the extremely rapid growth -- one of the largest in the country -- of the power demand in the FP&L system. Practically the entire southern portion of the Florida Peninsula is critically short of the electrical power necessary to adequately and reliably meet projected future power demands and to remedy currently inadequate reserve margins. The present situation with regard to the demand for electrical power was accurately summarized in a recent article appearing in the August 27, 1971 edition of The Miami Herald which concluded that, "If the demand for power continues to outstrip available supplies at the present rate, the inevitable result will be a succession of forced power cutbacks, brownouts and occasional blackouts."

Table V-1 lists the peak load and generating capability for the Applicant's system for the period 1961 to 1970 and the projected peak load and generating capability for the period 1971-1975.

The excess of generating capability over peak load is called "reserve". Adequate reserve capability is necessary to cover a variety of contingencies such as actual load being greater than forecast, and equipment, plant and transmission outages for maintenance. A reserve adequate to meet such contingencies is generally considered to be 15% to 25% of the peak load.

Examination of Table V-1 will show that for the year 1971 the maximum peak load experienced was 5635 MW while the actual generating capability of the Applicant's system was 6013 MW. This resulted in an actual reserve of 378 MW for a margin of 6.7% in excess of peak load. In 1974 it is anticipated that the maximum peak load will be 8100 MW while generating capability, without Hutchinson Island Unit #1, will increase to only 8713 MW. This will provide a reserve of 613 MW and a margin of only 7.6%. With Hutchinson Island Unit #1 on line and on schedule, a reserve of 18.1% will be obtained. In the past, the peak loads of the calendar year for Applicant's system occurred in the summer. However, experience indicates that peaks reached the following January or February are even higher than the previous year's peak. An indication of the critical nature of the available power supply is demonstrated by the necessity to curtail loads in recent years. The Applicant already relies heavily on automatic load shedding to restrict the disruption of electric service during system disturbances. If during 1974 (without Hutchinson Island) only the largest Turkey Point generating unit of 760 MW became inoperable or there were transmission line outages for this unit, a negative reserve of 147 MW would exist resulting in the inability of Applicant to provide adequate service at less than peak load. With the largest fossil plant out, instead of a nuclear plant, the reserve left would be 194 MW, or a safety margin of less than 2-1/2%.

In commenting on aspects of the implementing procedures of the proposed amendments to Appendix D of the Atomic Energy Commission's procedures for implementing the National Environmental Policy Act of 1969, John N. Nassikas, Chairman of the Federal Power Commission, by letter dated August 31, 1971, to James R. Schlesinger, Chairman of the Atomic Energy Commission, commented on the probably negative reserve for the summer of 1972 and anticipated the frequent service interruptions which would occur. It was observed that "additional delays of new power plants which would be physically ready for service will almost invariably have serious consequences adverse to the public interest, including detriment to the environment." The detriment to the environment, of course, would be by outages affecting water and waste treatment plants, industrial treatment facilities, and the like. It is further submitted that predictions of service interruption for 1972 clearly hold true for 1974, considering the similarity of reserve capabilities in both periods.

2. Alternative Methods of Procuring Power

Hutchinson Island Unit #1 is needed to furnish power in 1974. It is therefore necessary to consider whether any alternatives would be available in 1974 in the event Unit #1 were delayed. These alternatives are:

a. Transmission From Other Florida Power Systems

The alternative of purchasing power from outside sources is not available to the Applicant, because of the low reserves of all neighboring systems. The Applicant cannot depend on securing its power from other companies in Florida as is evident from the following table[1] taken from The Miami Herald.

Company	1971 Capacity (Megawatts)	1971 Reserves (Percent)
Florida Power & Light Company	6,013	1.7
Florida Power Corporation	2,634	11.1
Tampa Electric Company	1,825	41.9
Jacksonville Electric	966	-1.1
Orlando Utilities	361	12.5
Lakeland Municipal	260	78.1
Tallahassee Municipal	240	43.7
TOTAL	12,299	10.0

All evidence indicates that the situation may become slightly less critical but will not greatly improve for 5 to 10 years. At present, of the investor utilities only Tampa Electric has adequate reserves, and its entire capacity is relatively low. Problems also exist with maintaining any interconnection in the Florida group of utilities. The report reviewing the Florida power supply situation prepared by the Bureau of Power of the Federal Power Commission in 1970 made the following comment with regard to weaknesses existing in transmission ties; "Past performances have demonstrated the likelihood that connections in the northern part of the Florida Peninsula, in the general vicinity of Suwanee, Fort White, and Silver Springs in the Florida Power Corporation's system, will open under power swings which accompany most network disturbances." Note: Figures for capacities and reserves as given above and in Table V-1 were derived at different times based on peaks and capabilities projected at the time of preparation.

b. Transmission From Areas Outside Florida

To go beyond Florida to Georgia or Alabama would not provide a satisfactory solution because reserve capacities are not high in either of those states. The long transmission lines that would be required for out-of-state purchases of power would be, of course, subject to normal transmission losses and to natural hazards such as hurricanes and tornadoes. Moreover, transmission lines of the required type will not be available in the near future.

In recent comments on power requirements in Florida, the Federal Power Commission (letter of Chairman, FPC, to Chairman, AEC, July 2, 1971) stated:

> "Furthermore, the distance from Miami to the Florida-Georgia state boundary is approximately 400 miles and, according to the Southeastern Electric Reliability Council's April 1, 1971, submission of its Coordinated Bulk Power Supply Program 1971-1980 in response to FPC Order No. 383-2, it may be as late as 1980 before 500-kilovolt EHV interconnections, presently estimated or projected, are in operation. In the meanwhile, existing low voltage interconnections between the subregions are inadequate for importing sufficient amounts of power in the event of major generation deficiencies within the State of Florida during peak load conditions."

Since power supplies are not available from others, the Applicant must generate its own.

c. Other Methods of Generation

No other new plants can be put into operation by 1974. Fossil fuel-fired plants require an estimated 5 years to complete and an alternative nuclear generating plant would require an even longer time.

Peaking Units

Gas turbine peaking units which could be installed by 1974 are not acceptable alternatives for a base load plant such as Hutchinson Island Unit #1. As shown in Figure V-1, the Applicant has installed 888 Mwe and will have installed by 1974 a total of 1332 Mwe of these units. Experience has shown that gas turbines are not suited for carrying base loads. Gas turbine capacity beyond that already planned for the system would be required to operate for more hours than would normally be the case for gas turbines intended solely for peaking capacity. Especially when base loaded, maintenance is much more often required than for other types of generating units. Since service maintenance time keeps the turbine off-line to some extent, a system cannot rely heavily on peaking load units to carry its base load. In addition, fuel costs are high, and this increased cost, along with maintenance costs is passed on to the consumer. Gas turbines would have a lower capital cost (estimated to be $90.00 per kw excluding transmission) than Hutchinson Island Unit #1 (estimated to be $250.00 per kw when completed excluding transmission). However, gas turbines would have a much higher production cost (about 25 mills per kwh based on use of liquid fuel at 90¢/MBtu, a fixed charge rate of 17%, and 1500 hours per year operation as compared to approximately 8.1 mills per kwh for Hutchinson Island Unit #1). As a result of the significantly higher operating costs, total system costs will be greater if a gas turbine alternative were installed.

Fossil Units

As previously discussed, the necessity for meeting the 1974 load requirements forecloses the installation of fossil units because of the five years required to get these units on the line. However, the selection of a nuclear unit rather than a fossil unit for Hutchinson Island was based on the following reasons.

A large gas-fired unit was not possible because adequate supplies of gas are not available in South Florida. FP&L has found it impossible to expand its gas supplies in the last few years. To install a gas-fired unit, it would first be necessary to find an assured long-term supply of gas at some field. Since present gas lines into Florida are of inadequate capacity, Federal approval for new lines would be necessary and these lines would have to be built. The time required for these operations, even if the gas were available, makes this alternative unacceptable.

The availability of fuel oil is better, but unfortunately, the supply of low-sulfur fuel oil is limited. The continuing political disturbances in the Far East pose a threat to both availability and cost. Delay and uncertainty plague the Alaskan North Slope fields and pipeline. Another Florida utility, The Jacksonville Electric Authority, has suddenly found that its cost per barrel of low-sulfur fuel oil jumped from $1.90 per barrel under a recently expired contract to $3.94 per barrel quoted for new supplies.[2]

Of the fossil fuels, coal is the most costly due to the distance of the source of supply. Low-sulfur coal is in extremely short supply and even were it available, particulate and gaseous releases from coal plants are much greater than from oil or gas burning plants. Considerable research is underway to develop methods to reduce stack emissions from coal plants. These investigations are making progress and may ultimately be successful, but at present, the problem of stack emissions is important.

An idea of what is involved in a coal generation system can be derived from the practice of another Florida utility. Tampa Electric Company is the only utility in the State which relies heavily on coal. Their first major coal unit started in 1954 and 86.8 percent of their generation is now from this fuel. As described in their company magazine,[3] the coal is mined in western Kentucky, shipped down the Ohio and Mississippi on river barges, and transshipped at New Orleans to large ocean-going barges to cross the Gulf. A bulk product backhaul arrangement is important to the system's economy and success. The total shipping distance is 1,600 miles. The system has been quite successful for Tampa Electric. The Hutchinson Island area is by no means as suitable for such shipping as it is 400 to 500 miles farther by sea from New Orleans than is Tampa, and while the Tampa port facilities ship considerable quantities of phosphate and other bulk commodities, the Ft. Pierce area produces no quantities of bulk materials suitable for backhaul freight. The lack of backhaul freight might as much as double barge transportation costs. Coal costs at Hutchinson Island would then be higher than in Tampa due to increased freight charges.

While a coal based generating system has evidently been quite successful in Tampa, the increased freight costs and the necessity of establishing a rather complex and expensive transportation system do not make it economically attractive.

FP&L's policy on generation is to build a balanced system in which generation capacity will be divided between fossil, nuclear, and gas turbine plants. With a continually expanding system, each planned addition must be considered from the standpoint of its economics, its proposed environmental impact, its reliability and optimum utilization of natural resources. The nuclear alternative permits avoidance of complete reliance on a one-fuel system with the attendant future uncertainties concerning the development of satisfactory emission controls, and long-term fuel supply.

No additional power can be made available by deferring retirement of older stations, as all present units are to remain in service.

B. Heat Dissipation Alternatives

As discussed in the original Environmental Report the possible alternative heat dissipation systems could be considered to include:

1. Dry cooling towers
2. Wet cooling towers - mechanical draft
3. Wet cooling towers - natural draft
4. Spray ponds and power spray modules
5. Once through cooling
   a. With intake from the Indian River, discharge to the ocean
   b. With ocean intake and discharge

These alternatives can be considered in order.

Dry Cooling Towers

The dry cooling tower, which is similar in its mode of operation to an automobile radiator, is as yet undeveloped except in quite small sizes. In line with sound engineering practice, the Hutchinson Island units only employ components whose performance has been proven in sizes at least comparable to those to be used. It might also be noted that the dry cooling tower, because it can only approach the dry bulb temperature of the air, and not the wet bulb temperature, cools so inefficiently that a different turbine would have to be designed and built to operate on the much worse condenser condition which the warmer cooling water would provide. Dry cooling towers would then result in a less efficient cooling system; but, also, of more importance, a long and expensive research and development program would be required to bring the dry cooling tower system to the stage of development necessary for its adoption. Such a development program, even if its success was assured, was not within the proper scope of plant procurement and the alternate was dropped from consideration.

Wet Cooling Towers

FP&L had commissioned an in-depth study[4] of wet cooling towers for its Turkey Point nuclear plants. The important conclusions from this study apply equally to a Hutchinson Island installation.

The thermodynamic performance of cooling towers is sufficiently well known so that their behavior can be predicted. It could be determined that if mechanical draft towers were employed at Hutchinson Island, an installation 10 times the size of the largest known salt water facility in service would be required. For natural draft, hyperbolic towers, three units, each 500 feet in height, would be necessary. The manufacturers were in agreement that either mechanical draft or hyperbolic towers could be constructed to withstand winds of hurricane force up to 140 mph. Materials of construction and methods of inhibiting marine growth on the wetted surfaces were thought to present difficult but not insoluble problems.

The major difficulty with mechanical cooling towers was with drift. Simply defined, drift refers to the water carried up the stack in fine droplets and released to the atmosphere. In salt water cooling towers these droplets contain salt. The problems are: (1) how much salt comes out of the cooling towers, (2) what is the size of the area over which this salt is deposited, and (3) what effect does the salt have upon the surrounding environment, including plant and animal life, and soil and structures of the area. The cooling tower suppliers are willing to guarantee a maximum limit of drift from their equipment; however, the industry possesses no accurate standard method for experimentally measuring drift, and therefore present drift guarantees are probably not too meaningful, particularly at low values. The significant problem is that even when operating within the guaranteed drift values for currently operating towers, the amount of salt which would come out of the Hutchinson Island cooling towers is calculated to be from 10 to 200 tons per day and potential area deposition rates are prohibitively high. Prior to building a salt water cooling tower as large as that required for Hutchinson Island, substantial research, development, and prototype testing would be required. There is no such research, development and testing being carried out at this time. FP&L intends to begin testing of salt water cooling tower behavior at their Turkey Point site but critical data may not be available from the program for two to four years.

Hyperbolic, or natural draft, cooling towers are believed to produce acceptable drift, but their costs, as will be seen later, are excessive.

Spray Ponds

Concerning sprayed cooling ponds, these systems have been used with fresh water for more than half a century for power plant and industrial cooling, with the majority of spray installations having been put in service decades ago. Spray cooling is basically a form of evaporative cooling. The water to be cooled is sprayed into the air in droplets providing a large surface area in contact with the air. The lower limit of cooling by a spray system is the wet bulb temperature of the air; however, a close approach to the wet bulb temperature is not generally practical.

A large area is required for a spray pond. Various handbooks and manufacturer's data show that the pond surface area required is 2 to 10 square feet for each gpm of flow, depending on pond shape and size, climatic conditions, air lanes, etc. On this basis, a total area of 1,060,000 to 5,300,000 square feet would be required. No spray ponds of such large size are known. A tremendous amount of piping would be required to distribute the water to this large number of nozzles. The power required by the pumps for the system would be on the order of 10,000 to 15,000 horsepower. Engineering handbooks state that typical spray pond installations experience large losses due to fine droplets being carried away by the wind (drift). They further state that these losses can equal or even exceed evaporation losses. This represents a drift loss exceeding 1% of the condenser flow rate. (This amount of drift is 10 times higher than the nominal drift from a mechanical draft cooling tower.)

Spray ponds using salt water would probably be unacceptable because of the large amount of salt which would be put into the air by drift. No spray cooling pond, for utility or industrial service, that utilizes sea water is known.

A recent modification of the cooling pond concept is the power spray module (PSM) such as is manufactured by the Ceramic Cooling Tower Company of Fort Worth, Texas. The power spray module consists of a pump, spray nozzles with interconnecting piping, and plastic floats. In operation, the unit floats in a canal, pond, or other body of water with only the tops of the floats, the pump motor, and the four spray nozzles exposed above the surface of the water. The pump draws water from the canal about two feet below the surface and pumps it to the nozzles where it is sprayed into the air.

There are several important differences between such a spray module and a conventional spray cooling system. The spray module does not require the large amount of fixed piping which carried water to the many spray heads in a conventional system. However, there is the attendant disadvantage that the cooled spray continually mixes with the water being cooled, thereby reducing the bulk water temperature, and as a result the heat dissipation capability of each succeeding downstream unit is slightly reduced.

After a study of the available information and a visit to the manufacturer, the referenced report[5] drew the following conclusions, among others:

--- "No PSM has ever been designed or built for salt water service."

---"There has been no long-term continuous operation of a PSM in fresh or salt water to prove the reliability of the motor-pump assembly or its components, especially the bearings. While this is a simple device, a high degree of operational reliability and low maintenance must be proven."

---"Structural adequacy of the unit under severe wave action has not been determined."

---"Drift represents a real problem area. Questions which must be answered are: how much salt is dispersed into the air by the drift, over what area is the salt deposited, and what effect does the salt have upon the surrounding environment?"

Conventional sprayed cooling ponds were not acceptable because of their cost and complexity as regards pumps and piping, but of more importance was the tremendous amount of salt drift released by them. The power spray module is of doubtful utility because of the complete lack of experience with it in large sizes and in salt water. In addition, hurricanes and high water might be extremely destructive to the modules, but there is no information on such effects.

To summarize, the mechanical draft cooling towers and the spray ponds both presented the major problem of excessive salt spray. While the approximate two mile distance to the mainland might be sufficient to prevent damage there, there is as yet no evidence to support this. Damage to neighboring parts of the island would be quite probable. A further consideration is that any cooling tower system using salt water would have to be a once through system to avoid the excessive concentration of salt and related blowdown problems which would be associated with closed circuit cooling. The problem of damage to entrained biota in the cooling system would be worse as any plankton or eggs in the cooling water would not only pass through the condenser but also the cooling towers when additional mechanical damage would be probable. The only advantage which can be claimed for the cooling towers is the lower temperature of the discharge. However, there is no evidence that these slightly lower temperatures would provide any actual improvement over the present system as regards environmental effects. There is not sufficient space available on Hutchinson Island to accommodate the spray ponds. The natural draft towers would also be crowded in the Island and would have a considerable visual impact if placed at the plant site. Three large towers, 500 feet high, or two and a half times as high as the largest major plant structure, would be visible from a large area of the mainland and most of the Island. It is doubtful that they would be aesthetically acceptable. Considerable resentment among the local people could be expected.

None of the alternatives discussed appeared to offer any advantage over the once through cooling system as regards environmental impact. The mechanical draft cooling towers showed potential for unacceptable damage to the environment. Detailed design and cost studies, therefore, have not been made. The designs would depend on the maximum release temperature set for the cooling water. If a maximum release temperature of 90 F is assumed, costs of a cooling system at Hutchinson Island can be interpolated approximately from more detailed studies made at Turkey Point as follows:

Mechanical draft towers	$15,125,000
Natural draft towers	$19,690,000

Once Through Cooling

The once through cooling systems considered are (1) the earlier version based on taking cooling water from the Indian River and discharging it to the ocean, and (2) the present design in which water is taken from, and released to the ocean. The first version was discarded as described in Section 2.3.6. of the original Environmental Report because of possible hazards to the ecology of the Indian River. The present system takes its water from and discharges into an area which is both low in nutrients and biota. The estimated costs for these two versions of the cooling water system are:

Indian River to Ocean	$ 3,340,000
Ocean to Ocean	$13,138,000

The ocean to ocean system, while considerably more expensive, justifies its cost in protecting the environment by assuring minimum damage to tne aquatic biota. The spread between the cost of the mechanical cooling towers and the once-through, ocean to ocean system is not great enough to be the controlling factor. The selection of the once-through system was made to prevent salt spray damage and for the other reasons discussed.

REFERENCES

1. The Miami Herald, August 22, 1971.

2. The Florida Times-Union, Jacksonville, Florida, September 22, 1971.

3. Being TECO (a quarterly magazine), Communications Department, Tampa Electric Company, P. O. Box 111, Tampa, Florida.

4. An Evaluation of the Feasibility of Salt Water Cooling Towers for Turkey Point, Southern Nuclear Engineering Inc., Dunedin, Florida, February, 1970.

5. An Evaluation of the Powered Spray Module for Salt Water Service at Turkey Point, Southern Nuclear Engineering, Inc., Dunedin, Florida, May, 1970.

TABLE V-1

FLORIDA POWER & LIGHT COMPANY
SUMMER PEAK LOADS, CAPABILITIES AND RESERVES
(Capability is Summer Peak Capability)

Year	Peak Load Gross 15-Min. MW	% Incr.	Capability MW	Reserve MW	Reserve %	Largest Unit	Reserve With Largest Unit Out MW	Reserve With Largest Unit Out %	Gas Turbine MW	Gas Turbine % Capability
1961	1636	13.9	1963	327	20.0	225	102	6.2		
1962	1874	14.5	2263	389	20.8	300	89	4.7		
1963	2163	15.4	2538	375	17.3	300	75	3.5		
1964	2419	11.8	2938	519	21.5	400	119	4.9		
1965	2693	11.3	3597	904	33.6	400	504	18.7		
1966	3038	12.8	3498	460	15.1	400	60	2.0		
1967	3338	9.9	3898	560	16.8	400	160	4.8		
1968	4004	20.0	4298	294	7.3	400	(106)	(2.6)		
1969	4563	14.0	5125	562	12.3	400	162	3.6		
1970	5230	14.6	5569	339	6.4	400	(61)	(1.2)	444	8.0
1971	5635	7.7	6013	378	6.7	400	(22)		888	14.8
1972	6500	11.5	8313	1813	27.9	728	1085	16.7	1332	16.0
		(Turkey Point #3 - 760/728 MW - 1/72)								
		(Turkey Point #4 - 760/728 MW - 6/72)								
		(Sanford #4 - 419/400 MW - 4/72)								
		(Lauderdale Gas Turbines - 444 MW - 6/72)								
1973	7250	11.7	8713	1463	20.2	728	735	10.1	1332	15.3
		(Sanford #5 - 419/400 MW - 1/73)								
1974	8100	11.7	9563	1463	18.1	850	613	7.6	1332	13.9
		(Hutchinson Island #1 - 890/850 MW - 5/74)								

Notes: Capability shown is Winter Gross/Summer Gross - MW.
Capability does not reflect Turkey Point curtailment.

VI. BENEFIT-COST ANALYSIS

A. Alternatives

The design of the Hutchinson Island Unit #1 is believed at this time to be that which will be ultimately completed and licensed. Modifications to this design are not foreclosed but there are no alternative subsystems now being recommended, considered or designed.

Thermal dissipation by means of an ocean intake and discharge is believed to be optimum due to the limited opportunity for damage to marine biota. This system's freedom from other environmental effects is considered superior to the previous concept in which the cooling water was removed from the Indian River. No system is presently known which would be superior to it.

Concerning the release of radioactivity and other possible detrimental effects to air and water, although no available facts indicate the need for modifications to the present waste handling systems, modifications can be made if information becomes available which would indicate the advisability of such changes. At present, however, no modifications are in process.

Since no specific alternatives are under consideration, the only reactor system discussed herein is that now under construction.

B. Benefits

1. Power

The power benefits have been calculated as suggested in the preliminary Guide to the Preparation of Benefit-Cost Analyses and are based on the following:

The Hutchinson Island Nuclear Unit has a capability of 833 Mwe net, and is expected to operate at an 80% capacity factor when considered at full production. It will have a lifetime for amortization purposes of 40 years. It is expected that during the first year, 1974, because of startup during the middle of the year and because of the normal startup difficulties, power production will only be 25% of full production. For the next 20 years operation will be at full production. The following 10 years will be at 75% of this and the last nine years at 50%. The equation provided in the Guide:

$$\text{Present value of Power Benefits} = \sum_{n=1}^{M} \frac{Y_n\ S}{R^n}$$

has been employed to calculate the power benefits and the 8% discount rate recommended for consistency in calculations has been used. The average sales price per kwh in 1970 was $.018. This price has been used in the calculation. The symbols employed are as follows:

M = amortization period for plant, 40 years

Y_n = net power output minus transmission and distribution losses and Company use (external to plant) for year, n, based on system experience for 1970.

S = average sale price in $ per kwh, $.018

R = discount factor for year, n, R=1 + d when d is the average discount rate assumed at 8% as recommended by the Guide.

Based on the above, the present value of the power to be generated by the Hutchinson Island Plant during its lifetime is:

$1,012,000,000

This amount, for the total electrical power to be produced and sold would be divided as 51% for residental use, 31% for commercial use, and 18% for industrial and other uses if the experience for the year 1970 was followed through the life of the reactor.

2. Environmental Enhancement

Operation of the Hutchinson Island Nuclear Unit will result in the enhancement of the environment in several ways, as has been discussed in more detail in the original Report. Unfortunately, these improvements cannot be quantified but should, however, be placed on the record.

a. Recreation

Two miles of beach will be preserved for the public use as a picnic area, for swimming, boating, scuba diving, etc. This beach will become of increasing importance as development of Hutchinson Island continues.

b. Wilderness Area

The plant site area will be preserved in its natural state and kept safe from the encroachment of housing and other developments.

c. Taxes

The amount of taxes to be paid to the County have not as yet been determined but are sure to be of such amount as to be of considerable assistance to County finances and to make possible improvements in County services.

C. Costs

Generating Costs

The generating cost has also been calculated from a formula suggested by the Guide:

$$\text{Present Value Generating Cost} = C + D + \sum_{n=1+J}^{M} \frac{L_n + O_n}{R^n} + \sum_{n=1}^{\ell} \frac{P_n M_n}{R^n}$$

where, in addition to the previous symbols:

C =	Total capital outlay when plant begins operation	$200,000,000
D =	Additional capital required by alternative	N.A.
ℓ =	Years of delay due to adoption of alternative	N.A.
J =	Years counted from start of full operation	N.A.
P_n =	Replacement power purchased in year, n	N.A.
M_n =	Cost per kwh of replacement power	N.A.
O_n =	Yearly operating and maintenance cost plus nuclear insurance in year, n	18,100,000
L_n =	Total fuel cycle cost per year, equilibrium in year, n	10,000,000

However, since no reason for modification of the plant after startup can be foreseen at this time, those factors covering replacement power and down-time for backfitting can be removed and the equation then becomes:

$$\text{Present Value Generating Cost} = C + \sum_{n=1}^{M} \frac{L_n + O_n}{R^n}$$

Here again the 8% discount for present value calculations was employed and the 40 year history was considered to be that given above.

On this basis, the present value generating cost for the life of the reactor is:

$507,800,000

Environmental Costs

1. Heat Discharge to Water Body

As given in the original Report (Table 2.3.6-2) the catch of fish in the Atlantic Ocean in the area during 1970 was:

Total catch	2,941,134 lbs
Value	$575,798

or 19.5¢/lb. The area in which these fish were caught is not precisely defined but can be taken conservatively as an area having a length equal to one-half the distance to the nearest important fishing port to the south (Stuart) plus one-half the distance to the next important port to the north (Vero Beach). The total of these distances is 10 miles. The width of the area can be taken as the average distance to the 10 fathom line or 6 2/3

miles. About 86% of the fish reported were caught in shelf waters, that is, within the 10 fathom line (p. 43).* The conservative catch area, then, is 10 x 6 2/3 = 66.6 sq. miles, or 42,600 acres. The area of the 1.5F isotherm from the discharge is 400 acres and for the 3F isotherm, 25 acres (p. 32). These isotherms are 0.94% and 0.06% of the catch area.

No evidence is known which indicates any important damage to fish or fish nutrients at a ΔT of 1.5F. Damage at 3F under Hutchinson Island conditions is equally doubtful. Even if damage were possible at a 3F ΔT, the area involved is so small that even if all the fish within this area were destroyed, their annual value would be:

$$\$575,798 \times .0006 = \$346$$

However, this destruction is not considered credible.

As will be seen from Figure 2.3.3-3 of the original Report, the 1.5F plume is 1 1/2 miles in length while the 3F plume is 1/3 miles long. Even if the 3F differential acted as a barrier, the migration path is the width of the 10 fathom shelf, or 6 2/3 miles, so that the 3F plume is only 5.2% of the path. This could hardly act as a barrier even if the temperature were high enough to actually deflect fish.

The capacity of the receiving water body, the Atlantic Ocean, is so large that the effect on it of the heat released and the small changes in oxygen content are negligible. It has been estimated (p. 28) that the amount of cooling water pumped through the plant at maximum capacity in one year is one one-hundred-millionth of the volume of the ocean into which it discharges.

2. <u>Mechanical Effects on the Water Body</u>

After a study of the area, the nature of the sea bottom in the discharge area, and the available literature on mechanical damage to marine organisms passing through the condenser system, the original Environmental Report concluded (p. 48) that:

> "Assuming the worst case, i.e., complete destruction of all entrained organisms, the impact on the environment would be negligible; first, because of the barren nature of the water to begin with and second, because only a small volume of the offshore water will be used for cooling."

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* Page and table numbers given in parenthesis refer to the original Environmental Report.

"Since the low plankton counts in the water are due to nutrient limitations and because there will be species of organisms not affected by entrainment the ecological system will re-establish its equilibrium within a short distance of the end of the outfall. Such recoveries have been observed in several systems.[13, 14, 15, 17, 19, 22, 23, 24]"

"The effects on the entrained organisms inventory in the area was concluded to be negligible."

Studies are underway which will develop information from which special fish protective devices for the cooling water intake can be designed. It is expected that highly efficient protective devices will be developed but predicting the efficiency of these devices is not yet possible.

From the plant design there is no reason to believe that there will be any increase in turbidity in the water discharged from the plant.

3. Chemical Discharge to the Water Body

At the present state of design and construction of the Hutchinson Island Plant the details of the chemical discharge treatment system and the quantities of chemicals to be discharged have not been precisely determined. The chemical waste system is described in Section 2.3.4 of the original Report. It is similar to the Turkey Point Units 3 and 4 systems, except that coagulation is not necessary at Hutchinson Island. Because of the similarity, approximate but indicative numbers can be derived on the quantities and concentrations of chemical releases at Hutchinson Island.

The major chemical releases will be from the demineralizer regeneration chemicals, sodium hydroxide and sulfuric acid. The maximum possible release would be caused by the demineralizers running at full capacity continuously, a highly unlikely situation. By extrapolating from Turkey Point requirements, the discharge would amount to 13,400 lbs. of sodium sulfate equivalent per day. The actual compounds released would be those exchanged on the demineralizer resins and would be high in calcium, but the sodium sulfate equivalent can be taken as indicative of the quantity released. As discussed in the original Report, the chemical effluents are held in a retaining basin and adjusted to a pH between 6.0 and 8.5. After the insoluble materials have settled, the clear liquid is discharged to the cooling water circuit for dilution before entering the sea. At a circulating water flow of 530,000 gpm, or 763,000,000 gallons per day, the 13,400 lbs of chemicals would be diluted to a concentration of 2.1 ppm. As this discharge would be entering seawater with a solids content of 33,000 ppm, or 16,000 times this concentration, the effects under these maximum conditions are negligible. The actual discharges would be considerably lower than those given above, as the demineralizer will not operate at full capacity continuously. Also the actual discharge would contain a large proportion of calcium salts. These would have limited solubility and would remain in the settling basin for ultimate removal and burial.

4. Consumption of Water

The only fresh water used will be secured from the City of Ft. Pierce Municipal Water System whose wells have no known limitation on supply.

5. Chemical Discharge to Ambient Air

No chemicals are expected to be released to the air nor will odors be generated.

6. Salt Discharge from Cooling Towers

Such towers will not be used.

7. Chemical Contamination of Ground Water (excluding salt)

As the only discharge is to the sea, such contamination cannot occur. (Ground water under the site is saline.)

8. Radionuclides Discharged to Water Body

The possibility that people who use the water for recreational purposes near the point of effluent discharge may receive some radiation exposure from the radionuclides that are released has been considered. These people would include those engaged in in-water activities, such as swimmers or scuba divers, and others engaged in above-water activities, such as water skiers, fishermen and boat users. An evaluation has been made of the radiological cost to recreational water users in the vicinity of the Hutchinson Island unit. The two mile beach which fronts the facility is used, on the average, by about ten people for 3 hours a day. These figures for this rather limited use are based upon observations made by people stationed at the site.

Doses were calculated, conservatively assuming that the recreational water user(s) were exposed to the annual average radioactive concentrations in the circulating water discharge for two hours every day of the year. These concentrations are given in Table 2.3.7-1 (p. 61) of the original Report. An "infinite-cloud" of radiation was assumed in determining the dose to a person participating in in-water activities. The dose was calculated to be less than one-tenth of a mrem/yr and is actually slightly less than would be received from radioactivity normally present in seawater, mainly potassium-40. For a person engaged in above-water activities, a "slab model" calculational technique was used. Again, the resulting dose was found to be less than one-tenth of a mrem/yr. Doses of this magnitude will have essentially no biological impact upon an individual. Furthermore, since the waters offshore of the Hutchinson Island unit will not be used by many people for recreational purposes, the integrated dose (man-rem) is also expected to be extremely small. Based on the ten people using these waters two hours each day of the year for recreational purposes, the integrated dose resulting from discharged radionuclides would be less than one-thousandth (10^{-3}) of a man-rem per year.

Because of the extremely low doses, both to individuals and to the population, it is concluded that the radiological cost from recreational uses of the waters offshore of Hutchinson Island is insignificant.

A discussion of radiation pathways to man and the resulting impact is presented in Section 2.3.7.3 of the original Report. Attention is given to the aquatic food chain and the subsequent ingestion of seafood. Direct ingestion of seawater is obviously of no concern since its salt content precludes its use as a supply of drinking water.

The yearly radiation dose to a person resulting from the consumption of fish has been calculated. This includes the dose from both fin and shellfish. It was assumed that 25% of the fish caught and then ingested consisted of fish that were previously exposed to the average radioactive concentrations of the facility's circulating water discharge. This percentage is conservative since offshore marine life is minimal, and such benthic marine life as exists is not of commercial importance. Appropriate reconcentration factors were used to account for the concentration of radionuclides in the food chain, including exposure of the fish to radioactivity higher than normally found in seawater. The resulting dose to an individual person has been estimated to be approximately 3 mrem/yr.

An estimate of the man-rem dose to the population resulting from ingested seafood is much more difficult to make than that to an individual person. The population within approximately 5 miles of the site is very small. From about 5-10 miles the population is approximately 60,000. The population within 10 miles of the plant is used to estimate the man-rem dose. It should be noted that 50 miles is not used as is normally done when calculating the man-rem dose from atmospheric releases of activity. For atmospheric releases, some activity will indeed be carried out to 50 miles. Concerning the man-rem dose from seafood ingestion, it is obvious that most of the seafood ingested within 10 miles of the plant will not be affected at all by operation of the Hutchinson Island unit. The basis for the dose estimate is again taken to be from both fin and shellfish. It is conservatively estimated that one percent of the fish landed and subsequently ingested by the population have been previously exposed to the concentration of radioactivity discharged to the ocean offshore Hutchinson Island. Based on the previously estimated dose of 3 mrem/yr to an average individual, the following would be the man-rem dose:

$$\frac{3\ \text{mrem}}{\text{yr-person}} \times 60{,}000\ \text{persons} \times 0.01 \times 10^{-3}\ \frac{\text{rem}}{\text{mrem}},$$

or

$$\frac{1.8\ \text{man-rem}}{\text{yr}}$$

Both the individual and integrated (man-rem) doses are quite small, and it is thus concluded that the radiological cost to people from the ingestion of seafood is not significant. Further, because the marine life offshore of Hutchinson Island is minimal and no significant spawning areas exist near the proposed discharge, the environmental cost to aquatic life from radiological discharges to the ocean is also considered to be very small.

9. Radionuclides Discharged to Ambient Air

During normal operation of the facility, external exposure from released gaseous activity is expected to have hardly any effect. Based on the gaseous releases listed in Table 2.3.7.1 (p. 62) of the original Report, the dose to a person standing at the plant boundary for a year would be slightly greater than half a mrem. The annual dose from released gaseous activity to a person standing on the west bank of the Indian River would be even lower, about a quarter of a mrem per year. These are obviously conservative dose estimates, since they assume a person remains at one place for a whole year. However, the estimates do clearly indicate that the radiological cost to a person from the discharge of radionuclides to the ambient air is extremely small.

A calculation of the integrated dose out to fifty miles (man-rem) has been made. The population within this distance receives approximately two and one-half man-rem/yr. This is an extremely low value and it can be concluded that the radiological cost to the population from the discharge of radionuclides to the ambient air is negligible.

Other than noble gases, the release of radionuclides to ambient air is expected to be essentially zero. Thus, it is not anticipated that deposition of radioactivity will take place on vegetation and soil. This in turn precludes concern for radionuclide accumulation in foods or its uptake in plants and animals.

10. Radionuclide Contamination of Ground Water

Consideration has been given to the possibility of contaminating ground water with radionuclides. It is concluded that the potential for such contamination is essentially non-existent.

Radioactive liquids pose the only possible source for such ground water contamination. At Hutchinson Island, these liquids, after suitable treatment, are released to the circulating water system. The water from this system in turn is discharged into the Atlantic Ocean at the end of a long discharge pipe, some 1200 ft. from the shoreline. Thus, the chance of liquid radioactivity causing contamination of the ground water is extremely remote, especially since the design of the discharge tends to carry any discharged water further offshore (refer to Section 2.3.3.2 of the original Report).

Since ground water contamination resulting from radionuclides is not expected to occur, no environmental cost is anticipated from this potential primary impact.

11. Fogging and Icing

The once-through cooling system will produce no fogging. The water surface exposed in the cooling system canals is minute in comparison to the surface of the Indian River, the Atlantic Ocean, and the Hutchinson Island creeks and swamps so that evaporation from the canal surfaces will not be an important contributor to atmospheric moisture. Icing conditions are rare at Hutchinson Island.

12. Raising/Lowering of Ground Water Levels

The amount of fresh water used in primary and secondary loop make-up is so small as to have no important effect on ground water levels.

13. Ambient Noise

Noise should not be detectible beyond the restricted area.

14. Aesthetics

The aesthetics of the plant were discussed in Section 2.3.9 of the original Report. As shown in Figure 2.1.2-1 of that Report, the plant will fit unobtrusively into its surroundings.

15. Pre-emption of Land

As discussed in Section 2.3.1.1 of the original Report, most of Hutchinson Island is at present uninhabited because of the lack of fresh water. Development of the neighboring land will be dependent on the future availability of fresh water and not on the presence of the plant.

16. Impediments to Navigation

The plant or its transmission lines will create no impediments to navigation. The Corps of Engineers have issued a Permit (included in Appendix B) for the transmission line crossing of the Indian River.

17. Degradation of Flood Control and Erosion

The plant has no implications for flood control. As stated in the Central and South Florida Flood Control District Permit included in Appendix C the transmission line crossing "does not affect District facilities".

APPENDIX A

For Office Use: UTILITY INSTALLATION

Permit No. 253.03(7)-230

Date November 13, 1970

STATE OF FLORIDA

BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

WHEREAS, application by: Florida Power and Light Company
c/o Mr. E. L. Bivans, Chief Engineer
Post Office Box 3100
Miami, Florida 33101

for a permit under the provisions of Chapter 253, Florida Statutes, to perform certain works in the navigable waters of the State of Florida, was approved by said State of Florida Board of Trustees of the Internal Improvement Trust Fund at the meeting of

NOW, THEREFORE, this Permit authorizes the above named applicant, hereinafter called Permittee, to perform such works subject to the conditions contained herein: to install an aerial transmission line over Indian River in Sections 17 and 18, Township 36 South, Range 41 East, St. Lucie County.

1. The proposed work shall be done in the area designated on the map ed on the reverse side hereof;
2. All dredging shall be done in such a manner as to prevent or mini. dispersion of silt and debris and destruction of marine resources in the public waters;
3. If the dredging is being done in other than a meandered body of fresh water, only sand shall be removed. No oyster bars or shell deposits shall be disturbed or undermined by dredging or other operations pursuant to this Permit;
4. The use of draglines or dredges with cutter heads is prohibited in fresh water lakes without special approval in writing from the State of Florida Board of Trustees of the Internal Improvement Trust Fund. The impermeable seal or strata shall not be disturbed;
5. Material removed in construction shall be placed upon the adequately diked spoil disposal area or areas designated on said map;
6. The material removed shall be used only for the improvement of upland property owned by the Permittee and shall not be sold. Under no circumstances shall the Permittee remove more material than authorized by this Permit without specific approval of the State of Florida Board of Trustees of the Internal Improvement Trust Fund;
7. No fill shall be made on the water side of the original natural ordinary or mean high water mark. This Permit conveys no title to land or water, and does not constitute authority for the reclamation of water bottom unless herein provided;
8. Extreme care shall be exercised to prevent any adverse or undesirable effects from this work on the property of others. This Permit authorizes no invasion of private property or rights in property;
9. This Permit is granted subject to the rights of the United States in navigable water, and shall be subject, further, to the rights of the public in boating, bathing, fishing, and other rights for which purposes the waters and submerged land thereunder are held by the State. This Permit does not relieve the Permittee from requirement of permit from the U.S. Army Corps of Engineers nor from necessity of compliance with all applicable local laws, ordinances, and zoning or other regulations;
10. Permittee, in accepting this Permit, covenants and agrees to comply with and abide by the provisions and conditions herein and assumes all responsibility and liability and agrees to save the State of Florida Board of Trustees of the Internal Improvement Trust Fund harmless from all claims of damage arising out of operations conducted pursuant to this Permit;
11. This Permit is granted subject, further, to the following special terms and conditions:

If the work authorized is not completed on or before the 13th day of November, 1973, this authorization, if not previously revoked or specifically extended, shall cease and be null and void.

12. A copy of this Permit shall be posted in a conspicuous place on the equipment being used in the dredging operation or shall be readily available for inspection at the project site by all duly constituted law enforcement officers having jurisdiction. This Permit shall become effective upon acceptance by the Permittee and receipt of the executed copy by the State of Florida Board of Trustees of the Internal Improvement Trust Fund, Elliot Building, Tallahassee, Florida 32304.

Accepted this 16th

day of November

A.D., 1970

Florida Power & Light Co.
PERMITTEE

By [signature]
E. L. Bivans NAME & TITLE Chief Engineer

STATE OF FLORIDA BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

By [signature: James W. Apthorp]
Executive Director

This permit is not valid unless seal of Board of Trustees of the Internal Improvement Trust Fund appears on the attached sketch.

BIT7 (7-69)

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
FEDERAL BUILDING, P. O. BOX 4970
JACKSONVILLE, FLORIDA 32201

PERMIT

SAJSP Permits (70-761)

District Engineer, Corps of Engineers
Jacksonville, Florida
14 January 1971

Florida Power & Light Company
P. O. Box 3100
Miami, Florida 33101

Gentlemen:

Referring to written request dated 9 November 1970 , upon the recommendation of the Chief of Engineers, and under the provisions of Section 10 of the Act of Congress approved March 3, 1899 (33 U.S.C. 403), entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," you are hereby authorized by the Secretary of the Army

to construct three aerial electric power transmission lines with a minimum vertical clearance of 90.0 feet above mean high water across the Intracoastal Waterway channel and 60.0 feet elsewhere,

in the Intracoastal Waterway Jacksonville to Miami, Indian River,

xxt approximately 7 miles north of State Road A1A (Jensen Beach) bridge, from mainland to Hutchinson Island in St. Lucie County, Florida,

in accordance with the plans and drawings attached hereto marked:

Proposed Overhead Crossing,

subject to the following conditions:

(a) That this instrument does not convey any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of Federal, State or local laws or regulations, nor does it obviate the necessity of obtaining State or local assent required by law for the structure or work authorized.

(b) That the structure or work authorized herein shall be in accordance with the plans and drawings attached hereto and construction shall be subject to the supervision and approval of the District Engineer, Corps of Engineers, in charge of the District in which the work is to be performed.

(c) That the District Engineer may at any time make such inspections as he may deem necessary to assure that the construction or work is performed in accordance with the conditions of this permit and all expenses thereof shall be borne by the permittee.

(d) That the permittee shall comply promptly with any lawful regulations, conditions, or instructions affecting the structure or work authorized herein if and when issued by the Federal Water Quality Administration and/or the State water pollution control agency having jurisdiction to abate or prevent water pollution, including thermal or radiation pollution. Such regulations, conditions or instructions in effect or hereafter prescribed by the Federal Water Quality Administration and/or the State agency are hereby made a condition of this permit.

(e) That the permittee will maintain the work authorized herein in good condition in accordance with the approved plans.

(f) That this permit may, prior to the completion of the structure or work authorized herein, be suspended by authority of the Secretary of the Army if it is determined that suspension is in the public interest.*

(g) That this permit may at any time be modified by authority of the Secretary of the Army if it is determined that, under existing circumstances, modification is in the public interest.* The permittee, upon receipt of a notice of modification, shall comply therewith as directed by the Secretary of the Army or his authorized representative.

(h) That this permit may be revoked by authority of the Secretary of the Army if the permittee fails to comply with any of its provisions or if the Secretary determines that, under the existing circumstances, such action is required in the public interest.*

(i) That any modification, suspension or revocation of this permit shall not be the basis for a claim for damages against the United States.

(j) That the United States shall in no way be liable for any damage to any structure or work authorized herein which may be caused by or result from future operations undertaken by the Government in the public interest.

(k) That no attempt shall be made by the permittee to forbid the full and free use by the public of all navigable waters at or adjacent to the structure or work authorized by this permit.

(l) That if the display of lights and signals on any structure or work authorized herein is not otherwise provided for by law, such lights and signals as may be prescribed by the United States Coast Guard shall be installed and maintained by and at the expense of the permittee.

(m) That the permittee shall notify the District Engineer at what time the construction or work will be commenced, as far in advance of the time of commencement as the District Engineer may specify, and of its completion.

(n) That if the structure or work herein authorized is not completed on or before the 31st day of December 1974 , this permit, if not previously revoked or specifically extended, shall cease and be null and void.

(o) That the legal requirements of all Federal agencies be met.

(p) That this permit does not authorize or approve the construction of particular structures, the authorization or approval of which may require action by the Congress or other agencies of the Federal Government.

(q) That all the provisions of this permit shall be binding on any assignee or successor in interest of the permittee.

(r) That if the recording of this permit is possible under applicable State or local law, the permittee shall take such action as may be necessary to record this permit with the Registrar of Deeds or other appropriate official charged with the responsibility for maintaining records of title to the interests in real property.

(s) That the permittee agree to make every reasonable effort to prosecute the construction of work authorized herein in a manner so as to minimize any adverse impact of the construction or work on fish, wildlife and natural environmental values.

(t) That the permittee agrees that it will prosecute the construction of work authorized herein in a manner so as to minimize any degradation of water quality.

(u) That the permittee will promptly comply with any future regulations or instructions affecting [illegible] work hereby authorized if and when issued in accordance with law by any departme[illegible] [illegible]f the Federal Government for the aid or protection of aerial navigation.

---

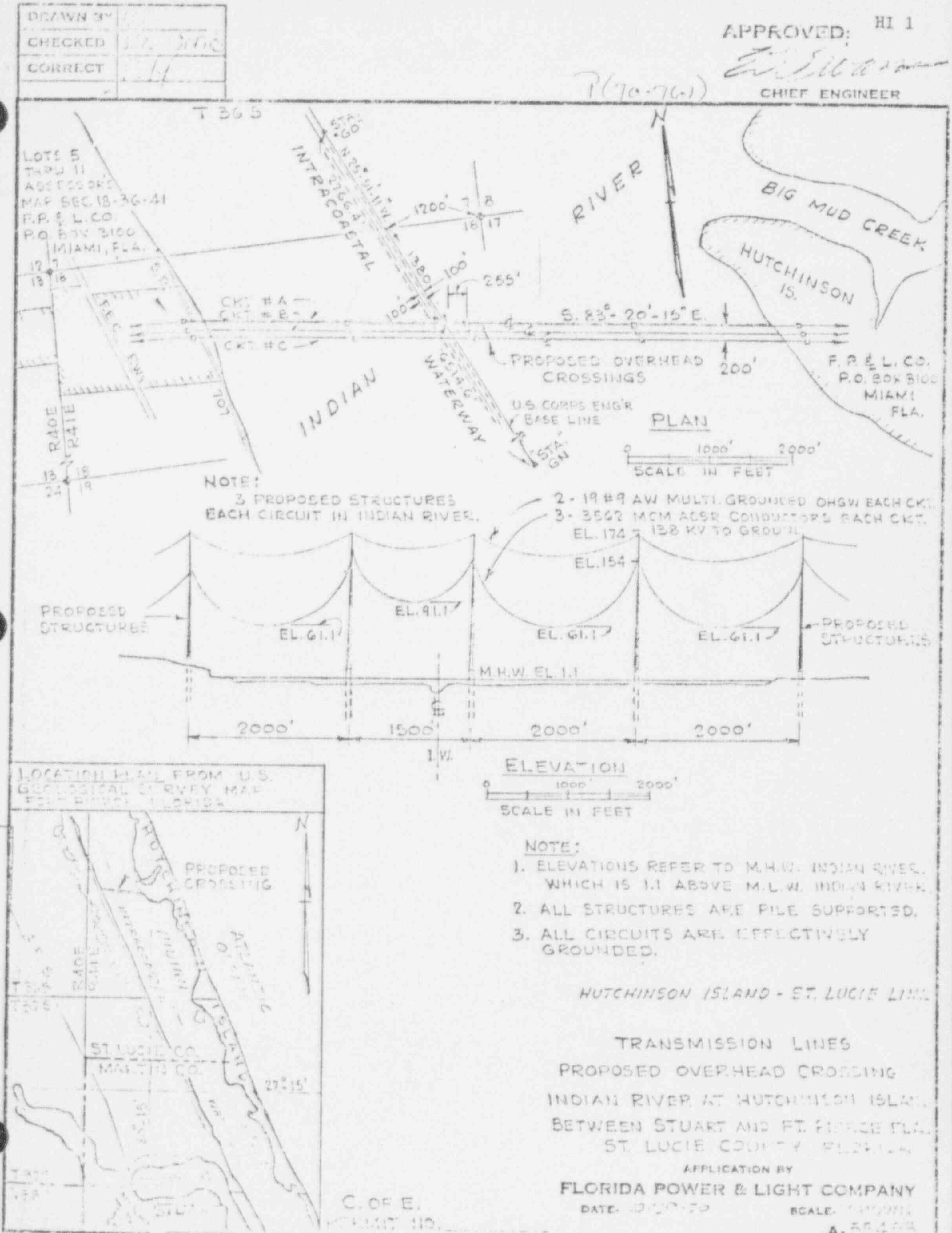
*A judgment as to whether or not suspension, modification or revocation is in the public interest involves a consideration of the impact that any such action or the absence of any such action may have on factors affecting the public interest. Such factors include, but are not limited to navigation, fish and wildlife, water quality, economics, conservation, aesthetics, recreation, water supply, flood damage prevention, ecosystems and, in general, the needs and welfare of the people.

By authority of the Secretary of the Army:

for A. S. FULLERTON — 25 JAN 1971
Colonel, Corps of Engineers — Date
District Engineer

Permittee hereby accepts the terms and conditions of this permit.

Permittee — Jan. 18, 1971
Date
E. L. Bivans, Chief Engineer
Florida Power & Light Company



DRAWN BY
CHECKED
CORRECT
APPROVED:
CHIEF ENGINEER
P(70-76-1)
T 36 S
LOTS 5 THRU 11 ASSESSORS MAP SEC. 18-36-41 F.P.&L.CO. P.O. BOX 3100 MIAMI, FLA.
INTRACOASTAL WATERWAY
INDIAN RIVER
BIG MUD CREEK
HUTCHINSON IS.
CKT. #A
CKT. #B
CKT. #C
S. 83°-20'-15" E.
PROPOSED OVERHEAD CROSSINGS
200'
255'
1200'
1380'
F.P.&L.CO. P.O. BOX 3100 MIAMI FLA.
U.S. CORPS ENG'R BASE LINE
R40E
R41E
PLAN
SCALE IN FEET
NOTE: 3 PROPOSED STRUCTURES EACH CIRCUIT IN INDIAN RIVER.
2 - 19 #9 AW MULTI. GROUNDED OHGW EACH CKT.
3 - 3562 MCM ACSR CONDUCTORS EACH CKT.
EL. 174
138 KV TO GROUND
EL. 154
EL. 91.1
EL. 61.1
PROPOSED STRUCTURE
PROPOSED STRUCTURES
M.H.W. EL. 1.1
2000'
1500'
2000'
2000'
ELEVATION
SCALE IN FEET
LOCATION PLAN FROM U.S. GEOLOGICAL SURVEY MAP
PROPOSED CROSSING
ATLANTIC OCEAN
ST. LUCIE CO.
MARTIN CO.
27°15'
C. OF E.
NOTE:
1. ELEVATIONS REFER TO M.H.W. INDIAN RIVER WHICH IS 1.1 ABOVE M.L.W. INDIAN RIVER
2. ALL STRUCTURES ARE PILE SUPPORTED.
3. ALL CIRCUITS ARE EFFECTIVELY GROUNDED.
HUTCHINSON ISLAND - ST. LUCIE LINE
TRANSMISSION LINES
PROPOSED OVERHEAD CROSSING
INDIAN RIVER AT HUTCHINSON ISLAND
BETWEEN STUART AND FT. PIERCE FLA.
ST. LUCIE COUNTY FLORIDA
APPLICATION BY
FLORIDA POWER & LIGHT COMPANY
DATE
SCALE

DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION
FEDERAL ACTIVITIES COORDINATION PROGRAM

Water Quality Considerations
For
Construction and Dredging Operations
June 1968

General

In order to protect water quality within the Southeast region, there are several considerations which are considered important. In the planning, design, construction, and operation of water oriented projects, fully cooperative actions should be developed with local, State and Federal authorities having responsibilities for public health, conservation, and water pollution control. Generally, the criteria for these considerations will be reflected in the State Water Quality Standards.

FWPCA concurrence in the implementation of projects or permits is contingent upon full compliance with existing local, State and Federal laws and regulations. When violations occur in any phase of a program, such concurrence is automatically terminated and responsible corrective action by the sponsor is in order.

Waste Disposal

All waste discharges that are generated in connection with the construction and operation of projects should be provided with adequate treatment in accordance with Executive Order 11288. The quality of the effluent from all outfalls constructed or operated by contract or permit should provide compliance with State Water Quality Standards, laws and regulations.

Piers and Marinas

Piers and Marinas should be provided with facilities for the removal of waste materials from vessels and conveyance to sewerage systems which provide adequate treatment. In the event such facilities are not practicable, regulations should be instituted which will prohibit the discharge of inadequately treated waste materials. Preventive measures for the control of spills of fuel, lubricants, and other hazardous materials should be provided.

Dredging and Disposal Operations

Dredging and disposal operations should be carried out in such a manner as to minimize the degradation of water quality and damage to aquatic biota and particularly, bottom fauna. Attention should be given to the dredging and disposal of materials containing sanitary and/or industrial sludge or toxic substances. The disturbance of anaerobic and/or toxic deposits often encountered in the vicinity of waste outfalls can seriously affect water quality. In order to accomplish these objectives, the following phases are considered particularly pertinent:

1. Consideration in the design, maintenance, and operation of dredging equipment should be directed to minimizing pollutional effects.

2. In general, controlled land disposal is preferred to aqueous disposal in order to minimize the pollution effect on aquatic biota and water quality.

3. Land disposal areas should be diked or bulkheaded and provided with adequate weirs to assure the deposit and retention of spoil materials within the project areas and to minimize the run-off of settled solids. In order for ponds to be effective, overflow devices should be placed high enough to provide the settling velocities appropriate for the type of materials being dredged. Dikes should be protected from erosion by seeding, sodding, rip-rap, or other stabilizing materials.

4. Where the aqueous disposal of spoil material is unavoidable, particular care should be provided to confine the operation within the project area. Spoil piles located in bays, inlets, or other confined water bodies should be oriented in such a way as to provide minimum obstruction to natural tidal flushing action.

5. Dredging and screening operations should be carried out in such a manner as to:

   a. Prevent excessive disturbance of silt and other detritus in the water course.

   b. Tailings from washing and screening operations should be removed in adequately designed and constructed ponds equipped with weirs or by other approved methods which will insure the effective removal of setteable solids.

6. Dredging Canals or Waterways - In construction projects involving canals and waterways, water quality can frequently be preserved by providing confinement of suspended materials within pools formed within locks, dams, or other flood control structures In other instances, confinement within a pool can be obtained by the construction of temporary dams.

GENERAL DISCUSSION

Potential Effects of Dredging on Water Quality

The following list is not presented as an all-inclusive summary, but as examples of potential water quality damage which can result from dredging activities.

1. Water Supply

a. Fresh Water Sources

Dredging can add to water treatment costs in the form of sediment removal, taste, odor, and color removal, and conceivably through the removal of toxic residues put insuspension or solution. Furthermore, present water supply treatment methods usually are not designed for the removal of many toxic compounds, which thereby become a hazard to public health.

b. Salt Water Sources

Salt water sources are used primarily for industrial cooling water. Where dredging produces sizable quantities of suspended matter, adverse effects in the form of clogged intake screens and heat transfer coils can create a maintenance problem.

2. Bathing, Swimming and Recreation

Damages resulting from dredging in this water-use category relate principally to aesthetic qualities. The presence of high turbidity, scum, sludge, odors, and color which could result from dredging would be aesthetically unacceptable in recreational areas. The public health aspects of water quality damage becomes a problem when toxic, e.g. pesticide, compounds are dispersed through disturbance and transport of settled material.

3. Fish Propagation

Dredging can effect a change in pH or dissolved oxygen as a result of disturbing anaerobic sediments. This action can be detrimental to fish and other aquatic life. Instances have been reported of damage to fish from long-term exposure in highly turbid waters. The potential for exposure of toxic sediments is also a possibility in any dredging activity. Perhaps the greatest amount of damage to fish propagation results in damage to members of the food chain. Increased color or turbidity can reduce the growth of plankton necessary to the fish food cycle. Siltation can destroy valuable bottom fauna.

4. Shellfish

Studies have shown that a pH less than 7.5 may be detrimental to shellfish growth. Dredging conceivably could effect a lowering of pH as a result of disturbance of acidic deposits. Dredging can also expose a greater amount of deleterious material to the "straining" action of shellfish ingestion. Large amounts of suspended material not needed as food by shellfish can competitively eliminate food material, thus starving the shellfish. The free-swimming larvae stage can be caused to settle prematurely in the presence of large concentrations of suspended solids. There is also a great hazard in burying the sedentary adult shellfish form as a result of settling of dredged material.

5. Agricultural Water Supply

The resuspending of colloidal and other material in irrigation waters could detrimentally affect soil infiltration rates and damage irrigation equipment through abrasive action. There is also a problem of maintenance in canals related to the deposition of dredged material.

6. General Construction including Piers, Bulkheads, Wharves, Submarine Pipelines, Cables, etc.

In general the same conditions attributed to dredging apply to the construction of these facilities

G. E. DAIL, JR., Executive Director

APPENDIX C

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT

P. O. BOX 1671
WEST PALM BEACH, FLORIDA 33402

RECEIVED
FLORIDA POWER & LIGHT CO.
DEC 28 1970
OFFICE
CHIEF ENGINEER

Chairman
ROBERT W. PADRICK, FORT PIERCE
Vice Chairman
M/Gen. H. J. SANDS, Jr., USAF (ret)
Satellite Beach
JOHN G. DuPUIS, Jr., MIAMI

IN REPLY REFER TO: 5-SLC-41 December 18, 1970

District Engineer, Jacksonville District
Corps of Engineers, U. S. Army
P. O. Box 4970
Jacksonville 1, Florida

Dear Sir:

RE: SAJSP Permits (70-761)

APPLICATION OF: FLORIDA POWER & LIGHT COMPANY

ADDRESS: P. O. Box 3100
Miami, Florida 33101

FOR: TO CONSTRUCT THREE AERIAL ELECTRIC POWER TRANSMISSION LINES ACROSS THE INTRACOASTAL WATERWAY, JACKSONVILLE TO MIAMI, INDIAN RIVER, APPROXIMATELY 7 MILES NORTH OF STATE ROAD A1A (JENSEN BEACH) BRIDGE, FROM MAINLAND TO HUTCHINSON ISLAND IN ST. LUCIE COUNTY, FLORIDA AS SHOWN ON DRAWING ON REVERSE SIDE OF THE PUBLIC NOTICE. THE AERIALS WOULD PROVIDE A MINIMUM VERTICAL CLEARANCE OF 90.0 FEET ABOVE MEAN HIGH WATER ACROSS THE INTRACOASTAL WATERWAY CHANNEL AND 60.0 FEET ELSEWHERE.

(Action of Flood Control District indicated by X)

( ) Flood Control District permit required.

(X) No Objection: Proposed does not affect District facilities.

( ) No Comment: Proposed is located outside District boundary and jurisdiction.

( ) Protest on the following grounds:

Central and Southern Florida Flood Control District

Original Signed

By G. E. Dail, Jr.

Executive Director

ROUTE TO: Files, P&J File, Ayers

cc: to Applicant
to Legal
to Permits

APPENDIX D

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDER (oan)
Seventh Coast Guard District
Room 1018, Federal Building
51 SW. 1st Avenue
Miami, Fla. 33130

OCT 2 8 1971

.3264
Serial: 2455
22 October 1971

Mr. W. J. Rom
Ebasco Services, Inc.
Two Rector Street
New York, New York 10006

Dear Mr. Rom:

I refer to your letter of 20 October 1971 regarding the proposed transmission lines crossing Indian River at Hutchinson Island, Florida.

Based on a review of the revised drawings (EBASCO #C-209340 and C-209341) you have provided this office, which show the closest tower to the Intracoastal Waterway to be approximately 500 feet from the edge of the channel, you are exempted from the requirements of Title 33, Code of Federal Regulations, Chapter 1, Part 66.01-35. Since the lighting requirement is waived, you may disregard my letter 3264 of 4 March 1971, Serial 1278. However, should conditions change, the Coast Guard reserves the right to impose lighting requirements.

Thank you for your interest in aids to navigation.

Sincerely,

R E Nielsen

R. E. NIELSEN
Commander, United States Coast Guard
Chief, Aids to Navigation Branch
Seventh Coast Guard District
By direction of the District Commander

P.O. BOX 3100 MIAMI, FLORIDA 33101

FPL
FLORIDA POWER & LIGHT COMPANY

May 20, 1971

REC USAEC REG 5 24 71 50 335/2463

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Re: AEC Docket Nos. 50-335 and 50-389 -
Hutchinson Island Units Nos. 1 and 2

Dear Dr. Morris:

We are sending you herewith Florida Power & Light Company Hutchinson Island Plant Environmental Report in accordance with the requirements of the general policy and procedure entitled "Implementation of the National Environmental Policy Act of 1969" (35 FR 18469) and Appendix D, 10 CFR 50. This report generally conforms with the AEC "Draft Guide for the Preparation of Environmental Reports for Nuclear Power Plants" of February 1971.

The first section of the report applies to Unit No. 1 and the site generally.

The second section contains the additional material required by the installation of Unit No. 2.

Very truly yours,

George Kinsman
Senior Vice President

GK:std

enc.

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
UNIT NO. 1

ENVIRONMENTAL REPORT
SUPPLEMENT NO. 2

MAY 15, 1972

DOCKET NO. 50-335

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

APR 13 1972

Docket No. 50-335

Mr. George Kinsman
Senior Vice President
Florida Power & Light Company
P. O. Box 3100
Miami, Florida 33101

Dear Mr. Kinsman:

In the course of our review of your Environmental Report and Supplement to the Environmental Report for the Hutchinson Island Plant, Unit No. 1, we have identified certain information, required for conduct of our environmental review of the facility, which is either missing or is inadequately discussed in the above documents. These specific data needs are identified in the enclosure to this letter.

It is requested that this information be made available for the site visit, tentatively scheduled for May 3, 4, and 5, 1972; and that it be submitted by May 15, 1972 in the form of three signed originals and 297 additional copies of a sequentially numbered supplement to your Environmental Report.

Sincerely,

Richard C. DeYoung
Assistant Director for
Pressurized Water Reactors
Division of Reactor Licensing

Enclosure:
Additional Environmental Information
Required

cc: Troy B. Conner, Jr., Esq.
1701 K Street, N.W.
Washington, D. C. 20006

Docket No. 50-335 April 11, 1972

ADDITIONAL ENVIRONMENTAL INFORMATION REQUIRED

HUTCHINSON ISLAND PLANT, UNIT NO. 1

1. Provide a list of bird species inhabiting or using Hutchinson Island. Indicate seasonal patterns if possible. Indicate endangered or rare species which live on, nest on, or visit the island.

2. Provide a list of the dominant shrub and grass species on the island.

3. Provide a list of native animals which live on the island, on the adjacent mainland and in the waters around the island. Indicate abundance of each.

4. Identify number, location and other data relevant to turtle nests on Hutchinson Island. Where are the preferred areas?

5. Provide, in tabular form, the joint frequency wind speed distribution listing the percent of time that a particular wind speed, wind direction, and stability classification occurs.

6. Provide data on local ocean currents for all times of the year.

7. Provide a plot of ocean temperature distributions for different tidal and wind conditions.

8. Provide a plot of the isotherms showing the vertical temperature patterns in the ocean pertinent tothe discharge area.

9. Provide year-round ocean water temperature data. What is the maximum and the minimum recorded temperature, and what is the period of record?

10. Provide data on how oceanic nutrient levels vary with time.

11. Provide a schematic or other suitable drawing showing the Y-type discharge jet.

12. Provide an analysis to demonstrate the extent of any fogging hazard (highways and waterways) or aesthetic impact of fog. This analysis should quantitatively discuss the frequency of occurrence and extent of fogging. Statements of operating experience from facilities with similar discharge situations and for similar or worse climatological conditions would be of value.

13. Identify present and projected recreational activities in the vicinity of the facility. Include number of people and hours per year at each location: boating, swimming, fishing, clam digging, hunting, water skiing, etc.

14. Provide updated population distribution maps to include 1970 census figures. Include population segments centered on the 16 points of the compass with concentric rings at 1, 2, 3, 4, 5, 10, 20, 30, 40 and 50 miles from the facility.

15. Identify distances and directions from the facility to the nearest dairy and to the nearest single cow.

16. Identify distances and directions from facility to nearest truck farm and beef producer.

17. Identify locations, frequencies and type of analyses used or to be used in the environmental monitoring program.

18. Provide data on natural salt deposition as a function of distance inland from the shoreline. If these are not specific to the site, discuss their applicability.

19. Provide data on the transmission lines in terms of right-of-way width, type circuits and pole structure, special access roads, prior land use, potential for expansion, beneficial uses, etc.

20. Provide a table showing the forecasted demand for power and the net effects of a one-year and a two-year delay in construction of Hutchinson Island Nuclear Station Unit 1.

21. Provide a population forecast for the utility's service area between 1971 and 1981.

22. Provide artist sketches and/or pictures suitable for reproduction showing the plant during construction and operation from the main areas of public access (mainland shore, Indian River, State Road A-1-A, offshore)

23. State the size of the construction work force with time during plant construction.

24. Provide calculations showing the size, cost and operating characteristics of a spray pond that would be required for plant condenser cooling during normal operation of Hutchinson Island Unit 1.

25. Provide data on the approximate additional cost of mechanical and natural draft cooling towers guaranteed for various drift levels, e.g., 0.02, 0.05, and 0.005%.

26. Provide a list of major information meetings, consultations, etc., which have been held or are planned with Federal, State and local agencies or groups other than those listed in Table 2.3.8-1, page 69, of the Environmental Report.

QUESTION 1 Provide a list of bird species inhabiting or using Hutchinson Island. Indicate seasonal patterns if possible. Indicate endangered or rare species which live on, nest on, or visit the island.

ANSWER:

Following is a tabular summary of the different species of birds that inhabit Hutchinson Island and adjacent land areas. Abundances are proportional to the number of "x" marks given. Seasonal use of the area is also indicated as follows: M - migrant; P - permanent; W - winter; Sp - spring; Su - summer; F - fall.

Species	Abundance	Seasonal Occurrence
Common Loon (Gavia immer)	x	W[1]/
Horned grebe (Colymbus auritus)	x	W
Pied-billed grebe (Podilymbus podiceps)	x	W, Sp
White pelican (Pelecanus erythrorhynchos)	xx	W
Brown pelican (Pelecanus occidentalis)	xxx	P
Gannet (Moris bassana)	x	W
Double-crested cormorant (Phalacrocorax auritus)	xxx	P
Anhinga (Anhigna anhinga)	xx	P
Magnificent frigatebird (Fregata magnificens)	x	P
Great white heron (Ardea occidentalis)	x	Sp. Su
Great blue heron (Ardea herodias)	xxx	P
Green heron (Butorides virescens)	x	P
Little blue heron (Florida caerula)	xx	P
Cattle egret (Bubulcus ibis)	xxxx	P
Common egret (Casmerodius albus)	xxxx	P
Snowy egret (Leucophyx thula)	xxx	P
Louisiana heron (Hydranassa tricolor)	xx	P
Black-crowned night heron (Nycticorax nycticorax)	x	P
Yellow-crowned night heron (Nyctanassa violacea)	x	P
Least bittern (Ixobrychus exilis)	x	P
Wood ibis (Mycteria americana)	xx	P
Glossy ibis (Plegadis falcinellus)	x	P
White ibis (Endocimus albus)	xx	P
Pintail (Anas acuta)	x	W
Florida duck (Anas fulvigula)	x	P
Green-winged teal (Anas carolinensis)	x	W
Blue-winged teal (Anas discors)	xxx	W
American widgeon (Mareca americana)	x	W
Shoveller (Spatula clypeata)	x	W
Wood duck (Aix sponsa)	x	P
Ring-necked duck (Aythya collaris)	x	W
Lesser scaup (Aythya affinis)	xx	W
Hooded merganser (Lophodytes cucullatus)	x	W
Red-breasted merganser (Mergus serator)	xxx	W
Turkey vulture (Cathartes aura)	xxx	P
Black vulture (Coragyps atratus)	xx	P
Swallow-tailed kite (Elanoides forficatus)	x	P
Cooper's hawk (Accipiter cooperii)	x	P
Red-tailed hawk (Buteo jamaicensis)	x	P

Red-shouldered hawk (Buteo lineatus)	x	P
Bald eagle (Haliaeetus leucocephalus)	x	W, Sp, F
Marsh hawk (Circus cyaneus)	x	P
Osprey (Pandion haliaetus)	xxx	P
Peregrine falcon (Falco peregrinus)	x	W
Pigeon hawk (Falco columbarius)	x	W
Sparrow hawk (Falco sparverius)	xxx	P
Bobwhite (Colinus virginianus)	xxx	P
Clapper rail (Rallus longirostris)	x	P
Purple gallinule (Porphyrula martinica)	x	P
Common gallinule (Galinula chloropus)	xx	P
American coot (Fulica americana)	xxxx	W
Semipalmated plover (Charadrius hiaticula)	x	W
Piping plover (Charadrius melodus)	x	W
Killdeer (Charadrius vociferus)	xx	P
Black-bellied plover (Squatarola squatarola)	xxx	W
Ruddy turnstone (Arenaria interpres)	xx	W
American woodcock (Philohela minor)	x	W
Common snipe (Capella gallinago)	x	W
Spotted sandpiper (Actitis macularia)	x	M
Willet (Catoptrophorus semipalmatus)	xx	Sp, Su, F
Greater yellowlegs (Totanus malanoleucus)	x	W
Lesser yellowlegs (Totanus flavipes)	x	W
Least sandpiper (Erolia minutilla)	x	F, W, Sp
Dunlin (Erolia alpina)	xx	W
Short-tailed dowitcher (Limnodronus griseus)	xxx	W
Semipalmated plover (Ereunetes pusillus)	x	W, Sp
Western sandpiper (Ereunetes mauri)	x	W
Sanderling (Crocethia alba)	xxx	W
Avocet (Recurvirostra americana)	x	M
Great black-backed gull (Larus marinus)	x	W
Herring gull (Larus argentatus)	xx	W, Sp, F
Ring-billed gull (Larus delawarensis)	xxxx	W
Laughing gull (Larus atricilla)	xxx	P
Bonaparte's gull (Larus philadelphia)	xx	W
Forster's tern (Sterna forsteri)	x	M
Common tern (Sterna hirundo)	x	M
Royal tern (Thalasseus maximus)	xxx	P
Sandwich tern (Thalasseus sandvicensis)	xx	P
Caspian tern (Hydroprogne caspia)	xx	W
Black skimmer (Rynchops nigra)	xxx	P
Mourning dove (Zenaidura macroura)	xxx	P
Ground dove (Columbigallina passerina)	xx	P
Yellow-billed cuckoo (Coccyzus americanus)	xx	Su
Smooth-billed ani (Crotophaga ani)	xx	P
Barn owl (Tyto alba)	x	P
Screech owl (Otus asio)	x	P
Great-horned owl (Bubo virginianus)	x	P
Barred owl (Strix varia)	x	P
Chuck-wills widow (Caprimulgus carolinensis)	x	Su
Nighthawk (Chordeilas minor)	xx	Su
Ruby-throated hummingbird (Archilochus colubris)	x	Su
Belted kingfisher (Megaceryle alcyon)	xxx	P
Yellow-shafter filcker (Colaptes auratus)	xx	P
Pileated woodpecker (Dryocopus pileatus)	x	P
Red-bellied woodpecker (Centurus carolinus)	xx	P
Red-headed woodpecker (Centurus erythrocephalus)	x	P
Yellow-bellied sapsucker (Sphyrapicus varius)	x	W, M

Downy woodpecker (*Dendrocopus pugescens*)	x	P
Eastern kingbird (*Tyrannus tyrannus*)	xx	Su
Crested flycatcher (*Myriarchus crinitus*)	xx	Su
Eastern phoebe (*Sayornis phoebe*)	x	W
Tree swallow (*Iridoproche bicolor*)	xxxxx	W, M
Purple martin (*Progne subis*)	xx	Su
Blue jay (*Cyanocitta cristata*)	xx	P
Scrub jay (*Aphelocoma coerulescens*)	x	P
Common crow (*Corvus brachrhynchos*)	x	P
Fish crow (*Corvus ossifragus*)	xxxxx	P
House wren (*Troglodytes aedon*)	x	W
Florida wren (*Thryothorus ludovicianus*)	x	P
Long-billed marsh wren (*Telmatodytes palustris*)	x	W
Mockingbird (*Mimus polyglottos*)	xxx	P
Catbird (*Dumetella carolinensis*)	xx	W, M
Brown thrasher (*Toxostoma rufum*)	x	P
Robin (*Turdus migratorius*)	xxxxx	W
Hermit thrush (*Hylocichla guttata*)	x	W
Florida bluebird (*Sialia sialis*)	x	P
Blue-gray gnatcatcher (*Polioptila caerula*)	xx	Su
Ruby-crowned kinglet (*Regulus calendula*)	x	W
Cedar waxwing (*Bombycilla cedorum*)	xxx	W, M
Loggerhead shrike (*Lanius ludovicianus*)	xx	P
Starling (*Sturnus vulgaris*)	xx	P
White-eyed vireo (*Vireo griseus*)	x	Su
Solitary vireo (*Vireo solitarius*)	x	W
Black and white warbler (*Miniotilta varia*)	x	M
Worm-eating warbler (*Helmitheros vermivorus*)	x	M
Orange-crowned warbler (*Vermivora celata*)	x	W
Myrtle warbler (*Dendroica coronata*)	xxx	W, M
Parula warbler (*Parula americana*)	x	M
Yellow warbler (*Dendroica petechia*)	x	M
Yellow-throated warbler (*Dendroica dominica*)	x	Su
Pine warbler (*Dendroica pinus*)	x	P
Prairie warbler (*Dendroica palmarum*)	xxx	W, M
Ovenbird (*Seiurus aurocapillus*)	x	W, M
Northern waterthrush (*Seiurus noveboracensis*)	x	M
Yellowthroat (*Geothlypis trichas*)	xx	P
American redstart (*Setophaga ruticilla*)	xx	M
House sparrow (*Passer domesticus*)	xxx	P
Eastern meadowlark (*Sturnella magna*)	xx	P
Red-winged blackbird (*Agelaius phoenicus*)	xxxx	P
Baltimore oriole (*Icterus galbula*)	x	M
Rusty blackbird (*Euphagus carolinus*)	xx	W
Boat-tailed grackle (*Cassidix mexicanus*)	xxxx	P
Common grackle (*Quiscalus quiscula*)	xxx	P
Brown-headed cowbird (*Melothrus albus*)	xx	M
Summer tanager (*Piranga rubra*)	xx	Su
Cardinal (*Richmondena cardinalis*)	xxx	P
Indigo bunting (*Passerina cyanea*)	x	M
Painted bunting (*Passerina ciris*)	xx	M
American goldfinch (*Spinus tristis*)	xxx	W
Rufous-sided towhee (*Pipilo erythrophthalmus*)	xx	P
Savannah sparrow (*Passerculus sandwichensis*)	xx	W
Sharp-tailed sparrow (*Ammospiza caudacuta*)	x	W
Seaside sparrow (*Ammospiza nigrescens*)	x	P

Chipping sparrow (Spizella passerina)	x	W
Field sparrow (Spizella pusilla)	x	W
White-throated sparrow (Zonotrichia albicollis)	x	W
Swamp sparrow (Melospiza georgiana)	x	W, M
Song sparrow (Melospiza melodia)	x	W

Several species of birds classified as "Rare or Endangered" by the U. S. Bureau of Sport Fisheries and Wildlife (1968) may occasionally occur in the region of Hutchinson Island. These include the following:

Florida great white heron, Ardea o. occidentalis Audubon
This bird breeds principally in southern Florida but may occasionally wander northward through the Hutchinson Island area.

Short-tailed hawk, Buteo brachyurus Viellot
This species is more likely to occur inland but it could also occur in the Hutchinson Island area. It breeds throughout peninsular Florida, being more common in deep cypress swamps.

Southern bald eagle, Haliaeetus l. leucocephalus (Linnaeus)
Eagles doubtless occur everywhere along the Indian River, never with any great abundance; they all migrate northward out of the state during the summer months.

American peregrine falcon, Falco peregrinus anatum (Bonaparte)
Peregrine falcons (also known as duck hawks) are classified as rare migrants along the Atlantic coastal islands bordering the eastern coast of Florida; some writers list this species as a regular winter resident; this species is likely to occur on Hutchinson Island itself.

Florida sandhill crane, Grus canadensis pratensis (Meyer)
This is a permanent resident of interior peninsular Florida, but may occasionally wander eastward into the wet prairies lying on the mainland west of Hutchinson Island.

Southern red-cockaded woodpecker, Dendrocopus borealis hylonomus (Wetmore)
These birds are characteristic of virgin longleaf pine lands and would thus never occur on Hutchinson Island itself because of the absence of longleaf pines, but they could occasionally occur on the mainland to the west.

Bachman's warbler, Vermivora bachmanii (Audubon)
This species is listed as a very scarce migrant through the state of Florida; it could pass through the Hutchinson Island area but it has not been recorded to date.

Dusky seaside sparrow, Ammospiza migrescens (Ridgway)
This bird is characteristic of the salt marshes situated some 50 to 100 miles to the north; it could also occur as far south as Hutchinson Island; water control measures designed to reduce mosquitoes in such areas have drastically modified the marshes and have caused substantial decreases in the numbers of this species.

QUESTION 2 Provide a list of the dominant shrub and grass species on the island.

ANSWER:

The property has three distinctly different kinds of vegetation with each having different plant species components and usually each with its particular animal and other life. These are:

1. Mangrove swamps -- usually when undisturbed, are arranged in two zones with the red mangroves, Rhizophora mangle, abundant in the outer zone where tide water regularly occurs and often water is present at low tide; and an inner zone of black mangroves, Avicennia nitida, growing on flats covered partly by high tides. The white mangrove, Laguncularia racemosa, is present mainly on soils seldom regularly flooded by tides, and here mainly on the downward slopes of spoil banks along canals. For many years these swamps have been modified for mosquito control.

   The mangrove swamps of this area were nearly all disturbed and altered by ditching canals and making spoil banks along them that prevented the normal tide flow exchange, and pumps were used to keep water levels higher than normal tides. This impounding of water and lack of tide flow exchanged has killed off most of the black mangroves leaving old snag trees and rotting debris. In these stagnant, high water areas there has been little or no recovery of the original black mangrove swamp zone. There has been a red mangrove growth developed over the past 25 to 40 years in some parts of the swamp areas. This is not a restoration of the original black mangrove swamp but it is a partial restoration of the plant habitat for animals. The best regrowth of mangroves, mostly red mangroves, has occurred in the area across Highway A-1-A from the plant. The least is northwest of Blind Creek and on the finger northwest of the construction area. It is unlikely that the original black mangrove habitat will ever return. Changes in water regulation with breaching of the spoil banks and return to normal tide exchange could possibly aid in restoring the former normal black mangrove habitat.

   As of now, the animal life in the water impounded areas is very sparse. There are few to none of the usually common fiddler crabs, ladder spiders, and snails. Fish minnows such as species of Fundulus, are very few and the water birds are not in usual abundance.

   In the sense of an ecological appraisal these parts of the area are relatively "biological deserts" so altered for mosquito control that the normal ecosystem of mangrove swamps is gone and restitution will be difficult.

2. Coastal strand beaches and dunes -- which are a narrow zone along the Atlantic Ocean. Here the dune line is mostly one dune ridge on the top of which the exotic Australian pine, Casuarina spp. has established itself along many parts. It has such a compact and extensive root system and such dense shade from its foliage that few to no plants grow under these trees.

   The normal vegetation of the dune ridge is: Sea oats, Uniola paniculata, on the down slope of the dune toward the sea, with also some other dune forming plants, among which are: Spartina patens, Ipomoea pes-caprae, the beach morning-glory, and Iva imbricata, marsh elder. On the upper slopes, top and back of the dune ridge are many shrubs and some herbs and grasses among which are: Suriana maritima, bay cedar, Yucca, the showy sea grape, Coccoloba uvifera, Opuntia, prickly pear cactus, Sesuvium portulacastrum, Helianthus debilis, beach sunflower, and the dune pea vine Canavalia obtusifolia.

   The swale back of the dune ridge is now mostly occupied by red mangroves with water impounded deeply and no tide exchange.

3. There are a few upland areas of loamey and shell soils usually located well above normal tides and on the mounds is the coastal hardwoods and cabbage palm scrub type forest. The cabbage palm Sabal palmetto is usually the tallest and most abundant tree. A few live oaks, Quercus virginiana, occur, the red bay, Persea is common, the Australian pine, Casuarina, is increasing and may take over some areas. Other shrub and tree size plants are: Bumelia spp., Rapanea, Baccharis, Icacorea, Morus rubra, the Hercules club, Zanthoxylum clava-hercules, and a few clumps of the saw palmetto, Serenoa repens.

   These so called hammocks are with more kinds of plants than any of the other types of vegetation; they are not flooded by salt water except during storms and they can be made into nice park type groves for beautification of the area.

   The area immediately surrounding the power plant and bordered by a perimeter road is, with the exception of mangroves bordering the outside of this road, now almost completely changed by settling ponds, spoil bank and fill from pumping of the dredges. It is of very uneven topography and the spoil and fill materials are of many different qualities ranging from sand and silt to rock and shells. The old black mangroves remain in some ponded areas and there is some growth of red mangroves between the outer perimeter road and an inner canal.

   With the spoil and fill materials piled up to 25 ft. M.S.L. some of the sides and slopes of these piles have a few grasses, bushes and weeds growing on them. One of the commonest grasses is a dropseed or smut grass, Sporobolus floridanus. It is a bunchgrass and will not be useful as a pasture or lawn grass as sod. This grass is not a salt tolerent plant and grows on high spoil because the soils have been leached of salt by rains. Other plants are mainly annual ruderals or weeds.

The whole area of spoil, sump pits and ponds could be probably converted into upland by spreading the spoil and filling pits to establish a soil surface above high tide. On such an area many ornamental and other trees and shrubs could be grown.

SUMMARY

The mangrove areas of the property are all so much altered by perimeter roads and dikes of spoil and by keeping stagnant non-tidal water in them by pumping, all for mosquito control purposes, that the natural former black mangrove and some red mangrove vegetation of them will not restore itself until a tidal exchange of water is allowed into the interiors. The animal life as well as the mangrove trees and bushes are much less abundant and vigorous than in normal mangrove swamp areas. If some restoration of the former mangrove swamp life is desired a program of re-establishing tidal exchanges into these areas could possibly restore some of the productivity of these areas. As they are now, these areas are nearly biological or ecological deserts with very little productivity of life forms.

LIST OF PLANTS ABUNDANT TO COMMON

To supplement the ecological description which gave some of the species of plants this list gives almost all of those noted in the area, excluding some lower forms, such as algae.

Mangroves and mangrove border plants:

Avicennia nitida -- black mangrove
Raguncularia racemosa -- white mangrove
Rhizophora mangle -- red mangrove
Batis maritima -- saltwort
Baccharis halimifolia -- sand myrtle
Schinus terebinthifolius -- Brazilian pepper tree
Casuarina spp. -- Australian pine
Ficus aurea -- native fig
Distichlis spicata -- salt grass
NOTABLE WAS THE ABSENCE OF buttonwood trees -- Conocarpus, and not many sedges and rushes, such as Juncus and Spartina.

Dune ridge plants:

Uniola paniculata -- sea oats
Ipomoea pes-caprae -- beach morning-glory
Iva imbricata -- marsh elder
Suriana maritima -- bay cedar
Spartina patens -- cordgrass
Yucca -- Spanish bayonet
Coccoloba uvifera -- sea grape
Opuntia -- prickly pear cactus
Sesuvium portulacastrum -- sea purslane
Helianthus debilis -- sand sunflower
Canavalia obtusifolia -- dune pea vine
Casuarina spp. -- Australian pine

Upland, coastal Hammock forest: Partial list as many species occur.

Sabal palmetto -- cabbage palm
Quercus virginiana -- live oak
Persea -- red bay
Casuarina -- Australian pine
Morus rubra -- red mulberry
Baccharis -- sand myrtle
Serenoa repens -- saw palmetto
Rapanea guyanensis -- Rapanea
Icacorea paniculata -- marl berry
Zanthoxylon clava-hercules -- Hercules club
Rhus copallina -- sumach
Rhus toxicodendron -- poison ivy
Eugenia spp. -- stopperwoods

QUESTION 3 Provide a list of native animals which live on the island, on the adjacent mainland and in the waters around the island. Indicate abundance of each.

ANSWER:

Summarized below is a list of mammals that occur on Hutchinson Island and in the surrounding areas. Abundance is proportional to the number of "X" marks given.

Species	Abundance & Location		
	Hutch. Island	Indian River	Mainland
Virginia opossum (Didelphis virginiana)	XXX		XXX
Short-tailed shrew (Blarina brevicauda)	X		X
Least shrew (Cryptotis florida)	X		X
Eastern mole (Scalopus aquaticus)	XX		XX
Mississippi myotis (Myotis austroriparius)	XX	XX	XX
Big brown bat (Eptesicus fuscus)	XX	XX	XX
Yellow bat (Dasypterus floridanus)	X	X	X
Evening bat (Nycticeus humeralis)	X	X	X
Florida fretail bat (Tadarida cynocephala)	X	X	X
Armadillo (Dasypus novemcinctus)			XX
Cottontail rabbit (Sylvilagus floridanus)			XX
Marsh rabbit (Sylvilagus palustris)	XX		X
Gray squirrel (Sciurus carolinensis)	X		X
Fox squirrel (Sciurus niger)			X
Flying squirrel (Glaucomys volans)			X
Pocket gopher (Geomys pinetus)			X
Rice rat (Oryzomys palustris)	X		X
Beach mouse (Peromyscus polionotus)	XXX		XX
Pine mouse (Peromyscus gossypinus)	XX		XXX
Cotton rat (Sigmodon hispidus)	XX		XX
Wood rat (Neotoma floridana)	X		X
Water rat (Neofiber alleni)	X		X
Roof rat (Rattus novegicus)			X
Brown rat (Rattus rattus)	X		X
Porpoise (Stenella frontalis)		X	
Gray fox (Urocyon cinereoargenteus)	X		X
Black bear (Ursus americanus)			X
Raccoon (Procyon lotor)	XXX		XXX
Mink (Mustela frenata)	X		X
Spotted skunk (Spilogale ambarvalis)	X		X
Striped skunk (Mephitis mephitis)			X
River otter (Lutra canadensis)	X	X	X
Panther (Felis concolor)			X
Bobcat (Lynx rufus)	X		X
Manatee (Trichechus manatus)		X	
White-tailed deer (Odocoileus virginianus)	X		XX

The following mammals are classed as "rare or endangered":

Florida manatee, Trichechus manatus latirostris (Harlan)
Florida panther, Felis concolor coryi Bangs

One mammal is listed as status "undetermined":

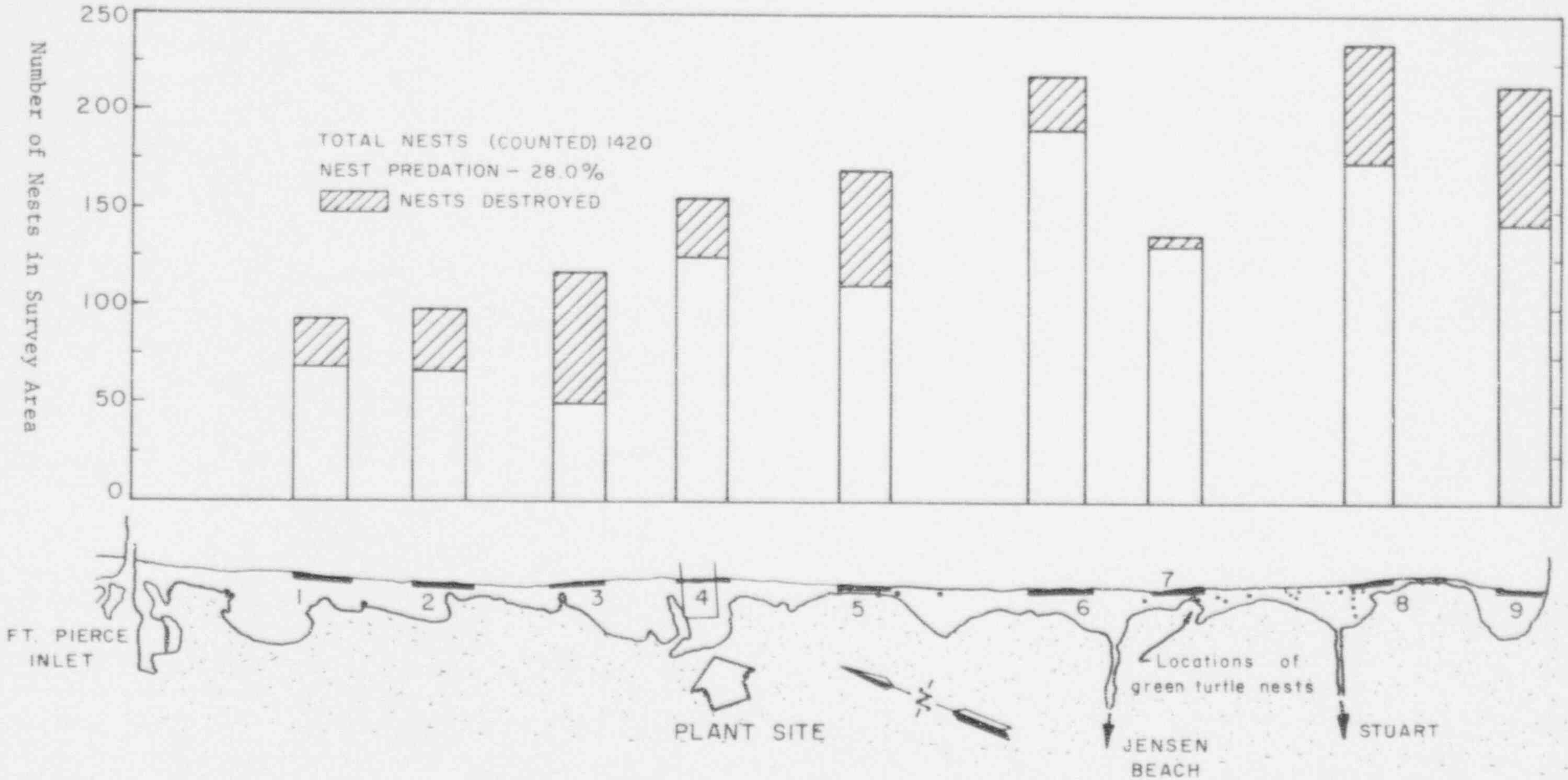
Florida water rat, Neofiber alleni (probably nigrescens A. H. Howell)

QUESTION 4 Identify number, location, and other data relevant to turtle nests on Hutchinson Island. Where are the preferred areas?

ANSWER:

Nine study areas, each 0.75 miles long, were selected along the beach, as shown in Figure 4-1. Area 4 was located to include the power plant intake and effluent locations. Other areas were chosen to represent various beach conditions. The bar graph of Figure 4-1 shows the total number of loggerhead turtle nests counted in each survey area during the 1971 nesting season. The shaded area of each bar represents nests lost to predation by raccoons. A total of 3350 nests, each with an average of 120 eggs, was estimated for 1971. As the figure shows, there is a higher density of nesting at the southern end of Hutchinson Island than at the northern end.

Green turtle nests were located individually, without regard to survey areas. A total of 22 was found, as shown in Figure 4-1. Approximately 2421 eggs were removed from 18 nests and relocated to the House of Refuge Museum for hatching, rearing, and release. All green turtle nests were south of the plant site.



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
LOCATION OF TURTLE NEST
SURVEY AREAS AND DENSITY OF NESTING

FIGURE 4-1

QUESTION 5 Provide, in tabular form, the joint frequency wind speed distribution listing the percent of time that a particular wind speed, wind direction, and stability classification occurs.

ANSWER:

Table 5-1 lists the requested information.

JOINT FREQUENCY DISTRIBUTIONS OF STABILITY CLASSIFICATIONS, WIND SPEED AND WIND DIRECTIONS

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 1
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = A
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = A
PASQUILL A-A

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
ENE	3	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
E	4	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.05	3.90
ESE	5	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
SE	6	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
SSE	7	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	4.00
SW	10	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.05	5.85
WSW	11	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
W	12	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.03	8.55
WNW	13	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.07	4.65
NW	14	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.07	0.99
TOTAL		0.09	0.14	0.07	0.00	0.00	0.00	0.00	0.39	4.68

NUMBER OF VALID CATEGORY OBSERVATIONS = 34

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 2
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = A
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = B
PASQUILL A-B

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
NE	2	0.00	0.02	0.05	0.01	0.00	0.00	0.00	0.08	9.55
ENE	3	0.00	0.01	0.06	0.00	0.00	0.00	0.00	0.07	9.30
E	4	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.03	5.55
ESE	5	0.01	0.06	0.02	0.00	0.00	0.00	0.00	0.09	6.26
SE	6	0.00	0.03	0.05	0.00	0.00	0.00	0.00	0.08	8.12
SSE	7	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
S	8	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
SSW	9	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.03	5.55
SW	10	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02	7.80
WSW	11	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.03	5.55
W	12	0.00	0.08	0.05	0.02	0.01	0.00	0.00	0.16	9.41
WNW	13	0.00	0.06	0.06	0.03	0.02	0.00	0.01	0.19	10.32
NW	14	0.00	0.05	0.13	0.05	0.00	0.00	0.00	0.22	10.20
NNW	15	0.00	0.02	0.02	0.02	0.00	0.00	0.00	0.07	10.38
N	16	0.00	0.02	0.02	0.06	0.00	0.00	0.00	0.10	12.11
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.01	0.51	0.48	0.19	0.03	0.00	0.00	1.23	9.29

NUMBER OF VALID CATEGORY OBSERVATIONS = 108

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 3
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = A
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = C
PASQUILL A-C

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.16	0.45	0.06	0.00	0.00	0.00	0.67	9.45
NE	2	0.00	0.57	0.24	0.00	0.00	0.00	0.00	0.81	6.08
ENE	3	0.01	0.55	0.43	0.06	0.00	0.00	0.00	1.05	7.02
E	4	0.01	0.40	0.23	0.03	0.01	0.00	0.00	0.68	7.76
ESE	5	0.00	0.68	0.40	0.05	0.00	0.00	0.00	1.13	7.54
SE	6	0.00	0.38	0.57	0.09	0.00	0.00	0.00	1.04	8.90
SSE	7	0.00	0.03	0.09	0.06	0.00	0.00	0.00	0.19	10.61
S	8	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.07	10.97
SSW	9	0.00	0.38	0.03	0.01	0.00	0.00	0.00	0.13	7.69
SW	10	0.00	0.03	0.11	0.15	0.02	0.00	0.00	0.30	12.34
WSW	11	0.00	0.10	0.24	0.06	0.02	0.00	0.00	0.45	10.59
W	12	0.00	0.09	0.07	0.03	0.01	0.00	0.00	0.21	9.61
WNW	13	0.01	0.08	0.15	0.02	0.01	0.00	0.00	0.27	9.35
NW	14	0.00	0.09	0.19	0.07	0.03	0.00	0.00	0.38	10.29
NNW	15	0.01	0.10	0.21	0.05	0.00	0.00	0.00	0.37	9.23
N	16	0.00	0.09	0.36	0.37	0.00	0.00	0.00	0.85	11.97
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.03	3.46	3.89	1.06	0.09	0.00	0.00	8.57	9.01

NUMBER OF VALID CATEGORY OBSERVATIONS = 751

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 4
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = A
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = D
PASQUILL A-D

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.17	0.27	0.03	0.00	0.00	0.00	0.48	8.36
NE	2	0.02	0.42	0.15	0.00	0.00	0.00	0.00	0.59	6.55
ENE	3	0.06	0.83	0.16	0.00	0.00	0.00	0.00	1.05	6.06
E	4	0.01	1.97	0.86	0.11	0.00	0.00	0.00	2.96	7.23
ESE	5	0.00	0.90	0.60	0.01	0.00	0.00	0.00	1.52	7.42
SE	6	0.01	0.79	1.77	0.13	0.00	0.00	0.00	2.69	8.96
SSE	7	0.01	0.11	0.37	0.22	0.00	0.00	0.00	0.71	10.38
S	8	0.02	0.05	0.13	0.06	0.00	0.00	0.00	0.26	9.77
SSW	9	0.00	0.07	0.11	0.01	0.00	0.00	0.00	0.19	8.79
SW	10	0.02	0.10	0.17	0.07	0.01	0.00	0.00	0.36	9.70
WSW	11	0.00	0.05	0.03	0.00	0.00	0.00	0.00	0.08	7.48
W	12	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.05	0.34	0.11	0.00	0.00	0.00	0.50	10.89
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.16	5.56	4.96	0.75	0.01	0.00	0.00	11.44	8.13

NUMBER OF VALID CATEGORY OBSERVATIONS = 1003

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 5
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = A
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = E
PASQUILL A-E

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
ENE	3	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.05	5.55
E	4	0.00	0.18	0.01	0.00	0.00	0.00	0.00	0.19	5.81
ESE	5	0.00	0.05	0.07	0.00	0.00	0.00	0.00	0.11	9.25
SE	6	0.00	0.06	0.33	0.06	0.00	0.00	0.00	0.45	10.18
SSE	7	0.00	0.01	0.03	0.03	0.00	0.00	0.00	0.08	11.76
S	8	0.00	0.06	0.06	0.06	0.00	0.00	0.00	0.17	10.30
SSW	9	0.01	0.02	0.07	0.03	0.00	0.00	0.00	0.14	10.03
SW	10	0.00	0.10	0.08	0.01	0.00	0.00	0.00	0.19	7.99
WSW	11	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.02	0.56	0.65	0.19	0.00	0.00	0.00	1.43	8.91

NUMBER OF VALID CATEGORY OBSERVATIONS = 125

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 6
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = A
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = F
PASQUILL A-F

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
SE	6	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	15.55
SSE	7	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.03	10.38

NUMBER OF VALID CATEGORY OBSERVATIONS = 3

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 7
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = A
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = G
PASQUILL A-G

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NUMBER OF VALID CATEGORY OBSERVATIONS = 0

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 8
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = B
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = A
PASQUILL B-A

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
S	8	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02	6.15
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.01	0.06	0.02	0.00	0.00	0.00	0.00	0.09	6.26

NUMBER OF VALID CATEGORY OBSERVATIONS = 8

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

TABLE 5-1 CONTINUED

CODE#LSD-2 — FLORIDA POWER & LIGHT COMPANY — PAGE 9
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = B
PASQUILL D-B

SECTOR	SECTOR NUMBER	1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
		SPEED(MPH) ADJUSTED TO 10-METER ELEVATION								
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
ENE	3	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	15.55
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
SSW	9	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
SW	10	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
WSW	11	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
W	12	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.03	5.55
NNW	15	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.05	0.11
TOTAL		0.02	0.10	0.03	0.01	0.00	0.00	0.00	0.22	5.38

NUMBER OF VALID CATEGORY OBSERVATIONS = 19

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 — FLORIDA POWER & LIGHT COMPANY — PAGE 10
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = C
PASQUILL D-C

SECTOR	SECTOR NUMBER	1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
		SPEED(MPH) ADJUSTED TO 10-METER ELEVATION								
NNE	1	0.00	0.07	0.02	0.02	0.00	0.00	0.00	0.11	9.45
NE	2	0.00	0.03	0.05	0.02	0.00	0.00	0.00	0.09	8.12
ENE	3	0.00	0.09	0.02	0.02	0.00	0.00	0.00	0.14	7.97
E	4	0.01	0.08	0.03	0.02	0.00	0.00	0.00	0.13	8.30
ESE	5	0.01	0.05	0.01	0.01	0.00	0.00	0.00	0.08	7.15
SE	6	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.03	13.72
SSE	7	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02	10.05
S	8	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
SSW	9	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.02	8.90
SW	10	0.00	0.08	0.02	0.02	0.00	0.00	0.00	0.10	8.77
WSW	11	0.00	0.06	0.02	0.02	0.01	0.00	0.00	0.11	10.05
W	12	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.03	8.55
WNW	13	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.03	8.58
NW	14	0.00	0.02	0.01	0.01	0.00	0.00	0.00	0.05	9.17
NNW	15	0.00	0.02	0.03	0.05	0.00	0.00	0.00	0.10	11.49
N	16	0.00	0.02	0.08	0.10	0.03	0.00	0.00	0.24	13.62
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.03	0.54	0.37	0.33	0.05	0.00	0.00	1.31	9.79

NUMBER OF VALID CATEGORY OBSERVATIONS = 115

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 — FLORIDA POWER & LIGHT COMPANY — PAGE 11
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = D
PASQUILL D-D

SECTOR	SECTOR NUMBER	1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
		SPEED(MPH) ADJUSTED TO 10-METER ELEVATION								
NNE	1	0.00	0.04	0.03	0.01	0.00	0.00	0.00	0.07	9.47
NE	2	0.00	0.09	0.01	0.00	0.00	0.00	0.00	0.10	6.05
ENE	3	0.03	0.07	0.02	0.00	0.00	0.00	0.00	0.13	5.47
E	4	0.00	0.09	0.02	0.00	0.00	0.00	0.00	0.11	6.45
ESE	5	0.00	0.06	0.02	0.00	0.00	0.00	0.00	0.08	6.64
SE	6	0.00	0.08	0.05	0.01	0.00	0.00	0.00	0.14	7.88
SSE	7	0.00	0.03	0.07	0.05	0.00	0.00	0.00	0.15	10.70
S	8	0.01	0.03	0.03	0.00	0.00	0.00	0.00	0.08	7.01
SSW	9	0.01	0.03	0.01	0.00	0.00	0.00	0.00	0.06	5.79
SW	10	0.00	0.01	0.06	0.02	0.03	0.00	0.00	0.13	13.70
WSW	11	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02	7.80
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02	10.05
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.06	0.55	0.37	0.09	0.03	0.00	0.00	1.10	8.21

NUMBER OF VALID CATEGORY OBSERVATIONS = 96

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 — FLORIDA POWER & LIGHT COMPANY — PAGE 12
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = E
PASQUILL D-E

SECTOR	SECTOR NUMBER	1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
		SPEED(MPH) ADJUSTED TO 10-METER ELEVATION								
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.06	5.55
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.05	4.72
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.05	7.92
SW	10	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
WSW	11	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.01	0.13	0.03	0.00	0.00	0.00	0.00	0.17	6.23

NUMBER OF VALID CATEGORY OBSERVATIONS = 15

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 13
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = B
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = F
PASQUILL B-F

SECTOR	SECTOR NUMBER	1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
		SPEED(MPH) ADJUSTED TO 10-METER ELEVATION								
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NUMBER OF VALID CATEGORY OBSERVATIONS = 0

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 6764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 14
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = B
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = G
PASQUILL B-G

SECTOR	SECTOR NUMBER	1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
		SPEED(MPH) ADJUSTED TO 10-METER ELEVATION								
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NUMBER OF VALID CATEGORY OBSERVATIONS = 0

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 6764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 15
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = C
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = A
PASQUILL C-A

SECTOR	SECTOR NUMBER	1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
		SPEED(MPH) ADJUSTED TO 10-METER ELEVATION								
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.03	5.75
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02	7.80
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.02	0.03	0.05	0.00	0.00	0.00	0.00	0.10	6.82

NUMBER OF VALID CATEGORY OBSERVATIONS = 7

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 6764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 16
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = C
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = B
PASQUILL C-B

SECTOR	SECTOR NUMBER	1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
		SPEED(MPH) ADJUSTED TO 10-METER ELEVATION								
NNE	1	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.75
NE	2	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02	7.80
ENE	3	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.03	16.22
E	4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
ESE	5	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
SE	6	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	15.55
SSE	7	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
S	8	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
SSW	9	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
SW	10	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
WSW	11	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02	6.15
W	12	0.00	0.05	0.01	0.00	0.00	0.00	0.00	0.06	6.45
WNW	13	0.00	0.05	0.01	0.01	0.00	0.00	0.00	0.07	7.97
NW	14	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
NNW	15	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
N	16	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.02	0.24	0.09	0.02	0.02	0.00	0.00	0.40	7.88

NUMBER OF VALID CATEGORY OBSERVATIONS = 27

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 6764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 17
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = C
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = C
PASQUILL C-C

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.07	0.07	0.03	0.02	0.00	0.00	0.19	10.79
NE	2	0.00	0.13	0.11	0.03	0.00	0.00	0.00	0.27	8.67
ENE	3	0.05	0.05	0.08	0.01	0.00	0.00	0.00	0.18	7.32
E	4	0.00	0.03	0.02	0.07	0.03	0.00	0.00	0.13	11.82
ESE	5	0.00	0.07	0.07	0.00	0.00	0.00	0.00	0.14	7.48
SE	6	0.00	0.06	0.02	0.01	0.00	0.00	0.00	0.09	7.03
SSE	7	0.01	0.05	0.00	0.02	0.00	0.00	0.00	0.08	7.94
S	8	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.05	6.97
SSW	9	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.03	10.39
SW	10	0.01	0.06	0.08	0.03	0.00	0.00	0.00	0.18	9.19
WSW	11	0.00	0.06	0.02	0.01	0.01	0.00	0.00	0.10	7.44
W	12	0.00	0.05	0.00	0.01	0.00	0.00	0.00	0.06	7.55
WNW	13	0.01	0.10	0.03	0.00	0.00	0.00	0.00	0.15	6.33
NW	14	0.02	0.05	0.03	0.01	0.00	0.00	0.00	0.11	7.74
NNW	15	0.02	0.03	0.10	0.00	0.00	0.00	0.00	0.14	7.97
N	16	0.00	0.03	0.05	0.06	0.02	0.00	0.00	0.16	12.69
CALM AND VARIABLE	0								0.21	0.06
TOTAL		0.14	0.87	0.73	0.32	0.06	0.00	0.00	2.32	8.10

NUMBER OF VALID CATEGORY OBSERVATIONS = 203

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 18
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = C
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = D
PASQUILL C-D

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.05	0.05	0.01	0.00	0.00	0.00	0.10	8.66
NE	2	0.01	0.06	0.01	0.00	0.00	0.00	0.00	0.08	5.72
ENE	3	0.03	0.06	0.02	0.00	0.01	0.00	0.00	0.13	6.92
E	4	0.01	0.14	0.07	0.01	0.00	0.00	0.00	0.23	7.23
ESE	5	0.00	0.18	0.06	0.00	0.00	0.00	0.00	0.24	6.62
SE	6	0.00	0.14	0.09	0.01	0.00	0.00	0.00	0.24	7.74
SSE	7	0.00	0.09	0.16	0.09	0.00	0.00	0.00	0.34	10.32
S	8	0.02	0.04	0.15	0.01	0.00	0.00	0.00	0.22	9.06
SSW	9	0.00	0.06	0.07	0.10	0.01	0.00	0.00	0.24	11.63
SW	10	0.00	0.17	0.13	0.02	0.01	0.00	0.00	0.33	8.50
WSW	11	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.08	6.16
W	12	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.03	6.45
WNW	13	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.75
NW	14	0.00	0.05	0.01	0.00	0.00	0.00	0.00	0.06	6.45
NNW	15	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02	7.80
N	16	0.00	0.03	0.07	0.02	0.00	0.00	0.00	0.13	9.02
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.11	1.12	0.92	0.29	0.03	0.00	0.00	2.48	8.45

NUMBER OF VALID CATEGORY OBSERVATIONS = 217

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 19
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = C
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = E
PASQUILL C-E

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.06	5.35
ESE	5	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.03	8.55
SE	6	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
SSE	7	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
S	8	0.00	0.02	0.08	0.01	0.00	0.00	0.00	0.11	9.70
SSW	9	0.01	0.08	0.06	0.02	0.00	0.00	0.00	0.17	8.16
SW	10	0.01	0.07	0.05	0.00	0.00	0.00	0.00	0.13	6.89
WSW	11	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.02	0.31	0.23	0.03	0.00	0.00	0.00	0.59	7.73

NUMBER OF VALID CATEGORY OBSERVATIONS = 52

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 20
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = C
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = F
PASQUILL C-F

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55

NUMBER OF VALID CATEGORY OBSERVATIONS = 1

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

TABLE 5-1 CONTINUED

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 21
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = C
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = D
PASQUILL C-D

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55

NUMBER OF VALID CATEGORY OBSERVATIONS = 1

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 22
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = A
PASQUILL D-A

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
ENE	3	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.02	13.55
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
WSW	11	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
W	12	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02	7.50
WNW	13	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
NW	14	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.03	4.45
NNW	15	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.02	10.55
N	16	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.01	0.17	0.02	0.01	0.01	0.00	0.00	0.23	7.13

NUMBER OF VALID CATEGORY OBSERVATIONS = 20

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 23
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = B
PASQUILL D-B

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.02	0.05	0.01	0.01	0.00	0.00	0.09	11.05
NE	2	0.00	0.00	0.05	0.05	0.07	0.01	0.00	0.18	17.21
ENE	3	0.01	0.05	0.02	0.06	0.11	0.00	0.00	0.25	15.35
E	4	0.00	0.02	0.00	0.05	0.03	0.00	0.00	0.10	15.33
ESE	5	0.00	0.03	0.00	0.01	0.02	0.00	0.00	0.05	8.05
SE	6	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.03	8.55
SSE	7	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.03	8.55
S	8	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.06	5.55
SSW	9	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
SW	10	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.02	5.55
WSW	11	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.03	5.95
W	12	0.00	0.01	0.03	0.01	0.00	0.00	0.00	0.06	10.25
WNW	13	0.00	0.05	0.00	0.02	0.00	0.00	0.00	0.07	8.88
NW	14	0.00	0.03	0.02	0.01	0.00	0.00	0.00	0.07	6.72
NNW	15	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.03	8.58
N	16	0.00	0.01	0.03	0.02	0.00	0.00	0.00	0.07	11.13
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.02	0.38	0.26	0.26	0.23	0.01	0.00	1.16	12.11

NUMBER OF VALID CATEGORY OBSERVATIONS = 102

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 24
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = C
PASQUILL D-C

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.03	0.16	0.21	0.07	0.00	0.00	0.47	13.32
NE	2	0.01	0.13	0.33	0.41	0.11	0.00	0.00	0.99	12.59
ENE	3	0.01	0.14	0.48	0.39	0.05	0.00	0.00	1.06	11.89
E	4	0.00	0.22	0.39	0.30	0.03	0.00	0.00	0.94	11.17
ESE	5	0.00	0.16	0.26	0.11	0.01	0.00	0.00	0.55	10.12
SE	6	0.00	0.08	0.08	0.10	0.00	0.00	0.00	0.26	10.53
SSE	7	0.00	0.10	0.09	0.03	0.00	0.00	0.00	0.23	8.35
S	8	0.00	0.07	0.05	0.00	0.00	0.00	0.00	0.11	7.75
SSW	9	0.00	0.05	0.01	0.01	0.00	0.00	0.00	0.07	7.77
SW	10	0.02	0.11	0.03	0.01	0.00	0.00	0.00	0.18	6.61
WSW	11	0.00	0.13	0.10	0.03	0.00	0.00	0.00	0.26	8.62
W	12	0.00	0.10	0.07	0.02	0.00	0.00	0.00	0.19	7.31
WNW	13	0.00	0.19	0.10	0.16	0.00	0.00	0.00	0.49	10.32
NW	14	0.01	0.27	0.21	0.13	0.00	0.00	0.00	0.62	9.03
NNW	15	0.00	0.10	0.21	0.21	0.00	0.00	0.00	0.51	11.75
N	16	0.00	0.13	0.26	0.41	0.03	0.00	0.00	0.83	12.56
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.06	2.01	[illegible]	2.56	0.31	0.00	0.00	7.76	11.10

NUMBER OF VALID CATEGORY OBSERVATIONS = 680

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

TABLE 5-1 CONTINUED

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 25
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = D
PASQUILL D-D

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.03	0.17	0.24	0.03	0.00	0.00	0.00	0.40	8.28
NE	2	0.01	0.11	0.10	0.00	0.00	0.00	0.00	0.23	7.41
ENE	3	0.05	0.24	0.26	0.00	0.00	0.00	0.00	0.55	7.43
E	4	0.03	0.57	0.55	0.13	0.00	0.00	0.00	1.28	8.37
ESE	5	0.03	0.56	0.25	0.02	0.00	0.00	0.00	0.87	6.99
SE	6	0.06	0.43	0.23	0.01	0.00	0.00	0.00	0.73	6.85
SSE	7	0.00	0.31	0.46	0.15	0.00	0.00	0.00	0.91	9.42
S	8	0.01	0.32	0.35	0.14	0.00	0.00	0.00	0.82	9.11
SSW	9	0.01	0.30	0.23	0.14	0.01	0.00	0.00	0.68	9.26
SW	10	0.06	0.60	0.38	0.13	0.05	0.00	0.00	1.21	8.44
WSW	11	0.02	0.29	0.23	0.00	0.00	0.00	0.00	0.54	7.32
W	12	0.07	0.13	0.03	0.00	0.00	0.00	0.00	0.23	5.30
WNW	13	0.07	0.14	0.01	0.00	0.00	0.00	0.00	0.22	4.74
NW	14	0.05	0.24	0.11	0.00	0.00	0.00	0.00	0.40	6.40
NNW	15	0.05	0.14	0.05	0.00	0.00	0.00	0.00	0.23	5.79
N	16	0.02	0.11	0.26	0.03	0.00	0.00	0.00	0.43	8.89
CALM AND VARIABLE	0								0.41	0.02
TOTAL		0.57	4.71	3.74	0.78	0.06	0.00	0.00	10.27	7.65

NUMBER OF VALID CATEGORY OBSERVATIONS = 900

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 26
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = E
PASQUILL D-E

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
ENE	3	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
E	4	0.03	0.08	0.07	0.00	0.00	0.00	0.00	0.18	6.62
ESE	5	0.01	0.02	0.02	0.00	0.00	0.00	0.00	0.06	6.69
SE	6	0.01	0.05	0.06	0.01	0.00	0.00	0.00	0.13	8.20
SSE	7	0.01	0.13	0.24	0.06	0.00	0.00	0.00	0.43	9.27
S	8	0.00	0.56	0.97	0.11	0.00	0.00	0.00	1.64	8.90
SSW	9	0.03	0.72	0.59	0.22	0.00	0.00	0.00	1.56	8.57
SW	10	0.01	0.33	0.14	0.03	0.00	0.00	0.00	0.51	7.34
WSW	11	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.03	5.55
W	12	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
NNW	15	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
N	16	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.16	1.95	2.11	0.43	0.00	0.00	0.00	4.66	8.41

NUMBER OF VALID CATEGORY OBSERVATIONS = 408

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 27
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = F
PASQUILL D-F

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.03	5.55
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.05	6.67
SSW	9	0.00	0.08	0.01	0.00	0.00	0.00	0.00	0.09	6.11
SW	10	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.18	0.02	0.00	0.00	0.00	0.00	0.21	6.05

NUMBER OF VALID CATEGORY OBSERVATIONS = 18

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 28
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/20/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = D
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = G
PASQUILL D-G

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55

NUMBER OF VALID CATEGORY OBSERVATIONS = 2

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 29
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = A
PASQUILL F-A

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.03	4.45
ENE	3	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
E	4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
S	8	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.02	10.55
W	12	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.03	5.95
WNW	13	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
NW	14	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	10.05
NNW	15	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.05	5.02
N	16	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.08	0.14	0.05	0.01	0.00	0.00	0.00	0.27	5.75

NUMBER OF VALID CATEGORY OBSERVATIONS = 24

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 30
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = B
PASQUILL F-B

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.02	0.01	0.06	0.01	0.00	0.00	0.00	0.10	7.43
NE	2	0.01	0.03	0.08	0.00	0.05	0.00	0.00	0.17	11.70
ENE	3	0.00	0.06	0.06	0.01	0.00	0.00	0.00	0.13	8.50
E	4	0.01	0.01	0.05	0.02	0.00	0.00	0.00	0.09	9.69
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.01	0.03	0.00	0.01	0.00	0.00	0.00	0.06	6.89
SSE	7	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.05	5.55
S	8	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.05	4.72
SSW	9	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.03	5.95
SW	10	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.03	3.35
WSW	11	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.05	5.05
W	12	0.01	0.03	0.02	0.00	0.00	0.00	0.00	0.05	6.36
WNW	13	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.05	6.97
NW	14	0.00	0.06	0.01	0.00	0.00	0.00	0.00	0.07	6.30
NNW	15	0.01	0.01	0.03	0.00	0.00	0.00	0.00	0.05	7.59
N	16	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.03	7.05
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.15	0.42	0.37	0.06	0.05	0.00	0.00	1.04	7.91

NUMBER OF VALID CATEGORY OBSERVATIONS = 91

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 31
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = C
PASQUILL F-C

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.02	0.06	0.19	0.01	0.00	0.00	0.00	0.29	8.75
NE	2	0.03	0.24	0.29	0.03	0.01	0.00	0.00	0.60	8.35
ENE	3	0.01	0.29	0.48	0.13	0.00	0.00	0.00	0.90	9.29
E	4	0.02	0.17	0.33	0.11	0.00	0.00	0.00	0.66	9.41
ESE	5	0.01	0.51	0.56	0.09	0.00	0.00	0.00	1.20	8.47
SE	6	0.02	0.15	0.18	0.11	0.00	0.00	0.00	0.47	9.56
SSE	7	0.00	0.07	0.06	0.00	0.00	0.00	0.00	0.13	7.60
S	8	0.02	0.06	0.01	0.00	0.00	0.00	0.00	0.09	5.29
SSW	9	0.02	0.05	0.01	0.00	0.00	0.00	0.00	0.08	5.25
SW	10	0.03	0.07	0.06	0.01	0.00	0.00	0.00	0.17	7.06
WSW	11	0.05	0.18	0.14	0.01	0.00	0.00	0.00	0.38	7.09
W	12	0.05	0.22	0.09	0.00	0.00	0.00	0.00	0.35	6.29
WNW	13	0.03	0.19	0.21	0.00	0.00	0.00	0.00	0.43	7.42
NW	14	0.01	0.18	0.42	0.00	0.00	0.00	0.00	0.62	8.57
NNW	15	0.01	0.14	0.27	0.00	0.00	0.00	0.00	0.42	8.38
N	16	0.02	0.07	0.17	0.00	0.00	0.00	0.00	0.32	9.51
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.38	2.66	3.49	0.57	0.01	0.00	0.00	7.11	8.41

NUMBER OF VALID CATEGORY OBSERVATIONS = 623

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 32
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = D
PASQUILL F-D

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.03	0.23	0.13	0.00	0.00	0.00	0.00	0.39	6.71
NE	2	0.07	0.30	0.13	0.00	0.00	0.00	0.00	0.49	6.24
ENE	3	0.18	0.71	0.18	0.00	0.00	0.00	0.00	1.07	5.75
E	4	0.09	0.86	0.34	0.06	0.00	0.00	0.00	1.35	6.89
ESE	5	0.23	1.37	0.32	0.02	0.00	0.00	0.00	1.94	6.02
SE	6	0.19	1.48	0.38	0.00	0.00	0.00	0.00	2.05	6.06
SSE	7	0.17	0.67	0.31	0.04	0.00	0.00	0.00	1.19	6.53
S	8	0.07	0.32	0.21	0.01	0.00	0.00	0.00	0.60	6.29
SSW	9	0.11	0.13	0.06	0.01	0.00	0.00	0.00	0.31	5.53
SW	10	0.26	0.82	0.19	0.07	0.00	0.00	0.00	1.35	6.06
WSW	11	0.22	0.67	0.09	0.00	0.00	0.00	0.00	0.98	5.24
W	12	0.25	0.34	0.02	0.00	0.00	0.00	0.00	0.62	4.37
WNW	13	0.11	0.46	0.06	0.00	0.00	0.00	0.00	0.63	5.36
NW	14	0.10	0.81	0.23	0.00	0.00	0.00	0.00	1.14	6.15
NNW	15	0.06	0.33	0.10	0.00	0.00	0.00	0.00	0.49	6.11
N	16	0.02	0.21	0.14	0.00	0.00	0.00	0.00	0.37	7.03
CALM AND VARIABLE	0								0.00	0.00
TOTAL		2.18	9.70	2.86	0.21	0.00	0.00	0.00	14.96	6.07

NUMBER OF VALID CATEGORY OBSERVATIONS = 1311

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 33
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = E
PASQUILL F-E

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.06	4.23
NE	2	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.07	3.49
ENE	3	0.02	0.06	0.00	0.00	0.00	0.00	0.00	0.08	4.61
E	4	0.09	0.08	0.00	0.00	0.00	0.00	0.00	0.17	3.79
ESE	5	0.19	0.14	0.00	0.00	0.00	0.00	0.00	0.33	3.82
SE	6	0.29	0.36	0.00	0.02	0.00	0.00	0.00	0.68	4.51
SSE	7	0.19	1.02	0.10	0.00	0.00	0.00	0.00	1.31	5.41
S	8	0.19	1.12	0.25	0.02	0.00	0.00	0.00	1.58	6.00
SSW	9	0.18	0.50	0.27	0.03	0.00	0.00	0.00	0.99	6.53
SW	10	0.39	0.87	0.05	0.00	0.00	0.00	0.00	1.31	4.73
WSW	11	0.23	0.09	0.00	0.00	0.00	0.00	0.00	0.32	3.19
W	12	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.09	2.66
WNW	13	0.16	0.01	0.00	0.00	0.00	0.00	0.00	0.17	2.47
NW	14	0.16	0.10	0.00	0.00	0.00	0.00	0.00	0.26	3.54
NNW	15	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.05	3.07
N	16	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.05	3.07
CALM AND VARIABLE	0								1.40	0.00
TOTAL		2.33	4.47	0.67	0.08	0.00	0.00	0.00	8.96	4.33

NUMBER OF VALID CATEGORY OBSERVATIONS = 785

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 34
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = F
PASQUILL F-F

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.08	3.66
ESE	5	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.03	4.49
SE	6	0.06	0.13	0.01	0.00	0.00	0.00	0.00	0.19	4.24
SSE	7	0.06	0.09	0.00	0.00	0.00	0.00	0.00	0.15	4.26
S	8	0.06	0.11	0.00	0.00	0.00	0.00	0.00	0.17	4.45
SSW	9	0.03	0.11	0.01	0.00	0.00	0.00	0.00	0.16	5.16
SW	10	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.07	3.90
WSW	11	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
W	12	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
WNW	13	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.05	2.91
NW	14	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.03	4.45
NNW	15	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.39	0.50	0.02	0.00	0.00	0.00	0.00	0.93	4.36

NUMBER OF VALID CATEGORY OBSERVATIONS = 87

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 35
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = G
PASQUILL F-G

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.03	3.35

NUMBER OF VALID CATEGORY OBSERVATIONS = 3

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 36
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DEL T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = A
PASQUILL F-A

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02	4.15
SSE	7	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
S	8	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
WNW	13	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.03	0.06	0.01	0.00	0.00	0.00	0.00	0.10	4.93

NUMBER OF VALID CATEGORY OBSERVATIONS = 9

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 37
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL
STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = B
PASQUILL F-B

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	3.90
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.03	3.25
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.08	3.19

NUMBER OF VALID CATEGORY OBSERVATIONS = 7

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 38
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL
STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = C
PASQUILL F-C

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.03	3.35
E	4	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
SW	10	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.05	5.02
WSW	11	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
W	12	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
WNW	13	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.03	4.43
NW	14	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
NNW	15	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.53
N	16	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.14	0.08	0.01	0.00	0.00	0.00	0.00	0.23	3.79

NUMBER OF VALID CATEGORY OBSERVATIONS = 20

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 39
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL
STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = D
PASQUILL F-D

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.05	4.23
NE	2	0.03	0.05	0.00	0.00	0.00	0.00	0.00	0.07	3.90
ENE	3	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.11	2.91
E	4	0.05	0.02	0.01	0.00	0.00	0.00	0.00	0.08	4.31
ESE	5	0.09	0.02	0.01	0.00	0.00	0.00	0.00	0.13	3.50
SE	6	0.07	0.09	0.02	0.00	0.00	0.00	0.00	0.18	4.06
SSE	7	0.07	0.03	0.01	0.00	0.00	0.00	0.00	0.11	4.02
S	8	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.08	3.61
SSW	9	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.10	3.35
SW	10	0.10	0.05	0.00	0.00	0.00	0.00	0.00	0.15	3.27
WSW	11	0.11	0.06	0.00	0.00	0.00	0.00	0.00	0.17	3.35
W	12	0.06	0.09	0.00	0.00	0.00	0.00	0.00	0.15	3.72
WNW	13	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.08	3.06
NW	14	0.06	0.11	0.00	0.00	0.00	0.00	0.00	0.17	4.45
NNW	15	0.02	0.19	0.00	0.00	0.00	0.00	0.00	0.22	5.20
N	16	0.02	0.03	0.00	0.01	0.00	0.00	0.00	0.07	6.12
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.97	0.87	0.06	0.01	0.00	0.00	0.00	1.91	4.06

NUMBER OF VALID CATEGORY OBSERVATIONS = 167

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 40
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL
STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = E
PASQUILL F-E

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.05	3.90
NE	2	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.05	2.25
ENE	3	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.03	3.35
E	4	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
ESE	5	0.10	0.02	0.01	0.00	0.00	0.00	0.00	0.14	3.45
SE	6	0.15	0.01	0.00	0.00	0.00	0.00	0.00	0.16	2.69
SSE	7	0.16	0.18	0.00	0.00	0.00	0.00	0.00	0.34	4.01
S	8	0.10	0.19	0.01	0.00	0.00	0.00	0.00	0.31	4.62
SSW	9	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.11	4.23
SW	10	0.11	0.26	0.00	0.00	0.00	0.00	0.00	0.38	4.55
WSW	11	0.06	0.07	0.00	0.00	0.00	0.00	0.00	0.13	4.05
W	12	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.07	3.35
WNW	13	0.11	0.03	0.00	0.00	0.00	0.00	0.00	0.15	3.01
NW	14	0.11	0.21	0.00	0.00	0.00	0.00	0.00	0.32	4.37
NNW	15	0.03	0.09	0.00	0.00	0.00	0.00	0.00	0.13	4.65
N	16	0.14	0.05	0.00	0.00	0.00	0.00	0.00	0.18	3.07
CALM AND VARIABLE	0								0.00	0.00
TOTAL		1.32	1.24	0.02	0.00	0.00	0.00	0.00	2.59	3.90

NUMBER OF VALID CATEGORY OBSERVATIONS = 227

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 41
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = F
PASQUILL F-F

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
NE	2	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
ENE	3	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
E	4	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	3.90
ESE	5	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.05	3.07
SE	6	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.10	3.35
SSE	7	0.10	0.06	0.00	0.00	0.00	0.00	0.00	0.16	3.43
S	8	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.13	2.85
SSW	9	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.07	2.50
SW	10	0.07	0.02	0.00	0.00	0.00	0.00	0.00	0.09	3.07
WSW	11	0.10	0.01	0.00	0.00	0.00	0.00	0.00	0.11	2.58
W	12	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.08	3.19
WNW	13	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.07	2.25
NW	14	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.10	4.08
NNW	15	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.07	4.65
N	16	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.03	3.35
CALM AND VARIABLE	0								2.29	0.33
TOTAL		0.82	0.32	0.00	0.00	0.00	0.00	0.00	3.37	1.41

NUMBER OF VALID CATEGORY OBSERVATIONS = 295

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 42
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = F
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = G
PASQUILL F-G

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
CALM AND VARIABLE	0								0.01	0.00
TOTAL		0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.96

NUMBER OF VALID CATEGORY OBSERVATIONS = 6

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 43
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = G
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = A
PASQUILL G-A

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NUMBER OF VALID CATEGORY OBSERVATIONS = 0

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE=LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 44
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = G
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = B
PASQUILL G-B

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NUMBER OF VALID CATEGORY OBSERVATIONS = 0

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE*LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 45
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = G
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = C
PASQUILL G-C

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
SW	10	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
WSW	11	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	2.25
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	14	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	3.90
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.10	2.62

NUMBER OF VALID CATEGORY OBSERVATIONS = 9

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE*LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 46
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = G
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = D
PASQUILL G-D

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
S	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	2.25
WSW	11	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
W	12	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
WNW	13	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
NW	14	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	5.55
NNW	15	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
N	16	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.17	0.03	0.00	0.00	0.00	0.00	0.00	0.21	2.90

NUMBER OF VALID CATEGORY OBSERVATIONS = 18

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE*LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 47
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = G
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = E
PASQUILL G-E

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	3	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
E	4	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02	6.15
ESE	5	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
SE	6	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	3.90
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	3.90
SSW	9	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.05	3.07
SW	10	0.06	0.04	0.00	0.00	0.00	0.00	0.00	0.10	2.98
WSW	11	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
W	12	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.06	2.91
WNW	13	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.09	2.25
NW	14	0.07	0.08	0.00	0.00	0.00	0.00	0.00	0.15	4.03
NNW	15	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.05	3.57
N	16	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.48	0.17	0.01	0.00	0.00	0.00	0.00	0.66	3.24

NUMBER OF VALID CATEGORY OBSERVATIONS = 58

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

CODE*LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 48
HUTCHINSON ISLAND SITE
PERIOD OF RECORD: 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = G
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = F
PASQUILL G-F

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
ESE	5	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
S	8	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	2.25
SSW	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	10	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
WSW	11	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5.55
W	12	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
WNW	13	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
NW	14	0.02	0.08	0.00	0.00	0.00	0.00	0.00	0.10	4.82
NNW	15	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	3.90
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.00	0.00
TOTAL		0.17	0.11	0.00	0.00	0.00	0.00	0.00	0.29	3.57

NUMBER OF VALID CATEGORY OBSERVATIONS = 25

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 8764

TABLE 5-1 CONTINUED

CODE#LSD-2 FLORIDA POWER & LIGHT COMPANY PAGE 49.
HUTCHINSON ISLAND SITE
PERIOD OF RECORD 3/ 1/71 TO 2/29/72

ANNUAL HOURLY PERCENT FREQUENCY OF VERTICAL AND HORIZONTAL
STABILITY CATEGORIES BY WIND DIRECTION AND WIND SPEED

VERTICAL STABILITY AS DEFINED BY DELTA-T = G
HORIZONTAL STABILITY AS DEFINED BY SIGMA-THETA = G
PASQUILL G-G

SECTOR	SECTOR NUMBER	SPEED(MPH) ADJUSTED TO 10-METER ELEVATION 1-3	4-7	8-12	13-18	19-24	25-31	>31	TOTAL	MEAN SPEED
NNE	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	2	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
ENE	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSE	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	8	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
SSW	9	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	2.25
SW	10	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
WSW	11	0.02	0.00	0.00	0.00	0.00	[illegible]	0.00	0.02	2.25
W	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WNW	13	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.25
NW	14	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	2.25
NNW	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CALM AND VARIABLE	0								0.70	0.41
TOTAL		0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.81

NUMBER OF VALID CATEGORY OBSERVATIONS = 74

NUMBER OF TOTAL VALID OBSERVATIONS (ALL CATEGORIES) = 6704

QUESTION 6 Provide data on local ocean currents for all times of the year.

ANSWER:

Data on ocean currents during the period of July 12, to July 20, 1969 are summarized in the Environmental Report, Section 2.3.2. No other data on local ocean currents have been taken.

QUESTION 7 Provide a plot of ocean temperature distributions for different tidal and wind conditions.

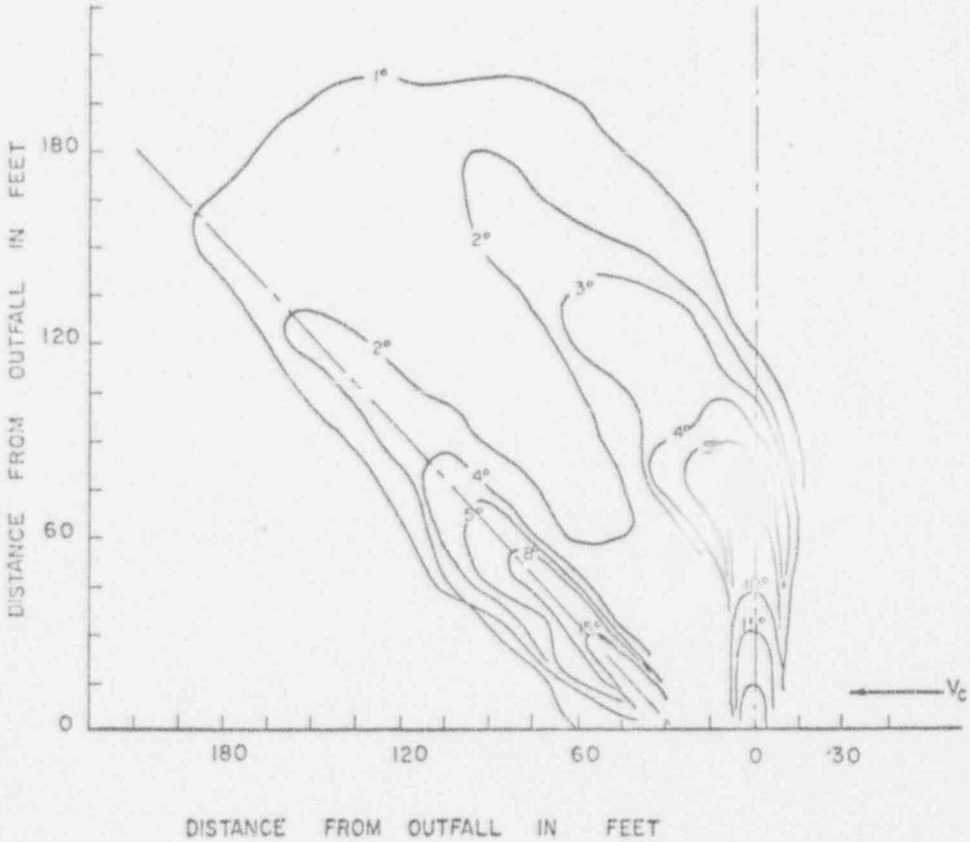
ANSWER:

Ocean temperature distributions in the area of the discharge jet are discussed in the answer to Question 8. There are no data on distributions under various tidal and wind conditions.

QUESTION 8 Provide a plot of the isotherms showing the vertical temperature patterns in the ocean pertinent to the discharge area.

ANSWER:

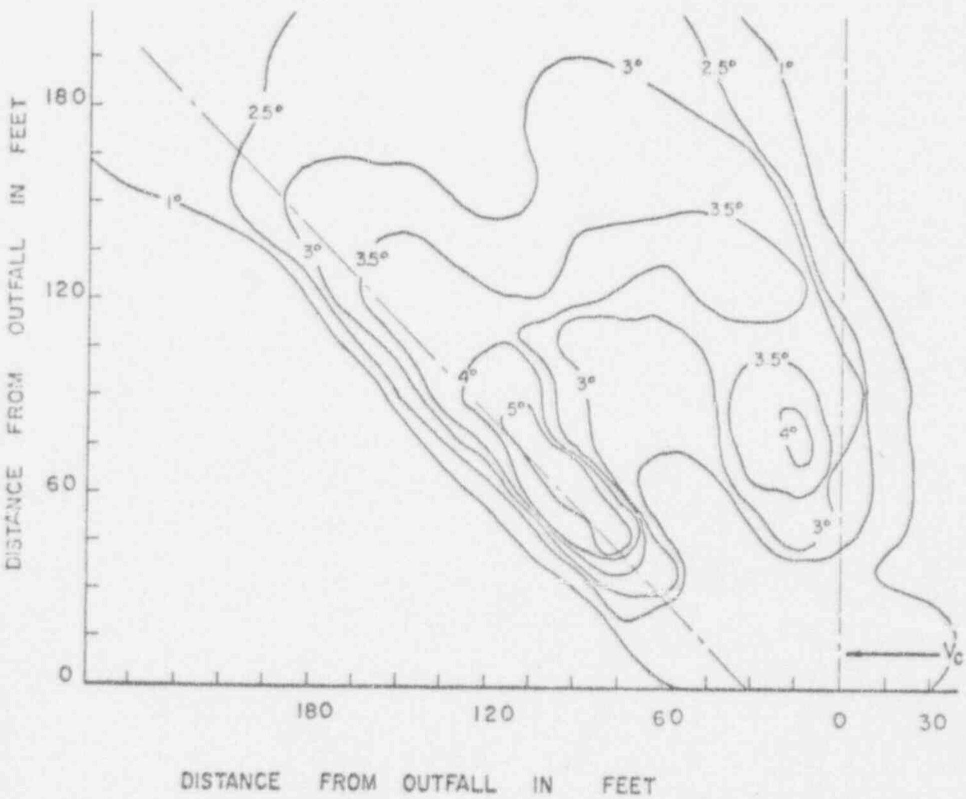
The Y-type discharge jet chosen for Hutchinson Island Unit No. 1 was the subject of model tests in which the temperature distribution in the discharge area was experimentally determined. Figure 8-1 through 8-3 show the distribution (as determined from these tests) at the surface, midway between the surface and the discharge, and at the discharge nozzle centerline. A current of 0.3 feet per second (Vc) existed in the direction indicated by the arrow on the figures.



ISOTHERMS AT MIDPOINT OF OUTFALL

HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
TEMPERATURE PATTERNS
OF DISCHARGE JETS

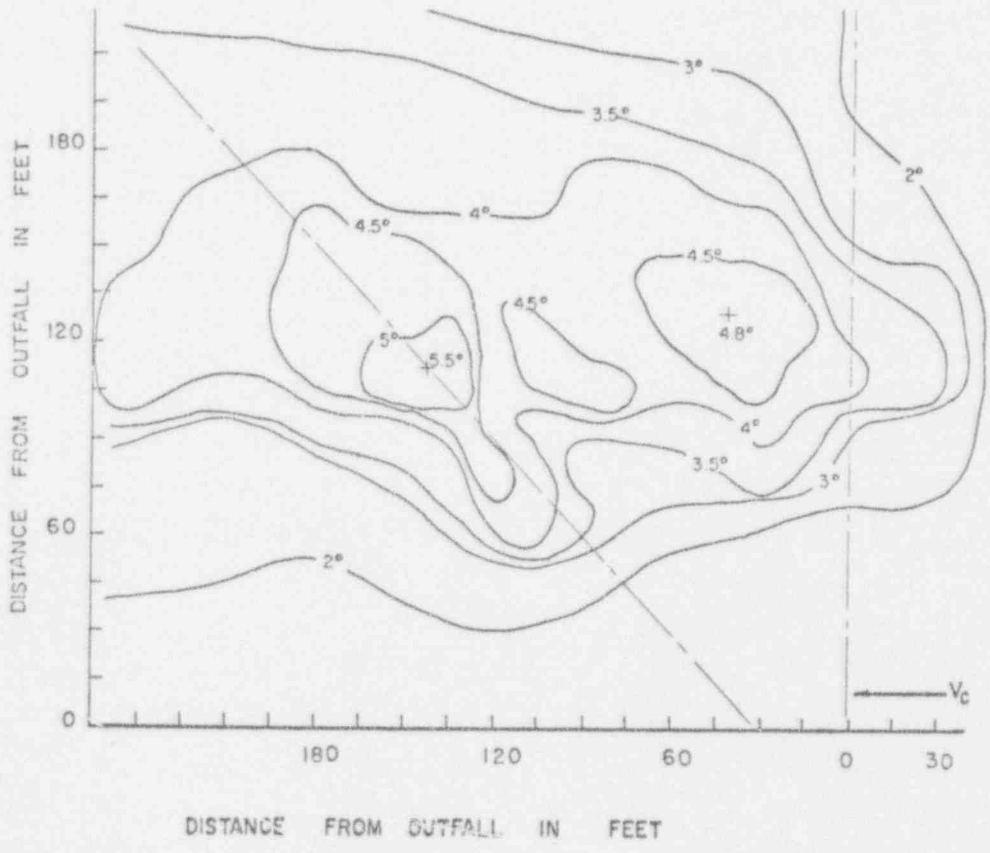
FIGURE 8-1



ISOTHERMS AT MIDDEPTH

HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
TEMPERATURE PATTERNS
OF DISCHARGE JETS

FIGURE 8-2



ISOTHERMS AT SURFACE

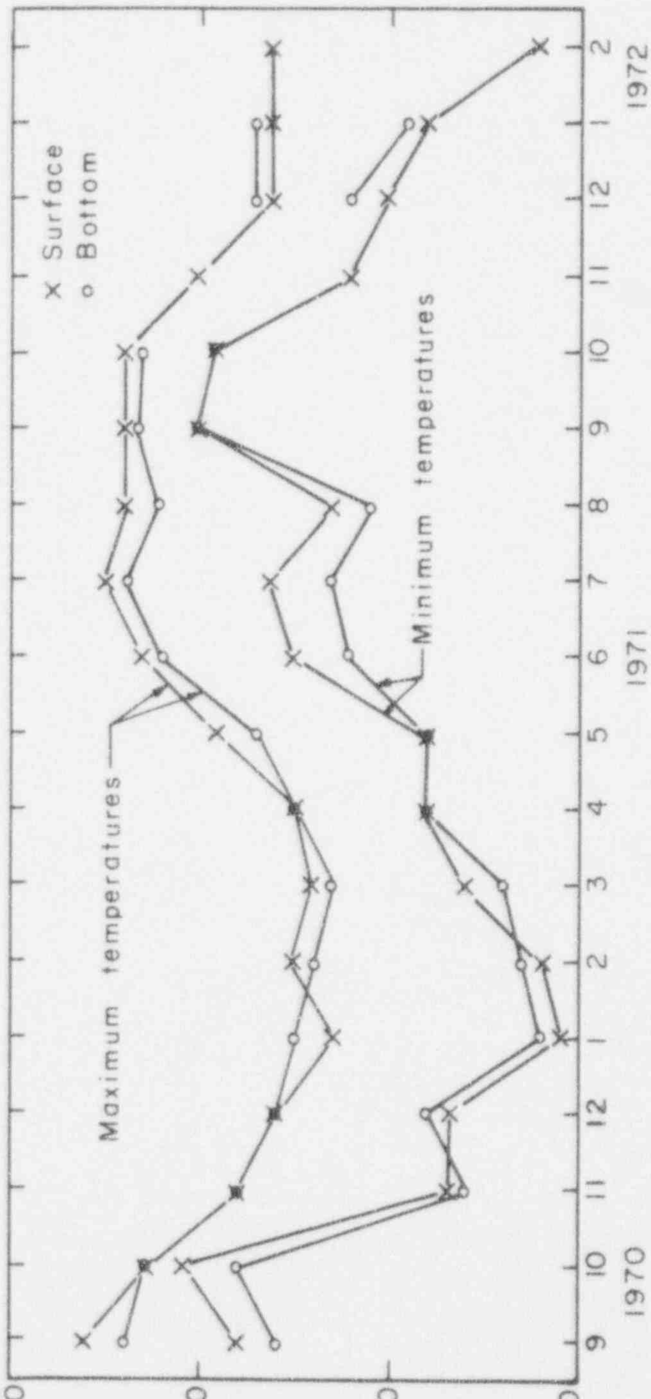
HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
TEMPERATURE PATTERNS
OF DISCHARGE JETS

FIGURE 8-3

QUESTION 9 Provide year-round ocean water temperature data. What is the maximum and the minimum recorded temperature, and what is the period of record?

ANSWER:

Ocean water temperature data at the Hutchinson Island plant site are now available for the period August, 1970 through March, 1972. The maximum temperatures during this period were 86 F at the surface and 84 F at the bottom, while the minimum temperatures were 61 F at the surface and 62 F at the bottom. Figure 9-1 shows a plot of the temperature data.



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
OCEAN TEMPERATURES
FIGURE 9-1

QUESTION 10 Provide data on how oceanic nutrient levels vary with time.

ANSWER:

Surface and bottom water samples were taken at five locations in the ocean near the plant during February, March and April, 1972. Nutrient levels in these samples are given in Table 10-1 below.

TABLE 10-1

Nutrient	Levels, ppm		
	Feb. 4, 1972	Mar. 1-2, 1972	Apr. 3, 1972
NO_3	0.0133 to 0.0748	0.0024 to 0.0189	0.0128 to 0.0341
NO_2	0.0016 to 0.0086	0.0003 to 0.0188	0.0018 to 0.0048
NH_3	0.682 to > 1/0	0.004 to 0.038	0.003 to 0.089
PO_4	0.032 to 0.056	0.052 to 0.070	0.129 to > 1.0
SiO_2	0.198 to 0.286	0.071 to 0.162	0.118 to 0.193

QUESTION 11 Provide a schematic or other suitable drawing showing the Y-type discharge jet.

ANSWER:

Figure 11-1 shows the plan of the condenser cooling water system, Figure 11-2 shows the ocean intake structure, and Figure 11-3 shows the discharge.

QUESTION 12 Provide an analysis to demonstrate the extent of any fogging hazard (highways and waterways) or aesthetic impact of fog. This analysis should quantitatively discuss the frequency of occurrence and extent of fogging. Statements of operating experience from facilities with similar discharge situations and for similar or worse climatological conditions would be of value.

ANSWER:

The Florida Power & Light Company has operated numerous power plants with discharge conditions which are similar to Hutchinson Island or more difficult from a fogging standpoint. These include the Cape Kennedy Plant, considerably north of Hutchinson Island, and Riviera Plant, to the south, as well as others. On infrequent occasions, light mists have been noted by plant operating personnel, but no significant amount of fog. On the basis of this experience, no problem with fog generation is anticipated at Hutchinson Island.

QUESTION 13 Identify present and projected recreational activities in the vicinity of the facility. Include number of people and hours per year at each location: boating, swimming, fishing, clam digging, hunting, water skiing, etc.

ANSWER:

The most important center of recreational activities in the vicinity of the plant is the Savannas Recreation Area, located approximately five miles west-northwest of the plant. Operated jointly by the City of Ft. Pierce and St. Lucie County, it features boating, fishing, swimming, camping, picnicking, etc. Overnight campers totaled approximately 9000 during a recent 12-month period, while 160,000 day visitors were reported. Public beach and park areas are located at the north end of Hutchinson Island. The nearest park to the Hutchinson Island plant site (and furthest from Ft. Pierce), Douglas Memorial, is more than five miles north of the plant. It is lightly used, averaging 25-50 visitors per day during the summer, with few visitors during the winter.

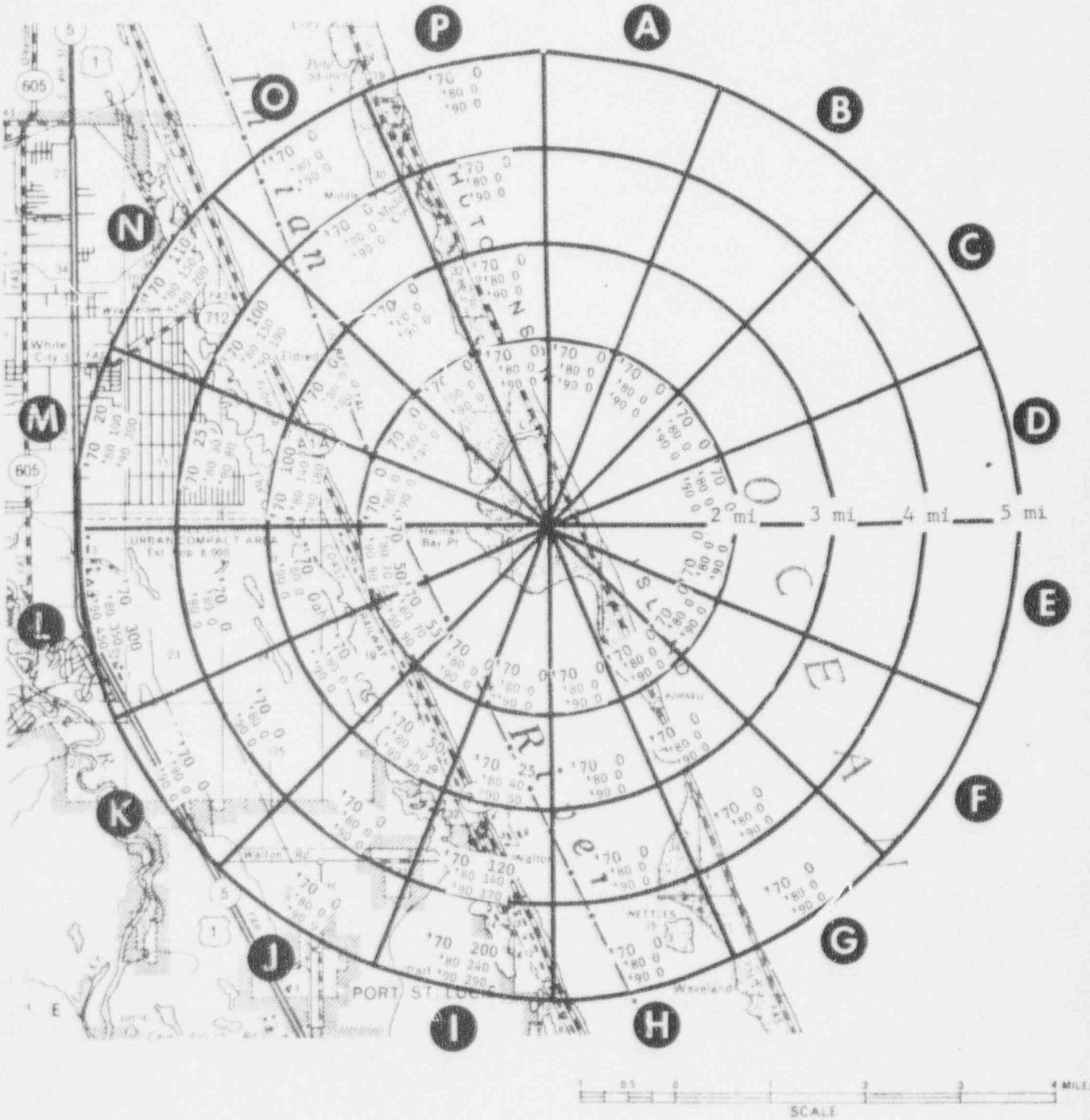
South of the plant site on Hutchinson Island are commercial campgrounds for travel trailers and similar vehicles. The nearest of these is approximately five miles from the plant. A public beach and park is located approximately seven miles south of the plant.

Other recreational activities in the vicinity of the plant include surfing and fishing in the ocean, and fishing and boating in the Indian River. Ducks are hunted on Hutchinson Island in season. Participants in these activities within several miles of the plant are few in number. Shellfishing in Indian River is currently prohibited by order of the State Board of Health.

QUESTION 14 Provide updated population distribution maps to include 1970 census figures. Include population segments centered on the 16 points of the compass with concentric rings at 1, 2, 3, 4, 5, 10, 20, 30, 40 and 50 miles from the facility.

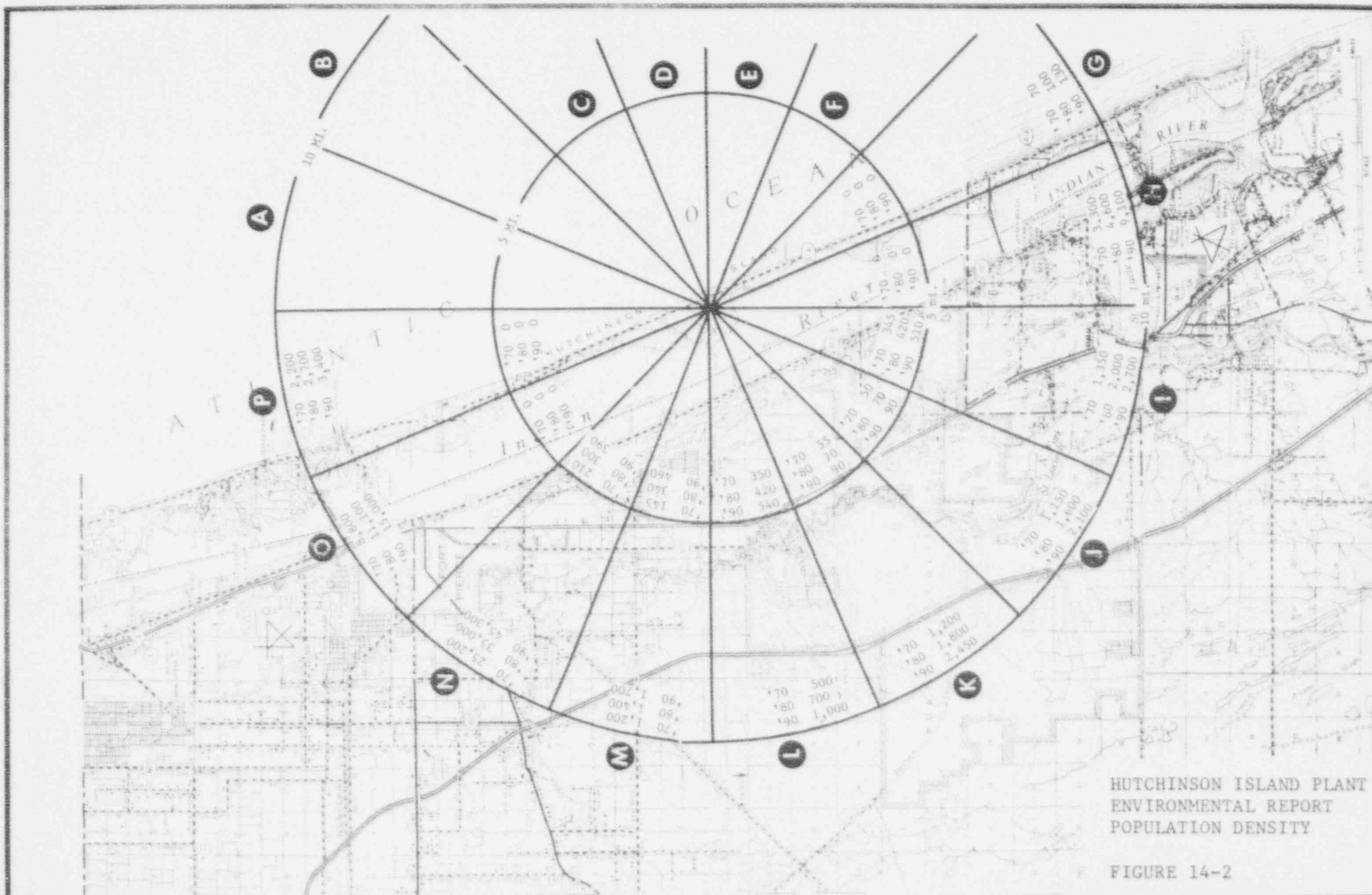
ANSWER:

Updated population distribution maps to include the 1970 census figures are included as Figures 14-1, 14-2 and 14-3.



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
POPULATION DENSITY

FIGURE 14-1



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
POPULATION DENSITY

FIGURE 14-2

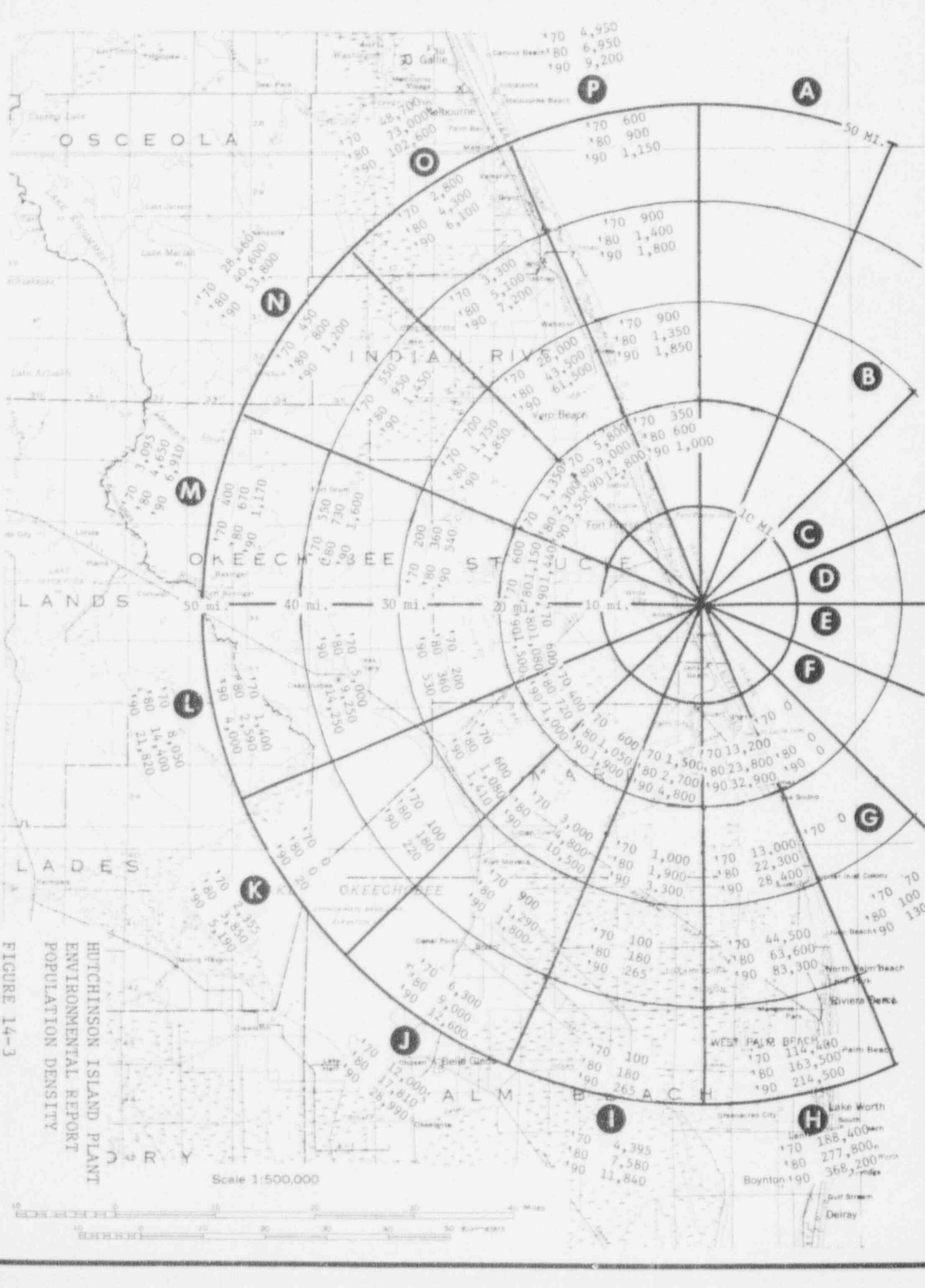


FIGURE 14-3

HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
POPULATION DENSITY

QUESTION 15 Identify distances and directions from the facility to the nearest dairy and to the nearest single cow.

ANSWER:

The dairy nearest the Hutchinson Island Plant is located approximately 14 miles west-southwest of the site. Single cows may exist at closer locations, but would be on the mainland, west of the Savannas and at a distance of five miles or more from the plant site.

QUESTION 16 Identify distances and directions from facility to nearest truck farm and beef producer.

ANSWER:

Agriculture near the plant site is primarily orange groves. The nearest groves are located near US Route 1 five miles west of the plant site. The nearest truck farm is in Martin County, approximately ten miles south of the site, while the nearest beef producer is near Port St. Lucie, about five miles to the southwest of the plant.

QUESTION 17 Identify locations, frequencies and type of analyses used or to be used in the environmental monitoring program.

ANSWER:

The Florida State Division of Health, in cooperation with FPL, has been conducting an environmental monitoring program which began in January 1971. This program includes samples of air, precipitation, surface water, ground water, bottom sediments, beach sand, various aquatic biota, milk, terrestrial biota and soil. It will continue into normal operation of Hutchinson Island Unit 1, providing about three years of background data prior to startup. Tables 17-1 and 17-2 show the types of samples taken, frequency, and type of analysis. Figures 17-1 and 17-2 show the locations of the sampling points. Typical background results for 1971 are shown in Table 17-3.

TABLE 17-1

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

	Criteria and Sampling Locations	Collection Frequency	Analysis/Counting
I. AIR			
A. Particulate and Iodine	Comparison on-site versus off-site & reference locations H-13, H-14, H-15 on-site in prevailing wind directions from plant H-09 thru H-12 off-site within a radius of 10 miles of plant in prevailing wind directions from the plant	Weekly	Gross beta Gamma spectral analysis of monthly composite if indicated by high beta activity Radioactive Iodine
B. Direct Radiation	Comparison of on-site versus off-site locations Sampling locations same as I A.	TLD's-Monthly	Determine direct radiation exposure
C. Precipitation	Comparison of on-site versus reference locations H-08 location - White City H-10 location - Indian River Field Laboratory H-13 On-site	Monthly	Gross beta Gamma spectral analysis Tritium
II. WATER			
A. Surface Water			
1. Ocean	H-15 East of Plantom Beach H-16 East of Blind Creek H-17 East of Big Mud Creek H-18 Near mouth of Discharge H-19 South of Discharge	Monthly	Gamma spectral analysis Tritium Sr-90
2. Indian River	H-13 Big Mud Creek H-29 St. Lucie River at U.S. Rte. 1	Quarterly	Gross alpha Gross beta Tritium
3. Inland	H-27 Walton Road & Marsh H-28 Weatherbee Road & Marsh	Quarterly	Same as II.A.2

TABLE 17-1 (continued)

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

	Criteria and Sampling Locations	Collection Frequency	Analysis/Counting
II. WATER (cont'd)			
B. Ground Water	H-10 Indian River Field Laboratory, well H-30 Ankona, well	Quarterly	Same as II.A.2
C. Potable Water	H-11 City of Fort Pierce, drinking water supply, well H-12 City of Stuart, drinking water supply, well H-31 Port St. Lucie, drinking water supply, well	Quarterly	Same as II.A.2
D. Bottom Sediment			
1. Ocean	H-15 off Plantom Beach, 500 ft. East of Discharge H-16 offshore, 1 mile North of Discharge H-19 offshore, 1 mile South of Discharge	Quarterly	Gamma spectral analysis Sr-90
2. Indian River	H-13 Big Mud Creek	Quarterly	Same as II.D.1
E. Beach Sand	H-15 Plantom Beach, opposite discharge H-16 East of Blind Creek, 1 mile North of Discharge H-19 Near Intake; 1 mile South of Discharge	Quarterly	Gamma spectral analysis Sr-90
F. Aquatic Biota			
1. Crustacea a. Lobster, crab &/or shrimp	H-17 offshore, 1/2 mile North of Discharge H-18 offshore, 1/2 mile South of Discharge H-20 Indian River North of site H-21 Indian River South of site	Quarterly	Gamma spectral analysis Sr-90
2. Fish (Vertebrates) a. Carnivores Mangrove Snapper	Same as II.F.1	Quarterly	Same as II.F.1
b. Herbivores Mullet (mugil cephalus)	Same as II.F.1	Quarterly	Same as II.F.1
3. Other a. Manatee Grass (syringodium filiforme)	Same as II.F.1	Semi-annually	Gamma spectral analysis Sr-90

TABLE 17-1 (cont'd)

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

	Criteria and Sampling Locations	Collection Frequency	Analysis/Counting
III. TERRESTRIAL			
A. Milk	St. Lucie County - H-01 SR70 H-02 SR70 H-03 Glades Cut-off Road	Quarterly	Gamma spectral analysis Chem. separ. & analysis Sr-90
B. Biota			
1. Citrus	H-10 Indian River Field Laboratory H-22 Canal Slough Road H-23 Easy Street H-24 Tumbling King Road H-25 Bell Avenue H-26 Beaches Canal - SR607	At Harvest	Gamma spectral analysis Sr-90
2. Food Crops	3 locations within a 10 mile radius of plant in prevailing wind directions from plant at harvest time	Semi-annually	Gamma spectral analysis Sr-90
3. Other Vegetation	5 locations within a 10 mile radius of plant generally where there are air particulate samplers	Semi-annually	Gamma spectral analysis Sr-90
C. Soil	H-08, H-09, H-10, H-27, H-28 within a ten mile radius of plant	Semi-annually	Same as III.B.3

TABLE 17-2

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

TYPES OF ANALYSIS

1. Gamma Spectroscopy

Ce-144	Ba-140
I-131	K-40
Ru-106	Ra-226
Cs-134	Th-232
Cs-137	Co-58
Zr-95	Co-60
Mn-54	Cr-51
Zn-65	

2. Beta Liquid Scintillation Spectroscopy

   H-3

   C-14

   P-32

3. Chemical Separation and Analysis

   Sr-89

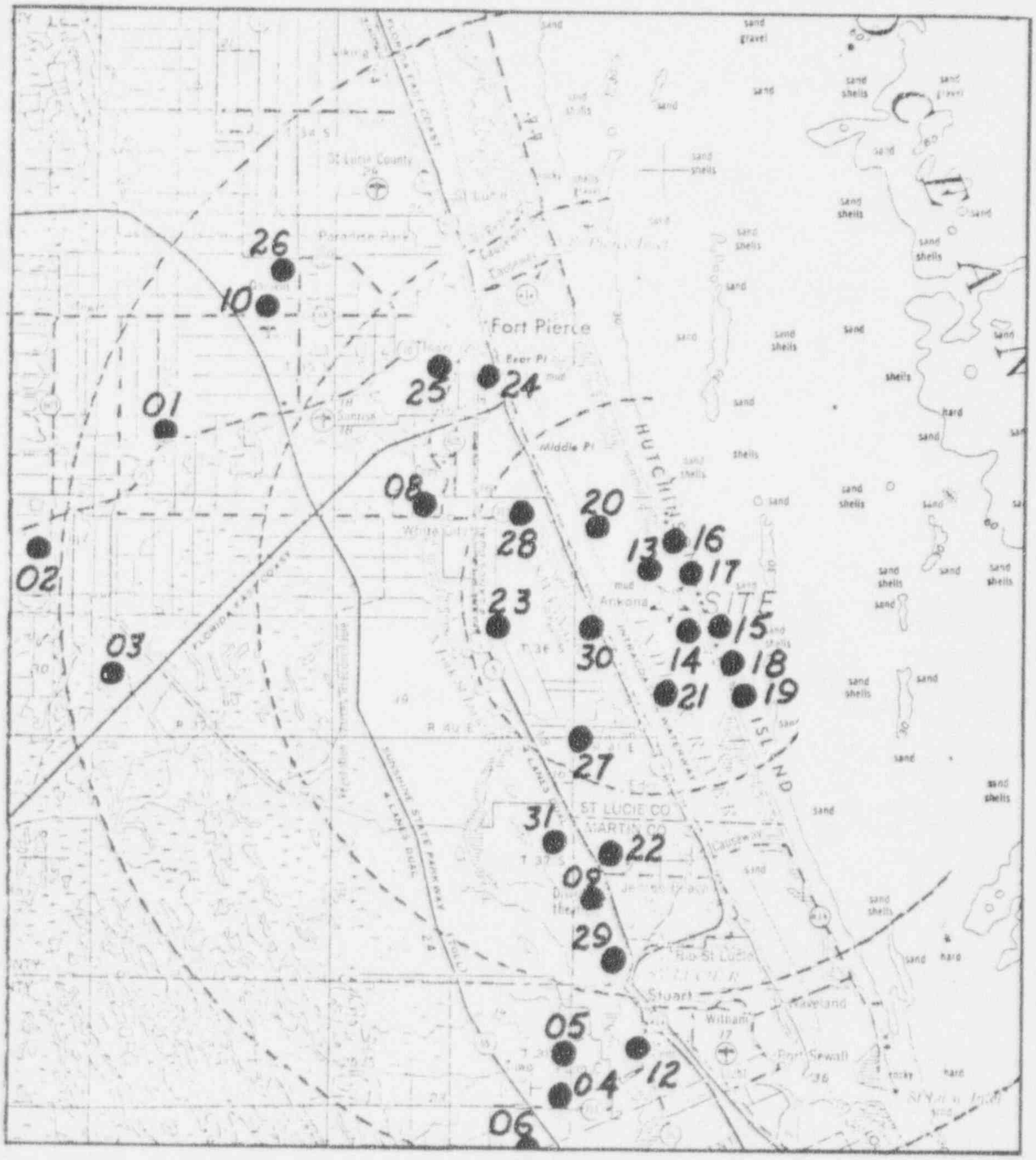
   Sr-90

TABLE 17-3

Hutchinson Island Environmental
Surveillance Program

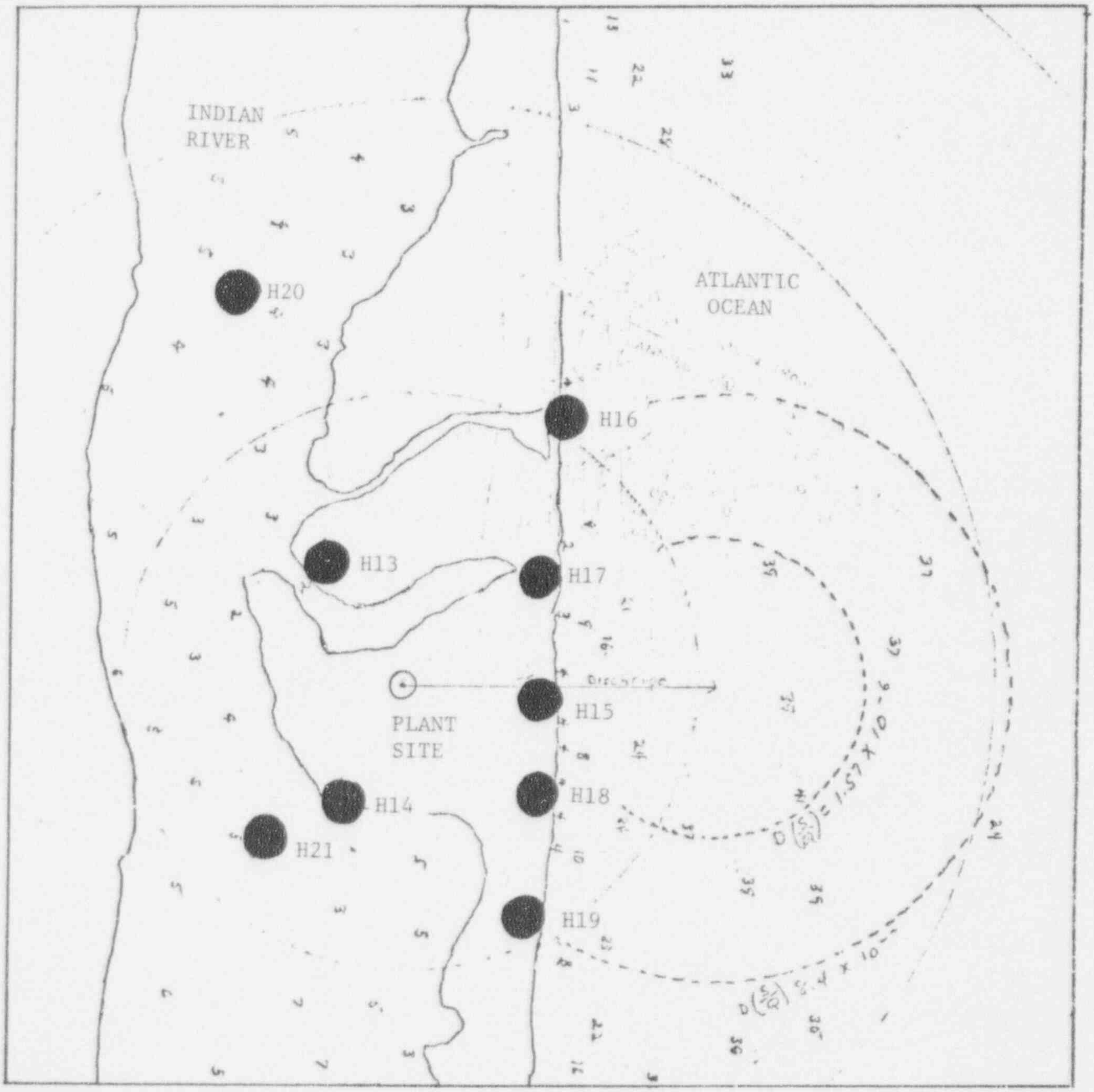
Typical Background Concentrations - 1971

Well Water (pCi/l)	β - 20
Sea Water (pCi/l)	β - 490; K 40-320
Biota (Fish) (pCi/kg)	β - 3000; K 40-2000; Fe 55-30; Sr 90-18
Citrus (pCi/kg)	β - 1800; K 40-1700; Sr 90-40; Cs 137-70
Milk (pCi/l)	K 40-150; Sr 90-6; I 131--; Cs 137-90
Soil (pCi/kg)	K 40-400; Zr 95-100; Cs 137-200
Beach Sand (pCi/kg)	Zr 95-70; Cs 137-200; Ce 144-400



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
RADIOLOGICAL SURVEILLANCE
SAMPLING STATIONS

FIGURE 17-1



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
MARINE BIOTA SAMPLING
LOCATIONS

FIGURE 17-2

QUESTION 18 Provide data on natural salt deposition as a function of distance inland from the shoreline. If these are not specific to the site, discuss their applicability.

ANSWER:

Little data on natural concentrations of airborne salt or deposition are available. Measurements have been reported for the New Jersey Coast, taken in the summer of 1971.* The area is similar to the Indian River-Hutchinson Island area in that there is a narrow island about two miles offshore, paralleling the mainland coast. Deposition rates of salt were reported to be in the range 0.1 to 2.6 $\mu g/(m^2)(sec)$ on the island, and below 0.4 to 0.006 on the mainland. As would be expected, the lowest values were found at the stations furthest inland.

Another indication of relative airborne salt concentration was found in a study of corrosion rates of metal specimens exposed near Jacksonville, Florida. High rates were noted in samples exposed at the beach, diminishing to normally expected rates at one mile inland.

---

* Jersey Central Power & Light Company, Forked River Nuclear Station Unit 1 Applicants Environmental Report, January 1972.

QUESTION 19 Provide data on the transmission lines in terms of right-of-way width, type circuits and pole structure, special access roads, prior land use, potential for expansion, beneficial uses, etc.

ANSWER:

Power from Hutchinson Island Unit 1 will be delivered to the FP&L system at the St. Lucie substation. The transmission link will consist of three 240 kv circuits carried on separate structures in a single corridor, each circuit being capable of carrying the full output of the plant. For the Indian River crossing, a long span design using single 3400 kc mil ACSR/AW conductors was chosen. The crossing is described in detail on page III-1 of the Environmental Report Supplement.

The land portion of the transmission link will be carried on concrete H-frame structures with an average span length of about 660 ft. Conductors will be 2-1691 kc mil. Right-of-way width is 1200 ft. immediately adjacent to the Indian River shore to minimize effects on adjacent properties, and 660 ft. elsewhere. Half the right-of-way will be required for the three transmission circuits, the remainder being held for future expansion. The right-of-way purchase has been completed. Line routing was chosen to avoid residential or other developed areas.

Of the approximately 760 acres of right-of-way, 43 acres of ridge land on the west side of the Indian River are divided into tracts. The two houses which have been purchased are located within this 43 acres. Approximately 712 acres of right-of-way are considered undeveloped and have been used for natural pasture lands. Of these 712 acres, approximately 80 acres are cultivated in orange trees, 40 acres are a water storage savanna and 30 acres are included in river swamp. The proposed transmission line will have very little effect on the orange groves within the right-of-way and have no significant effect on the water storage in the savannas or the river swamp.

Approximately 630 acres of right-of-way are suitable for residential and commercial development, of which 480 acres were held by a single land development company. The right-of-way has created a potential green belt through his future development.

This is the only natural corridor for a transmission right-of-way that would have a minimum environmental impact, located between suburban and urban development of Indian River Estates Subdivision and White City and Ft. Pierce to the north and the suburban and urban development of Port St. Lucie and Stuart to the south.

QUESTION 20 Provide a table showing the forecasted demand for power and the net effects of a one-year and a two-year delay in construction of Hutchinson Island Nuclear Station Unit 1.

ANSWER:

The requested data are shown in Table 20-1.

TABLE 20-1
FORECAST OF SUMMER PEAK
LOADS & GENERATION

	HUTCHINSON ISLAND NO DELAY		ONE YEAR DELAY	TWO YEAR DELAY
	1974	1975	1974	1975
Summer Peak Load - MW	8100	9000	8100	9000
Generation - MW	9563	10363	8713	9513
Reserve - MW	1463 (18.1%)	1363 (15.1%)	613 (7.6%)	513 (5.7%)
Largest Unit - MW	850	850	728	800
Reserve - MW Largest Unit Out of Service	613 (7.6%)	513 (5.7%)	-115 (-1.4%)	-287 (-3.2%)

The probability of having to interrupt load because of inadequate reserves and insufficient generation is shown by the following tabulation:

	Risk Index Days per Year	Increase Risk
1974 - Hutchinson Island No Delay	0.419	1.0 (Base)
1974 - Hutchinson Island Delayed One Year	3.72	8.9
1975 - Hutchinson Island Delayed Two Years	5.44	13.0

QUESTION 21 Provide a population forecast for the utility's service area between 1971 and 1981.

ANSWER:

Table 21-1 below shows population data for the FPL service area.

TABLE 21-1
POPULATION OF FPL SERVICE AREA

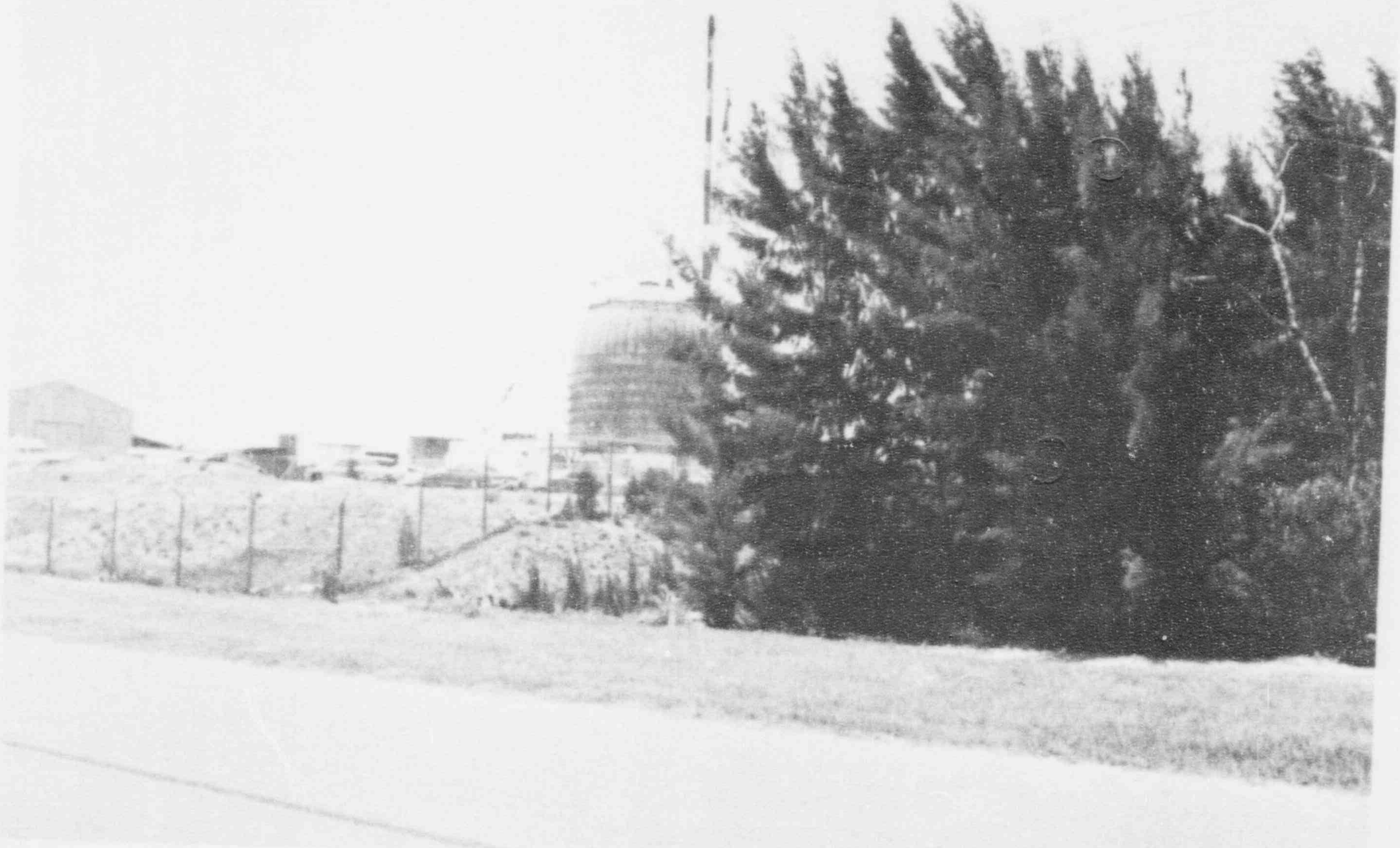
FPL Service Area:	1960	1970	1980
Brevard	111,400	230,000	285,500
Broward	333,900	620,100	920,000
Charlotte	12,600	27,600	45,300
Collier	15,800	38,000	64,000
Columbia	20,100	25,300	29,500
Dade	935,000	1,267,800	1,534,700
DeSoto	11,700	13,100	14,300
Flagler	4,600	4,500	4,600
Indian River	25,300	36,000	50,000
Lee	54,500	105,200	148,300
Manatee	69,200	97,100	120,800
Martin	16,900	28,000	40,500
Okeechobee	6,400	11,200	15,700
Palm Beach	228,100	348,800	472,600
Putnam	32,200	36,300	39,600
Sarasota	76,900	120,400	157,300
Seminole	54,900	83,700	161,500
St. Johns	30,000	30,700	31,300
St. Lucie	39,300	50,800	61,700
Suwannee	15,000	15,600	16,000
Volusia	125,300	169,500	227,500
Total	2,219,100	3,359,700	4,440,700

Source: 1960 and 1970 Data - U. S. Bureau of the Census
1980 Estimate - First Research Company, Miami

QUESTION 22 Provide artist sketches and/or pictures suitable for reproduction showing the plant during construction and operating from the main areas of public access (mainland shore, Indian River, State Road A-1-A, offshore).

ANSWER:

Photographs of the plant during construction taken from the main areas of public access are included as Figures 22-1, 22-2 and 22-3.



VIEW OF HUTCHINSON ISLAND PLANT
FROM HIGHWAY, LOOKING SOUTHWEST
FIGURE 22-1

VIEW OF HUTCHINSON ISLAND PLANT
FROM BEACH DUNES, LOOKING WEST
FIGURE 22-2

VIEW OF HUTCHINSON ISLAND PLANT
FROM THE WEST SHORE OF THE
INDIAN RIVER
FIGURE 22-3

QUESTION 23 State the size of the construction work force with time during plant construction.

ANSWER:

As of March, 1972, approximately 750 were employed in the construction work force. It is expected to peak at 1200 at the end of 1972, then decline to 900 in mid-1973, 600 at the end of 1973, 150 in mid-1974, and zero at the end of 1974.

QUESTION 24 Provide calculations showing the size, cost and operation characteristics of a spray pond that would be required for plant condenser cooling during normal operation of Hutchinson Island Unit 1.

ANSWER:

Utilizing one of the modular spray devices which are now available, a spray system could be considered for Hutchinson Island Unit 1. Such a system would require 200 or more of the spray devices, installed in a canal which would be a minimum of two miles long and 200 ft. wide. Cost would be $8,000,000 or more in direct costs, and the system would use about 2% of the plant output. Capitalized charges for reduction in generating capacity and power usage would be about $3,000,000.

There are little data available on salt water drift and its effects; such data would be required before such a system could be seriously considered.

QUESTION 25 Provide data on the approximate additional cost of mechanical and natural draft cooling towers guaranteed for various drift levels, e.g., 0.02, 0.05, and 0.005%.

ANSWER:

Mechanical draft cooling towers are now available with guaranteed drift rates of 0.03% to about 0.01%. However, allowance must be made for deterioration of performance (i.e., increased drift) over the life of the plant, even with the best maintenance program. Total installed cost of a cooling tower system for Hutchinson Island Unit 1, utilizing mechanical draft towers, would be in the range of $10,000,000. Additionally, the plant capacity would be reduced because of the power used by the tower pumps and fans and because of the increased heat sink temperature. The capitalized cost of the electric generating capacity reduction and power consumption would be in the vicinity of $3,000,000.

Natural draft cooling towers suffer from several disadvantages if considered for Hutchinson Island. There are: (1) the extremely high hurricane-wind loading design required for this site; (2) the fact that the unusually high wet bulb temperature characteristics of South Florida results in a large tower; and (3) the fact that the turbine-generator and condenser have been designed and their construction is well along, precluding optimization of the condensing temperature-cooling tower combination. Consequently, natural draft towers would be very expensive. An additional disadvantage would be the great size of a natural draft tower.

In the absence of detailed specifications, it is impossible to obtain precise cost data, especially for variations in drift guarantee.

It should also be noted that a cooling tower system would require discharge of a substantial quantity of heat for a once-through system, or high-salinity blowdown water for a closed cycle system.

QUESTION 26 Provide a list of major information meetings, consultations, etc. which have been held or are planned with Federal, State and local agencies or groups other than those listed in Table 2.3.8-1, page 69, of the Environmental Report.

ANSWER:

Florida Power & Light Company has maintained contact with authorities and regulatory agencies at the Federal, State and local levels as well as non-governmental groups. These have included the following:

Federal - Atomic Energy Commission, Department of Interior, U. S. Army Corps of Engineers, Bureau of Sport Fisheries and Wildlife, Florida Game and Fresh Water Fish Commission, Federal Aviation Authority.

State - Florida Board of Parks, Florida Air and Water Pollution Control Commission, Governor, Attorney General, Board of Conservation, Department of Health and Rehabilitation Services, Trustees of Internal Improvement Fund, Department of Natural Resources.

Local - St. Lucie County Zoning Board, St. Lucie County Attorney, St. Lucie County Planning and Zoning Commission, St. Lucie County Board of County Commissioners, Mosquito Control District, Flood Control District.

Citizens Groups - South Indian River District Association, St. Lucie County Farm Bureau, Ft. Pierce-St. Lucie County Chamber of Commerce, Martin County Taxpayers Association, Inc., Florida Audubon Society, River Restoration League, Martin County Alliance for Conservation.

Highlights of contacts are summarized below:

March-July 1968	Consideration for zoning classification change of plant site by Zoning Board, St. Lucie County, resulting in required zoning changes.
April-May 1968	Correspondence and meetings with South Indian River Association representatives. Group was satisfied with nuclear plans, stating that construction of fossil fueled plant would be vigorously opposed.
June 1968	St. Lucie County Farm Bureau passed resolution favoring Hutchinson Island Nuclear Plant, submitted this to St. Lucie County Commissioners.
June 1968 - July 1969	Correspondence and meetings with U. S. Department of Interior, regarding thermal discharge from plant.

July 1968	Resolution adopted by Board of Directors, Ft. Pierce-St. Lucie County Chamber of Commerce, supporting location of Hutchinson Island Plant.
July 1968 - January 1969	Processing Dredge and Fill permit Application to construct access channel to plant by St. Lucie County Commissioners. Permit granted.
January 1969	Certification from Florida Air and Water Pollution Control Commission to Internal Improvement Commission offering no objection to issuance of access channel dredge permit.
February 1969	Correspondence and meetings with Florida Air and Water Pollution Control Commission regarding thermal discharge from plant.
February - May 1969	Consideration bv Corps of Engineers and U. S. Fish and Wildlife Service of Department of the Interior of dredge permit. Permit granted.
March - April 1969	Correspondence with Florida Audubon Society regarding thermal discharges.
April 1969	Correspondence with Martin County Taxpayer's Association regarding environmental matters.
April 1969	Meeting with River Restoration League regarding dredge permit and thermal discharges.
April 1969	Meeting with Martin County Alliance for Conservation to discuss plans for plant.
July 1969	Meeting with Federal Bureau of Sport Fisheries and Wildlife concerning plant.
October 1969	Agreement by Florida Department Health and Rehabilitation Services for environmental monitoring of plant environs.
April-May 1970	Discussions and correspondence with Department of Interior regarding thermal discharges. Department of Interior expresses pleasure with FPL's decision in choosing ocean cooling water source.
November 1970	Permit granted by Florida Department of Air and Water Pollution Control Commission for construction of condenser cooling water discharge.
January - February 1970	Consideration by Florida Department of Air and Water Pollution Control Commission of Water Quality certification for construction of plant. Certificate issued.

February 1971	Marine biological study at site authorized in cooperation with Florida Department of Natural Resources.
Febrauiy - March 1971	Correspondence with Governor of Florida and Internal Improvement Board, and Department of Air and Water Pollution Control concerning permit for additional dredging in Big Mud Creek. Permit granted.
April 1971	Received Corps of Engineers Approval for dredging operations.
August 1971	Federal Aviation Authority permits for containment and shield buildings granted.
November 1971	Agreement by FPL allowing Mosquito Control District to work on FPL property.
November - December 1971	St. Lucie County Commission consideration and approval of construction of intake and discharge system.
December 1971	Meetings held with Department of Natural Resources, Beaches and Shores and Survey Management Departments, Internal Improvement Board, concerning cooling water intake and discharge.
December 1971	Consideration by Corps of Engineers of application for intake and discharge construction. Application pending.

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
UNIT NO. 1

ENVIRONMENTAL REPORT
SUPPLEMENT NO. 3

MAY 30, 1972

DOCKET NO. 50-335

INTRODUCTION

The Florida Power & Light Company Hutchinson Island Plant Environmental Report is herein supplemented to provide the additional information requested by Mr. Muller's letter of May 16, 1972. In addition a Question 19 has been included in the Supplement as requested by Mr. William H. Regan, Jr. DREP, per telephone conversation of May 24, 1972.

Also included are Figures 11-1, 11-2, and 11-3, which were inadvertently omitted from Supplement No. 2 submitted May 15, 1972. These figures are to be included with the answer to Question 11, Supplement No. 2.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

MAY 16 1972

Docket No. 50-335

Mr. George Kinsman
Senior Vice President
P. O. Box 3100
Miami, Florida 33101

Dear Mr. Kinsman:

A site visit to the Hutchinson Island Plant was made on May 3-5, 1972 by a team from our Directorate of Licensing and the Pacific Northwest Laboratory of Battelle Memorial Laboratory to review environmental factors related to the construction and operation of the plant.

As a result of this visit and our continued review of your plant, additional information will be required to complete our review. Accordingly, please submit by May 31 the information identified in the enclosure to this letter.

Your reply should consist of three signed originals and 297 additional copies as a sequentially numbered supplement to your Environmental Report.

Sincerely,

Daniel R. Muller

Daniel R. Muller, Assistant Director
for Environmental Projects
Directorate of Licensing

Enclosure:
Request for Additional Information

cc: Troy B. Conner, Jr., Esq.
1701 K Street, N.W.
Washington, D. C. 20006

REQUEST FOR ADDITIONAL INFORMATION

HUTCHINSON ISLAND PLANT

UNIT NO. 1

DOCKET NO. 50-335

1. Provide a current plot plan with projected ground contours for the site including the canal, dike, fill areas, beach line, and the remainder of the site terrain.

2. Indicate those mosquito species which are produced on Hutchinson Island, any disease vectors found in this area, and Florida Power and Light's plans for aiding the mosquito control program.

3. Estimate the proportion of the world population of turtles which nest on Hutchinson Island. Include data for green, leatherback and loggerhead turtles.

4. Describe the continuing environmental studies conducted by the Department of Natural Resources at the site. Include the objectives and scope of these studies as well as their planned duration. Indicate the personnel involved and the intended disposition of data collected.

5. Provide the height above MLW for the containment dome and vent.

6. List the estimated amounts and types of liquid and solid radioactive wastes to be generated during operation. Describe the method of packaging for shipment to be used for these.

7. Describe in detail the procedures for defouling the intake structure by recirculation. This description should include the following: the maximum water temperature to be achieved at the inlet structure and the temperature rise necessary to achieve it; the flow rate discharged from both the intake structure and outfall structure; the velocity of water entering the intake velocity cap during recirculation when all plant cooling water will enter one of the two intake pipes; the intake and outfall velocity, the maximum surface temperature rise expected; the length of time for this mode of operation (recirculation); and the frequency of recirculation. This information is necessary for the range of ambient water temperatures existing throughout the year.

8. Provide a detailed analysis, including source data, of the alternatives for transmission line crossings of the Indian River. These alternatives should at least include (1) conventional overhead transmission, (2) the currently planned overhead transmission system, and (3) an underground transmission system with mainland switchyard facilities located near the railroad tracks. The cost analysis should be consistent with the formula used on page VI-3 of the Environmental Report Supplement and should detail crossing costs and switchyard facilities costs as separate quantities. Provide engineering details which form the basis of the cost estimate. Other environmental advantages and disadvantages (including aesthetic and ecological) should be described for each alternative. The principal reasons for discarding other alternatives in favor of the presently planned system should be described.

9. Update the table on page V-11 of the Environmental Report Supplement to include data through 1980.

10. Separate total generation capacity for a five to six year period surrounding 1974 into the percent available from base load units versus the percent available from peaking units.

11. Document load curtailments, voltage reductions, etc., that have occurred in recent years as well as those anticipated to occur in 1972.

12. Detail planned additions and retirements to 1980, indicating location, capacity, type of unit (nuclear, fossil, turbine, etc.) and planned date of addition or retirement.

13. Expand the table on page V-2 of the Environmental Report Supplement to cover the period 1965 to 1980, if possible.

14. Indicate the current cost of fuel oil suitable for (1) oil fired facilities, and (2) gas turbine facilities.

15. Estimate the salvage value of the plant assuming (1) construction of a nuclear facility at another site, and (2) construction of a fossil (oil) facility at the present site by either converting or abandoning the nuclear plant.

16. Indicate the current status of construction including estimated percent completion, expenditures to date, and the portion of expenditures that remain unspent.

17. Indicate the environmental and economic impacts associated with the alternate sites considered, including the analysis used in selecting the plant site. Update table 2.5.3-1 from Docket Nos. 50-250 and 50-251 as it applies to Hutchinson Island.

18. With reference to the equation on page VI-3 in the Environmental Report Supplement, provide the basic data required to complete this equation assuming the following alternatives:

    a. That the present site is abandoned and a nuclear facility of equivalent capacity is constructed elsewhere.

    b. That an equivalent capacity oil-fired facility is constructed at the present site, either converting or abandoning the nuclear plant.

    c. That the base line cooling system design is modified for a cooling lake (specify required acreage only).

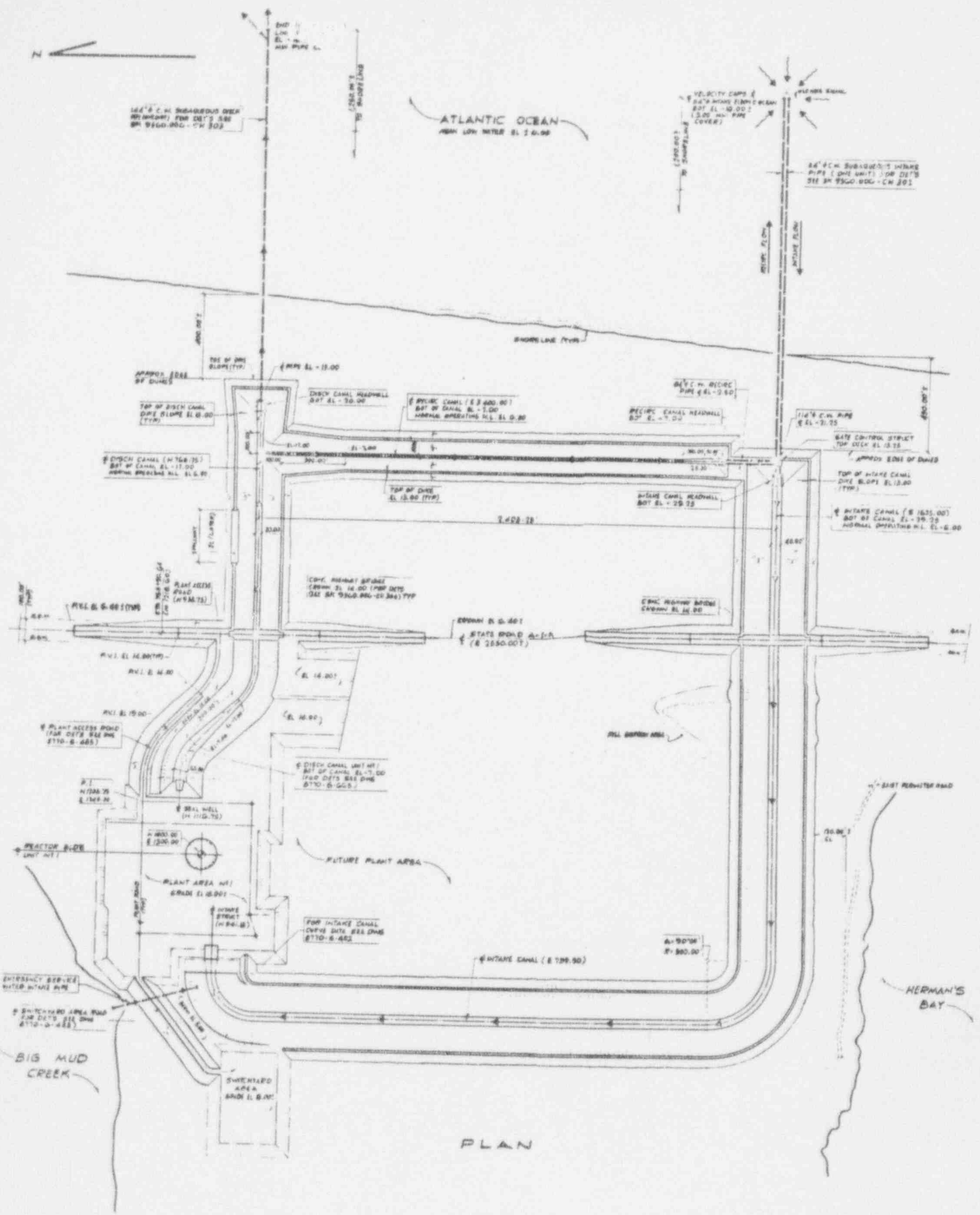
    d. That the base line cooling system design is modified for each of the three alternative discharge configurations that were considered by Florida Power and Light.

    Detail the delays, power purchases, environmental impacts, required acreage, and other assumptions that are associated with the above alternatives.

QUESTION 1 Provide a current plot plan with projected ground contours for the site including the canal, dike, fill areas, beach line, and the remainder of the site terrain.

ANSWER:

Figure 1-1 shows the most recent plot plan presenting contours and elevations. Details of the balance of site landscaping are not complete at this time.



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
CIRCULATING WATER SYSTEM
FIGURE 1-1

QUESTION 2 Indicate those mosquito species which are produced on Hutchinson Island, any disease vectors found in this area, and Florida Power & Light's plans for aiding the mosquito control program.

ANSWER:

The only mosquito species indigenous to Hutchinson Island is the salt marsh mosquito (Aedes taeniorhynchus). The common varieties of domestic mosquitoes (Culex species) are not capable of breeding in salt water marshes and thus are not to be found on Hutchinson Island. The salt marsh mosquito is not a carrier of encephalitis and correspondingly there have been no reports of disease vectors made to the St. Lucie County Health Department for the Hutchinson Island area. Florida Power & Light is giving full support to the St. Lucie County Mosquito Control District and allows the Control District personnel to flood the low lying land on the site in order to control mosquito breeding by natural fish predation of mosquito larvae.

QUESTION 3 Estimate the proportion of the world population of turtles which nest on Hutchinson Island. Include data for green, leatherback and loggerhead turtles.

ANSWER:

No data has been found to reasonably estimate the world population of sea turtles to better than a factor of 3 or 4. Certainly, no data exists on the current population ratios among the green, loggerhead and leatherback varieties. However, of the three, the leatherback is the least commonly seen on Hutchinson Island. These turtles range throughout the world, principally between the latitudes of 35°N and 35°S. The Hutchinson Island shoreline is estimated to contain about 0.1% of the world shoreline suitable and active for turtle nesting. On the basis of nesting data summarized in Item 4, Supplement 2 of the Environmental Report and on food industry data in "Sea Turtles and the Turtle Industry" by R. M. Ingle and F. G. W. Smith (University of Miami Press, 1949), the world population of sea turtles is approximately 10,000,000. The proportion of the world population of sea turtles that nested on Hutchinson Island in 1971 is about 1/3000, or 0.033 per cent.

The Hutchinson Island plant site nesting shoreline is slightly less than one tenth of the entire ocean side shoreline length of the island. Thus the typical proportion of the world population of sea turtles nesting on site is of the order of 0.003 per cent.

QUESTION 4 Describe the continuing environmental studies conducted by the Department of Natural Resources at the site. Include the objectives and scope of these studies as well as their planned duration. Indicate the personnel involved and the intended disposition of data collected.

ANSWER:

The Florida Department of Natural Resources (FDNR) is currently conducting a two year environmental studies program on the coastal waters near Hutchinson Island under the direction of the Chief of the Bureau of Marine Science and Technology. A seven member advisory committee of biologists from the FDNR Marine Research Laboratory in St. Petersburg, Florida has been selected to initiate and direct the progress of the study program.

The program will obtain biological data from five offshore stations located around the power plant discharge plume and from three beach stations near the plant site. The samples will be accumulated and analyzed from these and other mobile stations and will include investigations on amphipods, stomatopods, zooplankton, decapod crustaceans, lancelets, chlorophyll α, particulate matter, sediments, isopods, mollusks, echinoderms, polychaetes, phytoplankton, benthic algae, dissolved oxygen and trace metals. The analysis of these data along with temperature, flow and weather variations will establish a marine environmental balance for the on and offshore waters prior to startup of the Hutchinson Island unit.

This data will be used to determine if any actual marine environmental impact occurs from operation of the Hutchinson Island Power Plant.

QUESTION 5 Provide the height above mean low water for the dome and vent.

ANSWER:

The height above mean low water for the dome is 225.5 feet and for the plant vent (stack) is 202.67 feet.

QUESTION 6 List the estimated amounts and types of liquid and solid radioactive wastes to be generated during operation. Describe the method of packaging for shipmer to be used for these.

ANSWER:

The estimated quantities and sources of wastes to be shipped off-site excluding spent fuel are given on Table 6-1.

No wastes are expected to be shipped off-site in liquid form. In preparation for off-site disposal, spent ion exchanger resins may be sluiced from the ion exchangers directly to an outside shipping cask or may be stored in the spent resin tank and then sluiced to an outside shipping cask when off-site shipment disposal is required. Alternately the spent resin tank contents may be sluiced to drums at the drumming station.

Concentrator bottoms are pumped into 55 gallon drums at the drumming station and mixed with preloaded cement by rolling the drums.

Filter element assemblies are transferred from their respective housings to shipping containers via shielded transfer casks.

Miscellaneous radioactive solid wastes are collected in 55 gallon drums and compacted by a hydraulic baler. The baler is totally enclosed.

Solid wastes are removed from the site at scheduled intervals for burial by an AEC license contractor in accordance with DOT, ICC and other applicable safety regulations.

TABLE 6-1

SOLID RADIOACTIVE WASTES

Source	Waste Generating Operation	Volume or Quantity
Wastes Converted to Solid Form		
Dewatered Spent Resin	Sluice ion exchangers once per year	256 ft^3/yr
Concentrator Bottoms	Miscellaneous waste processing	8,000 gal/yr
Filter Elements	Change filter elements twice per year	14 per year

DElEtE

QUESTION Describe in detail the procedures for defouling the intake structure by recirculation. This description should include the following: the maximum water temperature to be achieved at the inlet structure and the temperature rise necessary to achieve it; the flow rate discharged from both the intake structure and outfall structure; the velocity of water entering the intake velocity cap during recirculation when all plant cooling water will enter one of the two intake pipes; the intake and outfall velocity, the maximum surface temperature rise expected; the length of time for this mode of operation (recirculation); and the frequency of recirculation. This information is necessary for the range of ambient water temperatures existing throughout the year.

ANSWER:

Fouling studies show that the uncontrolled growth of maring organisms, such as barnacles, in the intake and discharge pipelines will rapidly increase the flow resistance of the circulating water system such that the plant would have to be shut down after a few months of operation. A procedure for controlling such marine growth has been developed based on utility practice on the west coast wherein the discharge water is heated to 122-125 F and diverted into each of the intake pipe lines for approximately 4-6 hours once each month.

The procedure for circulating the plant discharge water into the intake pipe lines is as follows. First the amount of water being pumped to the main steam condenser is reduced and the plant power adjusted as required such that the water temperature leaving the condenser is maintained at 122-125 F. This operation is dependent on the temperature of the water entering the condenser which varies from 65 to 85 F. The condenser operation is summarized in the following table.

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TABLE 7-1

MAIN STEAM CONDENSER OPERATION FOR
CIRCULATING 125 F WATER TO OCEAN INTAKE PIPE LINES

PLANT POWER	INTAKE WATER TEMP	CONDENSER DISCHARGE WATER TEMP	TEMPERATURE RISE	CONDENSER WATER FLOW RATE
840 Mwe *	85F	109F	24F	1080 CFS **
840 Mwe	85F	125F	40F	675 CFS
840 Mwe	75F	125F	50F	540 CFS
840 Mwe	65F	125F	60F	450 CFS
640 Mwe	85F	104F	19F	1080 CFS
640 Mwe	85F	125F	40F	525 CFS
640 Mwe	75F	125F	50F	420 CFS
640 Mwe	65F	Unit not capable of raising temp to 125F		

* Unit full load, no recirculation
** Total circulating water flow is 1180 CFS, 1080 of which is for the main steam condenser

After approximately 30 minutes, the 125 F water will reach the entrance of the recirculation canal connecting the discharge canal to the intake canal, at which time sluice gates will be adjusted to divert approximately 40% of the discharge flow into one of the intake pipe lines. After an additional two hours, the water throughout the intake line will reach 120 F, the temperature required for defouling the line. After four hours at this temperature, normal intake flow will be re-established in the treated line and the recirculating water will be diverted to the other intake line for the same treatment.

At approximately one hour after the defouling operation is initiated, water discharging from the subaqueous wye discharge line will be approximately 120 F. The temperature rise of this water is defined as the difference between the temperature leaving the wye discharge and the ocean ambient temperature. The resulting ocean surface temperature increase is approximately one-third of the temperature rise and will encompass approximately the same surface area as the 6° isotherm shown in Figure 2.3.3-3 of the Environmental Report. The water discharging from the intake line during the time it is being defouled will mix with the water entering the adjacent intake line and thus limit the surface temperature rise to a few degrees. This mixing will also increase the temperature of the water entering the main steam condenser and the water flow will have to be adjusted to maintain the temperature of the water leaving the condenser at 122-125 F.

The velocity of the water in the intake and discharge lines during the defouling operation is summarized in the following Table.

TABLE 7-2

OCEAN INTAKE AND DISCHARGE PIPELINE
WATER VELOCITIES DURING RECIRCULATION

CIRCULATING WATER SYSTEM FLOW RATE	WYE DISCHARGE VELOCITY	WATER VELOCITY AT INTAKE VELOCITY CAP
700 CFS	7.9 FPS	2.0 FPS
500 CFS	5.6 FPS	1.4 FPS
300 CFS	3.4 FPS	0.9 FPS

QUESTION 8 Provide a detailed analysis including source data associated with the alternatives for transmission line crossings from the Indian River. These alternatives should include: 1) conventional overhead transmission, 2) the currently planned overhead transmission system and 3) underground transmission with mainland switchyard facilities located near the railroad tracks. The cost analysis should be consistent with the formula used on Page VI-3 of the Environmental Report Supplement and should break out crossing costs and switchyard facility costs separately. Other environmental advantages and disadvantages including aesthetic and ecological should be described for each alternative. The principal reasons for selecting the presently planned system and discarding the other alternatives should be presented.

ANSWER:

The design of the river crossing portion of the transmission system was chosen after consideration of environmental, aesthetic, economic and technical factors. Both underwater and overhead systems were considered.

The underwater system considered was pipe cables buried in a four foot deep, 30 foot wide trench. The cables are oil filled, cooled by conduction through the soil.

Underwater cables are limited to lower power capacities per circuit than overhead transmission lines. Although reliability experience has been excellent, the design must assume that failures will occur. It would require approximately four to six months to repair a failed cable, assuming the failure did not result in the pipe rupturing and contaminating the cable with water. A repair to a cable would require that the pipe be lifted out of the water at the point of failure, the pipe cut, and the damaged section of cable removed in order to determine the length of new cable required. A section of new cable would then be ordered from the manufacturer, which would require several weeks. Once the new cable is received, it can then be spliced and repairs to the pipe finished. This phase will require approximately two to three weeks.

Should the cable failure result in a pipe rupture which would allow the cable to be contaminated with salt water, replacement of the entire cable would then be necessary. Up to one year would be required before the cable could be returned to service.

Based on capacity and repair considerations, to carry the full plant output while meeting the required standards of reliability, would require four circuits for the river crossing, while only two are required for overhead transmission. The use of underwater transmission would require a substation on the mainland to connect the four underwater circuits to two overhead transmission circuits in the overland portion. Additional equipment would also be required at the plant substation for four circuits, as compared to the requirements for two overhead circuits.

A one-year delay is estimated if an underwater cable is used.

Aesthetically, underwater transmission is obviously most desirable. However, it is the most damaging ecologically, since the dredging and backfill would be required across the entire width of the Indian River, and further dredging and backfilling would be required for repairs. The cables would be filled with oil under pressure creating a potential environmental hazard from leakage of oil to the Indian River. In the event of cable casing leakage, oil pressure would be maintained in the cable until it could be repaired. Loss of oil pressure following pipe failure would allow salt water to enter the cable, necessitating replacement of the entire cable.

The overhead transmission systems considered included a long span design with steel towers and a concrete H-frame design. Either type would consist of two circuits with no additional substation or switching equipment. The steel tower design, although more expensive, was chosen on the basis of aesthetics and minimum disturbance to the Indian River.

Construction of the H-frame or steel tower line will be done using a barge. Some dredging may be required to allow it to reach the tower locations. It is apparent that more dredging would be required for the H-frame design.

On the basis of aesthetics, a single conductor per phase was chosen rather than the two conductors per phase which would otherwise be used.

Table 8-1 summarizes the costs associated with various systems.

TABLE 8-1

COST COMPARISON
INDIAN RIVER CROSSING
(THOUSANDS OF DOLLARS)

	Steel Towers	Conventional Overhead	Underground Cable
Additional Cost of Plant Switchyard for Underwater Cable Terminals	-	-	$ 575
4 - 240 KV 2,500 kcmil Cables	-	-	6,000
Mainland Substation to Terminate Cables	-	-	2,500
Steel Tower Line - 2 Circuits	3,000	-	
Wood H-frame Line - 2 Circuits (24 Structures per Circuit in the Water)	-	1,200	
Total	$3,000	$1,200	$9,075

QUESTION 9 Update the Table of Page V-11 of the Environmental Report Supplement to include data through 1980.

ANSWER:

Table 9-1 shows the required data.

TABLE 9-1

FLORIDA POWER & LIGHT COMPANY
SUMMER PEAK LOADS, CAPABILITIES AND RESERVES
(Capability is Summer Peak Capability)

Year	Peak Load Gross 15-Min. MW	% Incr.	Capability MW	Reserve		Largest Unit	Reserve with Largest Unit Out		Gas Turbine	
				MW	%		MW	%	MW	% Capability
1961	1636	13.9	1963	327	20.0	225	102	6.2		
1962	1874	14.5	2263	389	20.8	300	89	4.7		
1963	2163	15.4	2538	375	17.3	300	75	3.5		
1964	2419	11.8	2938	519	21.5	400	119	4.9		
1965	2693	11.3	3597	904	33.6	400	504	18.7		
1966	3038	12.8	3498	460	15.1	400	60	2.0		
1967	3338	9.9	3898	560	16.8	400	160	4.8		
1968	4004	20.0	4298	294	7.3	400	(106)	(2.6)		
1969	4563	14.0	5125	562	12.3	400	162	3.6		
1970	5230	14.6	5569	339	6.4	400	(61)	(1.2)	444	8.0
1971	5635	7.7	6013	378	6.7	400	(22)		888	14.8
1972	6500	11.5	7585	1085	16.7	728	357	5.5	1332	17.6
		(Turkey Point #3 - 760/728 MW - 6/72)								
		(Sanford #4 - 419/400 MW - 6/72)								
		(Lauderdale Gas Turbines - 444 MW - 7/72)								
1973	7250	11.7	8713	1463	20.2	728	735	10.1	1332	15.3
		(Turkey Point #4 - 760/728 MW - 12/72)								
		(Sanford #5 - 419/400 MW - 1/73)								
1974	8100	11.7	9563	1463	18.1	850	613	7.6	1332	13.9
		(Hutchinson Island #1 - 890/850 MW - 5/74)								
1975	9000	11.1	10363	1363	15.1	850	513	5.7	1332	12.9
		(Port Manatee #1 - 850/800 MW - 1/75)								
1976	10000	11.1	11607	1607	16.1	850	757	7.6	1776	15.3
		(Port Manatee #2 - 850/800 MW - 4/76)								
		(Gas Turbines - 444 MW - 5/76)								

TABLE 9-1 (Cont'd)

Year	Peak Load Gross 15-Min. MW	% Incr.	Capability MW	Reserve MW	Reserve %	Largest Unit	Reserve with Largest Unit Out MW	Reserve with Largest Unit Out %	Gas Turbine MW	Gas Turbine % Capability
1977	11150	11.5	12851	1701	15.3	850	851	7.6	2220	17.3
		(Unit X - 850/800 MW - 4/77)								
		(Gas Turbines - 444 MW - 5/77)								
1978	12400	11.2	14095	1695	13.7	850	845	6.8	2664	18.9
		(Unit Y - 850/800 MW - 4/78)								
		(Gas Turbines - 444 MW - 5/78)								
1979	13800	11.3	15695	1895	13.7	850	1045	7.6	2664	16.9
		(Unit - 850/800 MW - 4/79)								
		(Unit - 850/800 MW - 5/79								
1980	15400	11.5	17739	2339	15.2	850	1489	9.7	3108	17.5
		(Unit - 850/800 MW - 4/80)								
		(Unit - 850/800 MW - 5/80)								
		(Gas Turbines - 444 MW - 5/80)								
1981	17100	11.0	19339	2239	13.1	850	1389	8.1	3108	16.1
		(Unit - 850/800 MW - 4/81)								
		(Unit - 850/800 MW - 5/81)								

Notes: Capability shown is Winter Gross/Summer Gross - MW.
Capability does not reflect Turkey Point power curtailment to avoid exceeding Card Sound effluent temperature limits.

QUESTION 10 Separate total generation capacity for a five to six year period surrounding 1974 into the percent available from base load units versus percent available from peaking units.

ANSWER:

Table 10-1 shows the required data.

QUESTION 8 Provide a detailed analysis including source data associated with the alternatives for transmission line crossings from the Indian River. These alternatives should include: 1) conventional overhead transmission, 2) the currently planned overhead transmission system and 3) underground transmission with mainland switchyard facilities located near the railroad tracks. The cost analysis should be consistent with the formula used on Page VI-3 of the Environmental Report Supplement and should break out crossing costs and switchyard facility costs separately. Other environmental advantages and disadvantages including aesthetic and ecological should be described for each alternative. The principal reasons for selecting the presently planned system and discarding the other alternatives should be presented.

ANSWER:

The design of the river crossing portion of the transmission system was chosen after consideration of environmental, aesthetic, economic and technical factors. Both underwater and overhead systems were considered.

The underwater system considered was pipe cables buried in a four foot deep, 30 foot wide trench. The cables are oil filled, cooled by conduction through the soil.

Underwater cables are limited to lower power capacities per circuit than overhead transmission lines. Although reliability experience has been excellent, the design must assume that failures will occur. It would require approximately four to six months to repair a failed cable, assuming the failure did not result in the pipe rupturing and contaminating the cable with water. A repair to a cable would require that the pipe be lifted out of the water at the point of failure, the pipe cut, and the damaged section of cable removed in order to determine the length of new cable required. A section of new cable would then be ordered from the manufacturer, which would require several weeks. Once the new cable is received, it can then be spliced and repairs to the pipe finished. This phase will require approximately two to three weeks.

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Total	$3,000	$1,200	$9,075

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TABLE 9-1 (Cont'd)

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		(Unit - 850/800 MW - 4/79)								
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		(Unit - 850/800 MW - 4/80)								
		(Unit - 850/800 MW - 5/80)								
		(Gas Turbines - 444 MW - 5/80)								
1981	17100	11.0	19339	2239	13.1	850	1389	8.1	3108	16.1
		(Unit - 850/800 MW - 4/81)								
		(Unit - 850/800 MW - 5/81)								

Notes: Capability shown is Winter Gross/Summer Gross - MW.
Capability does not reflect Turkey Point power curtailment to avoid exceeding Card Sound effluent temperature limits.

QUESTION 10 Separate total generation capacity for a five to six year period surrounding 1974 into the percent available from base load units versus percent available from peaking units.

ANSWER:

Table 10-1 shows the required data.

QUESTION 8 Provide a detailed analysis including source data associated with the alternatives for transmission line crossings from the Indian River. These alternatives should include: 1) conventional overhead transmission, 2) the currently planned overhead transmission system and 3) underground transmission with mainland switchyard facilities located near the railroad tracks. The cost analysis should be consistent with the formula used on Page VI-3 of the Environmental Report Supplement and should break out crossing costs and switchyard facility costs separately. Other environmental advantages and disadvantages including aesthetic and ecological should be described for each alternative. The principal reasons for selecting the presently planned system and discarding the other alternatives should be presented.

ANSWER:

The design of the river crossing portion of the transmission system was chosen after consideration of environmental, aesthetic, economic and technical factors. Both underwater and overhead systems were considered.

The underwater system considered was pipe cables buried in a four foot deep, 30 foot wide trench. The cables are oil filled, cooled by conduction through the soil.

Underwater cables are limited to lower power capacities per circuit than overhead transmission lines. Although reliability experience has been excellent, the design must assume that failures will occur. It would require approximately four to six months to repair a failed cable, assuming the failure did not result in the pipe rupturing and contaminating the cable with water. A repair to a cable would require that the pipe be lifted out of the water at the point of failure, the pipe cut, and the damaged section of cable removed in order to determine the length of new cable required. A section of new cable would then be ordered from the manufacturer, which would require several weeks. Once the new cable is received, it can then be spliced and repairs to the pipe finished. This phase will require approximately two to three weeks.

Should the cable failure result in a pipe rupture which would allow the cable to be contaminated with salt water, replacement of the entire cable would then be necessary. Up to one year would be required before the cable could be returned to service.

Based on capacity and repair considerations, to carry the full plant output while meeting the required standards of reliability, would require four circuits for the river crossing, while only two are required for overhead transmission. The use of underwater transmission would require a substation on the mainland to connect the four underwater circuits to two overhead transmission circuits in the overland portion. Additional equipment would also be required at the plant substation for four circuits, as compared to the requirements for two overhead circuits.

A one-year delay is estimated if an underwater cable is used.

Aesthetically, underwater transmission is obviously most desirable. However, it is the most damaging ecologically, since the dredging and backfill would be required across the entire width of the Indian River, and further dredging and backfilling would be required for repairs. The cables would be filled with oil under pressure creating a potential environmental hazard from leakage of oil to the Indian River. In the event of cable casing leakage, oil pressure would be maintained in the cable until it could be repaired. Loss of oil pressure following pipe failure would allow salt water to enter the cable, necessitating replacement of the entire cable.

The overhead transmission systems considered included a long span design with steel towers and a concrete H-frame design. Either type would consist of two circuits with no additional substation or switching equipment. The steel tower design, although more expensive, was chosen on the basis of aesthetics and minimum disturbance to the Indian River.

Construction of the H-frame or steel tower line will be done using a barge. Some dredging may be required to allow it to reach the tower locations. It is apparent that more dredging would be required for the H-frame design.

On the basis of aesthetics, a single conductor per phase was chosen rather than the two conductors per phase which would otherwise be used.

Table 8-1 summarizes the costs associated with various systems.

TABLE 8-1

COST COMPARISON
INDIAN RIVER CROSSING
(THOUSANDS OF DOLLARS)

	Steel Towers	Conventional Overhead	Underground Cable
Additional Cost of Plant Switchyard for Underwater Cable Terminals	-	-	$ 575
4 - 240 KV 2,500 kcmil Cables	-	-	6,000
Mainland Substation to Terminate Cables	-	-	2,500
Steel Tower Line - 2 Circuits	3,000	-	
Wood H-frame Line - 2 Circuits (24 Structures per Circuit in the Water)	-	1,200	
Total	$3,000	$1,200	$9,075

QUESTION 9 Update the Table of Page V-11 of the Environmental Report Supplement to include data through 1980.

ANSWER:

Table 9-1 shows the required data.

TABLE 9-1

FLORIDA POWER & LIGHT COMPANY
SUMMER PEAK LOADS, CAPABILITIES AND RESERVES
(Capability is Summer Peak Capability)

Year	Peak Load Gross 15-Min. MW	% Incr.	Capability MW	Reserve MW	Reserve %	Largest Unit	Reserve with Largest Unit Out MW	Reserve with Largest Unit Out %	Gas Turbine MW	Gas Turbine % Capability
1961	1636	13.9	1963	327	20.0	225	102	6.2		
1962	1874	14.5	2263	389	20.8	300	89	4.7		
1963	2163	15.4	2538	375	17.3	300	75	3.5		
1964	2419	11.8	2938	519	21.5	400	119	4.9		
1965	2693	11.3	3597	904	33.6	400	504	18.7		
1966	3038	12.8	3498	460	15.1	400	60	2.0		
1967	3338	9.9	3898	560	16.8	400	160	4.8		
1968	4004	20.0	4298	294	7.3	400	(106)	(2.6)		
1969	4563	14.0	5125	562	12.3	400	162	3.6		
1970	5230	14.6	5569	339	6.4	400	(61)	(1.2)	444	8.0
1971	5635	7.7	6013	378	6.7	400	(22)		888	14.8
1972	6500	11.5	7585	1085	16.7	728	357	5.5	1332	17.6
		(Turkey Point #3 - 760/728 MW - 6/72)								
		(Sanford #4 - 419/400 MW - 6/72)								
		(Lauderdale Gas Turbines - 444 MW - 7/72)								
1973	7250	11.7	8713	1463	20.2	728	735	10.1	1332	15.3
		(Turkey Point #4 - 760/728 MW - 12/72)								
		(Sanford #5 - 419/400 MW - 1/73)								
1974	8100	11.7	9563	1463	18.1	850	613	7.6	1332	13.9
		(Hutchinson Island #1 - 890/850 MW - 5/74)								
1975	9000	11.1	10363	1363	15.1	850	513	5.7	1332	12.9
		(Port Manatee #1 - 850/800 MW - 1/75)								
1976	10000	11.1	11607	1607	16.1	850	757	7.6	1776	15.3
		(Port Manatee #2 850/800 MW - 4/76)								
		(Gas Turbines - 444 MW - 5/76)								

TABLE 9-1 (Cont'd)

Year	Peak Load Gross 15-Min. MW	% Incr.	Capability MW	Reserve MW	Reserve %	Largest Unit	Reserve with Largest Unit Out MW	Reserve with Largest Unit Out %	Gas Turbine MW	Gas Turbine % Capability
1977	11150	11.5	12851	1701	15.3	850	851	7.6	2220	17.3
		(Unit X - 850/800 MW - 4/77)								
		(Gas Turbines - 444 MW - 5/77)								
1978	12400	11.2	14095	1695	13.7	850	845	6.8	2664	18.9
		(Unit Y - 850/800 MW - 4/78)								
		(Gas Turbines - 444 MW - 5/78)								
1979	13800	11.3	15695	1895	13.7	850	1045	7.6	2664	16.9
		(Unit - 850/800 MW - 4/79)								
		(Unit - 850/800 MW - 5/79								
1980	15400	11.5	17739	2339	15.2	850	1489	9.7	3108	17.5
		(Unit - 850/800 MW - 4/80)								
		(Unit - 850/800 MW - 5/80)								
		(Gas Turbines - 444 MW - 5/80)								
1981	17100	11.0	19339	2239	13.1	850	1389	8.1	3108	16.1
		(Unit - 850/800 MW - 4/81)								
		(Unit - 850/800 MW - 5/81)								

Notes: Capability shown is Winter Gross/Summer Gross - MW.
Capability does not reflect Turkey Point power curtailment to avoid exceeding Card Sound effluent temperature limits.

QUESTION 10 Separate total generation capacity for a five to six year period surrounding 1974 into the percent available from base load units versus percent available from peaking units.

ANSWER:

Table 10-1 shows the required data.

TABLE 10-1

FLORIDA POWER & LIGHT COMPANY
SUMMER PEAK CAPABILITY - GROSS

Year	Total Capability MW	Base Load Units MW	Base Load Units % Capability	Gas Turbines MW	Gas Turbines % Capability
1968	4298	4298	100.0		
1969	5125	5125	100.0		
1970	5569	5125	92.0	444	8.0
1971	6013	5125	85.2	888	14.8
1972	7585	6253	82.4	1332	17.6
1973	8713	7381	84.7	1332	15.3
1974	9563	8231	86.1	1332	13.9
1975	10363	9031	87.1	1332	12.9
1976	11607	9831	84.7	1776	15.3
1977	12851	10631	82.7	2220	17.3
1978	14095	11431	81.1	2664	18.9
1979	15695	13031	83.1	2664	16.9
1980	17739	14631	82.5	3108	17.5

Note: Capability does not reflect Turkey Point power curtailment to avoid exceeding Card Sound effluent temperature limits.

QUESTION 11 Document load curtailments, voltage reductions, etc. that have occurred in recent years as well as those anticipated to occur in 1972.

ANSWER:

Table 11-1 shows data on load curtailment occurring from December, 1968 through 1971. Load curtailment results from a combination of circumstances, such as weather conditions and forced outages of generating units, due to mechanical or electrical failure. Reserves are maintained to allow for these events; obviously, curtailment becomes more likely as reserves are decreased, but cannot be anticipated or predicted.

TABLE 11-1

FP&L - RESULTS OF LOAD CURTAILMENT

Date	Load Curtailment Period	Number of Customers	Amount of Load Curtailed-Kw
12/16/68	5:00 - 7:00 PM	155	115,688
7/7/69	4:00 - 7:00 PM	46	87,240
7/8/69	4:00 - 7:00 PM	58	86,210
7/9/69	4:00 - 7:00 PM	67	77,980
1/8/70	5:00 - 9:00 PM	281	151,680
1/9/70	6:30 - 10:30 AM	204	131,080
1/9/70	5:00 - 9:00 PM	337	161,290
1/10/70	7:00 - 10:30 AM	254	148,910
1/10/70	5:00 - 9:00 PM	215	131,410
2/4/70	5:30 - 9:00 PM	182	122,660
7/15/70	4:45 - 7:00 PM	106	82,699 - Voluntary
7/16/70	4:30 - 7:00 PM	98	72,603 - Voluntary
7/27/70	4:00 - 7:00 PM	119	87,616 - Voluntary
7/28/70	4:30 - 7:00 PM	118	79,665
7/31/70	12:00 N- 10:00 PM	211	173,592
8/3/70	3:00 - 7:00 PM	349	112,237 - Voluntary
8/4/70	4:00 - 7:00 PM	108	80,422 - Voluntary
8/5/70	4:00 - 8:00 PM	317	104,452 - Voluntary
9/2/70	4:00 - 7:00 PM	257	105,570 - Voluntary
9/3/70	4:00 - 7:00 PM	137	90,072 - Voluntary
1/20/71	5:00 - 9:00 PM	467	175,272
4/29/71	4:00 - 8:00 PM	703	202,110
4/30/71	4:00 - 8:00 PM	498	149,372 - Voluntary
6/16/71	4:00 - 7:00 PM	572	162,082 - Voluntary
8/18/71	3:00 - 7:00 PM	684	246,788

QUESTION 12 Detail planned additions and retirements to 1980 indicating location, capacity, type of unit (nuclear, fossil, turbine, etc.) and planned date of addition or retirement.

ANSWER:

The required data is shown on Table 12-1.

TABLE 12-1

FLORIDA POWER & LIGHT COMPANY
DETAILS OF CAPACITY ADDITIONS
BY UNIT THROUGH 1980

In-Service Season	Plant or Location	Size MW	Type
S-1972	Turkey Point #3	760/728	Nuclear
S-1972	Sanford #4	419/400	Fossil
S-1972	Lauderdale	444/444	Gas Turbine
W-1972/73	Turkey Point #4	760/728	Nuclear
S-1973	Sanford #5	419/400	Fossil
S-1974	Hutchinson Island #1	890/850	Nuclear
S-1975	Port Manatee #1	850/800	Fossil
S-1976	Port Manatee #2	850/800	Fossil
S-1976	Undetermined	444/444	Gas Turbine
S-1977	Undetermined	850/800	Fossil
S-1977	Undetermined	444/444	Gas Turbine
S-1978	Undetermined	850/800	Fossil
S-1978	Undetermined	444/444	Gas Turbine
S-1979	Undetermined	850/800	Fossil
S-1979	Undetermined	850/800	Fossil
S-1980	Undetermined	850/800	Fossil
S-1980	Undetermined	850/800	Fossil

Notes: Capabilities shown are Winter Gross/Summer Gross.
No retirements are scheduled.

QUESTION 13 Expand the table of Page V-2 of the Environmental Report Supplement to cover the period 1965 to 1980, if possible.

ANSWER:

Table 13-1 shows the required data. Figure 13-1 gives further details of system capacities and loads.

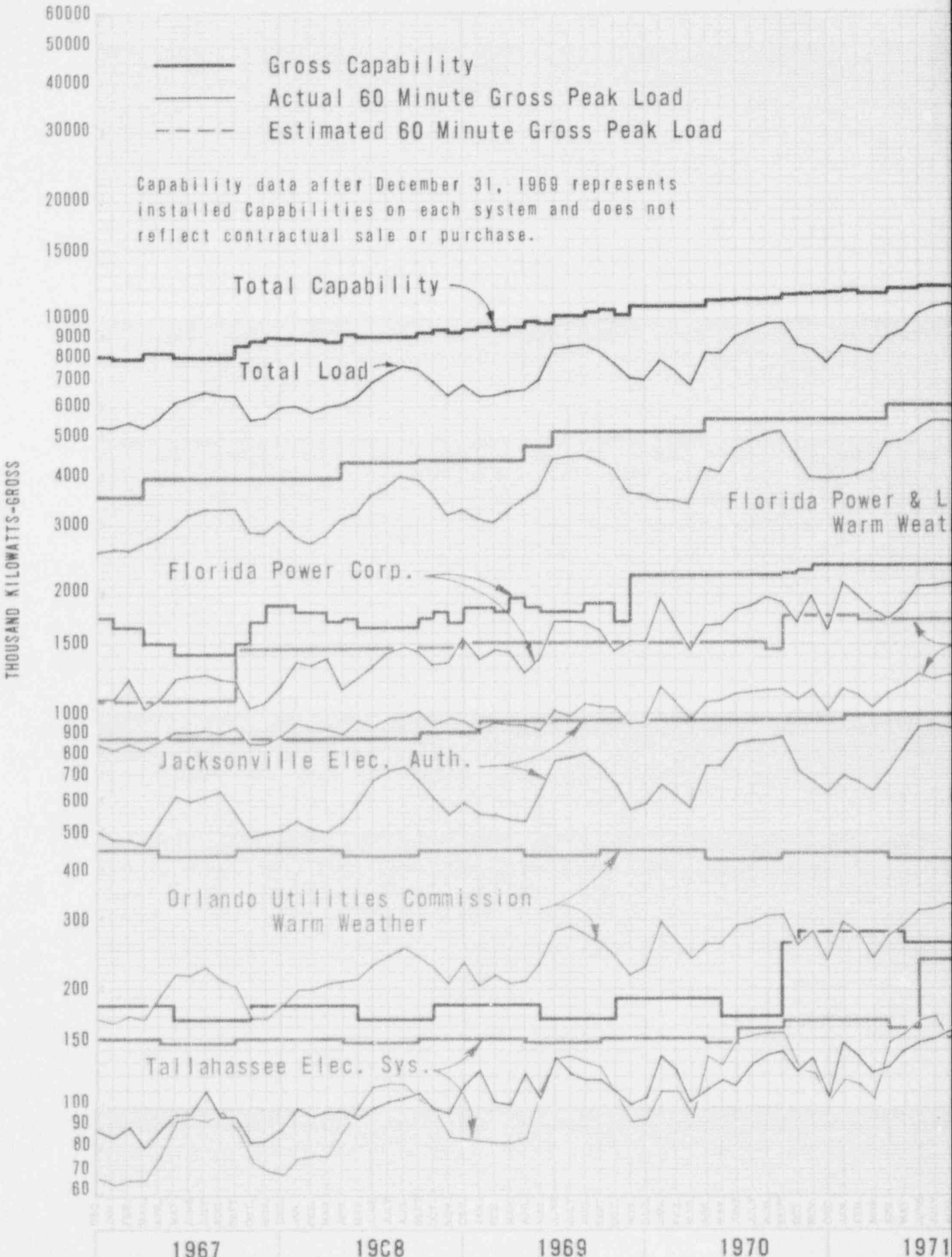
TABLE 13-1

SOUTHEASTERN ELECTRIC RELIABILITY COUNCIL
FLORIDA SUBREGION
ESTIMATED CAPABILITY-INTER-SUBREGIONAL EXCHANGE - RESERVE

Period	Peak Hour Load	Net Capability	Firm Power from	Total Capability	Load Responsibility	Reserve Megawatts	Reserve % Peak
1972 Summer	11371	13066	NONE	Same As Net Capability	Same As Peak Load	1695	14.9
72-73 Winter	11690	13791	↓	↓	↓	2101	18.0
1973 Summer	12574	15008				2434	19.4
73-74 Winter	12963	15833				2870	22.1
1974 Summer	13913	17477				3564	25.6
74-75 Winter	14319	17477				3158	22.1
1975 Summer	15337	20258				4921	32.1
75-76 Winter	15793	20258				4465	28.3
1976 Summer	16896	21418				4522	26.8
76-77 Winter	17438	21518				4080	23.4
1977 Summer	18597	23078				4481	24.1
77-78 Winter	19190	23278				4088	21.3
1978 Summer	20447	25785				5338	26.1
78-79 Winter	21110	26695				5585	26.5
1979 Summer	22474	28408				5934	26.4
79-80 Winter	23249	29233				5984	25.7
1980 Summer	24743	31627				6884	27.8
80-81 Winter	25490	31827				6337	24.9
1981 Summer	27171	33950				6779	25.0
81-82 Winter	27991	33950	↓	↓	↓	5959	21.3

GROSS CAPABILIT

FLORIDA POWER & LIGHT COMPANY - FLO
JACKSONVILE ELECTRIC AUTHORITY - ORLANDO UTILITIE



Data Furnished by Utilities Involved

...IES AND ESTIMATED LOADS

...RIDA POWER CORPORATION - TAMPA ELECTRIC COMPANY

...S COMMISSION - TALLAHASSEE ELECTRIC SYSTEM - CITY OF LAKELAND

ELB/JRS
1-31-72

ANSTEC
APERTURE
CARD

Also Available on
Aperture Card

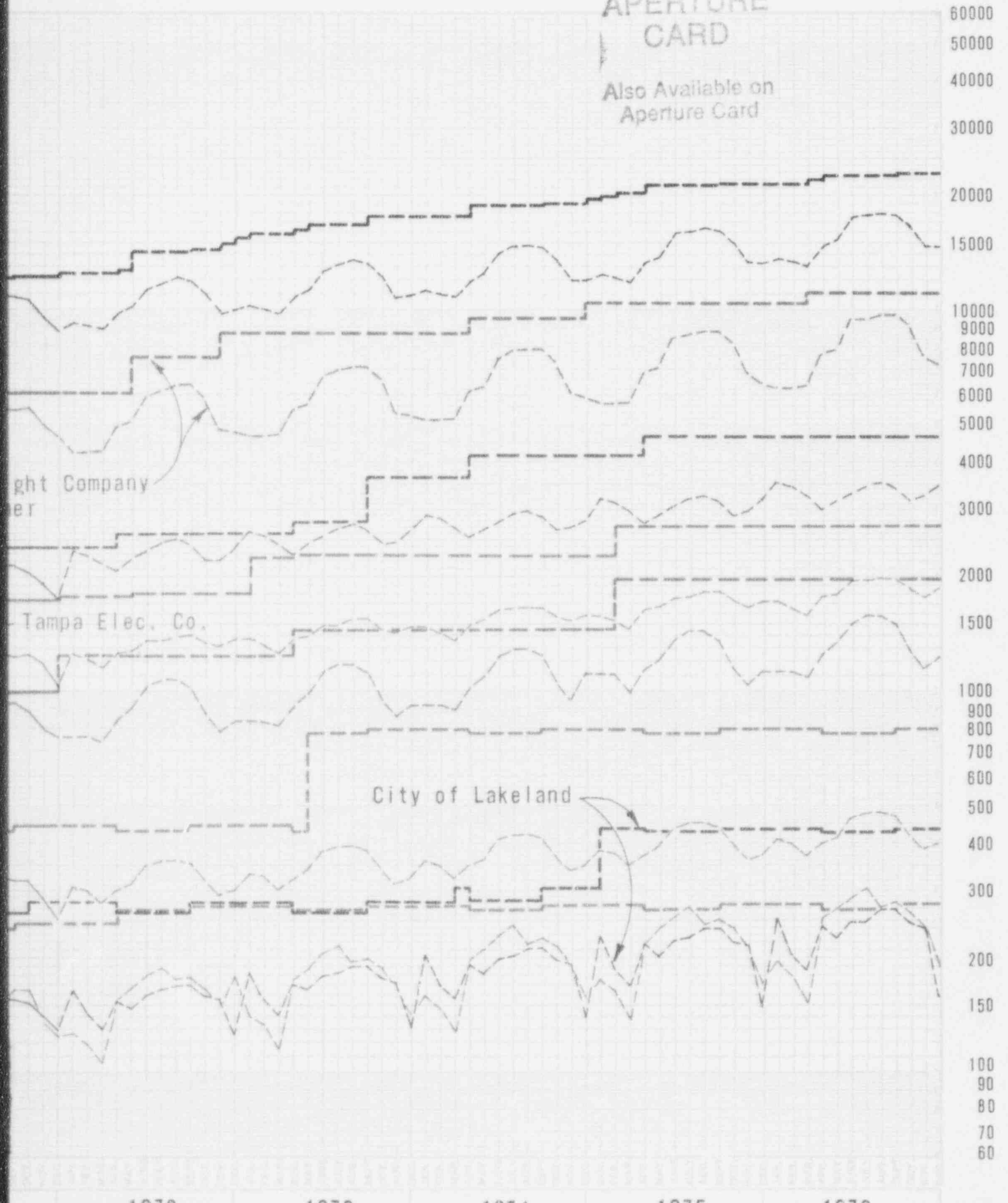


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FIGURE 13-1

QUESTION 14 Indicate the current cost of fuel oil suitable for (1) oil fired facilities and (2) gas turbine facilities.

ANSWER:

The current cost of low-sulfur fuel oil used in steam cycle generating plants is $3.33/bbl, or about 55¢/million Btu. The cost of fuel for gas-turbine generators is $4.90/bbl, or about 85¢/million Btu.

QUESTION 15 Estimate the salvage value of the plant assuming (1) construction of a nuclear facility at another site, and (2) construction of a fossil (oil) facility at the present site by either converting or abandoning the nuclear plant.

ANSWER:

Construction of a nuclear facility at another site would enable use of some items of major equipment such as the turbine-generator and feedwater heaters. The salvage value of these items (net after cost of removal and storage) is estimated to be about $20,000,000. A major portion of plant costs are for site preparation, foundations and structures, none of which can be salvaged for use at another site.

The plant is specifically designed as a nuclear unit. This is reflected not only in the steam supply, but also in the turbine cycle equipment which is designed for low temperature-low pressure steam conditions. The turbine generator has a guaranteed rating of 856 mw when operating with inlet steam conditions of 750 psi, 513 F. Typical fossil-fueled turbine-generators are designed for inlet steam conditions of 2400 to 3500 psi, 1000 F with reheat to 1000 F. Assuming construction of a fossil (oil) facility at the present site, salvage value would be about $2,000,000 for prepared site reclamation and otherwise virtually nil because of these differences.

QUESTION 16 Indicate the current status of construction including estimated percent completion, expenditures to date, and the portion of expenditures that remain unspent.

ANSWER:

Currently, construction of Hutchinson Island Unit 1 is approximately 20% complete. Field work completed includes site preparation, foundations, and erection of the containment structure. Major components have been completed such as the turbine-generator, reactor vessel, and steam generators. Expenditures to date total $100,000,000, and additional estimated expenditures are $100,000,000 of which approximately $50,000,000 are committed.

QUESTION 17 Indicate the environmental and economic impacts associated with the alternate sites considered, including the analysis used in selecting the plant site. Update Table 2.5.3-1 from Docket Nos. 50-250 and 50-251 as it applies to Hutchinson Island.

ANSWER:

At the time the choice was made, 1968, major criteria for the selection of the nuclear plant site were:

a) The distance of the site from population centers.

b) The availability of a large area of land at the site.

c) Natural characteristics of the site such that the impact on the environment would be minimal.

d) Proximity to the West Palm Beach load center.

e) Convenient access to navigable water for the transport of the heavy system components.

f) Provision for a cooling system with a minimum environmental effect.

A general discussion of siting problems in eastern Florida may be of interest. The major areas in which a plant could be located on the southeast coast include Miami and southward to the Keys, and the coast between West Palm Beach and Cape Kennedy. At Port Salerno and between Coral Gables and West Palm Beach the population density is too great to permit consideration.

The southern tip of Florida is largely occupied by Everglades National Park and, with the exception of Key Largo, the Florida Keys are too small to provide sites. Hurricane hazards are also higher along the Keys than elsewhere in Florida.

A Florida west coast site would require a long transmission line to reach the West Palm Beach load center, but the Naples to Sarasota coast could be considered. North of Sarasota the Gulf Coast is heavily populated as far as New Port Richey and beyond this point transmission costs are definitely excessive. The Tampa Bay area was then under consideration by FP&L for a large fossil unit and this unit, in addition to the seven Tampa Electric and three Florida Power Corporation stations already there, seemed to pre-empt the area.

Central Florida south of Lake Okeechobee is almost entirely Everglade Country. It includes the Big Cypress Swamp, the Seminole Indian Reservation and game sanctuaries. This area was ruled out because little is known about plant construction in such areas and because such construction would quite possibly prove hazardous to the ecology in the area. The area around Lake Okeechobee could be considered, however.

For convenience the site areas listed have been compared with the site selection criteria in Table 17-1. The criteria are abbreviated from the previous listing. The ratings on the table do not signify that the entire area could be ranked as given, but that certain of the more interesting sites which were believed to be available could be so ranked. This matter of actual availability of large tracts is critical. Site selection cannot be governed by academic rules but by the real estate market.

Although the comparisons on the table are qualitative they serve to demonstrate some important points. Concerning Lake Okeechobee, the environmental aspects of building a nuclear plant in that area were considerably less understood than were similar problems in a bay or estuarine location. The drought cycles in the Everglades which have had such disastrous results made it seem unwise to interfere, even slightly, with the local hydrology until the drought situation was clarified. This area was therefore dropped from consideration pending clarification of the hydrological questions.

Most possible sites in the Naples to Sarasota area would have a strong resemblance to Turkey Point. They would be situated on bays protected from the Gulf and hurricane damage by off-shore islands. These bays would probably be considerably less affected by pollution than is Biscayne Bay because the area lacks any cities comparable to Miami. It seemed quite possible that a satisfactory site could be selected in this area. Such a site could probably be much like Turkey Point but it would have the disadvantages of requiring a long and expensive transmission line to connect it to the load center. The cost-benefit aspects of such transmission lines are discussed in a subsequent section but the choice was made on the basis that, of two similar sites, the one requiring only a short transmission line is certainly preferable if the environmental aspects are equal.

A nuclear plant located on Key Largo would require protection from hurricanes and this would add considerably to the cost of the plant. Turkey Point is defended by the off-shore islands so that hurricane protection is less expensive. A large nuclear plant on Key Largo might not fit with the trend of development in the Keys, and on a relatively small island the plant would be more likely to intrude on its surroundings. The cooling water situation was also difficult. Fresh water supplies were not adequate for cooling towers and there was not sufficient area available for them. Heated water could not be discharged off-shore in the Key Largo Coral Reef Preserve.

As will be seen on the table, the area north of Palm Beach seemed to meet all the criteria, with Hutchinson Island being superior regarding proximity to the West Palm Beach load center.

From the above discussion the Lake Okeechobee area was ruled out, not on economic grounds, but because of its lack of access to navigable water and because since 1965 drought and hydrological questions made it unwise to locate a plant in the area.

The west coast of Florida, roughly from the vicinity of Naples to Sarasota, appeared to offer no specific advantages over other sites at that time. Possibly more interest would have developed in the west coast, but the distance was still excessive. Lacking any obvious advantages, the west coast had one definite disadvantage -- the necessity for transmission facilities. Estimates have been made of the average cost per mile of transmission line of sufficient capacity to handle the Hutchinson Island Nuclear Units. This average cost is $375,000 per mile. This can be applied to bracket the cost of a site between Naples and Sarasota as follows:

Naples to West Palm Beach	117 miles at $375,000/mile = $43,900,000
Sarasota to West Palm Beach	180 miles at $375,000/mile = $67,500,000

The cost of $375,000 per mile is an average cost which might well be exceeded in crossing the Everglades of southern Florida where it might be necessary to secure rights-of-way through Indian Reservations and parks. The cost given is only for land and construction; it does not include possible damage to the environment. This minimum additional cost for transmission, from $44 to $68 million, without any apparent offsetting advantages, ruled out the west coast except for west coast loads.

Key Largo, a possible east coast site, had the disadvantage of additional transmission line costs. Fifteen miles of land transmission line would have been required for Key Largo and a 1 mile water crossing from the Key to the mainland. This power line crossing has been estimated at $2,000,000. The total for transmission capital cost would be:

15 Miles at $375,000		$5,625,000
Water Crossing		2,000,000
	Total	$7,625,000

Although this sum is not large enough in itself to rule out the Key Largo site, this cost in addition to problems concerned with the effect of heated water discharges on the Key Largo Coral Reef serve and other questions contributed to disqualifying the site.

The total distance from West Palm Beach is around 155 miles which would bring transmission line costs to $58,100,000 at the average cost per mile given.

The selection of Hutchinson Island was justified both by the criteria of 1968 when the decision was made and by today's criteria.

The equivalent updated Table 2.5.3-1 from Docket Nos. 50-250 and 50-251 as it applies to the Hutchinson Island site is shown in Table 17-1.

TABLE 17-1

SITES AND SITE CRITERIA

	Site Areas					
Criteria	Hutchinson Island	Port Salerno	South of Miami	Key Largo	Naples to Sarasota	Lake Okeechobee
a. Population Centers	G	U	G	G	G	G
b. Large Areas Available	F	P	G	P	P	G
c. Environmental Aspects	G	P	G	F	G	G
d. Proximity to West Palm Beach Load Center	G	G	P	U	U	F
e. Navigable Water	G	G	G	G	G	G
f. Cooling System Aspects	G	F	G	G	G	F

Key: G - Good; F - Fair; P - Poor; U - Unacceptable

QUESTION 18 With reference to the equation of VI-3 of the Environmental Report Supplement, please provide the basic data required to complete this equation assuming the following alternatives: a. That the present site is abandoned and a nuclear facility of equivalent capacity is constructed elsewhere. b. That an equivalent capacity oil-fired facility is constructed at the present site, either converting or abandoning the nuclear plant. c. That the base line cooling system design is modified for a cooling lake (specify required acreage only). d. That the base line design is modified for each of the three alternative discharge configurations that were considered by Florida Power & Light.

Detail the delays, power purchases, environmental impacts, required acreage, and other assumptions that are associated with the above alternatives.

ANSWER:

The formula is:

$$\text{Present Value Generating Cost} = C + D + \sum_{n=1+J}^{M} \frac{L_n + O_n}{R^n} + \sum_{n=1}^{\ell} \frac{P_n M_n}{R^n}$$

where:

C = Total capital outlay when plant begins operation

D = Additional capital required by alternative

ℓ = Years of delay due to adoption of alternative

J = Years counted from start of full operation

M = Amortization period for the plant, years

P_n = Replacement power purchased in year n

M_n = Cost per kwh of replacement power

O_n = Yearly operating and maintenance cost plus nuclear insurance in year n

L_n = Total fuel cycle cost per year, equilibrium

R = Discount factor

n = Year

Assuming completion of the plant as planned, C = \$200,000,000; O_n = \$1,810,000; and L_n = \$10,000,000. Salvage values in the event of abandonment of the present plant are discussed in the answer to Question 15, and the costs incurred and committed to date are discussed in the answer to Question 16.

a. Construction cost of a nuclear facility at a new site is estimated at \$300/kw, or 255,000,000. Site selection, licensing and construction would be expected to delay the start of operation by about six years. Annual replacement power requirements, based on an 80% load factor, would be 5.96×10^9 kwh, at an average cost of 5 mills/kwh. Environmental effects associated with this alternate would, of course, depend on the specific new site.

b. Construction cost of an oil-fired facility at the Hutchinson Island site is estimated at \$150/kw, or \$128,000,000. Startup would be delayed by about three years. Annual replacement power requirements and costs would be the same as stated in the preceding paragraph. The major environmental effects of a fossil unit would be (1) stack emissions, (2) oil spill hazards inherent in fuel shipment and receipt, and (3) effects associated with construction of tanker unloading facilities and oil storage tanks.

c. A cooling lake would require a water surface area of approximately 1300 acres. Dikes, spoil banks, inlet and outlet structures, etc. would increase the total required area to perhaps 2000 acres, and a one year delay.

d. The Y type condenser cooling water discharge was compared with other discharge configurations and chosen considering environmental and economic considerations. Considering a low velocity, single-pipe discharge at an ocean depth of 18 feet as the base case, alternates considered were (1) the Y discharge, which is a high-velocity discharge at an ocean depth of 18 feet, (2) a low-velocity single pipe discharge at an ocean depth of 30 feet, and (3) a multi-port discharge configuration. The low-velocity discharge was rejected as resulting in an unacceptable temperature increase at the surface, but nevertheless serves as a base for economic comparisons. This comparison is shown in Table 18-1 below. The main economic differences are in construction costs, although there are minor differences in pumping power.

TABLE 18-1

OCEAN DISCHARGE COMPARISON

Configuration	Evaluated Cost Increment	Max. Surface ΔT	Estimated Delay
Low velocity, 18 ft. depth	Base	9.3 F	None
Y discharge	\$200,000	5.7	-
Low velocity, 30 ft. depth	\$1,000,000	5.7	1/2 year
Multiport	\$2,000,000	5.7	1/2 year

QUESTION 19 Identify the amounts, concentrations and frequency of occurrence of discharge of all chemicals discharged to the environment.

ANSWER:

The chemicals discharged from the plant into the circulating water system (530,000 gpm of ocean water) are identified in Section 2.3.4 of the Environmental Report. The amounts, concentration and frequency are tabulated in the following Table 19-1.

TABLE 19-1

CHEMICAL DISCHARGES

C[illegible]ical	Amount	Concentration	Frequency
Calcium (Note 1)	4.2 lb/hr	0.01 ppm (Note 2)	Continuous
Magnesium (Note 1)	0.4 lb/hr	0.001 ppm (Note 2)	Continuous
Sodium (Note 1)	0.8 lb/hr	0.002 ppm (Note 2)	Continuous
Chlorine (Note 3)		0	Two hours per week
Boric Acid	8,250 lbs	4 ppm (Note 2,4)	Once during plant life
	2,400 lbs	2 ppm (Note 2,5)	Once during each fuel cycle
	85 lb/yr	0 (Note 2,6)	Continuous

Note 1: Constituents of C[illegible] of Ft. Pierce water at 300 gpm collected by ion exchange and [illegible]equently removed from the ion exchange resin through resin regeneration.

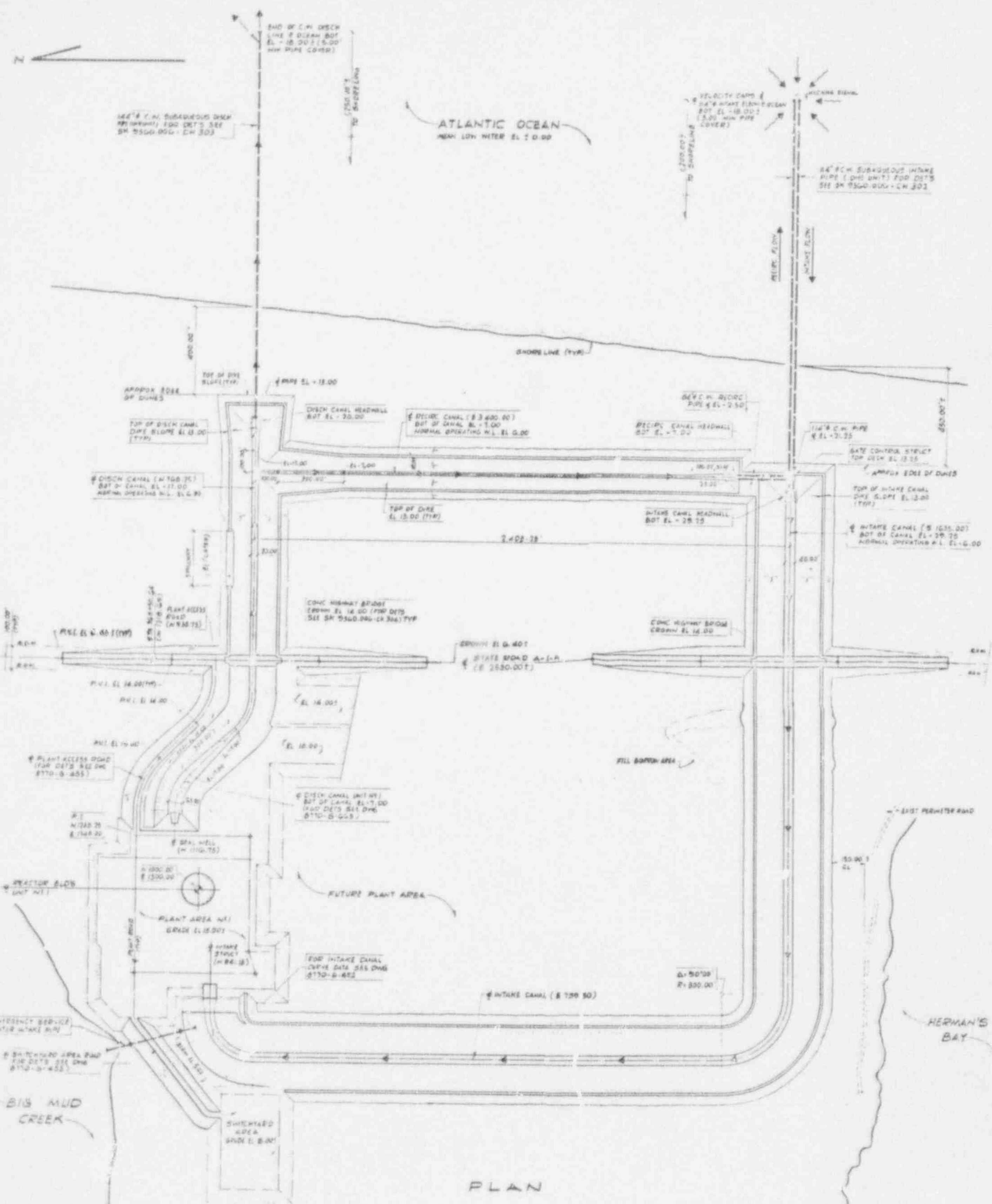
Note 2: Increase in ocean concentration at point of discharge into the ocean.

Note 3: Chlorine used for control of marine growth in plant equipment. Chlorine residual of 1 1/2 ppm leaving the plant will be completely depleted before discharge into the ocean by further action in the circulating water system.

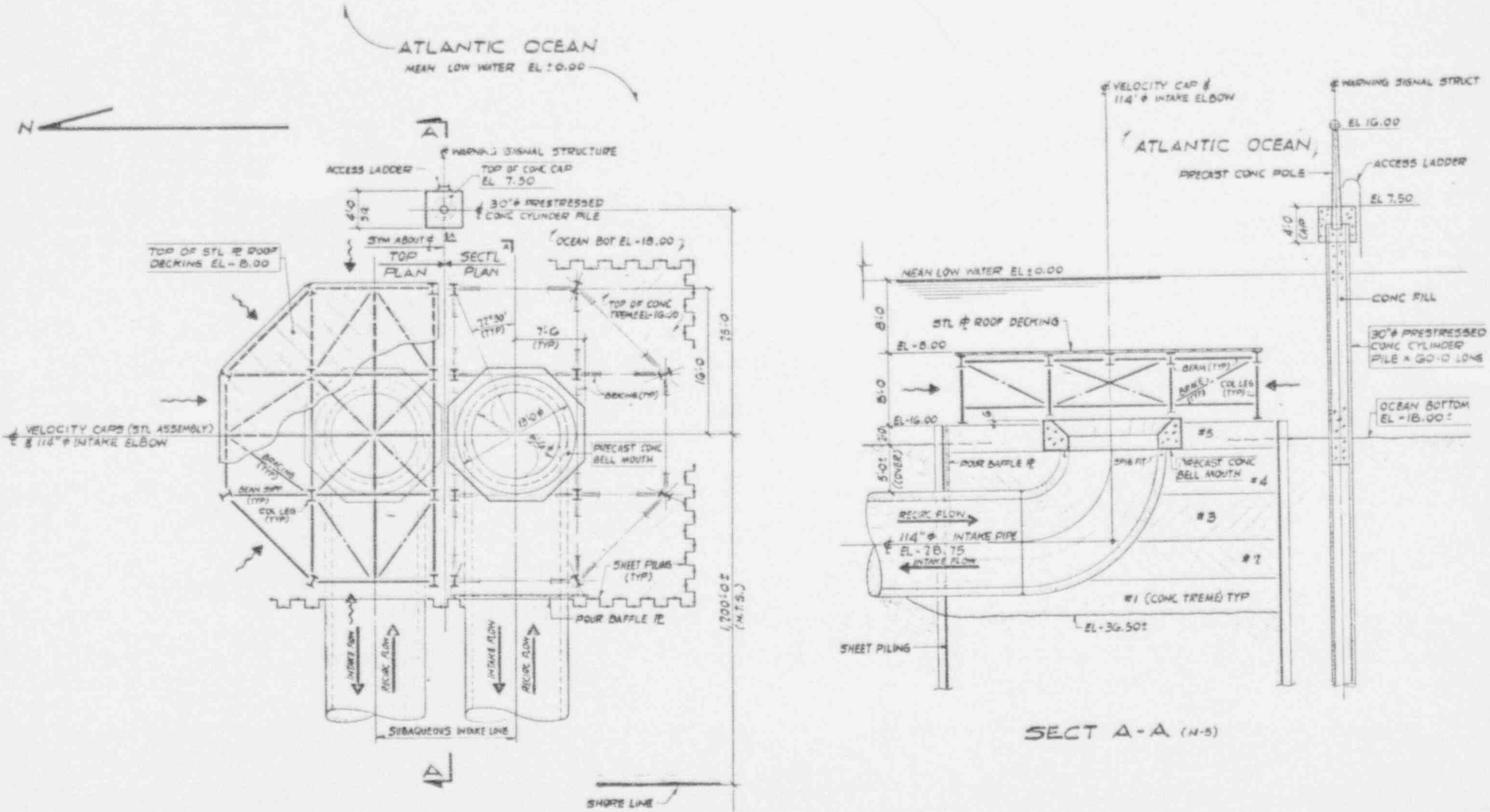
Note 4: Based on the release of the contents of the refueling water storage tank into the circulating water system over a period of eight hours.

Note 5: Based on the release of the contents of the boric acid holdup tanks into the circulating water system over a period of four hours.

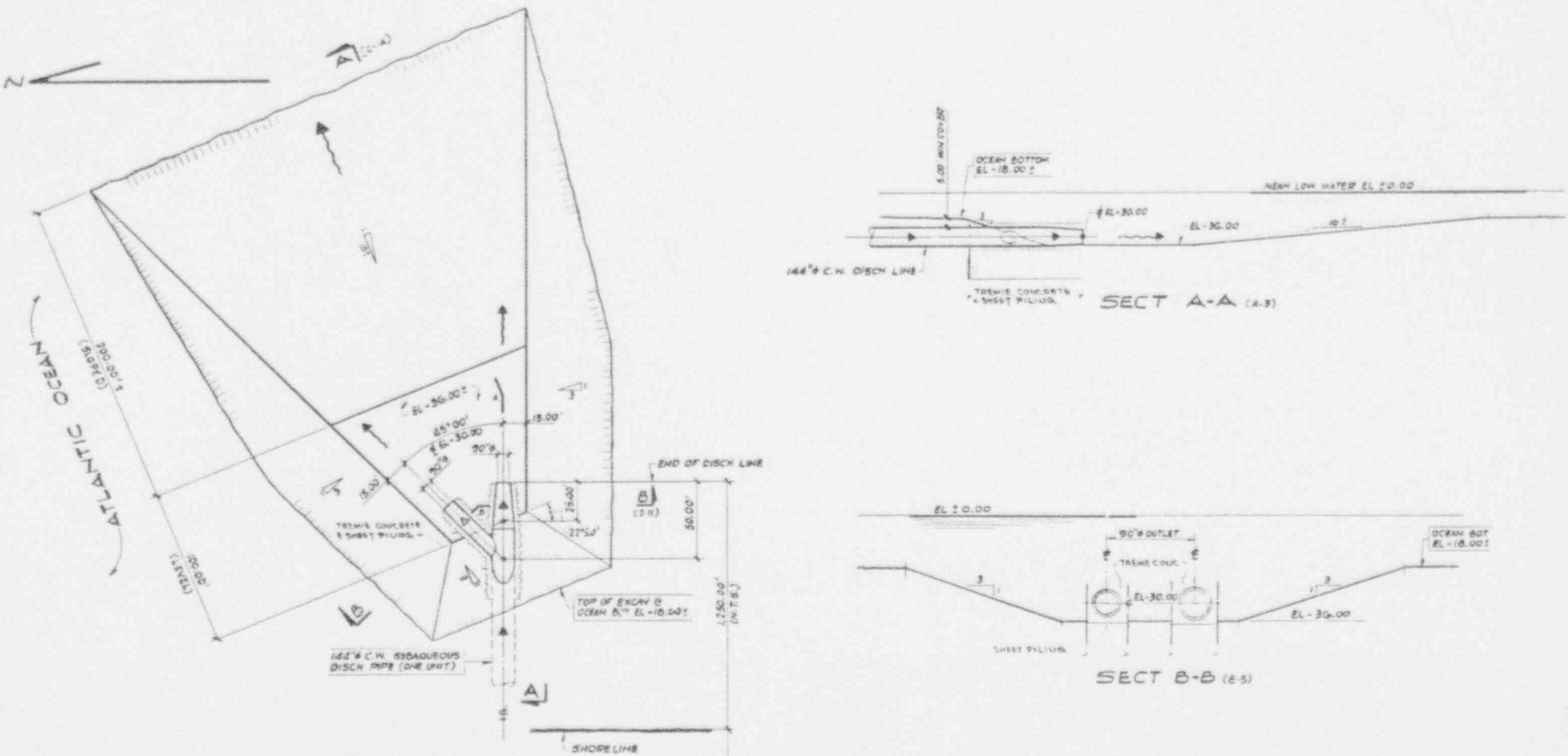
Note 6: Based on the continuous release of the effluent from the boric acid concentrators.



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
CIRCULATING WATER SYSTEM
FIGURE 11-1



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
OCEAN INTAKE STRUCTURES
FIGURE 11-2



HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
OCEAN DISCHARGE STRUCTURES
FIGURE 11-3

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
UNIT NO. 1

ENVIRONMENTAL REPORT
SUPPLEMENT NO. 4

June 27, 1972 Docket No. 50-335

INTRODUCTION

The Florida Power & Light Company Hutchinson Island Plant Environmental Report is herein supplemented to provide a revised answer to Question 19 of Supplement No. 3 as requested by Mr. Muller's letter of June 19, 1972.

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

JUN 19 1972

Docket No. 50-335

RECEIVED JUN 23 1972 Vice President PEC

Dr. James Coughlin
Florida Power & Light Company
P. O. Box 3100
Miami, Florida 33101

Dear Dr. Coughlin:

In the course of continued environmental review of the Hutchinson Island Plant, we have identified certain information which is inadequately discussed in Supplement No. 3 to your Environmental Report. This information is identified in the enclosure to this letter.

In order to maintain our licensing review schedule we will need a completely adequate response by June 30, 1972. Please inform us within 7 days after receipt of this letter of your confirmation of the schedule or the date you will be able to meet. If you cannot meet our specific date or if your reply is not fully responsive to our requests, it is highly likely that the overall schedule for completing the licensing review for this project will have to be extended. Since reassignment of the staff's efforts will require completion of the new assignment prior to returning to this project, the extent of extension will most likely be greater than the extent of delay in your response.

Your reply should consist of three signed originals and 297 additional copies as a sequentially numbered supplement to your Environmental Report.

Sincerely,

Daniel R. Muller

Daniel R. Muller, Assistant Director
for Environmental Projects
Directorate of Licensing

Enclosure:
Request for Additional Information

cc: See page 2

REQUEST FOR ADDITIONAL INFORMATION

HUTCHINSON ISLAND PLANT

UNIT NO. 1

DOCKET NO. 50-335

1. Identify the amounts, concentrations and frequency of release of all chemicals released to the environment. Include releases for corrosion control, spent solutions from the water treatment system used to purify city water, chemistry lab and laundry releases, and all other continuous or intermittent chemical releases.

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
UNIT NO. 1

ENVIRONMENTAL REPORT
SUPPLEMENT NO. 5

JUNE 28, 1972

DOCKET NO. 50-335

FOREWORD

The Florida Power & Light Company Hutchinson Island Plant Environmental Report is herein supplemented to provide the additional information requested by Mr. Giambusso's letter of May 12, 1972 concerning the Atomic Energy Commission's guide for submission of benefit and cost information in environmental reports.

I N T R O D U C T I O N

The material submitted herein has been prepared in accordance with the "Guide for Submission of Information on Costs and Benefits of Environmentally Related Alternative Designs for Defined Classes of Completed and Partially Completed Nuclear Facilities" dated May 1972. Most of the information has been previously submitted in the Hutchinson Island Plant Unit No. 1 Environmental Report dated May 20, 1971, in the Environmental Report Supplement No. 1 dated January 1972, and in the Environmental Report Supplements 2 and 3 dated May 1972. As directed in Mr. Giambusso's letter of May 12, 1972, emphasis has been placed on material which has not been previously submitted. For the convenience of the reviewer the place of publication in the above reports of this previously submitted information has been referenced and, where appropriate, this data is again presented in condensed form.

The required data have been entered on the suggested format. Notes accompany these forms to further amplify the data provided.

Alternatives

The design of the Hutchinson Island Nuclear Plant Unit No. 1 is believed at this time to be that which will be ultimately completed and licensed. Modifications to this design are not foreclosed but there are no alternative sub-systems now being recommended, considered or designed.

Thermal dissipation by means of an ocean intake and discharge as incorporated in the present design is believed to be optimum due to the limited opportunity for damage to marine biota. This system's freedom from other environmental effects is considerably superior to the previous concept in which the cooling water was removed from the Indian River and discharged to the sea. As discussed in Supplement 1 to the Environmental Report (page V-9) an additional cost of approximately 10 million dollars was incurred in making this change. No system is presently known which would be superior to the cooling system now being built. Other alternative cooling methods employing cooling towers or spray ponds have been discussed in detail in the Environmental Report (p 75), Supplement 1 (pages V-5 through V-9), and Supplement 2 (p 24-1 and 25-1). Briefly summarized, cooling towers were found to possess no advantages as regards effects on the marine biota. They do, however, present a potential hazard from the amount of salt drift released and are uneconomic. The small size of Hutchinson Island makes cooling ponds or spray ponds impractical.

Concerning the Radwaste systems and the possible release of radioactivity to the environment, the Hutchinson Island Unit No. 1 will meet the requirements regarding releases set forth in Appendix I to 10 CFR part 50, so that alternative Radwaste system designs are not required.

The only alternative which can be considered then is that of the plant now under construction for which an operating license is expected to be requested.

Summary

The important factors which influenced key decisions regarding the siting and present design of Hutchinson Island Unit No. 1 have been discussed at length in previous reports, as follows:

1. Choice of a nuclear rather than a fossil plant. The Environmental Report p 74, and Supplement 1, p V-3 through V-5.

2. Choice of the Hutchinson Island site, Supplement 3, p 17-1 through 17-4.

3. Choice of the present cooling system. The Environmental Report, p 75, Supplement 1, p V-5 through V-9 and Supplement 2, p 24-1 and 25-1.

Requirements for Additional Generating Capacity

The pressing need for the power to be generated at Hutchinson Island has been discussed in detail in the Environmental Report (p 20-21), and Supplement 1 (p V-1 through V-5). The effects of a one-year and a two-year delay on the reserve capacity and the Risk Index are shown in Table 20-1 (p 20-1) of Supplement 2. Updated data on projected system generating capacity, system capacity additions and projected subregional capability are given in Supplement 3, p 9-1 through 13-2. A list of load curtailments in the last three years is included.

Present Status

Currently, construction of Hutchinson Island Unit 1 is approximately 20% complete. Field work completed includes site preparation, foundations, and erection of the containment structure. Major components have been completed such as the turbine-generator, reactor vessel, and steam generators. Expenditures to date total $100,000,000, and additional estimated expenditures are $100,000,000 of which approximately $50,000,000 are committed.

SAMPLE FORMAT 1

BENEFITS FROM THE PROPOSED FACILITY[1]

Direct Benefits

		Note
Expected Average Annual Generation in Kilowatt Hours 833x.8x8760x1000	5,831,000,000	
Capacity in Kilowatts	833000	
Proportional Distribution of Electrical Energy–Expected Annual Delivery in Kilowatt Hours:		
Industrial 8.7% of 5,831,000,000 kwh	507,729,000	A
Commercial 28.7% of 5,831,000,000 kwh	1,673,500,000	
Residential 50.7% of 5,831,000,000 kwh	2,956,000,000	
Other 11.9% of 5,831,000,000 kwh	694,000,000	
Expected Average Annual Btu (in millions) of Steam Sold from the Facility	none	
Expected Average Annual Delivery of Other Beneficial Products (appropriate physical units)	none	

Revenues from Delivered Benefits (Annual)

Electrical Energy Generated 5,831,000,000 x $.0187	$109,000,000	A
Steam Sold	none	
Other Products	none	

Indirect Benefits (as appropriate)

Taxes (Local, State, Federal)	see note	B
Research	$285,000	C
Regional Product	see note	D
Environmental Enhancement		
Recreation		
Navigation		
Air Quality:		
SO_2 lbs produced by equivalent oil fired plant	(35,000,000)	E
NO_x lbs produced by equivalent oil fired plant	(41,200,000)	
Particulates lbs produced by equivalent oil fired plant	(3,960,000)	
Others Hydrocarbons lbs produced by equivalent oil fired plant.	(1,380,000)	
Employment		
Education		
Others		

[1] All benefits are to be described and qualified in narrative form as suggested under Benefits in Part III of this guide. Where financial or other entries are incorporated in more than one line item, the interrelationship should be identified and discussed in the narrative. It should be noted that entries are not meant to be additive, due to multiple accounting which is implicit in some of the entries. All monetary values should be reported in constant dollars.

Notes to Accompany Format 1 - Benefits from Proposed Facility

A. Percentages given for electrical energy distribution are those experienced for Kwh sales by the Company in 1971 as reported in the FPL Annual Report for 1971, Facts and Figures Supplement. The average revenue per Kwh for 1971 was 1.87¢ as reported in the above source.

B. Taxes to be paid by the Hutchinson Island plant have not as yet been determined. However, the plant will provide an important source of tax revenue to St. Lucie County and other taxing authorities.

C. The two year program on aquatic biology now being carried out at the site is estimated to have a total cost of $135,000. Previous programs such as those described in Section 2.3.6 of the Environmental Report cost about $150,000. The research programs included are those having general interest in the fields of marine ecology and biology.

D. The Regional Product does not consist of the readily quantifiable products of a few large industrial plants as it does in some areas. In the area served by FPL a large part of what might be considered the Regional Product are facilities and services provided to tourists, vacationers, and the retired. Motels, hotels, retirement homes and related facilities, in the aggregate, are large users of electrical power and the area must have this power in order to grow. Quantifying this product in terms of the electrical power required, however, is not amendable to simple analysis.

E. The quantities of emissions listed are those which would be released by an average steam plant burning low sulfer (0.5%S) oil and producing the same amount of power as the Hutchinson Island nuclear unit. Figures for pounds of emission per 1,000 gallons of oil burned were taken from Appendix D of the report, Considerations Affecting Steam Power Plant Site Selection, a Report sponsored by the Energy Policy Staff, Office of Science and Technology.

SAMPLE FORMAT 2

ALTERNATIVE PLANT DESIGN SUMMARY

ALTERNATIVES[1, 2]			A Plant As Is (Base Design)	B Plant With Minimal Environmental Impact	C Plant Operating License Request
IDENTIFICATION OF SUBSYSTEMS					See Introduction
Alternative Cooling Systems (I)			A[3]		
Alternative Rad Waste System (II)			A		
Alternative Chemical Effluent Systems (III)			A		
Alternative ________ System (specify) (IV)			A		
GENERATING COST[4]	Present Worth				$221,200,000
	Annualized				$1,935,500,000
LOST CAPACITY (KWe)					
INCREMENTAL ENVIRONMENTAL EFFECTS[5, 6, 7]		Units			
Primary Impact	Population or Resource Affected				
1. Natural Surface Water Body					
1.1 Cooling Water Intake Structure	1.1.1 Fish	lb/day lb/year			25 9125
1.2 Passage Through the Condensor and Retention in Closed Cycle Cooling Systems	1.2.1 Primary Producers and Consumers	lb fish per year equivalent			see note
	1.2.2 Fish	lb/year			see note
1.3 Discharge Area and Thermal Plume	1.3.1 Water Quality, Physical				Acres Acre-feet 2F 150 1200 3F 25 200 5F <1/4 2
	1.3.2 Oxygen Availability	acre-feet			no effect

	1.3.3 Aquatic Biota	lbs/year			no effect
	1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	acres			none
	1.3.5 Fish, Migration	lbs/year			none
1.4 Chemical Effluents	1.4.1 Water Quality, Chemical	acre/ ft/day			none
	1.4.2 Aquatic Biota	lbs/year			none
	1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	acres			none
	1.4.4 People	lost days			none
1.5 Radionuclides Discharged to Water Body	1.5.1 Aquatic Organisms	rad/year to single organisms			10^{-3}
	1.5.2 People, External	rem/year individual man rem year			1.0×10^{-4} 1.0×10^{-3}
	1.5.3 People, Ingestion	rem/year individual man rem year			3×10^{-4} 1.8
1.6 Consumptive Use (evaporative losses)	1.6.1 People	gallon/year			none
	1.6.2 Property	acre/ft/year			none
1.7 Other Impacts					none
1.8 Combined or Interactive Effects					none

2. Groundwater					
2.1 Raising/Lowering of Groundwater Levels	2.1.1 People	gallon/year lost			none
	2.1.2 Plants	acres			none
2.2 Chemical Contamination of Groundwater	2.2.1 People	gallon/year lost			none
	2.2.2 Plants	acres			none
2.3 Radionuclide Contamination of Groundwater	2.3.1 People	rem			none
	2.3.2 Plants and Animals	rem/yr			none
2.4 Other Impacts on Groundwater					none
3. Air					
3.1 Fogging and Icing (caused by evaporation and drift)	3.1.1 Ground Transportation				no effect
	3.1.2 Air Transportation				no effect
	3.1.3 Water Transportation				no effect
	3.1.4 Plants				no effect
3.2 Chemical Discharge to Ambient Air	3.2.1 Air Quality, Chemical				no effect
	3.2.2 Air Quality, Odor				no effect
3.3 Radionuclides Discharged to Ambient Air	3.3.1 People, External	rem/year individual man rem/year			5×10^{-4} 2.5
	3.3.2 People, Ingestion	rem / year individual man rem/year			~ 0 ~ 0
	3.3.3 Plants and Animals	rad/year			~ 0
3.4 Other Impacts on Air					no effects

4. Land					
4.1 Pre-emption of Land	4.1.1 Land, Amount	acres			none
4.2 Plant Construction and Operation	4.2.1 People (amenities)				no effect
	4.2.2 People (aesthetics)				acceptable
	4.2.3 Wildlife				acceptable
	4.2.4 Land, Flood Control				no implication
4.3 Salts Discharged from Cooling Towers	4.3.1 People				n. a.
	4.3.2 Plants and Animals				n. a.
	4.3.3 Pro, erty Resources				n. a.
4.4 Other Land Impacts					no effect s
4.5 Combined or Interactive Effects					none

1. Economic or environmental benefits, or reductions in costs, should be shown in parentheses.
2. Where a row is not relevant to a particular alternative, insert n.a. for not applicable.
3. Letter identifies alternative in Supplementary Form.
4. Compute on basis of total incremental costs as of submittal date of guide information. (See IV-B).
5. See Table 2 for units of measure and methods of computation, units should be specified by the applicant on the form.
6. Where items are the same for each alternative, put same in columns B and C.
7. Where appropriate, all environmental effects should be on an annual basis.

Notes to Accompany Format 2 - Alternative Plant Design Summary

1.1 Investigation of the fish kill problem at cooling water intakes at FPL plants to the north (Cape Kennedy) and south (Riviera Beach) indicate a very minor problem. Although approximating the number of fish killed is extremely difficult, from 10 to 50 lbs per day would appear to cover the expected range. Taking 25 pounds per day -

$$25 \times 365 = 9125 \text{ lbs fish per year}$$

The species encountered at the above plants include; catfish, puffer, mullet, horseshoe crabs and probably an occasional specimen of all the indigenious fish species.

1.2.1 Investigations of primary producers in the intake area are presently being carried out by the Florida Department of Natural Resources (Supplement 3, p 4-1). From presently available data as given in the Environmental Report on pages 40-41, samples were collected for micro-organism counts from 21 stations offshore at the site in February and June of 1969, and April 1970. The number of species found were 41 (not including plankton), 63, and 41 for the three dates. The number of organisms counted per milliliter were less than 100 for most of the samples. The greatest number of organisms were found six miles offshore. This can be compared with the 1,000 to 8,000 organisms per ml found in the Indian River (Ibid p 41).

The damage done to such organisms on passing through the condenser system is difficult to assess. While several studies have been, and are being, carried out on the problem, results so far do not seem to justify clear-cut conclusions. Several studies were carried out at the Turkey Point site on organism damage with the fossil units running. The experimental difficulties and the disagreement in results are summarized in the Turkey Point Plant Units No. 3 and 4, Environmental Report Supplement included here as Appendix 1. The effects of the Hutchinson Island Plant on marine biota are discussed in the Hutchinson Island Environmental Report, pages 46 through 48.

1.2.2 No data is available on fish larvae, eggs, etc. which might be drawn into the condenser system. In view of the barren nature of the water in the neighborhood of the intake, and the fact that the area is not a spawning ground, as described in detail in Section 2.3.6 of the Environmental Report, it is believed that no significant damage will be done. The Florida Department of Natural Resources is currently conducting a program at the site which will investigate the present population of plankton, other microorganisms, and benthic life in the intake and outfall areas (Supplement 3, p 4-1). This information, when available, will assist in assessing possible plant impacts on these biota.

1.3 Based on the thermal efficiency of the unit, 6.1×10^9 BTU per hour will be dissipated at full power. Work is continuing on the determination of isotherm areas. Values for these areas now available are:

Isotherm	Acres
2 F	150
3 F	25
5 F	1/4

The volume of water within these isotherms can be approximated as:

Isotherm	Acres-feet
2 F	1200
[illegible] F	200
[illegible]	2

1.3.2 The Florida Department of Natural Resources is currently conducting a program at the Hutchinson Island site (Supplement 3, 4-1) which will include determining dissolved oxygen in the water at the projected intake location. This data are not as yet available. In view of experience at other plants, no significant changes in oxygen content in the coolant water on passing through the system is expected. Some plants report slight increases in oxygen content on passage through the condenser system due to aspiration of small amounts of air at the circulating water pumps. The following data from the Turkey Point Plant for 10 randomly selected but representative days may be of interest.

Date	Dissolved Oxygen Content, ppm	
1971	Intake	Discharge
Feb. 4	5.7	5.5
May 20	3.4	3.4
July 22	2.8	2.7
Sept. 30	5.2	4.9
1972		
Jan. 20	6.3	6.2
Feb. 3	4.9	4.9
Feb. 17	5.5	5.4
March 16	5.9	6.0
May 4	5.6	5.8

1.3.3 Field measurements by the Florida Deparment of Natural Resources are currently underway (Supplement 3, p 4-1) which will investigate the primary producers in the intake area. This program is expected to amplify the data given under 1.2.1 above. From the comparatively small volume within the isotherms given under 1.3 and the relatively barren nature of the water at the intake, no important organism mortality is expected.

1.3.4 No wetlands or water surface furnishing a wildlife habitat will be affected by the discharge.

1.3.5 As described in Supplement 1 to the Environmental Report (p VI-6) "The 3 F plume is 1/3 miles long. Even if the 3 F differential acted as a barrier, the migration path is the width of the 10 fathom shelf, or 6 2/3 miles, so that the 3 F plume is only 5.2% of the path. This could hardly act as a barrier even if the temperature were high enough to actually deflect fish". No effect on spawning or fish survival is expected. There should also be no effect on the migration of turtles.

1.4.1 and 1.4.2

The maximum possible chemical discharge from the plant is described on page VI-5 of the Supplement 1 to the Environmental Report, and is given in detail in Supplement 4 to the Environmental Report.

1.4.3 Wetlands and water surfaces serving as wildlife habitats will not be affected.

1.4.4 Because all applicable water standards are met and the maximum possible solid content added to the sea water coolent is only 1/16000 of the naturally occurring salts no effect on recreational use would appear possible.

1.5.1 A conservative estimate has been made of the dose that an aquatic organism would receive from the radionuclides released in the circulation water discharge line. Assuming that such an organism were exposed continuously for one year to the annual average radioactive concentrations, the dose to the organism has been calculated to be approximately one-thousandth (10^{-3}) rad per year. The concentrations referred to are given in Table 2.3.7-1 (p. 61) of the original Environmental Report. This is an extremely small dose, and it is thus concluded that radiological effects on aquatic organisms will be completely insignificant.

1.5.2 The doses to individuals and to population groups resulting from recreational activities has been discussed on page VI-6 of Supplement 1 to the Environmental Report. In summary, it is estimated that the annual dose to a person engaged in in-water activities (swimming) or above water activities (skiing, etc.) would both be less than one-tenth of a mrem/yr while the annual integrated dose would be less than one-thousandth (10^{-3}) of a man-rem per year. Doses resulting from shoreline activities would essentially contribute no additional dose to that resulting from such recreational activities as swimming and water skiing.

1.5.3 Doses resulting from ingested food and water are discussed on pages VI-7 and VI-8 of Supplement 1 to the Enviromental Report. In summary, calculations indicate that the individual dose from consuming both fin and shellfish previously exposed to the plant's discharge would be approximately 3 mrem/yr, while the annual integrated dose to the population which may ingest such food would be about 1.8 man-rem. As mentioned in Supplement 1, the direct ingestion of seawater is of no concern because of its salt content.

1.6 The affected water body is salt water and there will be no effect on drinking water supplies or on agricultural uses.

1.7 and 1.8

No other significant environmental effects of the plant, or combined effects are known.

2.1 and 2.2

The only fresh water used will be secured from the City of Ft. Pierce Municipal water system. These wells have no known limitations on supply and there will be no effect on ground water levels.

2.3.1 and 2.3.2

As discussed on page VI-8 of Supplement 1 to the Hutchinson Island Environmental Report, radioactive liquids pose the only source for ground water contamination and a consideration of this source is given. In summary, these liquids are released to the circulating water system after suitable treatment. From there, they are carried and then discharged well out into the Atlantic Ocean. Contamination of ground water is thus considered extremely remote and no adverse effect is expected on people, plants or animals.

3.1 Concerning fogging, as stated in Supplement No. 2 to the Environmental

Report, (p 12-1) -

"The Florida Power & Light Company has operated numerous power plants with discharge conditions which are similar to Hutchinson Island or more difficult from a fogging standpoint. These include the Cape Kennedy Plant, considerably north of Hutchinson Island, and Riviera Plant, to the south, as well as others. On infrequent occasions, light mists have been noted by plant operating personnel, but no significant amount of fog. On the basis of this experience, no problem with fog generation is anticipated at Hutchinson Island."

3.2 No pollutant chemicals will be discharged to the ambient air nor will odors be released.

3.3.1 Page VI-8 of Supplement 1 to the Environmental Report discuss the doses to people that result from radionuclides discharged to the ambient air. In summary, the annual dose to a person standing at the plant boundary would be about half a mrem (5×10^{-4} rem), while the annual dose to a person standing on the west bank of the Indian River would only be about a quarter of a mrem (2.5×10^{-4} rem). The annual integrated dose out to fifty miles has been calculated to be approximately two and one-half man-rem. It is concluded that the radiological cost, both to individuals and the population, will be negligible.

3.3.2 and 3.3.3

As stated on page VI-8 of Supplement 1 to the Environmental Report, the release of radionuclides other than the noble gases, is expected to be essentially zero. This in turn would preclude concern for radionuclide accumulation in foods or its uptake in plants and animals.

3.4 The applicant believes that there are no additional environmental effects other than the insignificant ones mentioned above in the subsections to Section 3.

4.1 It is not expected that further land will be acquired.

4.2 Noise from the plant will be of low level and will not be audible off the site.

4.2.2 The Hutchinson Island Plant as described in the Enviromental Report (p 71) is expected to be aesthetically acceptable. "Only the upper points of the higher buildings will be visible to an observer on the Island as the switchyards and other low structures will be totally or partially concealed." No local or regional authorities concerned with plant appearance are known, but public reaction to the plant as a whole as shown by newspaper coverage, letters-to-the-editor, and public and private statements has been quite favorable.

4.2.3 From the standpoint of wildlife, the only direct affect has been on the plant area itself where construction is taking place. Construction noise may penetrate slightly beyond the area of actual construction, but this will soon cease. Overall effects on wildlife are expected to be very limited if any.

4.2.4 The only part of the plant which might have an implication for flood control is the transmission system. The Central and South Florida Flood Control District in a letter dated December 18, 1970 (Appendix C of the Supplement 1) stated that the proposed transmission lines do not affect District facilities.

4.3 Cooling towers will not be used so that the question of salt drift from them will not arise.

4.4 The plant will not encroach on archaeological or historical sites (Environmental Report p 25).

4.5 No synergistic effect of combined environmental impacts is expected.

Table 2 – GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
1. Natural surface water body	(Specify natural water body affected)			
1.1 Cooling water intake structure	1.1.1 Fish[2]	Juveniles and adults are subject to attrition.	Pounds per year (as adults by species of interest).	Identify all important species. Estimate the annual weight of each specie that will be destroyed. For young-of-the-year destroyed, only the expected population that would have survived naturally need be considered.
1.2 Passage through the condenser and retention in closed cycle cooling systems.	1.2.1 Primary producers and consumers	Primary producer and consumer life-forms may be reduced due to mechanical, thermal, and chemical effects.	Net effect in pounds per year (as adult fish by species of interest).	Field measurements are required to establish the average weight of organisms per unit volume by group (e.g., diatoms, green algae, zooplankton, etc.).
				Determine the mortality of organisms passing through the condenser and document. Include indirect[3] effects which affect mortality and document. Translate loss to pounds of fish.
	1.2.2 Fish	All life stages (eggs, larvae, etc.) which reach the condenser are subject to attrition.	Net effect in pounds per year (as adult fish by species of interest).	Identify all important species. Estimate the annual weight of each specie that will be destroyed. For larvae, eggs, and young-of-the-year destroyed, only the expected population that would have survived naturally need be considered.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

[2] "Fish" as used in this table includes shellfish and other aquatic invertebrates harvested by man.

[3] Indirect effects could include increased disease incidence, increased predation, interference with spawning, reduced metabolic rates, hatching of fish out of phase with food organisms, etc.

Table 2 – GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS (cont.)

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
1.3 Discharge area and thermal plume	1.3.1 Water quality, physical	The rate of dissipation of the excess heat, primarily to the atmosphere, will depend on both the method of discharge and the state of the receiving water, in respect to ambient temperature and water currents.	Acres and acre-feet.	Estimate the average Btu per hour dissipated to the receiving water at full power. Estimate the water volume and surface areas within differential temperature isotherms of 2°, 3°, and 5°F under conditions that would tend, with respect to annual variations, to maximize the extent of these areas and volumes.
	1.3.2 Oxygen availability	Dissolved oxygen concentration of receiving waters may be modified as a consequence of changes in the water temperature and the translocation of water of different quality.	Acre-feet.	Estimate volumes of affected waters with concentrations below 5, 3, and 1 ppm under conditions that would tend to maximize the impact.
	1.3.3 Aquatic biota	Primary producers and consumers (including fish) may be affected directly or indirectly due to adverse conditions in the plume.	Net effect in pounds per year (as adult fish by species of interest).	Field measurements are required to establish the average weight of organisms per unit volume by group. Estimate the mortality of organisms in the receiving water from direct and indirect effects. Translate loss to pounds of fish.
	1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles).	Suitable habitats for wildlife may be affected.	Acres	Determine the area of wet land or water surface impaired as a wildlife habitat because of thermal discharges, including effects on food resources. Document estimates of populations affected by species.
	1.3.5 Fish, migration	A thermal barrier may inhibit migration, hampering spawning and diminishing the survival of returning immature fish.	Pounds per year (as adult fish by species of interest).	Estimate the fraction of the stock that is prevented from reaching spawning grounds because of plant operation. Prorate this directly to a reduction in current and longterm fishing effort supported by that stock. Justify estimate on basis of local migration patterns, experience at other sites, and applicable state standards.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2 – GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS (cont.)

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
1.4 Chemical effluents	1.4.1 Water quality, chemical	Water quality may be impaired.	Acre-feet per day, %	The volume of water required to dilute the average daily discharge of each chemical to meet applicable water quality standards should be calculated. Where suitable standards do not exist, use the volume required to dilute each chemical to a concentration equivalent to a lethal concentration (e.g., LD_{10}) for the most sensitive organism of commercial or ecological importance in the receiving waters. The ratio of this volume to the annual minimum value of the daily net flow, where applicable, of the receiving waters should be expressed as a percentage, and the largest such percentage reported. Include the total solids if this is a limiting factor. Include in this calculation the blowdown from the cooling towers.
	1.4.2 Aquatic biota	Aquatic populations may be affected by toxic levels of discharged chemicals or by reduced dissolved oxygen concentrations.	Pounds per year (by species as fish).	Total chemical effect on aquatic biota should be estimated. Biota exposed within the facility should be considered as well as biota in receiving waters. Supporting documentation should include reference to applicable standards, chemicals discharged and their toxicity to the aquatic populations affected.
	1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles).	Suitable habitats for wildlife may be affected.	Acres	Estimate the area of wet land or water surface impaired as a wildlife habitat because of chemical contamination including effects on food resources. Document estimates of populations affected by specie.
	1.4.4 People	Recreational water uses may be inhibited.	Lost Annual User Days and Area for Dilution.	Volume of the net flow to the receiving waters required for dilution to reach established water quality standards must be determined on the basis of daily discharge and converted to either surface area or miles of shore. Cross section and annual minimum flow characteristics should be incorporated where applicable. User density for the locality must be obtained.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2 – GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS (cont.)

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
				This permits estimation of lost user days on an annual basis. Indirect recreation losses due to eutrophication and decreased fishing shall be included.
1.5 Radionuclides discharged to water body	1.5.1 Aquatic organisms	Radionuclide discharge may introduce a radiation level which adds to natural background radiation.	Rem per year.	Sum dose contributions from radionuclides expected to be released.
	1.5.2 People, external	Radionuclide discharge may introduce a radiation level which adds to natural background radiation for water users.	Rem per year for individual; man rem per year for estimated population as of the scheduled year of in-plant operation.	Sum annual dose contributions from nuclides expected to be released. Calculate for above-water activities (skiing, fishing, boating), in-water activities (swimming), and shoreline activities.
	1.5.3 People, ingestion	Radionuclide discharge may introduce a radiation level which adds to natural background radiation for ingested food and water.	Rem per year for individuals (whole body and organ); man rem per year for estimated population as of the scheduled year of in-plant operation.	Estimate biological accumulation in foods, and intake by individuals and population. Calculate doses by summing results for expected radionuclides.
1.6 Consumptive use (evaporative losses)	1.6.1 People	Drinking water supplies drawn from the water body may be diminished.	Gallons per year.	Where users withdraw drinking water supplies from the affected water body, lost water to users should be estimated.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2 – GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS (cont.)

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
	1.6.2 Property	[illegible] ay be withdrawn from agricul- [illegible] usage and use of remaining water [illegible] be degraded.	Acre-feet per year.	Where users withdrawing irrigation water are affected, the loss should be evaluated as the sum of two volumes: the volume of the water lost to agricultural users and the volume of dilution water required to reduce concentrations of dissolved solids in remaining water to an agriculturally acceptable level.
1.7 Other impacts				The applicant should describe and quantify any other environmental effects of the proposed plant which are significant.
1.8 Combined or inter-active effects				Where evidence indicates that the combined effects of a number of impacts on a particular population or resource are not adequately indicated by measures of the separate impacts, the total effect should be described.
2. Groundwater				
2.1 Raising/lowering of groundwater levels	2.1.1 People	Availability or quality of drinking water may be decreased and the functioning of existing wells may be impaired.	Gallons per year.	Volume of replacement water for local wells actually affected must be estimated.
	2.1.2 Plants	Trees and other deep-rooted vegetation may be affected.	Acres	Estimate the area in which groundwater level change may have an adverse effect on local vegetation. Report this acreage on a separate schedule by land use. Specify such uses as recreational, agricultural and residential.
2.2 Chemical contamination of groundwater (excluding salt)	2.2.1 People	Drinking water of nearby communities.	Gallons per year.	Compute annual loss of potable water.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2 — GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS (cont.)

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
	2.2.2 Plants	Trees and other deep-rooted vegetation may experience toxic effects.	Acres	Estimate area affected and report separately by land use. Specify such uses as recreational, agricultural and residential.
2.3 Radionuclide contamination of groundwater	2.3.1 People	Radionuclides which enter groundwater may introduce a radiation level which adds to natural background level for water and food supplies.	Rem per year for individuals (whole body and organ); man rem per year for population as of the scheduled year of in-plant operation.	Estimate intakes by individuals and populations. Sum dose contributions for nuclides expected to be released.
	2.3.2 Plants and animals	Radionuclides which enter groundwater may introduce a radiation level which adds to natural background level for local plant forms and animal population.	Rem per year.	Estimate uptake in plants and transfer to animals. Sum dose contributions for nuclides expected to be released.
2.4 Other impacts on groundwater				The applicant should describe and quantify any other environmental effects of the proposed plant which are significant.
3. Air 3.1 Fogging and icing (caused by evaporation and drift)	3.1.1 Ground transportation	Safety hazards may be created in the nearby regions in all seasons.	Hours per year.	Compute the number of hours per year that driving hazards will be increased on paved highways by fog and ice from cooling towers and ponds. Documentation should include the visibility criteria used for defining hazardous conditions on the highways actually affected.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2 – GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS (cont.)

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
	3.1.2 Air transportation	Safety hazards may be created in the nearby regions in all seasons.	Hours per year.	Compute the number of hours per year that commercial airports will be closed because of fog from cooling towers.
	3.1.3 Water transportation	Safety hazards may be created in the nearby regions in all seasons.	Hours per year.	Compute the number of hours per year ships will need to reduce speed because of fog from cooling towers or ponds or warm water added to the surface of the river, lake or sea.
	3.1.4 Plants	Damage to timber and crops may occur through introduction of adverse conditions.	Acres by crop.	Estimate the acreage of potential plant damage by crop.
3.2 Chemical discharge to ambient air	3.2.1 Air quality, chemical	Pollutant emissions may diminish the quality of the local ambient air.	% and pounds or tons	The actual concentration of each pollutant in ppm for maximum daily emission rate should be expressed as a percentage of the applicable emission standard. Report weight for expected annual emissions.
	3.2.2 Air quality, odor	Odor in gaseous discharge or from effects on water body may be objectionable.	Statement	A statement must be made as to whether odor originating in plant will be perceptible at any point off-site.
3.3 Radionuclides discharged to ambient air	3.3.1 People, external	Radionuclide discharge may introduce a radiation level which adds to natural background radiation for the local ambient air.	Rem per year for individuals (whole body and organ); man rem per year for estimated population as of the scheduled year of in-plant operation.	Sum dose contributions from nuclides expected to be released.

[1]Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2 – GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS (cont.)

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
	3.3.2 People, ingestion	Radionuclide discharge may introduce a radiation level which adds to natural background radiation and deposits may occur on vegetation and in soil.	Rem per year for individuals (whole body and organ); man rem per year for estimated population as of the scheduled year of in-plant operation.	For radionuclides expected to be released, estimate deposit and accumulation in foods. Estimate intakes by individuals and populations and sum results for all expected radionuclides.
	3.3.3 Plants and animals	Radionuclide discharge may introduce a radiation level which adds to natural background radiation for local plant and animal life.	Rem per year.	Estimate deposit of radionuclides on, and uptake in plants and animals. Sum dose contributions for radionuclides expected to be released.
3.4 Other impacts on air				The applicant should describe and quantify any other environmental effects of the proposed plant which are significant.
4. Land				
4.1 Pre-emption of land	4.1.1 Land, amount	Land potentially available for alternative uses may be utilized.	Acres	For site area required by alternatives and not presently acquired, report the total acreage. Separately tabulate by current and potential use.
4.2 Plant construction and operation	4.2.1 People (amenities)	Noise may induce stress.	Number of residents, school populations, hospital beds.	Use the Proposed HUD Criterion Guideline for Non-Aircraft Noise to establish areas receiving noise in the categories of "Clearly Unacceptable," "Normally Unacceptable" and "Normally Acceptable." For each area report separately the number of residences, the total school population, and the total number of hospital beds.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2 – GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS (cont.)

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
	4.2.2 People (aesthetics)	The local landscape as viewed by adjacent residential areas and neighboring historical, scenic, and recreational sites may be rendered aesthetically objectionable by the plant facility.	Qualified opinion	Summarize qualified opinion including views of cognizant local and regional authorities when available.
	4.2.3 Wildlife	Wildlife may be affected.	Qualified opinion	Summarize qualified opinion including views of cognizant local and state wildlife agencies when available, taking into account both beneficial and adverse effects.
	4.2.4 Land, flood control	Health and safety near the water body may be affected by flood control.	Reference to Flood Control District Approval	Reference must be made to regulations of cognizant Flood Control Agency by use of one of the following terms: Has **NO IMPLICATIONS** for flood control. **COMPLIES** with flood control regulation.
4.3 Salts discharged from cooling towers	4.3.1 People	Intrusion of salts into groundwater may affect water supply.	Pounds per square foot per year.	Estimate the amount of salts discharged as drift and particulates. Report maximum deposition. Supporting documentation should include patterns of deposition and projection of possible effect on water supplies.
	4.3.2 Plants and animals	Deposition of entrained salts may be detrimental in some nearby regions.	Acres.	Salt tolerance of vegetation in the affected area must be determined. That area, if any, receiving salt deposition in excess of tolerance (after allowance for dilution) must be estimated. Report separately an appropriate tabulation of acreage by land use. Specify such uses of recreational, agricultural and residential. Where wildlife habitat is affected, identify populations.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Table 2 – GUIDANCE FOR DESCRIPTION OF ENVIRONMENTAL EFFECTS (cont.)

Primary Impact	Population or Resource Affected	Description	Unit of Measure[1]	Method of Computation
	4.3.3 Property resources	Structures and movable property may suffer degradation from corrosive effects.	Dollars per year.	If salt spray impinges upon a local community, property damage may be estimated by applying to the local value of buildings, machinery, and vehicles a differential in average depreciation rates between this and a comparable sea-coast community to obtain an estimate of annual losses.
4.4 Other land impacts				The applicant should describe and quantify any other environmental effects by further construction associated with one or more alternatives such as accessibility to or encroachment on archeological and/or historical sites, etc.
4.5 Combined or interactive effects				Where evidence indicates that the combined effects of a number of impacts on a particular population or resource are not adequately indicated by measures of the separate impacts, the total effect should be described.

[1] Applicant may substitute an alternative unit of measure, where appropriate. Such a measure should be applied consistently to all alternatives for the effect being measured.

Plankton

Perhaps the most important single segment of the marine community are plankton. These include phytoplankton, which are primary energy producers, and zooplankton, which are primary energy consumers. These plankton are at the bottom of the food chain and thus their condition is fundamental to the development of the marine life community in any ecosystem.

Because of the importance of this component of the ecosystem, it has been studied more extensively than other components. Unfortunately, for several reasons, it is most difficult to arrive at quantitative conclusions in which comparative numbers have high levels of statistical significance. Before discussing the problems involved, it appears that a consensus is that at temperatures of 95 F or less, the plankton community is not significantly affected by temperature, and at temperatures of 90 F or less, there is no adverse effect of temperature on plankton.

The principal problems in plankton studies are (1) the patchy or heterogeneous nature of plankton population, (2) diurnal and seasonal variations in concentration, and (3) criteria for the health of observed plankton. Plankton tend to congregate in random locations in a body of water. Further, the concentration vertically in the water column seems generally lower near the top and higher near the bottom. In addition, these values vary between day and night. Finally, sampling of plankton is a relatively delicate operation. In early work, investigators report mortalities of 75% or more due to sampling alone. Hence, the comparisons of samples taken upstream and downstream of the power plant are very difficult to compare.

In spite of their small size (a range of 1-200 microns), plankton are subject to mechanical damage when passing through pumps, valves, condenser tubing, orifices, and the like. The damage ranges from the loss of an appendage to complete destruction. Unfortunately, no studies are available to show the quantitative effect of any of these mechanical devices. Qualitative evaluation from microscopic observation indicates that in the case of Turkey Point, this damage is well below 10%.[5] This introduces another variable in plankton study, i.e., how to detect the state of health of the observed undamaged plankton. Many experts use motility as this index. This is useful, although on occasion one must wait for an extended period of time before observing motility in any given sample. The technique which is increasingly more widely accepted is the Adenosine Triphosphate (ATP) analysis. All living cells contain ATP which rapidly decomposes on death. Thus the ATP analysis is finding increasing acceptance as a tool for such determinations. This technique has been used by all of the major investigators reported herein.

Further complicating these problems is the seasonal variation in the plankton level. As reported by Reeve[7] and Lackey[5], the plankton level shows a fall boom, a winter-spring plateau, and a decrease in the summertime prior to a subsequent fall boom. The periodicity of this phenomenon again shows that power plant operation has no long-term effect on the environment. The concentration of plankton during the year is relatively low as indicated in the section on the abiotic system.

Three major plankton studies have been conducted and/or are in progress. These are those of the University of Miami Rosenstiel School,[2] the FWQA study of 1970,[8] and the continuing work of Dr. James Lackey,[5] a consultant to FPL. A careful analysis of these studies in the light of the foregoing information is in order.

The University of Miami Study found the following changes to occur on copepods and larval types:

Net Size	Date	Percent Dead in 24 hrs.		Power Plant Discharge
		Intake	Outfall	Temperature, F
200 μ	9/22/70	38	57	98.2
	10/6/70	20	36	94.1
64 μ	9/22/70	77	93	98.2
	10/6/70	18	14	94.1

The conclusion from these data is that while the 24 hour mortality in the outfall was high at the 98 degree level, the inlet samples also showed high mortality which was obviously independent of power plant operation. Further, U. of M. work showed the cyclic nature of plankton levels previously discussed. Since the power plant has been in operation since 1967, it is clear that the magnitude of these effects has had no drastic influence on the Biscayne Bay-Card Sound system as a whole.

The FWQA (Prager)[8] studies on the other hand showed mortalities of all zooplankton of about 50% at 95 F, and from 75% to 90% at 100 F. These data must be considered with the knowledge that the samples were incubated at the temperature at which they were taken for a period of about five hours.

All experts agree that thermal stress is a time-temperature function; i.e., the longer the time at higher temperatures, the greater the stress. Thus, the method of these studies does not duplicate field conditions in that heated water from the actual power plant under the present cooling system is almost immediately diluted with cooler water and within ten minutes is discharged into Biscayne Bay where it is further cooled by dilution with bay water. Phase I operation using the Card Sound Canal will also use dilution and thereby immediately reduce the temperature markedly. However, the time required for passage through the Card Sound Canal, approximately 12 hours, will exceed the five-hour period indicated in the studies. In Phase II, that portion of the discharge passing through the cooling system will have a longer residence time at higher temperatures. However, it will also be cooler when discharged, and thus the discharge will have a lesser effect on Card Sound. When the ultimate cooling system is in operation, intake of water from, and discharge to, the Sound will be so small that even total plankton mortality would be of no importance.

The work of Lackey[5] has shown that no long-range and only minimal short-range damage occurs at temperatures of 95 F or less.

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
UNIT NO. 1

ENVIRONMENTAL REPORT
SUPPLEMENT NO. 6

July 6, 1972

Docket No. 50-335

INTRODUCTION

The Florida Power & Light Company Hutchinson Island Plant Environmental Report is herein supplemented to provide additional information on the proposed transmission lines as requested during the meeting of June 22, 1972 with Messrs. Muller and Widrig in Miami. The information is presented as a revision to Question 8 of Supplement 3 to the Environmental Report.

QUESTION 8 Provide a detailed analysis including source data associated with the alternatives for transmission line crossings from the Indian River. These alternatives should include: 1) conventional overhead transmission, 2) the currently planned overhead transmission system and 3) underground transmission with mainland switchyard facilities located near the railroad tracks. The cost analysis should be consistent with the formula used on Page VI-3 of the Environmental Report Supplement and should break out crossing costs and switchyard facility costs separately. Other environmental advantages and disadvantages including aesthetic and ecological should be described for each alternative. The principal reasons for selecting the presently planned system and discarding the other alternatives should be presented.

ANSWER:

The design of the river crossing portion of the transmission system was chosen after consideration of environmental, aesthetic, technical and economic factors. Both overhead and underwater crossings were considered.

A. Submarine Crossing

Four 3-conductor, oil-filled pipe cable circuits were considered for the crossing, each rated at 1100 amps or 440 MVA. The cables would be installed in a four foot deep, 30 foot wide trench beneath the floor of Indian River and would be cooled by conduction through the soil.

The choice of four cables for the crossing was based on available cable capacities and the requirement for reliability of transmission. Since submarine cables are limited to lower power capacities, a single cable can only provide 50 per cent, therefore two cables are required to equal the capacity of one overhead line. Although reliability experience has been excellent during the relatively short period of time underwater cables have been used, one additional (third) cable would not assure firm transmission capacity. The fourth cable provides reasonable assurance that reliability would be as good as overhead transmission.

Cable failures, when they occur, require lengthy outages for repair. For example assuming that a failure did not result in the pipe rupturing and contaminating the cable with water, four to six months would be required to repair the cable. Such a repair would require that the pipe be lifted out of the water at the point of failure, the pipe cut, and the damaged section of cable removed in order to determine the length of new cable required. A section of new cable would then be ordered from the manufacturer as it is not economically practical nor feasible to maintain a store of spare cable. Once the new cable is received, it would then be spliced and repairs to the pipe finished. Should the cable failure result in a pipe rupture which would allow the cable to be contaminated with salt water, replacement of the entire cable would be necessary. Up to one year would then be required before the cable could be returned to service.

Maintenance costs for underground transmission are reported in "Underground Power Transmission, A Report to the Federal Power Commission", by the Commissions Advisory Committee on Underground Transmission, April 1966 to be over $1,000 per 100,000 kw per mile per year, more than ten times the annual costs for maintenance of overhead transmission. Outages for maintenance of pipe type cable within the FP&L system have averaged 0.42 days and $1,700 per mile per year and due to the relatively short operating history of the industry with this type of installation, such figures may or may not be conclusive.

An additional consideration is that cable failure due to corrosion could affect all the cables in the installation more or less simultaneously due to the lengthy outage required for repair of a cable. Such an event would seriously jeopardize the source of off-site power required for the plant engineered safety features and to maintain the plant in a safe shutdown condition.

Additional information in regard to the reliability and operation of pipe cables can be obtained from IEEE Power Engineering Society, Insulated Conductors Committee, 345 East 47 Street, New York, New York 10017.

The use of submarine crossing would require a substation on the mainland to connect the four submarine circuits to the two overhead circuits. The substation would be located between Indian River Drive and the Florida East Coast Railway and would require a land area of 2-3 acres. Locating the substation west of the Florida East Coast Railway would require several hundred feet of additional underground cable, a crossing under the railway, extensive foundation preparation to a presently swampy area, and construction of access roads. A "breaker and one-half" scheme would be installed at this mainland switching station similar to the switching station at the plant and at St. Lucie, the terminus of the transmission lines. The breaker and one-half scheme provides the redundancy required to maintain service during equipment outages and is FP&L's standard design for major plants and switching stations. Anything less than the breaker and one-half of scheme would introduce a weak link in the system.

Aesthetically, submarine transmission would avoid impact on Indian River except for the switching stations at the site and on the mainland which would be visible from the Ft. Pierce and Jensen Beach bridges and from most of Indian River Drive between the two bridges.

From an ecological standpoint a submarine crossing is the most damaging since dredging and backfilling would be required across the entire width of the Indian River, and further dredging and backfilling would be required for repairs. The cables would be filled with oil under pressure creating a potential environmental hazard from leakage of oil to Indian River. In the event of cable casing leakage, oil pressure would be maintained in the cable until it could be repaired. The 10,000 foot crossing would contain approximately 30,000 gallons of oil per pipe, all or part of which could be released to Indian River depending on the size and location of the pipe rupture.

The cost estimates for a submarine crossing are presented in Table 8-1 as a comparison between a conventional overhead crossing and a steel tower crossing. It can be seen from the tabulation that the submarine crossing requires an additional $6,000,000 capital expenditure over the proposed steel tower crossing.

B. Overhead Crossing

The overhead transmission systems considered included a long span design with steel towers and a concrete H-frame design. Either type would consist of three circuits with no substation required between Indian River Drive and the Florida East Coast Railway. The steel tower design, although more expensive, was chosen on the basis of aesthetics and minimum disturbance to the Indian River.

Construction of the H-frame or steel tower lines will be done using a barge. Dredging may be required to allow it to reach the tower locations if the concrete H-frame design were used. No dredging will be required for the proposed steel tower design.

On the basis of aesthetics, a single conductor per phase was chosen rather than the two conductors per phase which would otherwise be used.

A detailed description of the proposed overhead river crossing is provided in the Unit No. 1 Final Safety Analysis Report, p. 3.1-10, Para. 3.1.17; p. 8.2-1, Para. 8.2.1.1; p. 8.2-2, Para. 8.2.2; and in the Environmental Report, pages III-1, III-2 and Appendices A-D of Supplement No. 1; and p. 19-1 of Supplement No. 2;

C. Summary

The overhead river crossing was selected over the submarine crossing on the bases of known superior reliability with significant dollar savings, less environmental impact and acceptability to governmental licensing agencies. The overhead transmission crossing provides ease of inspection and maintenance, significantly shorter outages to repair any type of failure, proven design for hurricane winds, a long history of reliable operation and is technically attractive even at a dollar premium. The overhead crossing requires no dredging of Indian River whereas considerable dredging is required for the installation of a pipe cable crossing and does not pose a threat of oil spillage.

No objections to the overhead crossing were noted by any of the agencies that have issued permits for construction of the overhead crossing. Copies of these permits were previously submitted as Appendices A-D to Supplement 1 to the Environmental Report. Copies of additional reviews, notices and hearings are submitted as Appendices A-F of this supplement which further document the licensing efforts to date for the overhead crossing.

D. Reconsideration of Submarine Crossing

Reconsideration of a submarine crossing at this time reveals no new arguments in favor of such a change and would in fact delay plant startup a minimum of 12 months since construction of the overhead lines was scheduled to commence in August 1972 and submarine crossing would require an additional year to engineer, obtain permits, purchase and install. The delay could be extended if the necessary permits could not be obtained in a timely manner. Such a delay would result in additional costs of $1,500,000 per month for interest during construction and approximately $2,000,000 per month for additional fuel and operating costs. In addition generating reserve margin would be reduced to 7.6% which could bring about load curtailment during peak load periods.

The August 1, 1972 start date for construction of the overhead crossing is dictated by the requirement for a large bloc of reliable power in the fall of 1973 necessary for preoperational startup and testing of various plant systems. The transmission lines are the preferred source of power since plant preoperational power requirements are not easily quantified due to the wide variability of startup activities. Preoperational power requirements will vary from a few thousand KVA to 30 or 40,000 KVA and the short term demand load required for starting large motors could far exceed these figures. A representative listing of plant electrical loads is presented in Table 8-1 of the Unit No. 1 PSAR.

Uprating the present distribution service provided to Hutchinson Island at 13 KV from White City Substation, six and one-half miles away, is possible but would fall far short of providing the necessary startup power. Presently the limit of these facilities is approximately 3600 KVA. Converting to 23 KV would increase the thermal capacity to 6300 KVA.

The use of on-site or barge-mounted gas turbines or diesels for startup power would necessitate a detailed study to determine the startup power requirements, the required and obtainable levels of reliability and the required size of the alternate power supplies since there is very little, if any, experience with the use of such power supplies for the long term load following requirements necessary for startup of a nuclear plant. In addition engineering for foundations, transformers, switchgear, fuel supply, fuel storage, and interface with the plant electrical systems; equipment procurement; installation and checkout would be required. Also expenditures for any of these alternate sources of power would require authorization by the Company Board of Directors since each would be a major capital expenditure not presently in the scope of the job. The time required to accomplish all of the above is optimistically estimated to be 15-18 months on an expedited basis.

If an alternate source could be installed in 12 months or less (some 3 to 6 months less than estimated) and if it is a reliable source of power, there would still be a delay in the start of commercial operation since a submarine crossing could not be completed until July 1974, at the earliest, some three months after the presently targeted fuel loading. Therefore it is concluded that the present plant startup schedule cannot be maintained using any source of startup power other than the transmission lines.

TABLE 8-1

COST COMPARISON
INDIAN RIVER CROSSING
(THOUSANDS OF DOLLARS)

	Steel Towers	Conventional Overhead	Underground Cable
Additional Cost of Plant Switchyard for Submarine Cable Terminals	-	-	$ 575
4 - 240 KV 2,500 kcmil Cables	-	-	6,000
Mainland Substation to Terminate Cables	-	-	2,500
Steel Tower Line - 2 Circuits	3,000	-	
Wood H-frame Line - 2 Circuits (24 Structures per Circuit in the Water)	-	1,200	
Total	$3,000	$1,200	$9,075

APPENDIX A

P U B L I C N O T I C E

DEPARTMENT OF THE ARMY
Jacksonville District, Corps of Engineers
400 West Bay Street, P.O. Box 4970
Jacksonville, Florida 32201

RECEIVED
FLORIDA POWER & LIGHT CO.
DEC 8 1970
OFFICE
CHIEF ENGINEER

SAJSP Permits (70-761)

7 December 1970

TO WHOM IT MAY CONCERN:

This District has received an application for a Department of the Army permit as described below:

APPLICANT: Florida Power & Light Company
P. O. Box 3100
Miami, Florida 33101

WATERWAY: Intracoastal Waterway, Jacksonville to Miami
Indian River
St. Lucie County, Florida

WORK: To construct three aerial electric power transmission lines across said waterway, approximately 7 miles north of State Road A1A (Jensen Beach) bridge, from mainland to Hutchinson Island in St. Lucie County, Florida as shown on drawing on reverse side of this notice. The aerials would provide a minimum vertical clearance of 90.0 feet above mean high water across the Intracoastal Waterway channel and 60.0 feet elsewhere.

This public notice is being distributed to all known interested persons in order to assist in developing facts on which decision by the Corps of Engineers can be based. For accuracy and completeness of the record, all data in support of or in opposition to the proposed work should be submitted in writing setting forth sufficient detail to furnish a clear understanding of the reasons for support or opposition. The decision as to whether a permit will be issued will be based on an evaluation of the impact of the proposed work on the public interest. Factors affecting the public interest include, but are not limited to, navigation, fish and wildlife, water quality, economics, conservation, aesthetics, recreation, water supply, flood damage prevention, ecosystems, and, in general, the needs and welfare of the people.

Comments on these factors will be accepted and made part of the record and will be considered in determining whether it would be in the best public interest to grant a permit.

Plans of the proposed work may be seen at the office of the District Engineer at the above address.

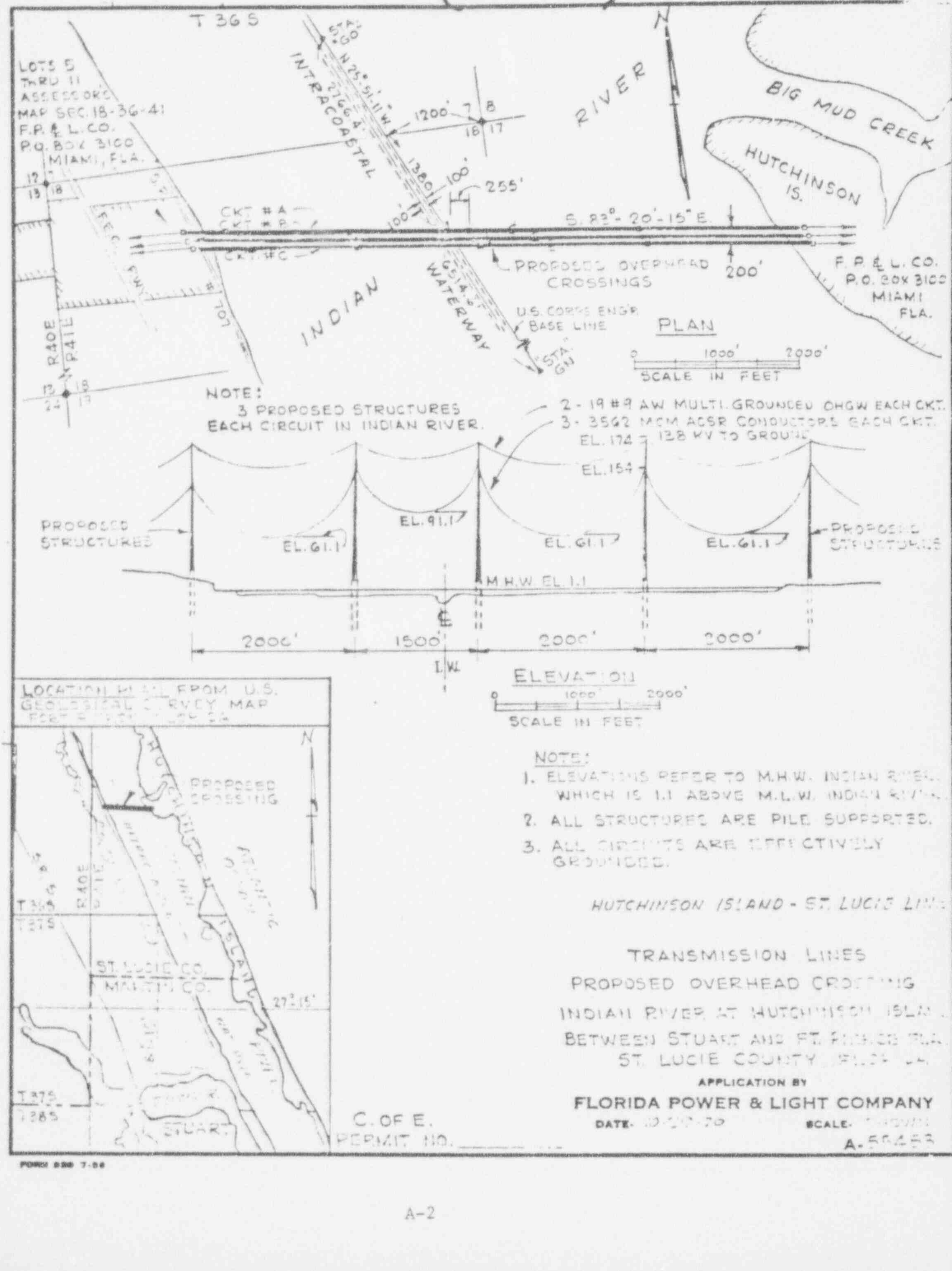
Comments regarding the application should be submitted to the District Engineer at the above address on or before 6 January 1971.

FOR THE DISTRICT ENGINEER:

A. L. McKnight

A. L. McKNIGHT
Chief, Operations Division

P(70-761)



T 36 S
LOTS 5 THRU 11 ASSESSOR'S MAP SEC. 18-36-41 F.P. & L. CO. P.O. BOX 3100 MIAMI, FLA.
INTRACOASTAL WATERWAY
RIVER
INDIAN
BIG MUD CREEK
HUTCHINSON IS.
N
CKT # A
CKT # B
CKT # C
S. 83°-20'-15" E.
PROPOSED OVERHEAD CROSSINGS
200'
255'
1200'
1380'
100'
F. P. & L. CO. P.O. BOX 3100 MIAMI FLA.
U.S. CORPS ENG'R. BASE LINE
R40E
R41E
PLAN
SCALE IN FEET
NOTE: 3 PROPOSED STRUCTURES EACH CIRCUIT IN INDIAN RIVER.
2 - 19 #9 AW MULTI. GROUNDED OHGW EACH CKT.
3 - 3562 MCM ACSR CONDUCTORS EACH CKT. 138 KV TO GROUND
EL. 174
EL. 154
EL. 91.1
EL. 61.1
PROPOSED STRUCTURES
M.H.W. EL. 1.1
2000'
1500'
2000'
2000'
L.W.
ELEVATION
SCALE IN FEET
LOCATION PLAN FROM U.S. GEOLOGICAL SURVEY MAP
PROPOSED CROSSING
T36S
T37S
T38S
ST. LUCIE CO.
MARTIN CO.
27°15'
STUART
NOTE:
1. ELEVATIONS REFER TO M.H.W. INDIAN RIVER WHICH IS 1.1 ABOVE M.L.W. INDIAN RIVER.
2. ALL STRUCTURES ARE PILE SUPPORTED.
3. ALL CIRCUITS ARE EFFECTIVELY GROUNDED.
HUTCHINSON ISLAND - ST. LUCIE LINE
TRANSMISSION LINES
PROPOSED OVERHEAD CROSSING
INDIAN RIVER AT HUTCHINSON ISLAND
BETWEEN STUART AND FT. PIERCE FLA.
ST. LUCIE COUNTY FLORIDA
APPLICATION BY
FLORIDA POWER & LIGHT COMPANY
DATE
SCALE
C. OF E. PERMIT NO.

APPENDIX B

STATE OF FLORIDA

BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

ELLIOT BUILDING — TALLAHASSEE, FLORIDA 32304

JAMES W. APTHORP
EXECUTIVE DIRECTOR

TELEPHONE 224-2101

December 9, 1970

RECEIVED
FLORIDA POWER & LIGHT CO.
DEC 11 1970
OFFICE
CHIEF ENGINEER

Honorable Randolph Hodges
Executive Director
Department of Natural Resources
Larson Building
Tallahassee, Florida 32304

Dr. O. E. Frye, Director
Game and Fresh Water Fish Commission
Farris Bryant Building
Tallahassee, Florida 32304

Gentlemen:

SAJSP Permit (70-761), St. Lucie County

Please furnish us with comments from your department regarding this notice so we can respond to the Corps of Engineers.

It is our understanding that such comments are required to comply with the Federal Wildlife Coordination Act and the Corps of Engineers administrative procedures. Until your comments are transmitted by this agency to the Corps, issuance of the federal permit will be delayed.

Sincerely,

Fred Vidzes

Fred Vidzes, Director
Land Management Division

FV/cb
Enclosure
cc: Florida Power and Light Company

Claude R. Kirk, Jr.
Governor

Tom Adams
Secretary of State

Earl Faircloth
Attorney General

Fred O. Dickinson, Jr.
Comptroller

Broward Williams
Treasurer

Floyd T. Christian
Commissioner of Education

Doyle Conner
Commissioner of Agriculture

STATE OF FLORIDA
BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND
ELLIOT BUILDING — TALLAHASSEE, FLORIDA 32304

JAMES W. APTHORP
EXECUTIVE DIRECTOR

TELEPHONE 224-2101

December 9, 1970

RECEIVED
FLORIDA POWER & LIGHT CO.
DEC 11 1970
OFFICE
CHIEF ENGINEER

District Engineer
Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32201

Dear Colonel Fullerton:

SAJSP Permit (70-761), St. Lucie County, Florida

This agency is proceeding to acquire comments from the Game and Fresh Water Fish Commission and the Department of Natural Resources relative to the referenced notice pursuant to the Wildlife Coordination Act.

In accordance with our understanding of the Act and in compliance with your administrative procedures, it is anticipated that issuance of the referenced permit will be delayed until comments from the environmental agencies are submitted to your department.

Sincerely,

Fred Vidzes

Fred Vidzes, Director
Land Management Division

FV/cb

cc: Florida Power and Light Company

Claude R. Kirk, Jr. Governor
Tom Adams Secretary of State
Earl Faircloth Attorney General
Fred O. Dickinson, Jr. Comptroller
Broward Williams Treasurer
Floyd T. Christian Commissioner of Education
Doyle Conner Commissioner of Agriculture

STATE OF FLORIDA

BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

ELLIOT BUILDING — TALLAHASSEE, FLORIDA 32304

JAMES W. APTHORP
EXECUTIVE DIRECTOR

TELEPHONE 224 210[illegible]

RECEIVED
FLORIDA POWER & LIGHT CO.
DEC 21 1970
OFFICE
CHIEF ENGINEER

December 17, 1970

District Engineer
Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32201

Dear Sir:

SAJSP Permit (70-75), St. Lucie County, Florida

This is to advise that after review of your notice, this office has no objection to issuance of the requested permit.

Sincerely,

Fred Vidzes

Fred Vidzes, Director
Land Management Division

REF	ROUTE TO	ANS
	Rivans Eyman Culberson Lewis	
/	Stanley Files FO File	
	Planning	
	Transmission	
	Substation Relay Drafting	
	Distribution Cath. Prot. Architect'l	
	Ayers	

FV:dgb

Enclosures

cc: Florida Power and Light Company

Claude R. Kirk, Jr.
Governor

Tom Adams
Secretary of State

Earl Faircloth
Attorney General

Fred O. Dickinson, Jr.
Comptroller

Broward Williams
Treasurer

Floyd T. Christian
Commissioner of Education

Doyle Conner
Commissioner of Agriculture

APPENDIX E

STATE OF FLORIDA
COUNTY OF ST. LUCIE

The undersigned Clerk of the Board of County Commissioners of the County and State aforesaid, does hereby certify that the foregoing is a true and correct copy of excerpts from the Minutes of the Board of County Commissioners' meeting held on the 15th day of December, 1970.

WITNESS my hand and the seal of said Board this 15th day of December, 1970.

ROGER POITRAS, CLERK CIRCUIT COURT

1

IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6"

1

IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6"

1

IMAGE EVALUATION
TEST TARGET (MT-3)

1.0 2.8 2.5 3.2 2.2 3.6 2.0 4.0 1.1 1.8 1.25 1.4 1.6

150mm

6"

1

IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6"

BOARD OF COUNTY COMMISSIONERS
December 15, 1970

The Board of County Commissioners in and for St. Lucie County, Florida, met in regular session in its meeting room in the Courthouse, Fort Pierce, Florida, on this 15th day of December, 1970, with the following members present: E. E. Green, Chairman, George D. Price, Vice Chairman, Marjorie B. Silver, W. R. McCain, and John B. Park.

Roger Poitras, Clerk Circuit Court, Ralph B. Wilson, County Attorney, Weldon B. Lewis, County Administrator, Ed. Heffron, Deputy Sheriff, and Josephine Rice, Secretary, were also present.

The meeting was brought to order by the Chairman at 9 A.M.

INVOCATION - COMMISIONER SILVER

MINUTES

Moved by Com. Price to approve the Minutes of December 8, 1970 was seconded by Com. McCain, and upon roll call, unanimously carried.

PISTOL PERMIT - PAUL BEAVER

Moved by Com. Price to approve the pistol permit of Paul Beaver to carry a 32 caliber #325671 pistol, was seconded by Com. Park, and upon roll call, unanimously carried.

Mr. Beaver appeared, and the necessary application, letters of recommendations, bond, and figerprinting report from Sheriff's office was recevied.

HIGH SCHOOL BAND TO INAUGURAL PARADE

At last week's meeting a motion was passed to authorize $300 to the High School Band in order that they might participate in the inaugural parade in Tallahassee, providing it could be done legally.

Memo was read from County Atty. advising the Atty. General in February, 1964, wrote an opinion in a letter to the effect that if the St. Lucie County High School band's appearance at the World's Fair would promote St. Lucie County, an expenditure could be authorized through the Advertising Committee, Industrial Development Commission or the Sandy Shoes Festival Committee. Since only the Sandy Shoes Festival Committee is still funded by the County it would seem logical to make the expenditure through them.

Moved by Com. McCain to amend lat week's motion and appropriate $300. from the advertising fund to the Sandy Shoes Festival Committee for the purpose of sending the school band to Tallahassee, was seconded by Com. Park, and upon roll call, unanimously carried.

FLORIDA POWER & LIGHT CO. - PERMISSION
GIVEN TO CONSTRUCT POWER TRANSMISSION LINES ACROSS RIVER

Mr. Richard Hill, Vice President, Fla. Power & Light Co. appeared to say that when the power plant is built on the island they would have to transport the current to the mainland and showed photos of proposed structures. He said they were planning on six structures now and possibly up to nine later, with 2000' between structures, constructed in tripod form with concrete bases, out of water 138-150'. He said he didn't think aerial navigational lights would be necessary, but if they were, they would be provided. There will be 96' clearance over waterway. Mr. Hill said they have been given Trustees, II Board approval.

Com. Silver asked what would be the alternative if the Corps denied granting this permit and Mr. Hill they would have to go underground, but this would require cutting a channel and dredging out, besides being very costly.

Admn. Lewis advised that the Corps of Engineers was sending notices that they have received application for this construction and the County can either approve, disapprove, or do nothing, on or before Jan. 6, 1971.

Moved by Com. Park to approve the design application was seconded by Com. McCain.

Com. Silver moved to amend the motion to include approval of application subject to approval by the Corps of Engineers, which was seconded by Com. Mc Cain, and upon roll call, unanimously carried.

FLORIDA POWER & LIGHT CO. - PARKING ON U.S. A-1-A

Admn. Lewis advised the State is issuing permits for "no parking" signs on A-1-A but if anyone breaks down they won't be prevented from parking until they can make other arrangements.

Mr. Hill said they had a large installation and the company constructing it are in charge of guarding it. He said they were anxious to have good relations with everyone so if any problems came up he and Mr. Zinni would take care of them, but protection was necessary because of the large investment.

Mr. Lewis said that when fishing was barred in Big Mud Creek, he called Mr. Hill who promptly took care of it.

HOSPITAL INDIGENT BILLS

It was moved by Com. Park, seconded by Com. McCain, and upon roll call, unanimously carried to approved the following Hospital Indigent Bills:

Ft. Pierce Memorial Hospital	$11,768.01
Medicaid	1,411.81

PORT ST. LUCIE - BRIDGES OVER NORTH FORK OF RIVER COMPLETED

Letter was received from Robert A. Bluem, Ass't. Vice President, General Development Corp. advising that construction of the Port St. Lucie Blvd. bridges over north fork St. Lucie River and Long Creek has been completed.

SOUTH BEACH PARK - PROPERTY DEEDED TO STATE AND LEASE AGREEMENT EXECUTED

Moved by Com. Park to adopt Resolution No. 70-93 which authorizes deeding south beach area (old Shamrock property) to State and leasing it back for 99 years, all contingent on receiving a $50,000 grant from theState for this development, was seconded by Com. McCain, and upon roll call, unanimously carried.

(Put Resolution No. 70-93 in Minutes)

BILLS

General Fund, Vouchers	#5846-5966,	Warrant List No. 10 . . .	$42,099.37
Road & Bridge, "	#1791-1811,	" " " 10 . . .	11,231.51
Operating Acct. Cks.	#977-1119		$53,330.88
Capital Outlay	#147		16,795.42
" "	Savings Acct.		14,000.00
Transferred funds to General Fund			$30,795.42

The Warrants so drawn being listed as specified by law and reference to said record is made a part of these Minutes as fully and completely as if said warrants were set out herein in detail.

Moved by Com.McCain to authorize the bills for payment was seconded by Com. Park, and upon roll call, unanimously carried.

RECEIVED
FLORIDA POWER & LIGHT CO.
DEC 23 1970
OFFICE
CHIEF ENGINEER

December 21, 1970

COPY

Mr. A. L. McKnight
Chief, Operations Division
U. S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32201

Re: SAJSP Permits (70-761)

Dear Mr. McKnight:

Your notice dated December 7, 1970 concerning subject permit was read and discussed at our Board meeting December 15, 1970. Our Board approved the application subject to your concurrence.

Very truly yours,

Weldon B. Lewis, P. E.
County Administrator

WBL/iw
cc: Mr. James Apthorp
✓Florida Power & Light Company
County Attorney
County Engineer

ROUTE TO	ARS
Bivans, Lyman, Culbertson, Lewis	
Stanley, Files, PO File	/
Planning	
Transmission	
Substation, Relay, Drafting	
Distribution, Gen. Plant, Architect'l	
Ayers	

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT
(FORMERLY HUTCHINSON ISLAND PLANT)
UNIT NO. 1

ENVIRONMENTAL REPORT
SUPPLEMENT NO. 9

June 5, 1973

Docket No. 50-335

INTRODUCTION

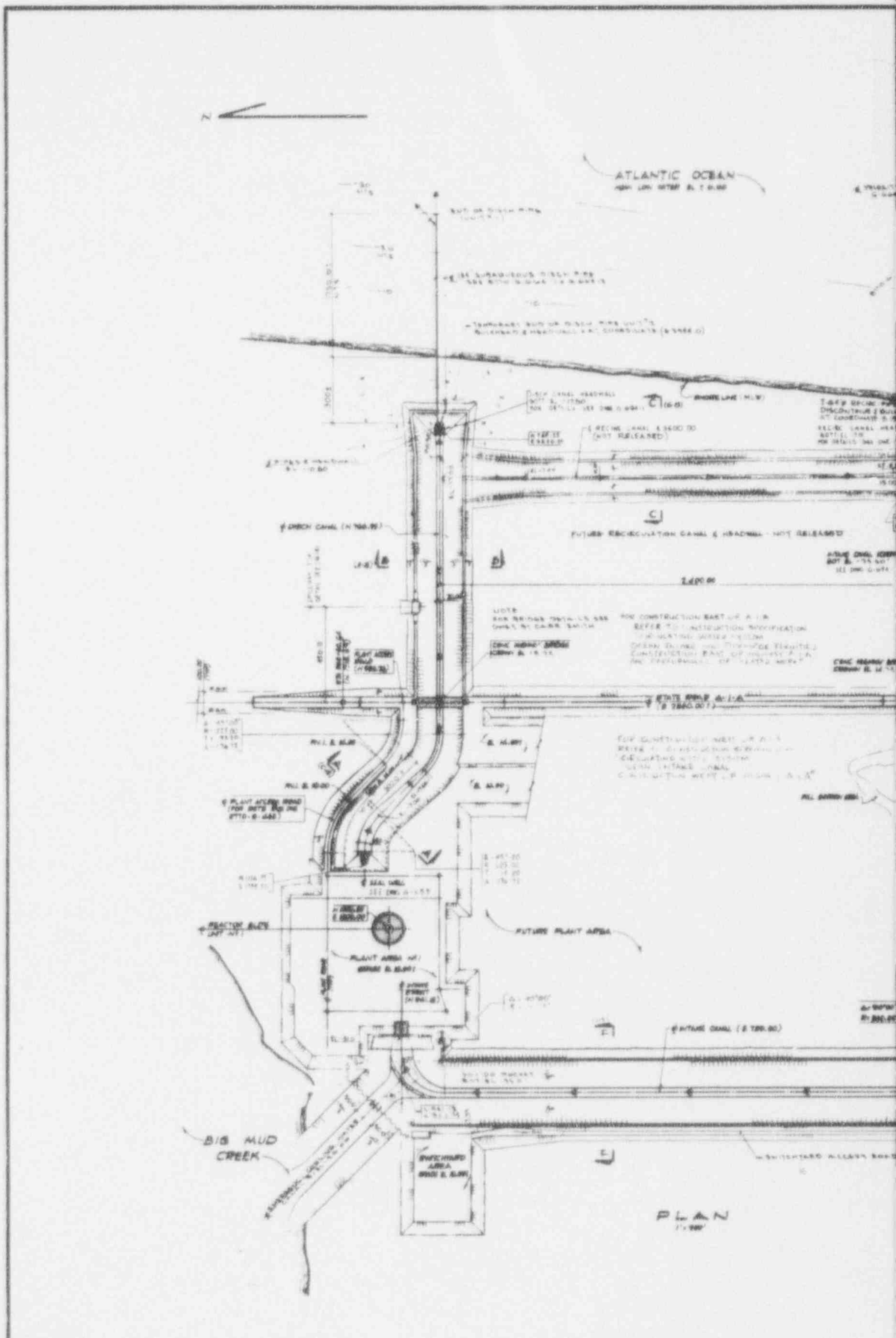
The Florida Power & Light Company St. Lucie Unit No. 1 (formerly Hutchinson Island) Environmental Report is herein supplemented by providing additional information by:

A. Condenser Cooling Water System - Replacement of pages 30 and 31, Section 2.3.3, Supplement 7 with pages 30, 31 and 31a, and Figures 2.3.3-4 through 2.3.3-7, Sup. 9.

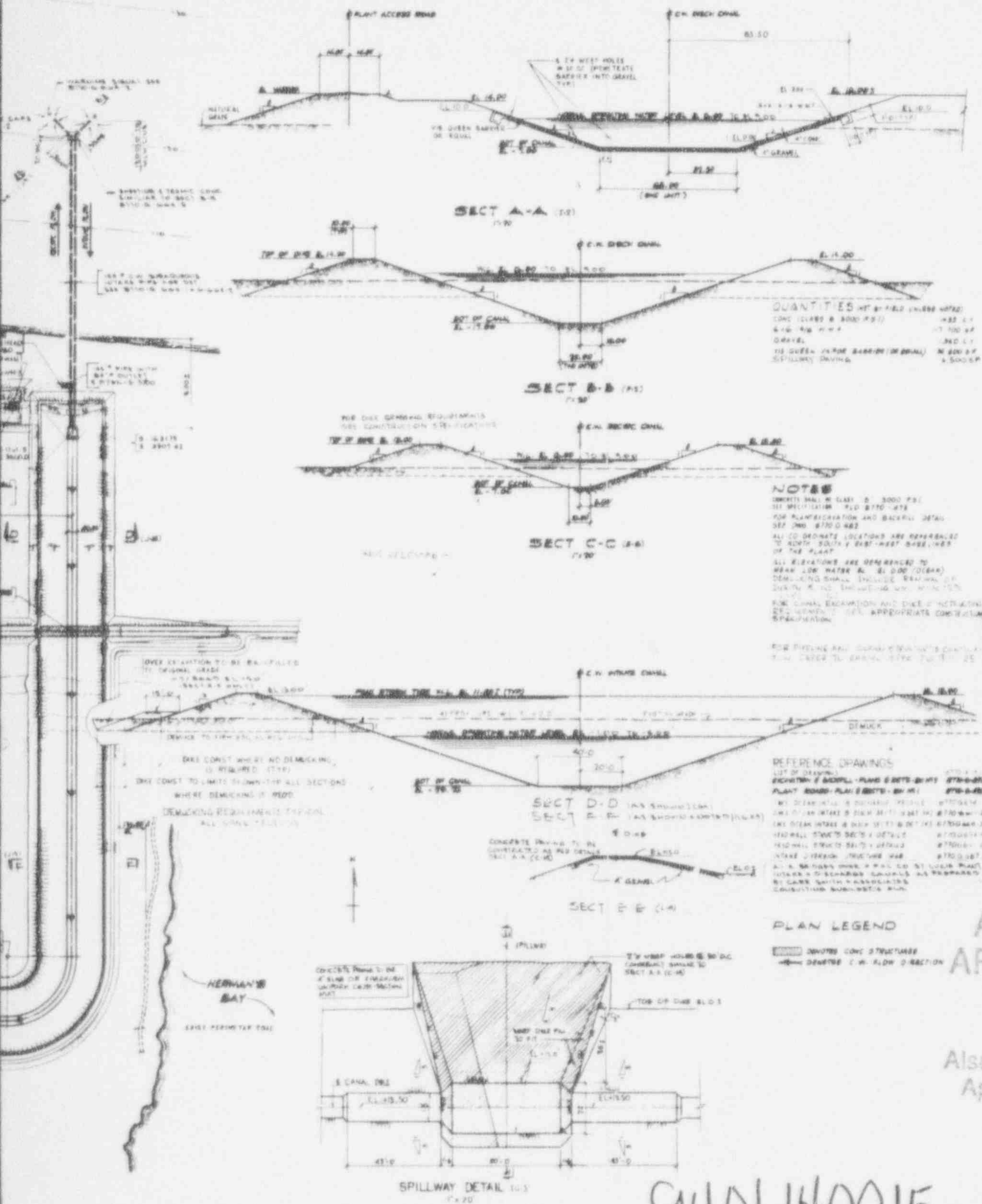
B. Steam Generator Blowdown Processing - Replacement of pages 56 and 57, Section 2.3.7 with pages 56 and 57, Sup. 9.

C. Air Quality Effects for Diesel - Generator Operation - Replacement of page 19-7, Question 19, Supplement 4 with page 19-7, Sup. 9.

D. Archaeological and Historical Resources Survey on the Transmission Line Right-of-Way - Addition of reference letter to Appendix 6, Documents Regarding Historical Sites.



N
ATLANTIC OCEAN
FUTURE RECIRCULATION CANAL & HEADWALL - NOT RELEASED
FUTURE PLANT AREA
BIG MUD CREEK
PLAN



ANSTEC APERTURE CARD

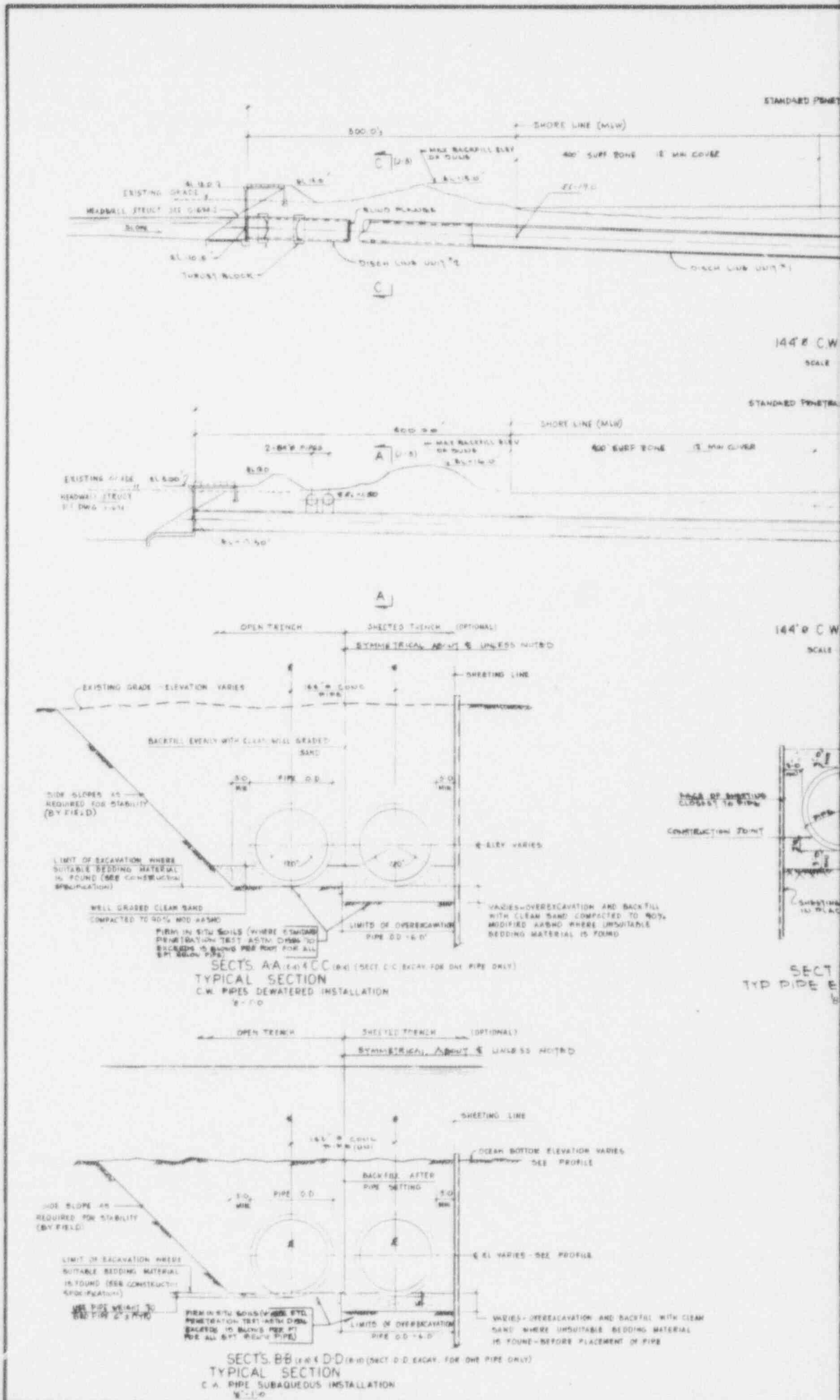
Also Available on Aperture Card

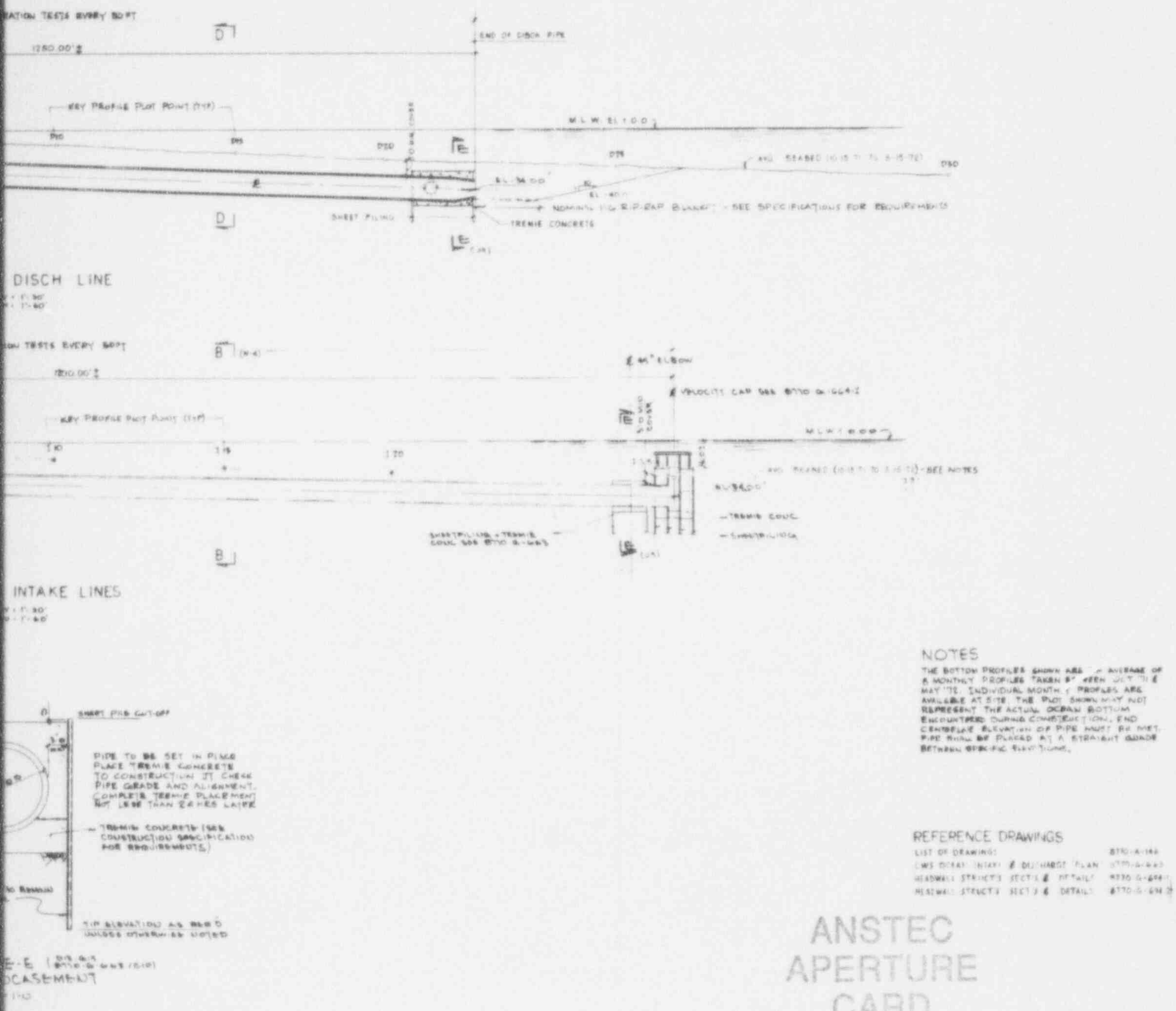
9406140015-14

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 1

CIRCULATING WATER SYSTEM
CANALS - PLAN AND SECTIONS

FIGURE 2.3.3-4


STANDARD PENET
SHORE LINE (MLW)
500.0'±
400' SURF ZONE 12' MIN COVER
EXISTING GRADE
THRUST BLOCK
144"⌀ C.W.
SCALE
SHORE LINE (MLW)
400' SURF ZONE 12' MIN COVER
EXISTING GRADE
OPEN TRENCH
SHEETED TRENCH (OPTIONAL)
SYMMETRICAL ABOUT ℄ UNLESS NOTED
SHEETING LINE
EXISTING GRADE - ELEVATION VARIES
BACKFILL EVENLY WITH CLEAN WELL GRADED SAND
PIPE O.D.
SIDE SLOPES AS REQUIRED FOR STABILITY (BY FIELD)
LIMIT OF EXCAVATION WHERE SUITABLE BEDDING MATERIAL IS FOUND (SEE CONSTRUCTION SPECIFICATION)
℄ ELEV VARIES
WELL GRADED CLEAN SAND COMPACTED TO 90% MOD AASHO
LIMITS OF OVEREXCAVATION PIPE O.D.+6'-0"
VARIES-OVEREXCAVATION AND BACKFILL WITH CLEAN SAND COMPACTED TO 90% MODIFIED AASHO WHERE UNSUITABLE BEDDING MATERIAL IS FOUND
CONSTRUCTION JOINT
SECTS. AA & CC
TYPICAL SECTION
C.W. PIPES DEWATERED INSTALLATION
SECT
TYP PIPE
OPEN TRENCH
SHEETED TRENCH (OPTIONAL)
SYMMETRICAL ABOUT ℄ UNLESS NOTED
SHEETING LINE
OCEAN BOTTOM ELEVATION VARIES SEE PROFILE
BACKFILL AFTER PIPE SETTING
PIPE O.D.
SIDE SLOPE AS REQUIRED FOR STABILITY (BY FIELD)
LIMIT OF EXCAVATION WHERE SUITABLE BEDDING MATERIAL IS FOUND (SEE CONSTRUCTION SPECIFICATION)
℄ EL VARIES - SEE PROFILE
LIMITS OF OVEREXCAVATION PIPE O.D.+6'-0"
VARIES - OVEREXCAVATION AND BACKFILL WITH CLEAN SAND WHERE UNSUITABLE BEDDING MATERIAL IS FOUND - BEFORE PLACEMENT OF PIPE
SECTS. BB & DD
TYPICAL SECTION
C.W. PIPE SUBAQUEOUS INSTALLATION



ANSTEC
APERTURE
CARD

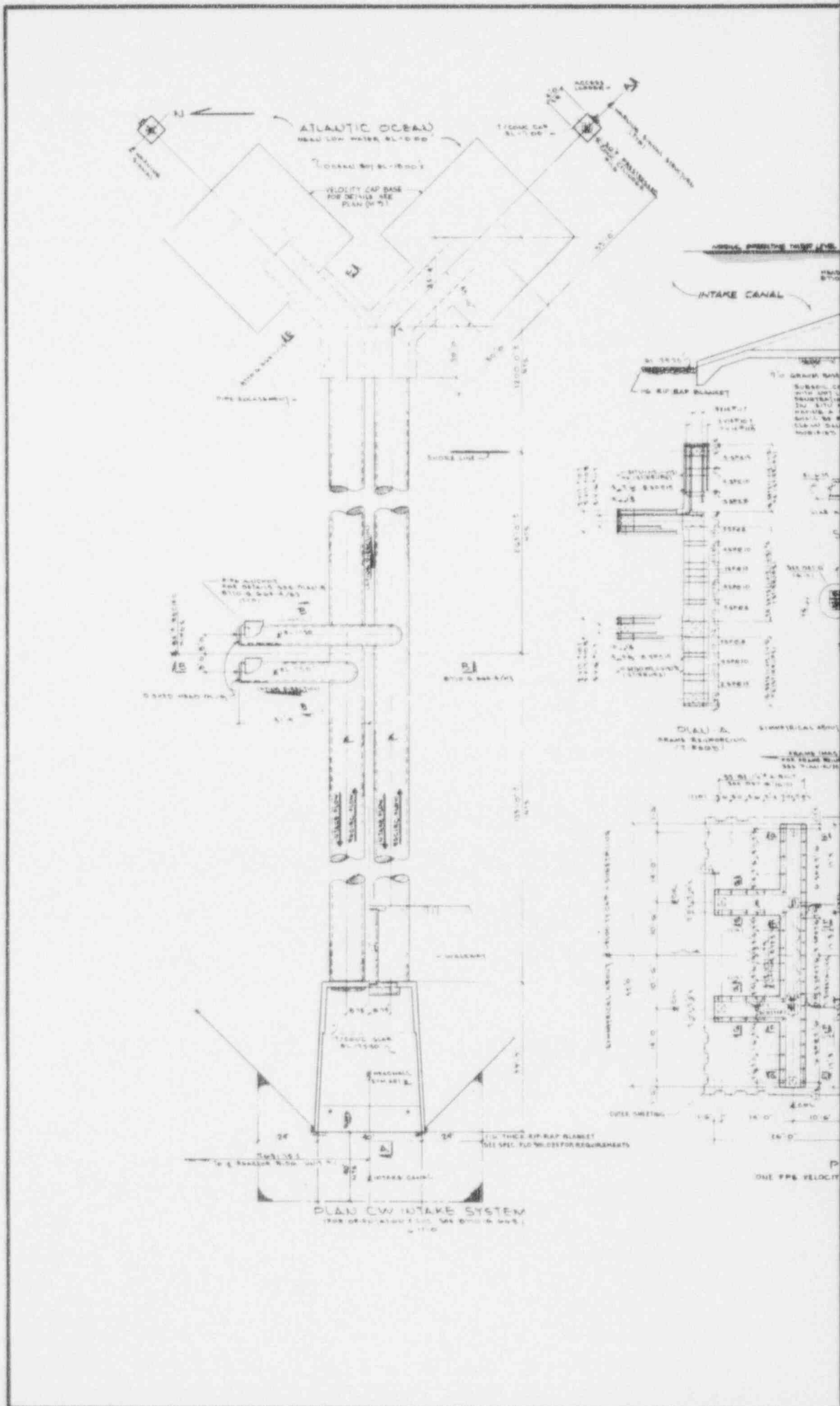
Also Available on
Aperture Card

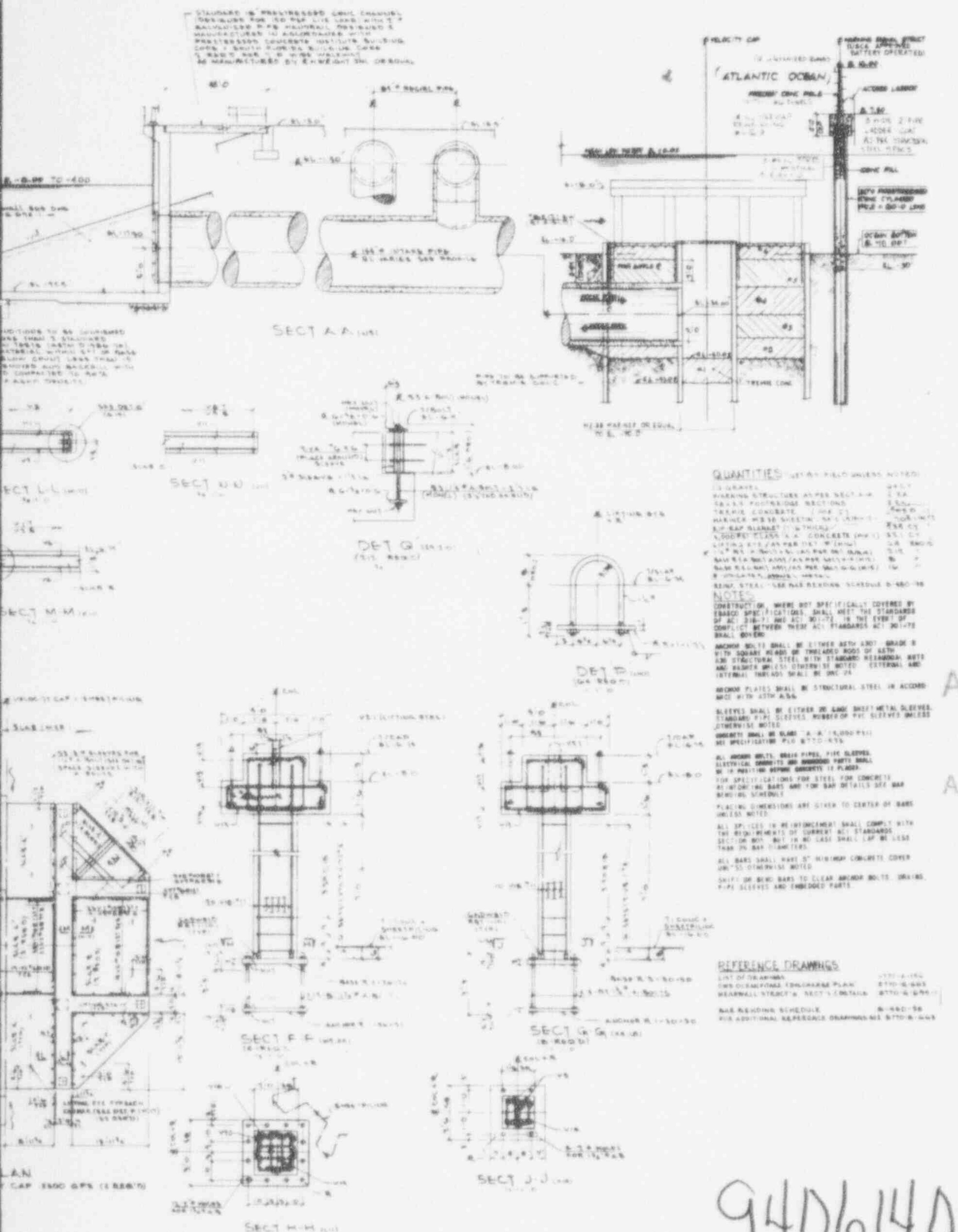
9406140015-15

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 1

CIRCULATING WATER LINES - SECTIONS

FIGURE 2.3.3-5


ATLANTIC OCEAN
INTAKE CANAL
PLAN CW INTAKE SYSTEM



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Also Available on
Aperture Card

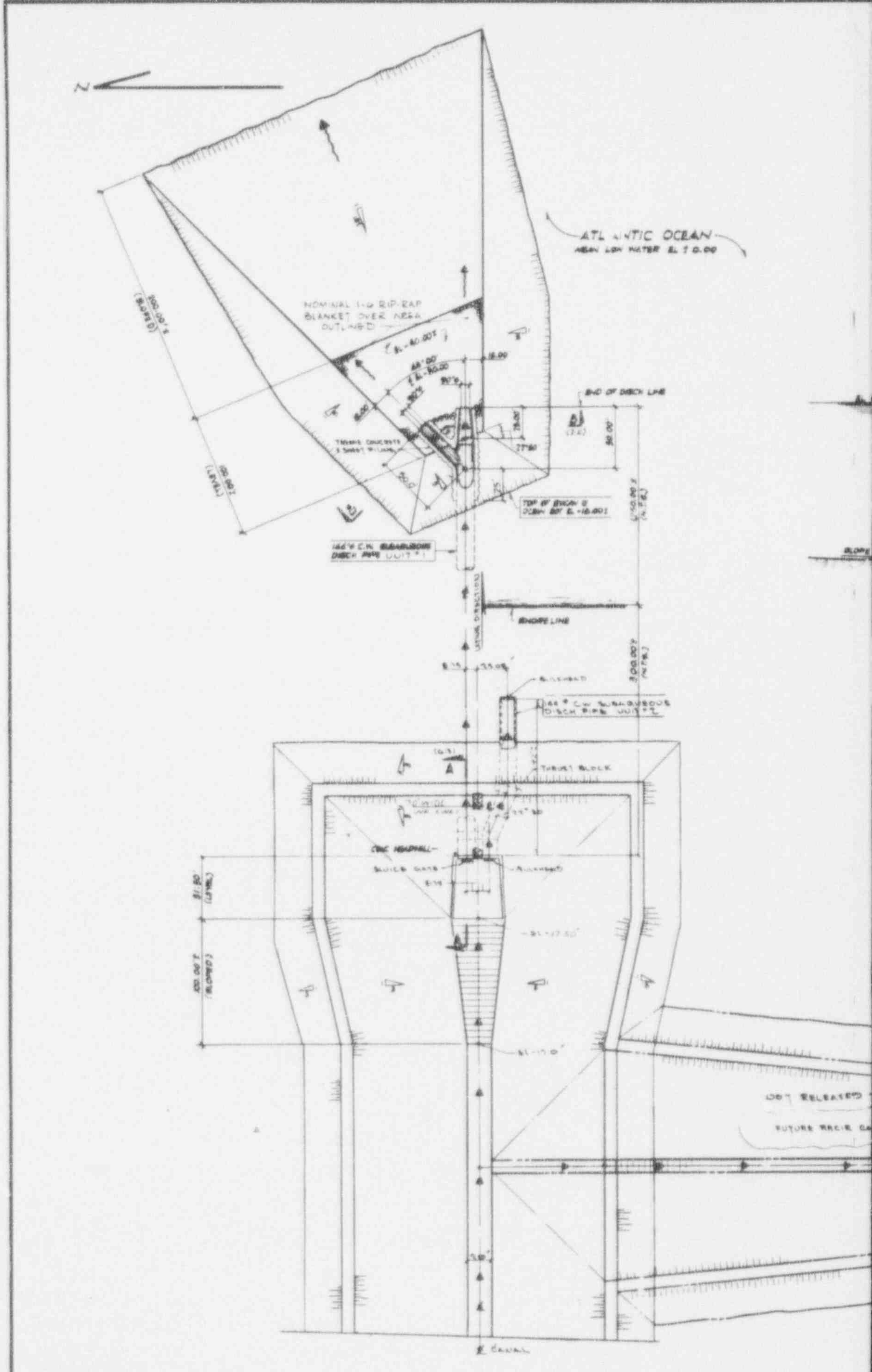
9406140015-16

FLORIDA POWER & LIGHT COMPANY

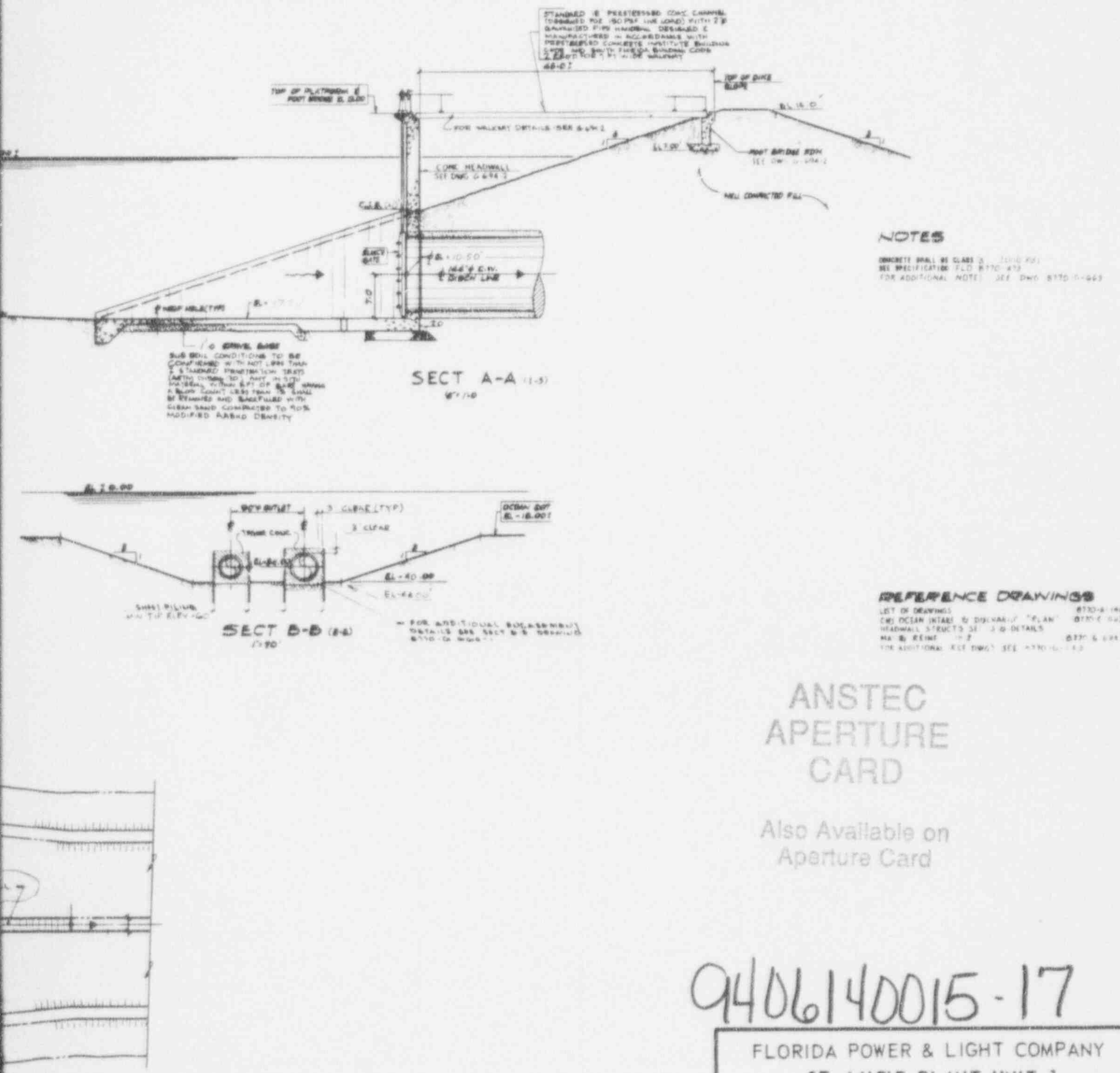
ST. LUCIE PLANT UNIT 1

CIRCULATING WATER SYSTEM
INTAKE - PLAN AND SECTIONS

FIGURE 2.3.3-6



PLAN - C.W. DISCH SYSTEM
(FOR ORIENTATION & LOCATION SEE DWG 8770-G-443)



ANSTEC
APERTURE
CARD

Also Available on
Aperture Card

9406140015-17

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT UNIT 1

CIRCULATING WATER SYSTEM
DISCHARGE - PLAN AND SECTIONS

FIGURE 2.3.3-7

2.3.7 RADIOACTIVE DISCHARGES

The Florida Power and Light Company has always reviewed, from the initiation of the Hutchinson Island project, the design and proposed operating procedures to assure that every effort will be made to maintain radiation releases to levels "as low as practicable." The applicant believes that the radwaste system's design meets the definition of "as low as practicable" as given in Part 10, Section 50.34a of the Code of Federal Regulations in which it is stated that such term means "as low as practicably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety and in relation to the utilization of atomic energy in the public interest."

The radwaste system's equipment installed will be capable, by virtue of successive process components and/or recycling features and the appropriate storage facilities, of reducing the contained activity in discharged liquids to, or nearly equal to, natural background levels, with the possible exception of tritium. However, even the tritium releases will be kept well below the permissible limits. Storage facilities are provided to reduce the gaseous activity levels by decay before their release. Nevertheless, in spite of the strong belief that the presently designed radwaste system is most adequate, Florida Power and Light will stay informed of developments in this area of radiation control and, if necessary, would consider the incorporation of advanced treatment equipment into the present waste management system as such systems are demonstrated to be practical and necessary.

As a case in point, provisions will be made to increase the capacity of equipment to process radioactive waste appearing in steam generator blowdown during the contingency of small amounts of steam generator tube leakage. The blowdown will be cooled sufficiently to preclude flashing in the blowdown tank to limit release of activity via the blowdown tank vent. An appropriate combination of evaporation and/or demineralization equipment will be utilized having at least a 10 gpm capacity to practically eliminate radioiodine release to the atmosphere and to the circulating water, thereby meeting the guidelines of 10 CFR 50, Appendix I.

The effects of any radioactive releases on the aquatic and terrestrial ecosystems will be measured in the radiological monitoring program. It is believed that the monitoring program will show no measurable radiological impact on the environs as a result of the operation of the plant.

2.3.7.1 Description of the Waste Management System

The waste management system, located in the auxiliary building, is composed of tanks, process equipment and piping necessary for handling radioactive wastes within the confines of the plant and for preparing these wastes for reuse or for offsite disposal. The waste management system includes two subsystems; (1) the boric acid recovery system for normally recoverable liquids, and (2) the waste treatment system for nonrecoverable liquid, gaseous and solid wastes.

The boron recovery system treats the recoverable hydrogen bearing liquid effluent from the reactor coolant system. The design of the system is based on the requirements for processing both the fission products which may be released while operating with 1 percent defective fuel and the radioactive corrosion products carried in the effluent. It should be noted that 1 percent defective fuel is a design number only and affords protection in the event of either transient or long time increases in the amount of failed fuel. The anticipated percent of defective fuel is expected to be at least an order of magnitude lower. The activity level of the liquid effluent is substantially reduced by decay during holdup and by filtration, ion exchange and degasification before it is concentrated and then monitored for either discharge or for reuse in the plant. Normally this treated liquid will be reused.

The waste treatment system treats all nonrecoverable radioactive liquid wastes, solid wastes and gaseous waste mixtures. The system is also designed to process effluent with an activity level based on plant operation with 1 percent defective fuel although, as indicated above, the anticipated percent of defective fuel is expected to be well below this. The basic processing methods used are storage, filtration and concentration. Radioactive solid wastes are compacted in drums for offsite disposal. Any releases of gaseous and liquid effluent from the waste treatment processes shall be in accordance with the provisions of Part 20 of Title 10 of the Code of Federal Regulations. Means are provided to sample potentially radioactive liquid and gaseous wastes in storage tanks prior to their release.

The waste management system is designed to provide controlled treatment and disposal of gaseous and solid wastes and either disposal or reuse of liquid wastes. The principal design criterion concerning disposal is to insure that the general public is protected by maintaining all releases of radioactive materials well within the limits of 10 CFR 20. Releases of radioactivity will be via the batch process after the stored liquid or gas to be released has been sampled. Liquid will be released to its circulating water discharge canal, which has an 1140 cfs (~510,000 gpm) flow. Gases will be discharged to the plant vent which is located on the side of the shield building and is released to the atmosphere at an elevation of 140 ft. Filters are located in the gaseous discharge line.

The waste management system flow diagrams are shown in Figs. 2.3.7-1, 2.3.7-2, 2.3.7-3, and 2.3.7-4. A description of the subsystems follows:

Boron Recovery System

This portion of the system is shown in Figs. 2.3.7-1 and 2.3.7-2. The major source of liquid waste containing hydrogen is reactor coolant letdown that occurs during plant startups and dilution operations. These are transient situations which the system can readily accommodate. Minor sources inside the containment are accumulated in the reactor drain tank during normal operation. These minor sources include leakoff, drain and relief flows from valves and equipment inside the containment which contain reactor coolant.

The liquid wastes either pumped from the reactor drain tank or released from the chemical and volume control system are sprayed into the flash tank. The dissolved hydrogen and any fission gases released from solution are purged to the gas surge header by nitrogen. The nitrogen is maintained in the flash tank at a pressure slightly above atmospheric to prevent air in-leakage and the formation of an explosive hydrogen-oxygen mixture. The flash tank pump operation is controlled automatically by a signal from the tank level. Pressure and level instrumentation with alarms inform the operator of any malfunction.

d. Storm, floor, and equipment drains that are not potentially radioactive are routed to a settling basin.

e. Floor and equipment drains that are potentially radioactive are routed to the waste management system for processing by filtration, concentration and/or ion exchange as necessary, prior to release to the circulating water.

f. The pertinent data on air quality effects from the normal operation of the diesel generators is summarized in the following table:

DIESEL GENERATOR AIRBORNE EMISSIONS

(One Unit, Normal Operation, Less than 100 Hrs/Yr., Average Loading = 2100 Kw)

Combustion Product	Emissions, Lb/Hr
Particulate	3.6
Oxides of sulphur* (SO_x as SO_2)	8.4
Carbon monoxide	9.8
Hydrocarbons	3.9
Oxides of nitrogen (NO_x as NO_2)	50.
Aldehydes (as HCHO)	0.6
Organic acids	1.0

*Based on No. 2 diesel fuel oil with sulphur content of 0.5 percent.

STATE OF FLORIDA
Department of State
THE CAPITOL
TALLAHASSEE 32304

RICHARD (DICK) STONE
SECRETARY OF STATE

ROBERT WILLIAMS, DIRECTOR
DIVISION OF ARCHIVES, HISTORY, AND
RECORDS MANAGEMENT
(904) 488-1480

May 31, 1973

Mr. W. J. Barrow, Jr.
Environmental Affairs
Florida Power and Light Company
Post Office Box 3100
Miami, Florida 33101

Re: Archaeological and Historical Survey Results of the St. Lucie Plant Transmission Line Right-of-way.

Dear Mr. Barrow:

This is to inform you that the above referrenced survey has been completed, and that this project will not affect any archaeological or historical sites. The survey was conducted by Lynn Nidy, a survey archaeologist with our agency. His assessment was made available March 22, 1973, and Florida Power and Light was to be notified March 26, 1973. Due to a clerical oversight, this notification was withheld until the present time. We apologize for any inconveniences this delay may have generated.

Sincerely,

L. Ross Morrell
State Archaeologist and
Chief, Bureau of Historic
Sites and Properties

LRM:ser

APPENDIX 1

PLANT DESCRIPTION

APPENDIX 1

PLANT DESCRIPTION

The following, with quite minor changes, has been taken directly from Section 1 of the PSAR (Ref. 1).

OVER-ALL PLANT ARRANGEMENTS

The turbine building for the Hutchinson Island Plant is oriented parallel to State Road A1A and the shoreline of the Atlantic Ocean, with the reactor containment structure located on the east, or seaward, side of the turbine building. The auxiliary building, shown in Fig. App. 1-1, is located perpendicular and close to the turbine building, running in an east-west direction and the fuel handling building is located next to the reactor containment building and the auxiliary building, running in a north-south direction. The service building is located north of the turbine building.

The containment structure houses the Nuclear Steam Supply System (NSSS), consisting of the reactor, steam generators, reactor coolant pumps, pressurizer, and some of the reactor auxiliaries which do not require access during power operation. The containment structure is served by a circular traveling bridge crane.

The auxiliary building, located next to the turbine and fuel handling buildings, houses the waste treatment facilities, engineered safeguards components, heating and ventilating system components, switchgear, laboratories, offices, laundry and control rooms.

The fuel handling building contains the spent fuel pool and new fuel storage facilities. The fuel transfer is via a fuel transfer tube running from the reactor containment building to the fuel handling building.

The turbine building houses the turbine generator, condensers, feedwater heaters, condensate and feedwater pumps, turbine auxiliaries and certain of the switchgear assemblies.

The service building provides offices, shop and warehouse space, and is located next to the turbine building unloading bay.

MAJOR SUB-SYSTEM DESCRIPTIONS

Reactor

The reactor core is fueled with uranium dioxide pellets enclosed in Zircaloy tubes with welded end plugs. The tubes are fabricated into assemblies in which end fittings prevent axial motion and grids prevent lateral motion of the tubes. The core consists of 217 fuel assemblies loaded with three different U-235 enrichments. The control element assemblies (CEA's) consist of NiCrFe alloy clad boron carbide absorber rods which are guided by tubes located within the fuel assembly.

The reactor vessel and its closure head are fabricated from Manganese-Moly steel clad with stainless steel. The vessel and its internals are designed so that the integrated neutron flux (greater than 1.0 Mev) at the vessel wall will be less than 2.14×10^{19} nvt over a 40-year period.

The internal structures include the core support barrel, the core support plate, the core shroud, the thermal shield, and the upper guide structure assembly. The core support barrel is a right circular cylinder supported from a ring flange from a ledge on the reactor vessel. It carries the entire weight of the core. The core support plate transmits the weight of the core to the core support barrel by means of vertical columns and a beam structure. The core shroud surrounds the core and minimizes the amount of bypass flow. The upper guide structure provides a flow shroud for the CEA's and prevents upward motion of the fuel assemblies during pressure transients. Lateral motion limiters are provided at the lower end of the core support barrel assembly.

Reactor Coolant System

The reactor coolant system is arranged as two closed loops connected in parallel to the reactor vessel. Each loop consists of one 42-in.-ID outlet (hot) pipe, one steam generator, two 30-in.-ID inlet (cold) pipes and two pumps. An electrically heated pressurizer is connected to one of the loops and a safety injection line is connected to each of the four inlet legs.

The reactor coolant system operates at a nominal pressure of 2,250 psi absolute. The reactor coolant enters near the top of the reactor vessel, then flows downward between the reactor vessel shell and the core support barrel into the lower plenum. It then flows upward through the core, leaves the reactor vessel, and flows through the tube side of the two vertical U-tube steam generators where heat is transferred to the secondary system. Reactor coolant pumps return the reactor coolant to the reactor vessel.

The two steam generators are vertical shell and U-tube units. The steam generated in the shell side of the steam generator flows upward through moisture separators which reduce its moisture content to less than 0.2 percent. All surfaces in contact with the reactor coolant are either stainless steel or NiCrFe alloy in order to maintain reactor coolant purity.

The reactor coolant is circulated by four electric motor driven single-suction centrifugal pumps. The pump shafts are sealed by mechanical seals. The seal performance is monitored by pressure and temperature sensing devices in the seal system.

Containment

The containment is comprised of a steel containment vessel surrounded by a reinforced concrete shield building. The containment vessel is a low leakage steel shell which is designed to confine the radioactive material that could be released from a postulated loss of integrity of the reactor coolant system boundary coupled with gross failure of fuel elements in the core. It is a cylindrical vessel with hemispherical dome and ellipsoidal bottom. The shield building is a medium leakage concrete structure which surrounds the steel containment vessel. It protects the containment vessel from external missiles, and provides biological shielding and a means of collecting radioactive fission products that may leak from the containment following a major hypothetical accident.

The containment in conjunction with the engineered safeguards is designed to withstand the internal pressure and coincident temperature resulting from the energy release associated with the worst postulated loss-of-coolant accident at a power level of 2,700 Mwt.

Engineered Safeguards Systems

Engineered safeguards systems protect the public and plant personnel in the highly unlikely event of an accidental release of radioactive fission products from the reactor system, particularly as the result of loss-of-coolant accidents. These safeguards function to localize, control, mitigate, and terminate such accidents to hold exposure levels below applicable limits.

The engineered safeguards systems are:

a. The safety injection system (including high pressure and low pressure safety injection pumps and the safety injection tanks);

b. The containment spray systems;

c. The containment cooling system;

d. Shield building ventilation system.

In the highly unlikely event of a loss-of-coolant accident, the safety injection system injects borated water into the reactor coolant system. This provides cooling to limit core damage and fission product release, and assures adequate shutdown margin regardless of temperature. The injection systems also provide continuous long-term post-accident cooling of the core by recirculation of borated water from the containment sump.

The containment is equipped with two 100 percent capacity spray systems and an independent full capacity containment cooling system for cooling the containment atmosphere following the postulated loss-of-coolant accident.

The containment sprays supply borated water to cool and reduce pressure in the containment atmosphere. The system is designed so that with one pump, one set of spray nozzles, and one shutdown cooling heat exchanger in operation, adequate cooling is provided to cool the containment atmosphere. The pumps take suction initially from the refueling water tanks. Long term cooling is based on suction from the containment sump through the recirculation lines.

The containment cooling system is designed to provide containment atmosphere mixing by recirculation. The cooling coils and fans of the containment cooling system are sized to provide adequate containment cooling at post-accident conditions of temperature and humidity.

A shield building ventilation system is provided to maintain a negative pressure in the annulus between the steel containment building and the concrete shield building following a loss-of-coolant accident. Two independent 100% capacity systems are provided. This system reduces the escape of radioactivity to the environment.

PLANT INSTRUMENTATION AND CONTROL

Control

The reactor control system provides for startup and shutdown of the reactor and for adjustment of the reactor power in response to turbine load demand. The Nuclear Steam Supply System is capable of following a ramp change from 15 percent to 100 percent power at a rate of 5 percent per minute and at greater rates over smaller load change increments up to a step change of 10 percent. This control is normally accomplished by automatic movement of CEA's in response to a change in reactor coolant temperature, with manual control capable of overriding the automatic signal at any time. A temperature controller compares the existing average reactor coolant temperature with the value corresponding to the power called for by the temperature control program. If the temperature is different, the CEA's are adjusted until the difference is zero. Regulation of the reactor coolant temperature in accordance with this program maintains the secondary steam pressure within operating limits and matches reactor power to load demand.

The reactor is controlled by a combination of control element assemblies and dissolved boric acid in the reactor coolant. Boric acid is used for reactivity changes associated with large but gradual changes in water temperature and fuel burnup. Additions of boric acid also provide an increased shutdown margin during the initial loading and subsequent refuelings. The boric acid solution is prepared and stored at a temperature sufficiently high to prevent precipitation.

CEA movement provides changes in reactivity for shutdown or power changes. The CEA's are actuated by control drive mechanisms mounted on the reactor vessel head. The control drive mechanisms are designed to permit rapid insertion of the CEA's into the reactor core by gravity. CEA motion can be initiated manually or automatically.

The pressure in the reactor coolant system is controlled by regulating the temperature of the coolant in the pressurizer, where steam and water are held in thermal equilibrium. Steam is formed by the pressurizer heaters or condensed by the pressurizer spray to reduce variations caused by expansion and contraction of the reactor coolant due to reactor system temperature changes.

Over-pressure protection is provided by power-operated relief valves and spring-loaded safety valves connected to the pressurizer and designed in accordance with Section III of the ASME code. The discharge from the pressurizer safety and relief valves is released under water in the pressurizer quench tank, where it is condensed and cooled. In the event the discharged steam exceeds the capacity of the tank, the tank relieves to the containment atmosphere.

Instrumentation

The nuclear instrumentation includes out-of-core and in-core flux detectors. Ten channels of out-of-core instrumentation monitor the neutron flux and provide reactor protection and control signals during startup and power operation. Four of the channels follow the neutron flux through the startup range, and six channels follow the neutron flux from within the startup range through the full power range. Of the latter, four are used for reactor protection and two for reactor control.

The in-core monitors provide information on neutron flux distribution.

The reactor parameters are maintained within the acceptable limits by the inherent characteristics of the reactor, by the CEA system, by boron in the moderator and by the operating procedures. In addition, in order to preclude unsafe conditions for plant equipment or personnel, the reactor protective system initiates reactor shutdown if selected parameters reach their preset limits. Four independent channels normally monitor each of the selected plant parameters. The reactor protective system logic is designed to initiate protective action whenever the signal of any two of four channels reaches the preset limit. Redundancy is provided in all parts of the reactor protective system to assure that no single failure will prevent protective action when it is required.

The process instrumentation monitoring includes those critical channels which are used for protective action. Additional temperature, pressure, flow and liquid level monitoring is provided, as required, to keep the operating personnel informed of plant conditions, and to provide information from which plant processes can be evaluated and/or regulated. The boron concentration in the reactor coolant water is also monitored and concentration information is presented in the control room.

Instrument signals penetrating the containment are electric. Instrument signal transmission for the remaining plant instruments is either electric or pneumatic depending on the function to be served.

The plant gaseous and liquid effluents are monitored for radioactivity. Activity levels are displayed and off-normal values are annunciated. Area monitoring stations are provided to measure radioactivity at selected locations in the plant.

ELECTRICAL SYSTEMS

The Hutchinson Island plant includes a 1,000 Mva, 0.85 power-factor generator delivering power to a 240 kv switchyard through a step-up power transformer. Auxiliary power is utilized at 6.9 kv, 4.16 kv, 480 v, and 120 v ac. 125 v dc systems are also provided for emergency power, engineered safeguards control, and essential nuclear instrumentation.

The auxiliary load is normally supplied from two auxiliary transformers connected to the main generator bus. Startup power is supplied from two startup transformers connected to the 240 kv switchyard. Emergency power for the engineered safeguards is supplied by redundant diesel generators.

AUXILIARY SYSTEMS

Chemical and Volume Control System

The purity level in the reactor coolant system is controlled by continuous purification of a bypass stream of reactor coolant. Water removed from the reactor coolant system is cooled in the regenerative heat exchanger. From there, the coolant flows to the letdown heat exchanger and then through a filter and a demineralizer where corrosion and fission products are removed. It is then sprayed into the volume control tank, and returned to the reactor coolant system by the charging pumps.

The chemical and volume control system automatically adjusts the amount of reactor coolant to compensate for changes in specific volume due to coolant temperature changes and reactor coolant pump shaft controlled seal leakage in order to maintain a constant level in the pressurizer.

Shutdown Cooling System

The shutdown cooling system is used to reduce the temperature of the reactor coolant at a controlled rate from 300°F to a refueling temperature of approximately 130°F and to maintain the prcper reactor coolant temperature during refueling.

The shutdown cooling system utilizes the low-pressure safety injection pumps to circulate the reactor coolant through two shutdown heat exchangers, returning it to the reactor coolant system through the low-pressure injection header.

The component cooling system supplies cooling water for the shutdown heat exchangers.

Component Cooling System

The component cooling system, consisting of three pumps and two heat exchangers, removes heat from the various auxiliary systems containing the reactor coolant. Corrosion inhibited, demineralized water is circulated by the system through all components of the nuclear steam supply system that require cooling water. During reactor shutdown, component cooling water is also circulated through the shutdown heat exchangers. The component cooling system provides an intermediate barrier between the reactor coolant system and the intake cooling water system.

Fuel Handling and Storage

New fuel is stored dry in vertical racks within a storage vault in the fuel handling building. Room is provided for storing two-thirds of a core. The vault construction and fuel assembly spacing precludes criticality.

The fuel pool is a reinforced concrete structure which provides storage capacity for one and one-third cores. Spent fuel assemblies are stored in vertical racks so spaced as to preclude criticality with no credit taken for the borated pool water. Provisions are made for storing two-thirds of a core inside the containment adjacent to the refueling canal.

Cooling and purification equipment is provided for the fuel pool water. This equipment may also be used for cleanup of refueling water after each fuel change in the reactor.

The fuel handling systems provide for the safe handling of fuel assemblies and control element assemblies under all foreseeable conditions and for the required assembly, disassembly, and storage of reactor internals. These systems include a refueling machine located inside containment above the refueling pool, the fuel transfer carriage, the tilting machines, the fuel transfer tube, a fuel handling machine in the spent fuel storage room, and various devices used for handling the reactor vessel head and internals.

Sampling Systems

Two sampling systems are provided; one for the reactor coolant and its auxiliary systems, and one for the turbine steam and feedwater system. These systems are used for determining both chemical and radiochemical conditions of the various process fluids used in the plant.

Cooling Water Systems

The turbine generator condenser is cooled by the circulating water system which takes suction from, and discharges into, the Atlantic Ocean.

An intake cooling water system provides seawater from the circulating water system intake structure to the component cooling water heat exchangers and the turbine closed cooling system heat exchangers.

The turbine closed cooling system removes heat from the turbine generator oil cooler, hydrogen coolers, feed pump oil coolers, sample coolers, and other components by circulating demineralized water buffered with potassium dichromate through the system.

Plant Ventilation Systems

Separate ventilation systems are provided for the containment vessel, the control room, the auxiliary building, and the turbine building. A purge system is also provided for the containment vessel atmosphere.

The annular space between the steel containment vessel and the concrete shield building has a separate ventilation system with charcoal filters. This system is automatically put into operation following a postulated loss-of-coolant accident.

Plant Fire Protection System

The fire protection system provides water to fire hydrants, spray systems and hose racks in the various areas of the plant.

Where possible, noncombustible and fire resistant materials will be used throughout the facility, particularly in areas containing critical portions of the plant such as the containment structure, control room, cable spreading room, and rooms containing components of the engineered safeguards systems.

A number of portable fire extinguishers are placed at key locations for use in extinguishing limited fires.

STEAM AND POWER CONVERSION SYSTEM

The turbine generator is furnished by the Westinghouse Electric Corporation. It is an 1,800 rpm tandem-compound, four-flow exhaust unit with 44 inch last stage blades. The feedwater pumps are electric motor driven. Each of two strings of feedwater heaters consists of five low pressure and one high pressure heater.

The auxiliary feedwater system contains two 325 gpm electric motor driven pumps and one 650 gpm pump driven by a non-condensing steam turbine. This system is designed to provide emergency heat removal capacity.

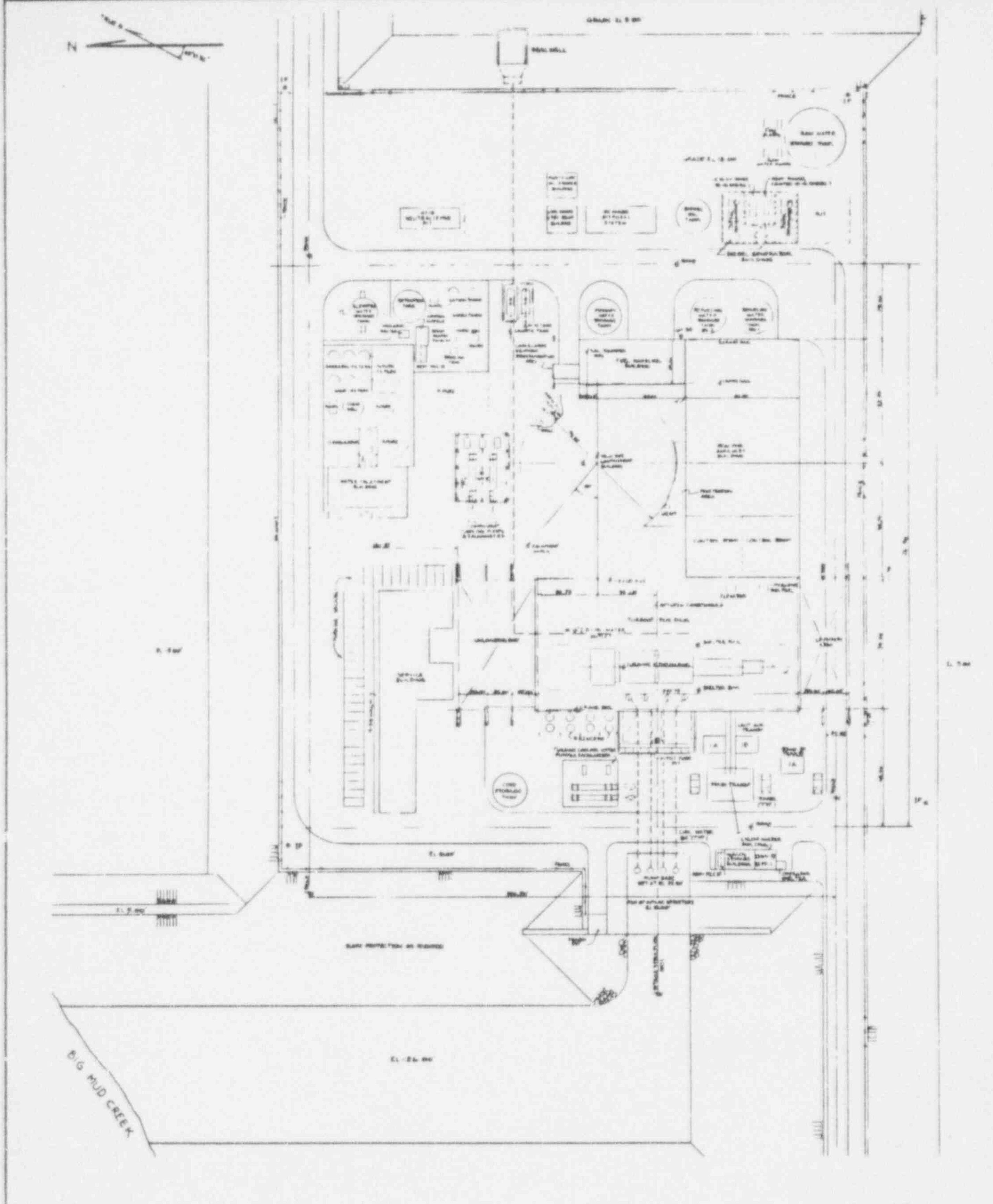
WASTE MANAGEMENT SYSTEM

The waste management system provides the means for controlled handling, storage and disposal of liquid, gaseous and solid wastes. In addition, the system provides the mechanism for reconcentrating and recovering dissolved boron from the liquid effluent for reuse in the plant.

Liquid effluent from the reactor coolant system is first passed through one of the purification ion exchangers in the chemical and volume control system. It is then processed in the waste management system, where the effluent is treated in the waste processing filters and ion exchangers and a boric acid concentrator for removal of radioactive materials. All of the liquid condensate that cannot be re-used is sampled prior to release. Liquid wastes such as from laboratory drains, building sumps, and contaminated showers are filtered and treated in the waste concentrator. Laundry wastes are normally only filtered. The concentrations of any liquid releases shall not exceed 10CFR20.

All solid wastes are stored in suitable containers for offsite disposal.

Waste gases are collected in the gas surge header and the waste gas surge tank and are compressed into the gas decay tanks. The waste gas is held in the gas decay tanks and is released to the plant vent after sampling. The three waste gas decay tanks have a 30-day storage capacity. The tank contents will be released in accordance with the limits established by 10CFR20.



NOTES

1. • GM - GEIGER - MULLER MONITOR
   • FP - FISSION PRODUCT
   • I P ION CHAMBER (PAIR)
2. PLANT DATUM SHALL BE MEAN LOW WATER EL. 0.00

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT

ENLARGED
PLANT PLOT PLAN

FIGURE APP. 1-1

APPENDIX 2.

PAST AND PRESENT CONDITION OF TIDAL LITTORAL PLANTS AND VEGETATION

Dr. Davis

APPENDIX 2

PAST AND PRESENT CONDITION OF TIDAL LITTORAL PLANTS AND VEGETATION AT AND NEAR SITE OF THE FLORIDA POWER AND LIGHT INSTALLATION ON HUTCHINSON ISLAND, FLORIDA

(February 19, 1971)

JOHN H. DAVIS, Ph. D.
ECOLOGY CONSULTANT
Gainesville, Florida

The area from Ft. Pierce to and including the Florida Power and Light Company's installation for a nuclear power plant on Hutchinson Island has along the western or inner side of this long island a distinct zone of mangrove and other tidal littoral vegetation. There are also, at levels above the high tides and on filled land areas, plants of the strand vegetation. These trees, shrubs and some herbaceous growth of plants have been, in many large to small parts of this island, changed by construction, mosquito control, and other activities of man. Approximately 50 percent of the total area has been thus altered, and many of these alterations have so severely changed the natural vegetation that it may take years to re-establish itself or may never do so.

Salt water marshes and salt water swamps, which in the subtropical areas of Florida are mainly mangrove shrubs and trees, are very effective breeding and refuge areas for many animals that include small fish, shrimp, shell-fish, many insects, and some reptiles and mammals. The birds use them for rookeries and feed in the pools and streams in these swamp areas. Not many mammals completely depend on them as a home habitat, but raccoons, the cougar, otter, and some deer frequent them.

Such swamps border lagoons, such as the Indian River, on the tidal areas and slightly above mean high tide. The Aedes, Culex and other pest and disease vector mosquitoes often breed abundantly in the salt marsh and mangrove areas. Control of these pest insects began decades ago, first by flooding using pumps, and later by spraying and some filling. The flooding was practiced in St. Lucie and adjacent counties on an extensive scale. Dr. Maurice Provost of the State Public Health Service, Vero Beach, has records of many of these mosquito control practices. He has definitely determined that black mangroves are injured or killed when water is held at levels above the height of the black mangrove pneumatophores. The areas thus killed are extensive along the Hutchinson Island road (State Route A1A) leading to the site of the power plant installation and on the site itself.

With these large areas of mangroves destroyed for the past few decades it is doubtful if any part of Hutchinson Island near the site and on it has been a normal mangrove habitat capable of supporting the normal complement of animals, especially the mammals, birds and reptiles. The building of the power plant has not and will not, therefore, reduce the area of good habitats for such animals because the favorable habitats had nearly all been severely altered or destroyed before construction began.

The most distinct alteration of the mangrove tidal areas of the inner, western side of the island has been by flooding for mosquito control. The damage has been mainly to the black mangrove, Avicennia nitida, vegetation that is most often interior from the Indian River border of red mangroves, Rhizophora mangle. In areas as large as a few hundred acres all or nearly all of the black mangroves and some of the red mangroves were drowned and killed as early as during the 1940's and there has been very little regrowth of the mangroves or of many of the other salt water littoral plants. A few red mangroves and some white mangroves, Laguncularia racemosa, were not so extensively killed as the black mangroves, and in some places these are re-populating the areas of heavy mangrove kill.

The early 1930's and 1940's method of mosquito control, that of pumping water onto mangrove swamp areas up to about 2 feet deep, had the effect of drowning many of the trees and bushes. The black mangroves have distinct upright roots that extend up from horizontal roots to levels of 1 to 2 feet above the soil. These upright roots are correctly known as pneumatophores because they breathe by allowing and promoting an exchange of gases, which for the plant are oxygen in and carbon dioxide out. The flooding above the levels of these pneumatophores deprived the roots and the whole tree or bush of some of their oxygen supply and injured or killed the plants. Similarly red mangroves have roots that breathe. These are the arching prop roots that have openings, known as lenticels. Such lenticels do not extend all the way up some of the prop roots and when water is high enough to cover the lenticels the red mangroves may suffer from oxygen deficiency. The kill of these is not, however, as frequent as the kill of black mangroves.

Such kills or other alteration of large areas of mangroves by excessive flooding made large areas near and on the power plant site a distinctly low quality vegetation area as far as the ecological attributes are concerned. The leaf fall from the red and other mangroves, which contributes the first nutrients of the food chain of animals, was reduced and with the death of the trees and bushes the usual animals using the mangroves as homes, such as the racoons, some birds, and many insects left or died. The despoiled mangroved areas became almost a biological desert.

The approximately 1,100 acres of the Florida Power and Light property had been greatly altered by this flooding for mosquito control. The size and areas of this despoiled area is shown on many air photos taken before the present construction began. Using these photos it is possible to show how much of the Florida Power and Light area was not in the natural state of good mangrove growth. At present most of the construction is on areas that were almost entirely despoiled and of no ecological balance or usefulness.

A perimeter road has been constructed around part of the property that circles the power plant site. Road fill material was piled to make this perimeter road at a height and at a slope that may with time erode some of the material into the healthy and mostly red mangroves that border much of this road. If this road is allowed to erode down into the mangroves that border it on the outside, the fill material will accumulate to a depth that may kill or otherwise damage some of the mangroves. This should be avoided as much as possible by encouraging and planting such bushes as Baccharis on the road shoulders.

The interior areas of this perimeter road are, during construction, subject to flooding and many other alterations. It is probably impossible to avoid this damage to the few living mangroves and other native plants inside this perimeter. However, plans should be made to re-plant after construction is completed. Such re-planting can be done with both native and exotic trees and shrubs, and some of these can be ornamental plants that will notably enhance the attractiveness of the power plant site.

APPENDIX 3.

HUTCHINSON ISLAND ECOLOGICAL SURVEYS

Dr. Lackey

HUTCHINSON ISLAND ECOLOGIC SURVEYS

Dr. James B. Lackey
Professor Emeritus, University of Florida
Report to the Florida Power and Light Company
(January 8, 1970)*

Introduction

Surveys of the Indian River adjacent to and including Big Mud Creek, and the Atlantic Ocean east of Big Mud Creek had been made during 1968, 1969 and 1970. These were designed to show:

1. The nature and abundance of the microscopic algae and protozoa, as a first step in the fish food chain.

2. The nature and abundance of the larger - or next in the food chain - animals, as demonstrated by plankton net catches.

3. The nature and abundance of the grasses and macroscopic algae as offering nursery grounds for invertebrate animals, their eggs, larvae, and juvenile fish.

4. The bottom dwelling (benthic) animals, both those indirectly of economic importance, and those (such as scallops) of direct importance.

These assays were made:

1. In Mud Creek, four stations, as shown on Figure HI-1.

2. In Indian River in a one to two mile semicircle around the mouth of Big Mud Creek. However, the plankton net samples were taken in Big Mud Creek and in the channel a mile north and a mile south of Beacon 206.

3. Plankton net samples in the Fort Pierce Inlet at midflow of incoming tide and of outgoing tide. This was to secure ocean water and Indian River water, and samples were taken near the Inlet mouth, when the current was about 5-6 knots. A similar set of net samples was taken in the St. Lucie Inlet.

4. Bottom (benthic) samples were taken for mud and sand dwelling animals at nine stations in Indian River and Big Mud Creek, shown on Figure HI-1, and at ten stations in the Ocean shown on Figure HI-2-1.

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* At the time this report was prepared plans called for a condenso cooling water intake from Big Mud Creek on the Indian River. In the present design the intake is from the Atlantic.

5. Water bottle samples were taken for plankton quality and quantity in the Ocean out from shore along the discharge transect. Additionally, visual observations were made by divers at all Ocean stations plus photographs whenever feasible. In Indian River photographs were hardly necessary because direct observation from the boat presented an accurate picture, but in the Ocean they were very useful, where the stations were in water 20 to 60 feet deep.

Other observations included temperature, and at some stations copper, nitrate and phosphate. The nature of the bottom - whether rocky, sandy or silty - was noted, and general notes on turbidity and color were included.

Findings

From the above studies certain generalizations are evident, and may be stated as conclusions valid for the times and places where work was done.

1. Indian River supports an enormous biomass of manatee grass and several species of macroscopic algae. Turtle grass, (Thalassia) was not found. The dominant alga was Gracilaria, but several others are common. Most of them are red algae, although patches of Sphacelaria, a brown alga, were found. This forest, often ten inches high, contains large numbers of gammarids (scud), shrimp, isopods, small crabs and juvenile fish. Egg masses or single eggs of various invertebrates are found here, and the branches and leaves of the plants support large numbers of caprellids, bryozoans, very small worms and very small attaching algae. The leaves of manatee grass are a substrate for the attachment of vast quantities of organisms, mostly diatoms such as Licmophora, but also various protozoa such as the colonial ciliate Zoothamnion.

Altogether Indian River supports the nursery concept very well indeed. It affords protection to a very large variety and number of animals. It offers an abundance of food for many animals, especially the smaller ones who browse on the attached diatoms and other plants. It is a place where re-cycling of the nutrients - organic matter to inorganic matter to organic matter - is a normal procedure. Three characteristics of this stretch of estuary should be noted, in view of the discussion which follows:

a. The growth is heaviest toward the western shore.

b. The character of the water, especially salinity and turbidity, varies considerably from time to time.

c. The growths are so thick as to trap and hold free floating particulate matter whether copepods, protozoa, eggs or invertebrates. The growths act much like a sieve such as Purdy long ago ascribed to the macroscopic growths in the Potomac below Washington.

2. Indian River supports an abundant and diverse plankton. It owes its character to a constant raindown of organic matter in the overgrown area, i.e., those from 0.0 to 4.0 feet, sometimes more, of depth. This organic matter undergoes bacterial decomposition on the bottom, and the mineral salts liberated are utilized by the algae, and the bacteria by protozoa, rotifers, copepods, etc., to maintain a high population. The diversity of this plankton and its connotations will be discussed later.

3. The sediment water interface is densely populated and it is inferred that it is a place of intense biochemical activity. This conclusion may not be valid for large areas, since only four cores have been examined. But the list for these is long and diverse and is quite comparable to cores from such estuarine situations as Great South Bay, New York.

4. The benthic population, as shown by Carr is large, containing many shellfish, tube dwelling worms and crustaceans. These either dwell in the mud or in tubes or crawl about in the macroscopic growths or on the bottom. Accordingly they are hardly susceptible to being displaced and swept along by a moderate current. Shrimp and juvenile fish are also abundant although not benthic. These are more responsive to current action, but for those which are hatched in the ocean, such as shrimp, it is hardly likely that all of them enter the River on the incoming tides at the two inlets. In fact, both are frequently brought up when scooping up a mass of algae and grass. In other words, many are not readily dislodged from the "forest". This point will be discussed later.

5. Tows in Big Mud Creek and in the channel of the intracoastal waterway revealed very few eggs or larval forms - only calanoid copepods. Certainly there is no vast assemblage of suspended invertebrates, eggs and juvenile forms routinely present in the river.

6. Plankton tows in the two inlets show considerable numbers of estuarine organisms being carried out on the outgoing tide, and considerable numbers of oceanic organisms being brought in on the incoming tide. Very few oceanic organisms persist in the River, and few estuarine organisms are found in the samples taken either by net or water bottle, in the ocean stations east of Big Mud Creek. Whether they die in the ocean or whether they are widely scattered is not determined. See "Discussion".

7. The only organisms of direct economic importance (aside from an occasional fish) found thus far in the River have been shrimp, young blue crabs and a very few conchs. Normally the River is fine for speckled trout, but in May and June at least, fishermen were far more abundant in both inlets. Channel bass, trout and snook appeared to be most commonly taken, but many other species such as drum, sheepshead and mangrove snappers were also caught.

8. In the ocean, only a few calico scallops were found in extensive diving with good visibility, and over a radius of several miles from the plant site. This is widely known; the large scallop beds found by the Fish and Wildlife Service are quite distant.

9. The ocean bottoms at all stations visited were sand or sand-shell, and with no grass or macroscopic algae, and virtually no rock or coral outcrops or reefs.

10. The benthic organisms were principally tube dwelling worms, shellfish and echinoderms, and they were much less in number than would be found in a bay or estuary.

11. The nutrient levels for the ocean plankton were low. There was no organic-silt interface on the bottom and phosphate levels in the upper waters were very low. Plankton was diverse in species, but very sparse in numbers.

Discussion

An investigation of this sort usually yields a rather composite picture of the biology and ecology of the area involved, but it should be remembered that there is some latitude for error since it covers only a limited period of time. Nevertheless, those of us who have made these investigations can balance them against past experience. Furthermore, generalized conclusions are based not only on conditions at the time the work was done, but also on this past experience.

The species found in the nine Indian River Stations on May 23, 1969 simply verified what has previously been stated for Indian River - that all of the plankton algal groups are present except Coccolithophora and Silicoflagellata, and that ciliates and zooflagellates of the Protozoa are present in sufficient abundance to have balancing function. The diversity of species (more than 90) indicates a water with no extreme conditions, and the numbers per ml. are high enough, despite the very small size of some components, as to indicate a water well supplied with nutrients. This is despite the competition for nutrients exerted by the huge crop of macroscopic algae. The indications of the species diversity and from a gross inspection of the bottom growths in Indian River are that it is highly productive, and that it is evenly balanced.

The same indications result from examining its sediment-water interface. Again the same groups are present, except that four species of sulfur bacteria occur. However, diatoms and dinoflagellates are far less represented, whereas colorless euglenids and ciliates are much more abundant, in species and in biomass. Evidently much organic matter is being decomposed by bacteria in the interface, and the colorless euglenids utilize the liberated soluble organic matter, and the ciliates eat the bacteria. Dissolved oxygen is low in the interface, judging from the facultative nature of the ciliates and colorless euglenids, and the paucity of diatoms and photosynthetic dinoflagellates there.

Approximately the same population of benthic organisms was present in the Indian River in May 1969 as in an earlier study. However the macroscopic vegetation had grown in height and density, as the temperature increased in the River, and it was necessary to pull the shrimp trawl 50 yards in this survey.

Of interest is that in the May, 1969 survey 16 species of fish observed are juveniles, and that they were taken in the macroscopic growths. Some such as sea trout, channel bass and sheepshead are much sought after, both for sport and as food, so they may be regarded as highly important. Of equal importance, and not found in this survey, are mangrove snapper, snook and drum. However the point is made that these beds of estuarine vegetation are important in providing us with both food and sport. Of equal interest is that no edible shellfish were found in this study, beyond a few quahogs which were picked up at Station 2.

Having assessed the biologic importance of the section of Indian River concerned, the question arises as to the population of fish food organisms, larvae and eggs which might be found in the water which will enter Big Mud Lake and the cooling system of the power plant, <u>if the cooling water is taken from this lake.</u>* These populations were sampled with a Clarke-Bumpus measuring plankton net, size 20 mesh. The net was towed approximately 100 yards just below the surface at three locations, viz., the mouth of Big Mud Creek; in the channel, a mile north of Big Mud Creek; and in the channel somewhat below Big Mud Creek. Very few organisms other than copepods were taken, and the numbers per liter were much lower than expected. Not a single juvenile fish was taken. The answer of course is that they were largely in the grass and algae. The significance of this will be dealt with later. At any rate, it appears that only the very small organisms are suspended in the water which might move into Big Mud Lake in any quantity.

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* Problems concerned with taking cooling water from Big Mud Lake (Creek) on the Indian River as posed in the report had considerable bearing on FP&L's decision to move the intake to the Atlantic side, even though considerable expense was involved in this major design change.

The Inlets
Plankton

One of the assertions concerning taking water from the River and emptying it into the Ocean is that enormous numbers of food organisms, eggs and larval forms will thus be lost. Such statements should not be made unless supported by data. Some of the organisms concerned do float passively, others swim against a current, and others occur in the larger vegetation of the bottom, to which they are attached (worm eggs, ascidians) or to which they cling (caprellids, shrimp, certain small mollusks) and from which they are dislodged only with difficulty. It is by no means a safe assertion that whatever is in Indian River is moved by a slight or even a strong current.

The velocity from Indian River into Big Mud Lake will be so low that very little entrapment of the larger plankton is envisaged. Not much transport of larger plankton is expected.

In Table 1, we have some indication of what plankton is being transported out through Fort Pierce Inlet, as taken by a Clarke-Bumpus net, but at high velocities. Aside from copepoda and the larvae of various other crustacea, the numbers per liter are small. The copepods, most of them calanoid types, dinoflagellates and ciliates, are found in considerable abundance in the Gulf Stream at Pompano Beach, and in even greater numbers in the shelf water. They also occur in great numbers in water taken from amid the Indian River vegetation. Inasmuch as this acts as a screen or protective trap, there is very little likelihood of serious depletion of their populations in Indian River, unless in the immediate vicinity of the access channel to Big Mud Lake. There has been some discussion of a screen to keep this larger plankton and juvenile fishes from entering the Lake. I consider it unnecessary for the plankton, although it might be useful for juvenile fishes. However, there will be no vegetation in the Lake, because of its depth, and all these organisms tend to be found where there is vegetation. The screen would have to be made of non-toxic material, its meshes could not be more than 2-3 millimeters in diameter, and clogging, along with growth of attaching organisms, would be a major problem.

Actually, as shown by Table 1, there is as much or more coming into the River on the flood tide, as is lost on the ebb tide when we consider the larger or net plankton such as copepods. Despite the absence of grass beds on the shelf, there is a substantial plankton there. If, however, we compare this plankton with that over grass beds, it is only a small fraction of what is found over grass. This population in Table 1 is measured in numbers per liter, and it is intended to quantitate the larger organisms - the first eight categories - which are not often found in centrifuging 100 mls. of raw water.

If we examine the centrifuge plankton of the shelf water, as shown in Table 2, the number of species, and the number per ml. is but a fraction - a tenth or a thousandth of the population in the Indian River, i.e., over the grass beds. In short, there is a huge population per liter of smaller than net plankton in the Indian River; a fraction of this same population in the ocean water over the shelf; and a reasonable population of copepods and net plankton in both areas.

This does not mean that plankton going out through the power plant would not be lost, but it does indicate that the plankton content of inshore waters is substantial, and that there is a high potential for replacement through the Inlets. No data are shown for St. Lucie Inlet, but the data there were almost identical with the Fort Pierce data. One notable exception was a much greater population of large dinoflagellates (Peridinium depressum, Gymnodinium splendens) in the shelf water, possibly because of fertilization by Okeechobee water. In both areas there were large populations of diatoms, not included here (except Coscinodiscus) because it was felt their small size enabled most of them to pass the net, and not give an accurate picture.

One trouble with sampling at both places was the very large amount of sand - as much as 25 mls. - caught by the net. This interfered with counting. Any repetition of this sampling will be done also with a No. 10 net, whose meshes are larger, and will be done for a shorter time, and nearer slack flood and slack ebb tide.

It is believed that the above data and considerations effectively disprove the idea that disastrous plankton losses from the River might occur because of current action.

The Inlets
Nutrient and Salinity Considerations

Loss of nutrients and increasing salinity have also been mentioned. The former requires a knowledge of some very complex factors, viz.:
(a) what proportion of River water flows out with each ebb tide and is not carried back in on flood tide; (b) what proportion of River water will be lost each 24 hours when the power plant goes into operation, as compared to replacement by ground water inflow, ground water runoff into the River between Fort P erce and St. Lucie, and inflow from the St. Lucie canal and river; (c) how much fresh water is added by rainfall. Considering the very small ratio of plant outflow to the two inlet outflows, very little salinity change may be expected, and the increasing population in the 10 or 12 mile stretch will be constantly increasing the amount of used fresh water entering the river. I would again recall the very excellent fishing in the St. Lucie Inlet, where salinity fluctuations are quite large.

Loss of nutrients via the power plant effluent - presuming water will be taken from the River - should also be negligible. Right now, the turnover of nutrients is fast and high, and the River has more fertilization than is needed. There is a constant accretion from the Okeechobee water, from thr ground water, and used water from Fort Pierce. The bottom, especially on the west side of the river, contains huge reserves in the organic matter there, which as in sludge banks, would be fed into the water for a long time, at a rate sufficient for good production, if any accretion from other sources suddenly dropped to zero.

The Ocean
The Shelf Plankton

Table 2 shows the numbers of plankton algae and protozoa as taken by a water bottle sample in the surface waters at the ocean stations opposite Big Mud Creek. As has been found in transects at Pompano Beach and Hollywood, these shelf waters are poor in plankton, especially as compared to Indian and Banana Rivers. The principal groups are present in limited numbers and the species list is rather poor. Actually, this table is for reference, just so we can say we know what is there. The biota is balanced and rather diverse, and represents a water of good quality, but poor in nutrients and of low productivity. This is to be expected; there is little or no runoff from the strip of sand between the ocean and Indian River; no grass or macroscopic algae to speak of on the sand or sand-shell ocean bottom; and no source of organic matter to be biologically degraded.

With such conditions in the shelf water, some enrichment could be expected from the plant effluent. How much would depend on the volume of water added, the circulation in the area, and the distance offshore of the outfall. Any enrichment would actually be beneficial. Under any circumstances there will inevitably be some fish in the alongshore stretch, and they will benefit from any plankton increase. So, there is no problem, ecologically, of adding the plant effluent to this location.

The Ocean
Bottom Conditions

In previous surveys, divers were employed to find whether or not there were economic aspects to be considered, such as shellfish, shrimp, reefs for fishing or growths. None were found. A large bed of scallops was known to be present well offshore, but only a few were found within a radius of 6 miles from the possible outfall site. These offered no commercial opportunities at all.

On June 6-7, Dr. W. E. S. Carr studied each of the Stations as to invertebrates, using 3100 ml. portions scooped up by a diver, and using a scallop (bottom) dredge, towed for 100 yards. Indices for relative abundance were the same as those previously used for the Indian River.

In all cases, the bottom was uniformly clean. No silt or mud was found, and while transparency was good, there were simply no bottom growths. All areas had a sand bottom with varying quantities of shell fragments. No rock formations or coral reefs were present. Table 3 is a list of the organisms found by Dr. Carr. His comments on the study follow.

The Ocean
Discussion

The benthic animals present in the study area offshore from Hutchinson Island are representative of a typical array of sublittoral bottom forms. As shown in Table 2, the predominant animals at most stations were polychaet worms, barnacles, amphipods, bryozoans, starfish, sand dollars, chitons, and slipper shell. Most of the other organisms listed in the table were collected at less than half of the stations and were present only in very small numbers. Stations 3, 4, 5 and 6 were the most productive areas in terms of the numbers of species and the numbers of individuals which were collected. It is noteworthy that the bottom at each of the latter stations was composed of an admixture of sand and mud with an abundance of shell fragments.

As shown in Table 2, none of the animals collected in the samples were species of immediate commercial significance. Sizable numbers of empty scallop shells were observed at two or three stations by the divers, but no live scallops appeared in any of the samples. No attached bottom vegetation was noted anywhere in the entire study area.

It seems unlikely to me that the discharge of a heated effluent into the offshore area which was studied would result in any drastic effects upon the benthic fauna. The area was not a nursery area as evidenced by the lack of attached vegetation. Furthermore, since none of the benthic forms which appeared in the samples are animals of commercial importance, any minor changes in the benthic populations which might result from elevated water temperatures would be localized and should not impair commercial or sports fisheries operations.

The Ocean
Chemical

Not enough chemical analyses have been made up to this time for an accurate picture. Three Indian River samples for orthophosphate give values of 0.22, 0.26 and 0.18 ppm. These may be regarded as high, such as are characteristic of a well-fertilized water. Two from the ocean in front of Big Mud Creek give values of 0.02 and 0.03 ppm. Nitrates, rather curiously, run lower - in Indian River 0.06, 0.05 and 0.03 while in the ocean there were only traces - about 0.01 in each sample. Copper was high in the river - 0.12 and 0.11, and low in the ocean - 0.005 and 0.004 ppm. All these values are higher than might be expected in ocean water. The numbers of photosynthetic organisms strongly support the phosphate and nitrate values, except the latter could well be higher in the river. The copper values are explained by proximity to land.

These values are important in determining the production of life, from bacteria to fishes, in the area concerned. But the operation of the power plant should not affect them, except that whatever amounts pass through the plant from the river will be lost to the nursery areas. It has been stated above that nutrients are not in short supply in the river, and the chances of depletion from the plant effluent I regard as nil.

Nevertheless, enough chemical analyses should be completed prior to operation so that the background is known, and the area should be monitored at intervals thereafter as a warning if changes do show up.

Resume

The above considerations indicate, along with two previous reports, the conditions now existing in Big Mud Creek and the adjacent Indian River Stations, a total of nine. There is also considered the conditions at ten stations, opposite, in the ocean. Organisms from algae to spermatophytes, from protozoa to fishes have been studied, as to abundance in the plankton, the vegetation, the sediment water interface and the bottom sediments. The study has considered possible changes from plant operation, but it is considered that only minor changes will occur and the vast nursery grounds will be unaffected, as will be the animals they harbor. Such possible, but not probable, changes hinge upon the amount of river water continuously withdrawn, and the current velocity into what will be Big Mud Lake. It is considered that construction and plant management features will minimize any undesirable effects.

Figures on velocity at the entrance to Big Mud Lake and ratios between plant effluent loss and loss through the inlets are given in the data of Dr. R. Dean.

Since there is such a small biota in the ocean water, it is highly probable that the heated water can be discharged at a good mixing depth with virtually no harm to the ocean.

Table 1

Numbers of certain larger plankton organisms in the outgoing and incoming tides at mid-flow June 6, 1969, at Fort Pierce Inlet. Numbers per liter.

Organisms	Outgoing	Incoming
Copepoda	516	405
Crustacean larvae	142	3
Worm Larvae	16	12
Univalve larvae	71	9
Bivalve larvae	30	33
Larvae, other	28	21
Plutei		12
Eggs	24	54
Ceratium furca	18	42
Ceratium fusus	1	7
Ceratium tripos		12
Ceratium minutum	3	3
Diplopsalis lenticula	1	12
Peridinium depressum		48
Peridinium longum	3	36
Peridinium sp.	3	12
Coscinodiscous sp.	2	9
Favella panamensis	3	6
Tintinnopsis platensis	7	12
Tintinnopsis prowazeki	3	6
Tintinnus tubus	1	3
Actinaria		15
Codonella cratera	6	

Table 2

The numbers of microorganisms per liter at the nine Hutchinson Island Ocean Stations. The numbers are very low, but the diversity of species is considerable. For example, there were at least five species of Chactoceras present. Samples collected June 7, 1969.

Stations	1	2	3	4	5	6	8	9	10
Blue greens									
Richelia intracellularis	1.0	1.0	.8	.5	.5	.7	1.0	4.0	.8
Skujaella sp.	.4	1.0	.3	.2	3.0	.3	1.0	2.0	2.0
Green cells									
Green cells	6.0	10.0	10.0	12.0	9.0	8.0	9.0	12.0	6.0
Dinoflagellata									
Ceratium furca	.1	.1	.1	.1	.1	.2		.1	.2
Diplopsalis lenticula	.1	.2	.1	.1		.1	.2		
Gymnodinium splendens					.1				
Gymnodinium, lge sp.		.2					.2		
Gyrodinium lachryma				.1					
Gyrodinium sp.		.8						.8	
Peridinium depressum			.1						
Peridinium globulus				.2		.1		.2	
Peridinium sp.		.4		.2	.2	.2	.2	.1	
Diatoms									
Amphiphora sp.				.1	.1		.8		
Asterionella japonica		.8		.4	.5	.6	3.0	.8	
Bacterastrum sp.				.4		1.0		2.0	
Biddulphia sp.	.1	.8	.2		.1	.1	.2		
Chactoceras decipiens	32.0	40.0	25.0	22.0	16.0	16.0	30.0	28.0	12.0
Cerataulina sp.					.2		2.0		5.0
Cocconeis sp.		.8						.2	.1
Corethron hystrix	.1	.3	.1	.4	.8	.2		.2	

Table 2, continued, page 2

Stations	1	2	3	4	5	6	8	9	10
Diatoms, con't									
Coscinodiscus sp.	.2	.2	.1	.2	.2	.3	.3	.1	.2
Diploneis sp.	.1	.2	.1	.2	.2	.1	.1	.2	.2
Grammatophora sp.			2.5				.2		
Guinardia flaccida	.2	.3		.3	.1	.2	.2	.1	.2
Hemiaulus haucki	.3	.4			.4		.2	.2	
Hemiaulus membranaceus	.3		7.5	.3	.2	.1		.1	
Hemiaulus sinensis		2.4						4.0	
Leptocylindrus danicus	12.0	16.8		2.0	1.0	3.0	6.0	4.0	4.0
Lithodesmium sp.				.2					
Melosira sulcata		.4	.5				.6		
Navicula spp.	3.0	2.4	7.5	1.6	.6	1.0	1.6	2.0	3.0
Nitzschia closterium	2.0	2.4	5.0	2.4	3.0	1.0	2.4	4.0	3.0
Nitzschia paradoxa, cols.		.3				.1		.1	.1
Nitzschia seriata	3.0	2.4	5.0	1.6	.4	.4	2.0	2.0	1.0
Pleurosigma sp.	.5	.2	.1	.7	.4	.5	.5	.4	1.0
Rhizosolenia alata	.1	.1	.2		.2	.2	.1	.2	.2
Rhizosolenia castracanci			.2	.1	.1	.1			
Rhizosolenia delicatula	.4	.4		.4	.5		.6	.4	
Rhizosolenia setigera	.5	3.6	1.0	.1	.4	1.0	.2	.2	.3
Rhizosolenia Stolterforthi	3.2	5.0	5.6	7.2	8.0	.8	6.4	4.2	3.6
Rhizosolenia styliformis	.4	.8	.3	1.0	.4	.4	1.0	.8	.6
Tabellaria sp.					4.0	2.0			
Thalasseonema sp.	3.0	2.4	.5	3.0	2.0	3.0	3.0	2.5	2.0
Thalassiothrix sp.	.2			.2	.1	.1	.1	.1	.4
Tropidoneis lepedoptera	.2	.1		.2	.1	.1	.3	.2	.2
Coccolithophora									
Syracosphaera carterae					.2	.1			

Table 2, continued, page 3

Stations	1	2	3	4	5	6	8	9	10
Zooflagellata									
Zooflagellata	6.0	10.0	5.0	10.0	6.0	8.0	8.0	8.0	12.0
Ciliata									
Amphorella sp.				.1					
Aspidisca costata								.1	
Cothyurnia sp.	1.2	3.0	1.0	.4	.2	.3		.1	1.6
Cyclidium sp.		.8							
Favella panamemsis	.1			.1	.1			.1	
Hemicyclidium sp.							.1		
Strombidium sp.	.1	.1			.1		.1		
Tintinnidium primitivum									
Tintinnopsis minuta		.1		.1		.1		.2	
Tintinnopsis platensis				.1	.1				
Vorticella sp.	.8		.1	.1		1.0		1.0	.2
Unid.			.1	.1	.2			.1	
Other									
Copepoda			.1						
Eggs			.1	.1	.1				
Hydracarina	.1								
Worms				.1					

Table 3

Summary of Benthic Animals Collected Offshore
from Hutchinson Island Ocean Stations, June 6-7, 1969.

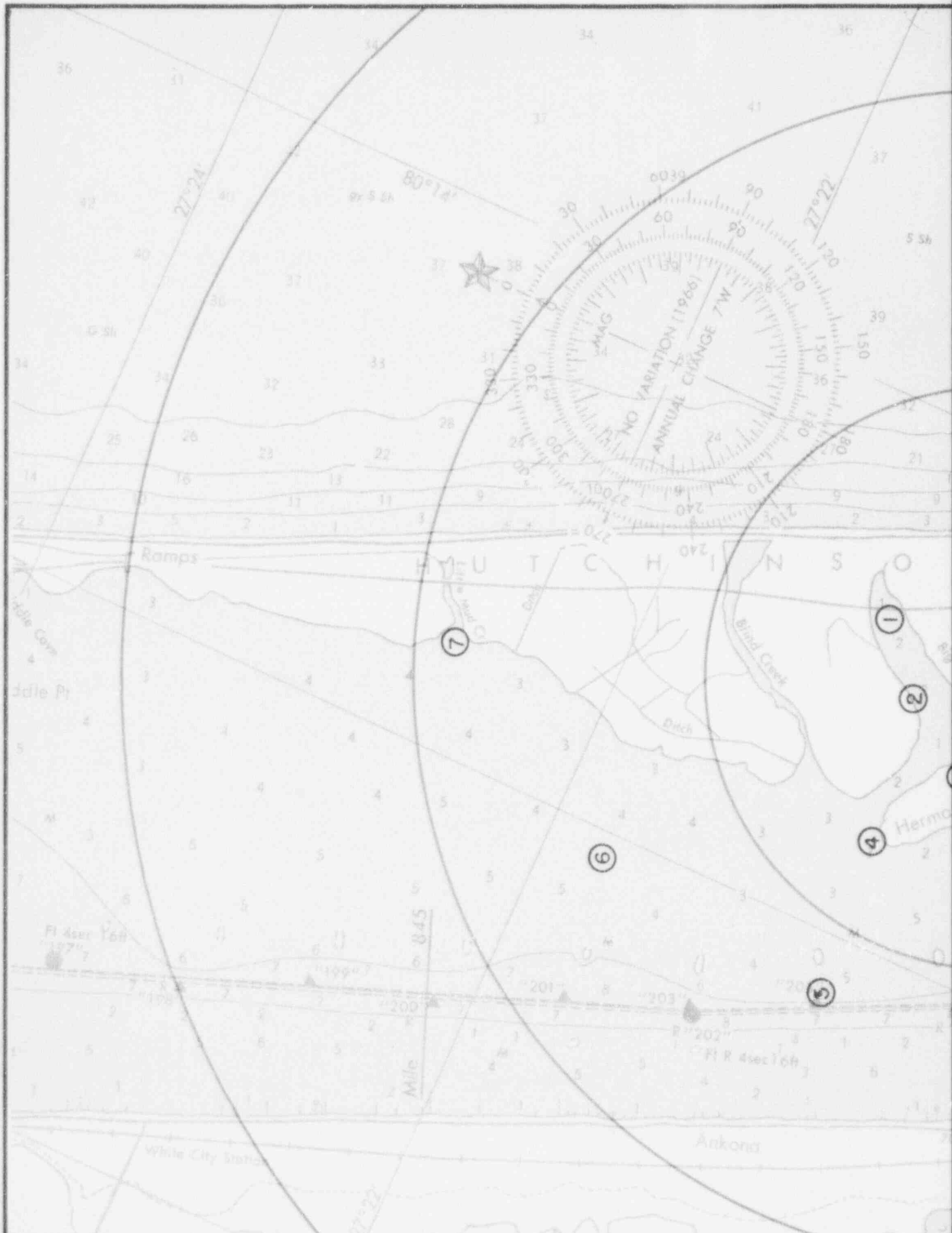
Animals / Stations	1	2	3	4	5	6	7B	8	9	10
Annelida-Polychaeta										
Amphaeretids					R					
Eunicids				R		R	F			F
Hesionids			R	R						
Lumbrinereids			F	R	R	R				
Maldanids			R		R					
Nephytids				R						
Nereids	R		F	R	F	R	F			R
Onuphids		R	C	R	F	F				
Oweniids		R	A							
Phyllodocids			F	R						
Polynoids	R					R				R
Sabellids			R							A
Serpulids	C		A	A	A	A	C		A	A
Syllids			R							
Terebellids	A		F		R	R				
Arthropoda - Crustacea										
Balanus - barnacles	A		A	A	A	A	A		A	
Gammerids - amphipods	F	C	C		F	R	A	R	R	
Gonodactylus										R
Libinia - spider crab			R				R			
Shrimp (unidentified)				R			R			
Pagurids - hermit crabs			R			R				
Xanthids - mud crabs					R	R				

Table 3, continued, page 2

Stations	1	2	3	4	5	6	7B	8	9	10
Bryozoa			C		A	C	C		A	
Chordata - Cephalochordata										
Branchiostoma - lancelets				R						
Coelenterata - Anthozoa										
Anemones (unidentified)						F				
Astrangia - small coral	F					F			F	
Echinodermata										
Asteroidea										
Asterias - starfish	F		R			F	A			C
Astropecten - starfish					R		F			
Luidea-starfish							R			
Echinoidea										
Arbacia - sea urchins	C		R							F
Encope - sand dollars			R	A	A	C		A	A	R
Lytechinus - sea urchins				R						C
Melitta - sand dollars		A		A	F	A				
Holothuroidea										
Thyone - sea cucumber		R			R					
Ophiuroidea - brittle stars			F	R	R	R			R	
Echiurida					R					
Mollusca										
Amphineura										
Chaetopleura - chitons	R			C	F	F			R	C
Gastropoda										
Anachis			R							
Crepidula - slipper shells	C	F	A	C	F	F			F	F

Table 3, continued, page 3

Stations	1	2	3	4	5	6	7B	8	9	10
Mollusca, con't										
Gastropoda, con't										
Eupleura	R									
Mitrella		R								
Olivella			R							
Polinices	R				R					
Seila	R									
Pelecypoda										
Chione				R						
Corbula							R			
Glycymeris				R					R	
Laevicardium					R					
Noetia						R				
Phoronidea					F					
Sipunculida							R			



80°14'
27°24'
27°22'
NO VARIATION (1966)
ANNUAL CHANGE 7'W
MAG
Ramps
H U T C H I N S O
Blind Creek
Ditch
Hermo
Mud Cr
Mile 845
Fl 4sec 16ft
"197"
"198"
"199"
"200"
"201"
"202"
"203"
Fl R 4sec 16ft
White City Station
Ankona

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
ECOLOGICAL SURVEY STATIONS
INDIAN RIVER

FIG. HI-1 1968-69

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OFFSHORE ECOLOGICAL SURVEY
FOR
FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND POWER PLANT SITE
February 8-9, 1969

This phase of survey consisted of underwater visual observation and photography conducted by a team of divers including Terry L. Davis, Marine Biologist, under the overall program direction of Dr. James B. Lackey. Ten water samples were also taken at 1000 ft. intervals along transect out from shore for qualitative and quantitative plankton analyses. The ambient temperature of water ranged from about 68°F to 72°F depending on depth.

Station numbers correspond with those on accompanying Florida Power & Light Company Figure HI-2.

Photographs were taken when feasible as a supplement to station remarks.

STATION NO.	REMARKS
1	Depth 46 ft. - 6 miles offshore along transect. Bottom - sandy, no outcropping of coral. No growth, no grass, no algae. Sand Dollars only life, numerous dead clam shells. Temperature - top 69.0 - bottom 68.0
2	Depth 45 ft. - 5-2/3 miles offshore along transect. Bottom - sandy, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 3 sq. ft. Scallops - very light, 1 per 30 sq. ft. Temperature - top 69.1 - bottom 68.2
3	Depth 42 ft. - 5-1/3 miles offshore along transect. Bottom - sandy, no outcropping of coral. No growth, no grass, no algae. Starfish - 1 per 10 sq. ft.
4	Depth 38 ft. - 5 miles offshore along transect. Bottom - sandy, rust colored and coarse, no outcropping of coral. No growth, no grass, no algae. Numerous Sand Dollars, 1 per 3 sq. ft. Scallops - very light, 1 per 50 sq. ft.

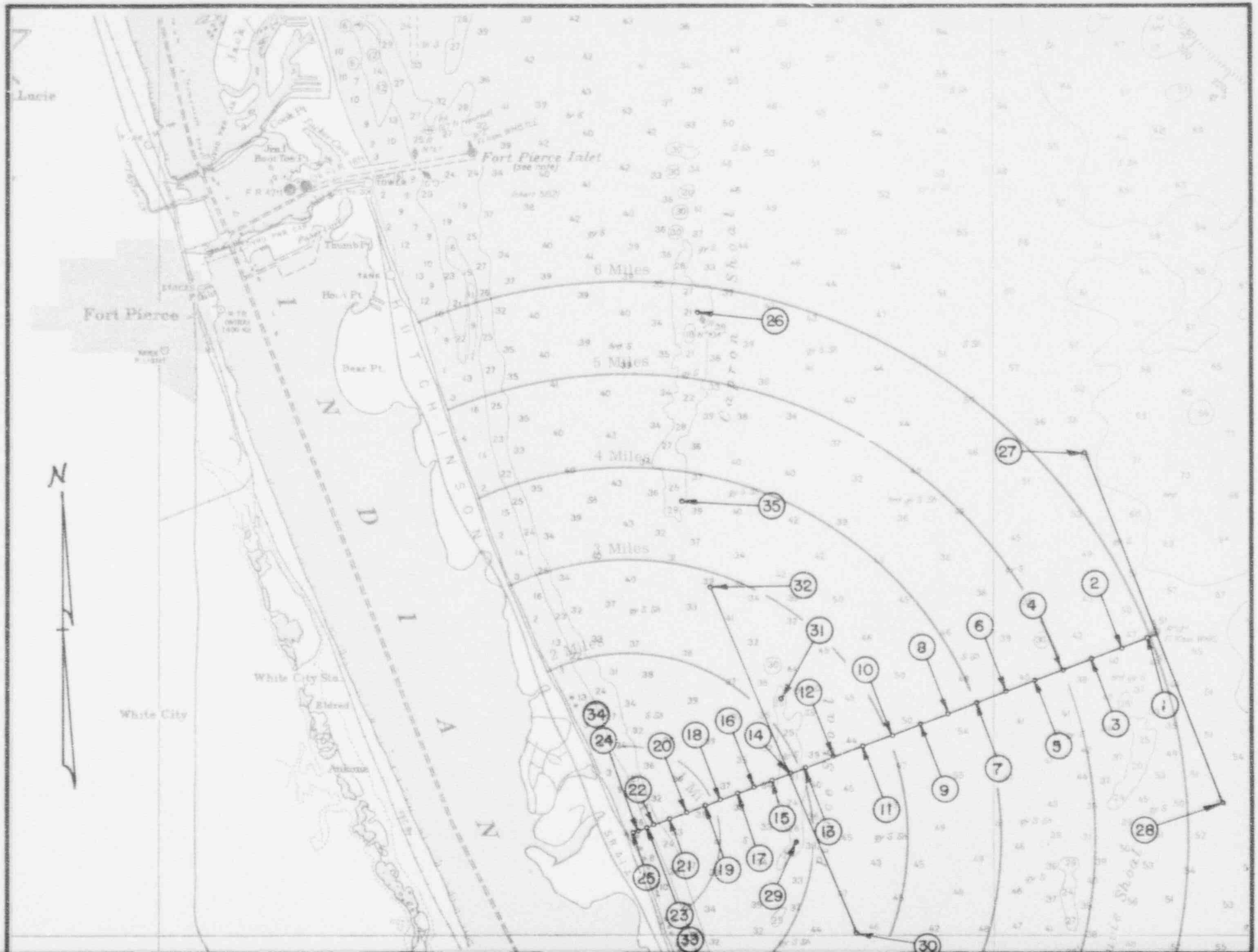
STATION NO.	REMARKS
5	Depth 35 ft. - 4-2/3 miles offshore along transect. Bottom - coarse sand, no outcropping of coral. No growth, no grass, no algae. Numerous Sand Dollars, 1 per 3 sq. ft. Starfish - 1 per 25 sq. ft.
6	Depth 41 ft. - 4-1/3 miles offshore along transect. Bottom - coarse sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per sq. ft. Starfish - 1 per 25 sq. ft.
7	Depth 45 ft. - 4 miles offshore along transect. Bottom - coarse sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 6 sq. ft. Starfish - 1 per 15 sq. ft.
8	Depth 50 ft. - 3-2/3 miles offshore along transect. Bottom - coarse sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 6 sq. ft. Starfish - 1 per 15 sq. ft.
9	Depth 53 ft. - 3-1/3 miles offshore along transect. Bottom - coarse sand, no outcropping of coral. No growth, no grass, no algae. Scallops - 1 per 10 sq. ft. Starfish - 1 per 10 sq. ft. Tubeworms - 1 per 3 sq. ft.
10	Depth 47 ft. - 3 miles offshore along transect. Bottom - coarse sand, no outcropping of coral. No growth, no grass, no algae. Scallops - 1 per 5 sq. ft. Starfish - 1 per 10 sq. ft. Tubeworms - 1 per 10 sq. ft. Anemone - 1 per 20 sq. ft.
11	Depth 45 ft. - 2-2/3 miles offshore along transect. Bottom - coarse sand, no outcropping of coral. No growth, no grass, no algae. Scallops - 1 per 50 sq. ft. Urchins - 1 per 3 sq. ft. Starfish - 1 per 3 sq. ft. Many Scallop shells (Starfish had eaten.)

STATION NO.	REMARKS
12	Depth 45 ft. - 2-1/3 miles offshore along transect. Bottom - coarse sand, no outcropping of coral. No growth, no grass, no algae. Scallops - 1 per 5 sq. ft. Urchins - 1 per 5 sq. ft. Starfish - 1 per 5 sq. ft. Many Scallop shells (Starfish had eaten.)
13	Depth 32 ft. - 2 miles offshore along transect. Bottom - sandy, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 3 sq. ft. Starfish - 1 per 50 sq. ft.
14	Depth 25 ft. - Pierce Shoal - 1-3/4 miles offshore along transect. Bottom - sandy hill, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 6 sq. ft. Starfish - 1 per 25 sq. ft.
15	Depth 32 ft. - 1-2/3 miles offshore along transect. Bottom - sandy, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 10 sq. ft. Urchins - 1 per 25 sq. ft. Scallops - 1 per 25 sq. ft.
16	Depth 40 ft. - 1½ miles offshore along transect. Bottom - coarse sand, laden with broken shells, no outcropping of coral. No growth, no grass, no algae. Scallops - extremely light, 1 per 50 sq. ft. Starfish - 1 per 6 sq. ft. Urchins - 1 per 5 sq. ft. Tubeworms - 1 per 10 sq. ft. Sand Dollars - 1 per 25 sq. ft.
17	Depth 40 ft. - 1½ miles offshore along transect. Bottom - coarse sand with broken shells, no outcropping of coral. No growth, no grass, no algae. Scallops - 1 per 50 sq. ft. Starfish - 1 per 50 sq. ft. Urchins - 1 per 25 sq. ft. Sand Dollars - 1 per 10 sq. ft. Tubeworms - 1 per 5 sq. ft.

STATION NO.	REMARKS
18	Depth 38 ft. - 1+ mile offshore along transect. Bottom - coarse sand with broken shells, no outcropping of coral. No growth, no grass, no algae. Scallops - extremely light, 1 per 50 sq. ft. Tubeworms - 1 per 2 sq. ft. Sand Dollars - 1 per 25 sq. ft. Urchins - 1 per 10 sq. ft.
19	Depth 37 ft. - 4700 ft. offshore along transect. Bottom - very bare. Fine sand, no outcropping of coral. No growth, no grass, no algae. Urchins - 1 per 25 sq. ft. Tubeworms - 1 per 25 sq. ft.
20	Depth 36 ft. - 3700 ft. offshore along transect. Bottom - extremely bare. Fine sand, no outcropping of coral. No growth, no grass, no algae. Tubeworms - 1 per 25 sq. ft.
21	Depth 33 ft. - 2600 ft. offshore along transect. Bottom - extremely bare. Fine sand, no outcropping of coral. No growth, no grass, no algae. Starfish - 1 per 50 sq. ft.
22	Depth 26 ft. - 1600 ft. offshore along transect. Bottom - extremely bare. Fine sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 3 sq. ft.
23	Depth 20 ft. - 1000 ft. offshore along transect. Bottom - extremely bare. Fine sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 10 per sq. ft. in patches.
24	Depth 10 ft. - 700 ft. offshore along transect. Bottom - extremely bare. Fine sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 10 sq. ft.

STATION NO.	REMARKS
25	Depth 6 ft. - 400 ft. offshore along transect. Bottom - extremely bare. Fine sand, no outcropping of coral. No growth, no grass, no algae. Hermit Crab - 1 per 25 sq. ft.
26	Depth 33 ft. - Capron Shoal, North Station. Bottom - sandy, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 4 sq. ft. 2 Sharks Starfish - 1 per 10 sq. ft. Temperature - Top 71.8 - Bottom 71.6
27	Depth 60 ft. - 6 Mile Transverse, North Station. Bottom - sandy, no outcropping of coral. No growth, no grass, no algae. Urchins - 1 per 20 sq. ft. Starfish - 1 per 20 sq. ft. Scallops - 1 per 2 sq. ft. Temperature - Top 71.0 - Bottom 68.0
28	Depth 50 ft. - 6 Mile Transverse, South Station. Bottom - ripply sandy, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 5 sq. ft. Starfish - 1 per 25 sq. ft. Urchins - 1 per 45 sq. ft. Temperature - Top 69.5 - Bottom 68.5
29	Depth 30 ft. - Pierce Shoal, South Station Bottom - fine sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 3 sq. ft. Urchins - 1 per 25 sq. ft. Temperature - Top 70.8 - Bottom 70.6
30	Depth 45 ft. - 2 Mile Transverse, South Station. Bottom - sandy, few dead shells, no outcropping of coral. No growth, no grass, no algae. Scallops - 1 per 10 sq. ft. Sand Dollars - 1 per 10 sq. ft. Tubeworms - 1 per 3 sq. ft. Starfish - 1 per 10 sq. ft. Temperature - Top 71.3 - Bottom 71.0

STATION NO.	REMARKS
31	Depth 30 ft. - Pierce Shoal, North Station. Bottom - fine ripply sand, no outcropping of coral. No growth, no grass, no algae. Scallops - 1 per 20 sq. ft. Sand Dollars - 1 per 5 sq. ft. Starfish - 1 per 50 sq. ft. Tubeworms - 1 per 50 sq. ft. Temperature - Top 70.8 - Bottom 70.6
32	Depth 38 ft. - 2 Mile Transverse, North Station. Bottom - sandy, no outcropping of coral. No growth, no grass, no algae. Starfish - 1 per 25 sq. ft. Sand Dollars - 1 per 5 sq. ft. Urchins - 1 per 25 sq. ft. Tubeworms - 1 per 5 sq. ft. 1 Pinshell Temperature - Top 70.9 - Bottom 70.8
33	Depth 20 ft. - 1-1/3 miles south of transect - 1100 ft. offshore. Bottom - extremely bare, fine sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 10 per sq. ft. in patches. Temperature - Top 71.0 - Bottom 71.0
34	Depth 10 ft. - 1-1/3 miles north of transect - 1100 ft. offshore. Bottom - extremely bare, fine sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 10 sq. ft. Temperature - Top 71.0 - Bottom 71.0
35	Depth 30 ft. - Capron Shoal, South Station Bottom - fine sand, no outcropping of coral. No growth, no grass, no algae. Sand Dollars - 1 per 3 sq. ft. Tubeworms - 1 per 50 sq. ft. Temperature - Top 71.8 - Bottom 71.6


Fort Pierce Inlet
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INDIAN
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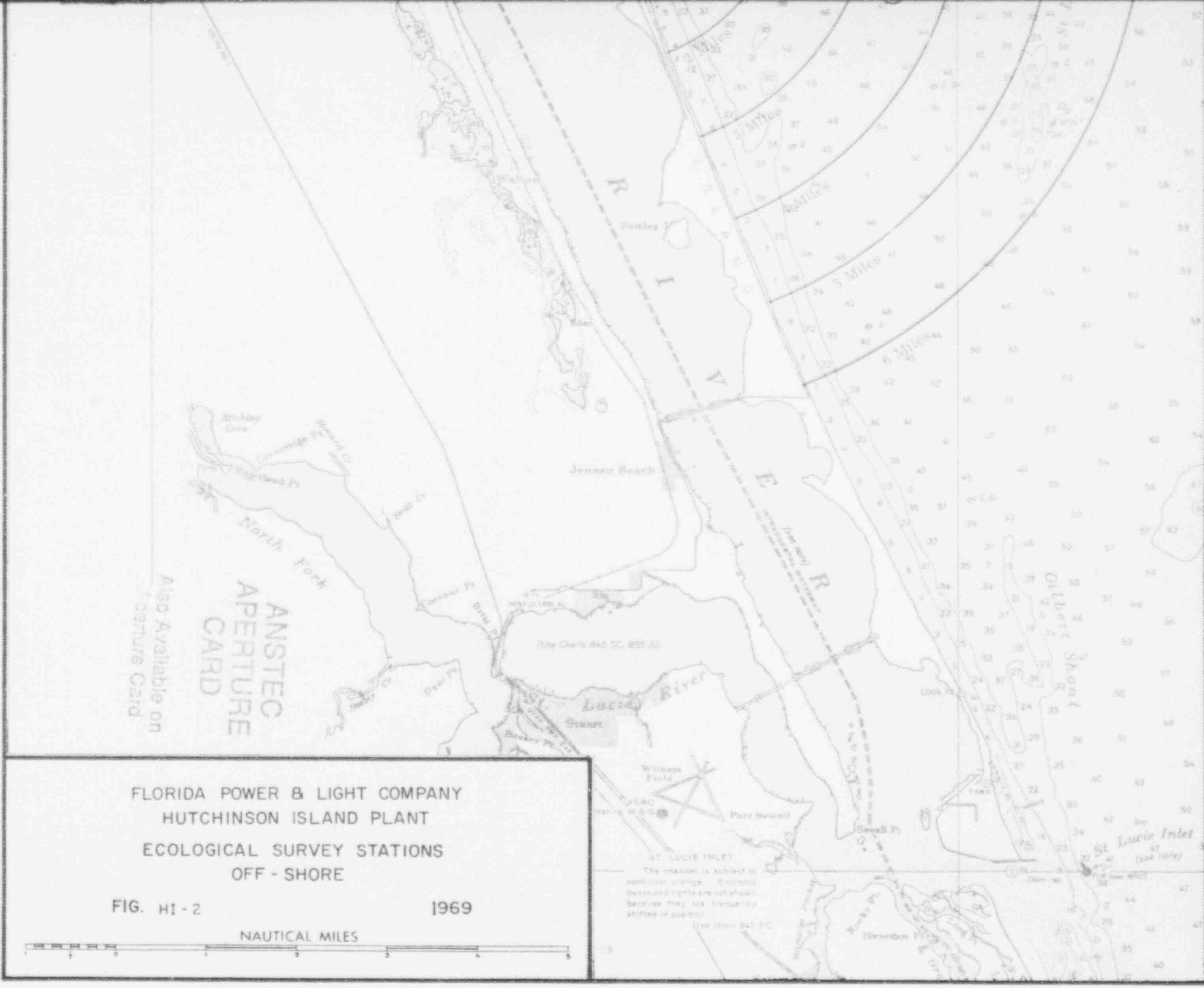

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
ECOLOGICAL SURVEY STATIONS
OFF - SHORE

FIG. HI - 2 1969

NAUTICAL MILES

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Photo by - Little Fin Inc., Riviera Beach, Fla. 2/8/69
Location - Sta. 5, 4-2/3 miles offshore along transect (See Fig. HI-2)
Depth - 35 ft.
Bottom Type - Sandy, no outcropping of coral, no growth, no grass, no algae
Animal Life - Sand Dollars - 1 per 3 sq. ft.
Starfish - 1 per 25 sq. ft.

Photo by - Little Fin Inc., Riviera Beach, Fla. 2/8/69
Location - Sta. 12, 2-1/3 miles offshore along transect (See Fig. Hi-2)
Depth - 45 ft.
Bottom Type - Coarse sand, no outcropping of coral, no growth, no grass, no algae
Animal Life - Scallops - 1 per 5 sq. ft.
Many Scallop shells (Starfish had eaten)
Urchins - 1 per 5 sq. ft.
Starfish - 1 per 5 sq. ft.

Photo by - Little Fin Inc., Riviera Beach, Fla. 2/8/69
Location - Sta. 18, 1+ miles offshore along transect (See Fig. HI-2)
Depth - 38 ft.
Bottom Type - Coarse sand with broken shells, no outcropping of coral, no growth, no grass, no algae
Animal Life - Scallops (very light) - 1 per 50 sq. ft.
Tubeworms - 1 per 2 sq. ft.
Urchins - 1 per 25 sq. ft.

Photo by - Little Fin Inc., Riviera Beach, Fla. 2/9/69
Location - Sta. 26, Capron Shoal, North Station (See Fig. HI-2)
Depth - 33 ft.
Bottom Type - Sandy, no outcropping of coral, no growth, no grass, no algae
Animal Life - Sand Dollars - 1 per 4 sq. ft.
Starfish - 1 per 10 sq. ft.
2 Sharks

OFFSHORE ECOLOGICAL SURVEY
FOR
FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND POWER PLANT SITE
June 6-7, 1969

This survey consisted of underwater visual observations, photographs, bottom sampling for benthic animal analysis and sampling for plankton. The team consisted of Dr. W. E. S. Carr, divers, and technicians, under the overall program direction of Dr. James B. Lackey. The ambient temperature of the water ranged from 79°F to 82°F, depending on depth.

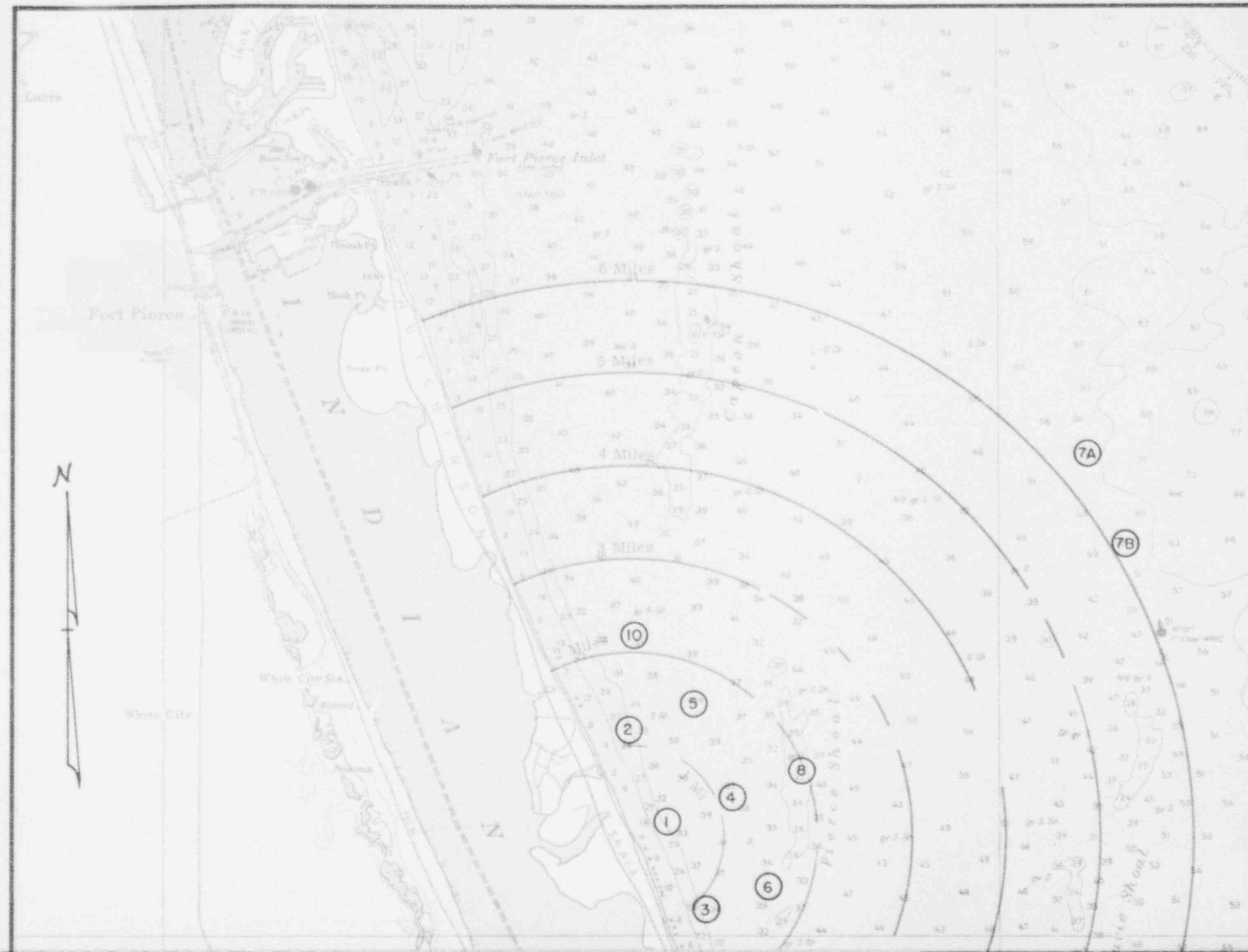
Station numbers correspond to those shown in Florida Power & Light Company Figure HI-2-1.

STATION NO.	REMARKS
1	Depth 30 ft. - about 2000 ft. offshore along proposed discharge transect. Bottom - ripply sand, extremely barren, no outcropping of coral, no grass, no algae. Visible animal life - none. Bottom area - sampled for benthic animal analysis, also water for plankton. Temperature - top 81.5° - mid-point 81.0° - bottom 80.2°
2	Depth 25 ft. - 1 mile north of proposed discharge transect and about 2000 ft. offshore. Bottom - sandy with shell fragments, no outcropping of coral, no grass, no algae. Visible animal life - sparse numbers of Starfish, Sand Dollars and Sea Cucumbers. Bottom area - sampled for benthic animal analysis - also water for plankton. Temperature - top 82.0° - mid-point 81.5° - bottom 81.3°

STATION NO.	REMARKS
3	Depth 35 ft. - 1 mile south of proposed discharge transect and about 2000 ft. offshore. Bottom - sandy and barren except for shell fragments, no outcropping of coral, no grass, no algae. Visible animal life - sparse numbers of Tube Worms and Sand Dollars. Bottom area - sampled for benthic animal analysis - also water for plankton. Temperature - top 81.5° - mid-point 81.1° - bottom 80.5°
4	Depth 37 ft. - 1-1/3 miles offshore along proposed discharge transect. Bottom - sandy with shell fragments, no outcropping of coral, no grass, no algae. Visible animal life - sparse numbers of Urchins, Sea Cucumbers and Starfish. Tube Worms about 20/yd. Bottom area - sampled for benthic animal analysis - also water for plankton. Temperature - top 80.5° - mid-point 80.0° - bottom 79.0°
5	Depth 39 ft. - 1 mile north of proposed discharge transect and about 1-1/3 miles offshore. Bottom - ripply sand, no outcropping of coral, no grass, no algae. Visible animal life - sparse numbers of Starfish, Sand Dollars 20/yd. Bottom area - sampled for benthic animal analysis - also water for plankton. Temperature - top 81.0° - mid-point 80.5° - bottom 79.0°

STATION NO.	REMARKS
6	Depth 36 ft. - 1 mile south of proposed discharge transect and about 1-1/3 miles offshore. Bottom - sandy, laden with shell fragments, no outcropping of coral, no grass, no algae. Visible animal life - sparse number of Starfish, Sand Dollars and Urchins. Bottom area - sampled for benthic animal analysis - also water for plankton. Temperature - top 80.5° - mid-point 80.0° - bottom 79.0°
7A	Depth 60 ft. - 2 miles north of Buoy R "12" and <u>6 miles offshore</u>. Bottom - sandy with shell fragments, no outcropping of coral, no grass, no algae. Visible animal life - sparse number of Scallops and Starfish. Temperature - top 81.2° - mid-point 80.5° - bottom 80.2°
7B	Depth 60 ft. - 1 mile north of Buoy R "12" and <u>6 miles offshore</u>. Bottom - sandy with shell fragments, no outcropping of coral, no grass, no algae. Visible animal life - Starfish - 3 per sq. yd. Scallops - 2 per sq. yd. plus numerous dead scallop shells (Starfish had eaten) Menhaden Fish - school of about 20. Bottom area - sampled for benthic animal analysis. Temperature - top 81.5° - mid-point 80.2° - bottom 79.9°

STATION NO.	REMARKS
8	Depth 21 ft. - Pierce Shoal, 2 miles offshore. Bottom - a sand hill, very barren, no outcropping of coral, no grass, no algae Visible animal life - sparse number of Sand Dollars. Bottom area - sampled for benthic animal analysis - also water for plankton. Temperature - top 80.0° - mid-point 80.0° - bottom 79.8°
9	Depth 35 ft. - 2 miles south of proposed discharge transect and 1 mile offshore. Bottom - sandy with shell fragments and dead scallop shells, no outcropping of coral, no grass, no algae. Visible animal life - sparse number of Starfish and Sand Dollars. Bottom area - sampled for benthic animal analysis - also water for plankton. Temperature - top 80.0° - mid-point 79.8° - bottom 79.5°
10	Depth 38 ft. - 2 miles north of proposed discharge transect and 1 mile offshore. Bottom - sandy with shell fragments, no outcropping of coral, no grass, no algae. Visible animal life - sparse number of Starfish and Urchins. Bottom area - sampled for benthic animal analysis - also water for plankton. Temperature - top 80.0° - mid-point 79.8° - bottom 79.5°



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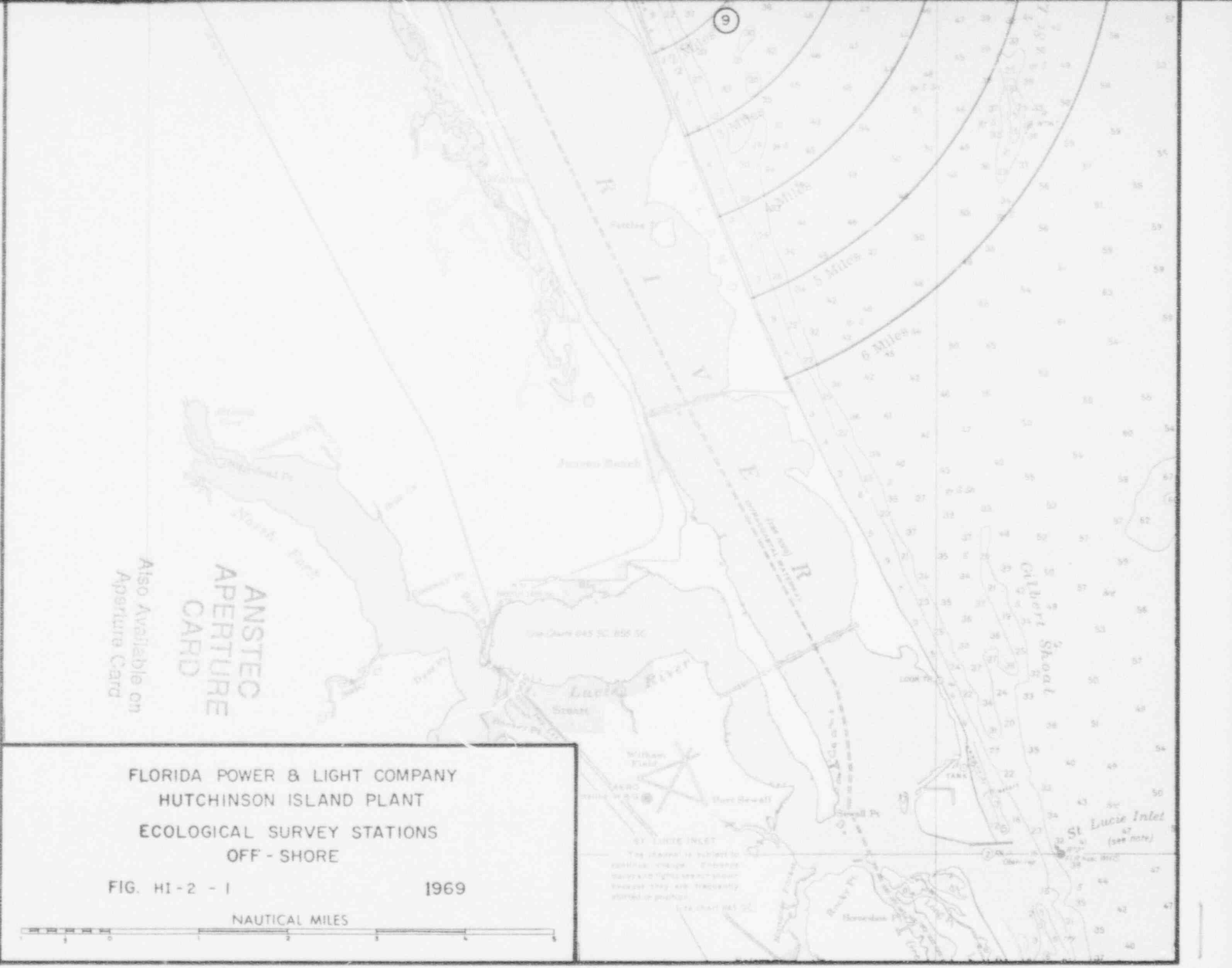

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
ECOLOGICAL SURVEY STATIONS
OFF - SHORE

FIG. HI-2-1 1969

ANSTEC
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CARD

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Aperture Card

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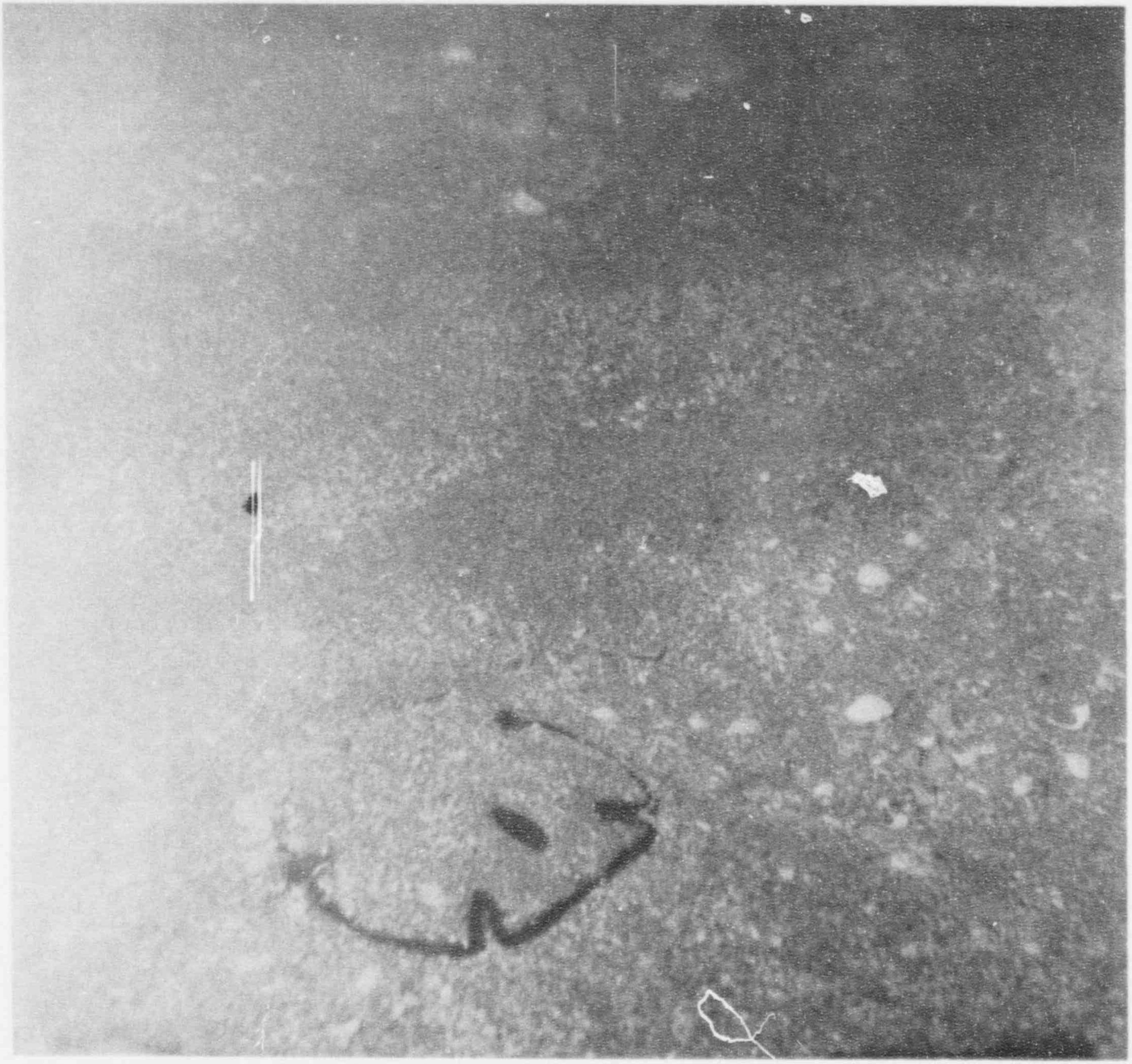

Photo by - Little Fin Inc., Riviera Beach, Fla. 6/6/69
Location - Sta. 3, 1 mile south of proposed discharge transect and about 2000 ft. offshore. (See Fig. HI-2-1)
Depth - 35 ft.
Bottom Type - Sandy and barren except for shell fragments, no outcropping of coral, no grass, no algae.
Visible Animal Life - Sparse number of Tube Worms and Sand Dollars.

Photo by - Little Fin Inc., Riviera Beach, Fla. 6/6/69
Location - Sta. 6, ½ mile south of proposed discharge transect and about 1-1/3 miles offshore. (See Fig. HI-2-1)
Depth - 36 ft.
Bottom Type - Sandy, laden with shell fragments, no outcropping of coral, no grass, no algae.
Visible Animal Life - Sparse number of Starfish, Sand Dollars and Urchins.

Photo by - Little Fin Inc., Riviera Beach, Fla. 6/7/69
Location - Sta. 9, 2 miles south of proposed discharge transect and
1 mile offshore. (See Fig. HI-2-1)
Depth - 35 ft.
Bottom Type - Sandy with shell fragments and dead Scallop shells,
no outcropping of coral, no grass, no algae.
Visible Animal Life - Sparse number of Starfish and Sand Dollars.

OFFSHORE ECOLOGICAL SURVEY
FOR
FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND POWER PLANT SITE
April 30, 1970

This survey involved underwater visual observations, photographs where possible, sampling for plankton and temperature recording. The team consisted of divers, a biologist and technicians, under the overall program direction of Dr. James B. Lackey. The ambient temperature of the water ranged from 68°F to 75°F, depending on depth. Underwater visibility was extremely poor for photographs. In fact, the entire bottom area was stirred up apparently by a rather strong current.

In brief, this survey further confirmed previous surveys that very little animal life exists in the area nor is there any coral, grass or algae.

Station numbers correspond to those shown in Florida Power & Light Company Figure HI-2-2.

STATION NO.	REMARKS
Test Tower	Depth 8 ft. - about 500 ft. offshore along discharge transect. Bottom - ripply sand, extremely barren, no outcropping of coral, no grass, no algae. Visible animal life - none. Temperature - top 71°F
1	Depth 22 ft. - 1100 ft. offshore along discharge transect. Bottom - hard sand, no outcropping of coral, no grass, no algae. Visible animal life - a few Sand Dollars and one Starfish. Temperature - top 71.1°F - bottom 68.3°F

STATION NO.	REMARKS
2	Depth 29 ft. - 1700 ft. offshore along discharge transect. Bottom - sandy, no outcropping of coral, no grass, no algae. Visible animal life - one Starfish and 2 Sea Pansies. Temperature - top 72.5°F - bottom 68.5°F
3	Depth 33 ft. - 2300 ft. offshore along discharge transect. Bottom - dirty sand, no outcropping of coral, no grass, no algae. Visible animal life - a few Sand Dollars. Temperature - top 72.8°F - bottom 68.4°F
4	Depth 34 ft. - 2900 ft. offshore along discharge transect. Bottom - Coarse sand with broken shells, no outcropping of coral, no grass, no algae. Visible animal life - Sand Dollars and Worms. Temperature - top 72.4°F - bottom 68.2°F
5	Depth 35 ft. - 3500 ft. offshore along discharge transect. Bottom - Coarse sand with shells, no outcropping of coral, no grass, no algae. Visible animal life - Sand Dollars and a few White Urchins. Temperature - top 72.0°F - bottom 68.0°F
6	Depth 36 ft. - 4100 ft. offshore along discharge transect. Bottom - Coarse sand, no outcropping of coral, no grass, no algae. Visible animal life - a few White Anemones, a few Starfish and Sand Dollars. Temperature - top 73.0°F - bottom 67.9°F
7	Depth 37 ft. - 1 mile offshore along discharge transect. Bottom - ripply coarse sand, no outcropping of coral, no grass, no algae. Visible animal life - heavy with Sand Dollars, a few White Urchins, a moderate number of Anemones and Starfish. Temperature - top 74.5°F - bottom 68.0°F

STATION NO.	REMARKS
8	Depth 39 ft. - ½ mile south of discharge transect and about 1 mile offshore. Bottom - sandy, no outcropping of coral, no grass, no algae. Visible animal life - a moderate number of Sand Dollars and Anemones, and one Starfish. Temperature - top 74.5°F - bottom 68.0°F
9	Depth 35 ft. - 1 mile south of discharge transect and about 1 mile offshore. Bottom - sandy, no outcropping of coral, no grass, no algae. Visible animal life - a moderate number of Sand Dollars, a few Starfish, White Urchins, Anemones, and two Egg Collars. Temperature - top 74.7°F - bottom 68.1°F
10	Depth 37 ft. - ½ mile south of discharge transect and about 3/4 mile offshore. Bottom - Coarse sand with broken shells, no outcropping of coral, no grass, no algae. Visible animal life - two Starfish and a few Sand Dollars. Temperature - top 74.7°F - bottom 68.2°F
11	Depth 24 ft. - 1 mile south of discharge transect and about 1100 ft. offshore. Bottom - dirty sand, no outcropping of coral, no grass, no algae. Visible animal life - one Starfish, many Sand Dollars. Temperature - top 74.5°F - bottom 68.7°F
12	Depth 25 ft. - ½ mile south of discharge transect and about 1100 ft. offshore. Bottom - hard sand, no outcropping of coral, no grass, no algae. Visible animal life - very heavy with Sand Dollars. Temperature - top 74.5°F - bottom 68.9°F

STATION NO.	REMARKS
13	Depth 26 ft. - ½ mile north of discharge transect and about 1100 ft. offshore. Bottom - hard sand, no outcropping of coral, no grass, no algae. Visible animal life - a few Sand Dollars. Temperature - top 74.5°F - bottom 69.5°F
14	Depth 21 ft. - 1 mile north of discharge transect and about 1100 ft. offshore. Bottom - hard sand, no outcropping of coral, no grass, no algae. Visible animal life - one Sand Dollar. Temperature - top 75.0°F - bottom 69.5°F
15	Depth 35 ft. - 1 mile north of discharge transect and about 1 mile offshore. Bottom - hard sand, no outcropping of coral, no grass, no algae. Visible animal life - heavy with Sand Dollars. Temperature - top 75.0°F - bottom 68.5°F
16	Depth 35 ft. - ½ mile north of discharge transect and about 3/4 mile offshore. Bottom - hard sand, no outcropping of coral, no grass, no algae. Visible animal life - heavy with Sand Dollars and one Starfish. Temperature - top 74.0°F - bottom 68.5°F

Fort Pierce Inlet
Fort Pierce
Lucie
White City
White City Sta.
Deer Pt.
Hook Pt.
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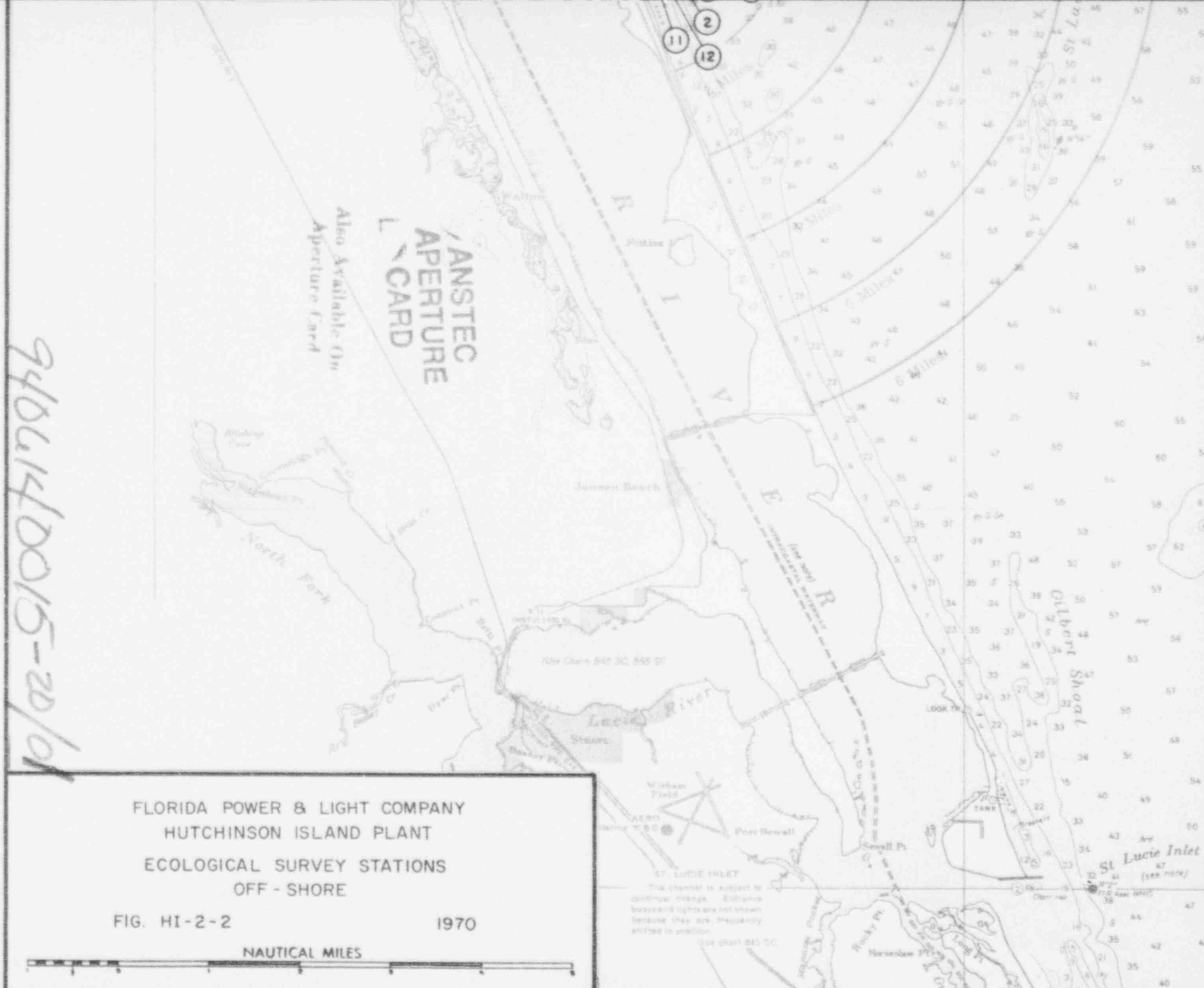

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
ECOLOGICAL SURVEY STATIONS
OFF - SHORE

FIG. HI-2-2 1970

ANSTEC APERTURE CARD

Also Available On Aperture Card

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APPENDIX 4.

HUTCHINSON ISLAND
ECOLOGICAL LITERATURE REVIEW
EBASCO SERVICES INCORPORATED

APPENDIX 4

HUTCHINSON ISLAND
ECOLOGICAL LITERATURE REVIEW

For

FLORIDA POWER & LIGHT COMPANY

EBASCO SERVICES INCORPORATED
TWO RECTOR STREET
NEW YORK

APRIL 1971

I - SUMMARY

I - SUMMARY

A - PURPOSE

This report is a compilation of ecological literature which contains the results of investigations made for the Hutchinson Island area. The study was authorized on October 9, 1970 by Mr. W. H. Rogers, Jr., Power Plant Engineering Manager of Florida Power & Light Company (FP&L).

Data were obtained from numerous sources, including scientific journals, National Marine Fisheries Service (ex U. S. Bureau of Commercial Fisheries) records, Florida State Board of Conservation publications and personal discussions with commercial fishermen based in Martin and St. Lucie Counties, Florida.

In order to evaluate the effects of any proposed environmental alteration on the marine biota in the Hutchinson Island locale, it is necessary to determine what organisms, resident and transient, occur offshore of Hutchinson Island in the Atlantic Ocean. Equally important are such physical parameters as temperature, salinity, and, for benthic organisms, the nature of the sediments on the sea bottom.

This report summarizes the available ecological information and discusses the general physical nature of the Hutchinson Island area.

B - RESULTS

The literature reviewed and the data analyzed in the course of this study have produced the following results:

1 - Salinity offshore of Hutchinson Island probably does not vary markedly during the course of the year. No halocline has been observed.

2 - Temperature data from the Hutchinson Island area indicate that thermal stratification does not occur. Highest measured ocean surface water temperature recorded during the field studies conducted for FP&L during August, 1970, was 87 F.

3 - The longshore current at Hutchinson Island runs south about 65 percent of the time at a velocity up to 1.2 fps, and typically, at 0.6 fps or less. During 25 percent of the time the current flowed north at a velocity up to 0.6 fps, and at an average of about 0.2 fps. Ten percent of the time, the longshore flow was essentially zero.

4 - The limited water chemistries performed on water samples taken offshore of Hutchinson Island show that orthophosphate, nitrate and copper are present in normal concentrations.

5 - Sediments offshore of Hutchinson Island are primarily calcareous sands containing some shell fragments.

6 - Plankton were present in limited numbers offshore of Hutchinson Island. While numbers and diversity of plankters were low, the organisms observed were considered typical for an onshore water mass rather low in nutrients (nitrates and phosphates).

7 - Benthic organisms were not common, and no attached marine plants or coral were observed. The bottom animals which were collected were typical sublittoral organisms. No scallops were observed within two miles of the shore.

8 - A large number of fishes are landed each year in St. Lucie County. Spanish and king mackerel, bluefish, gray trout and pompano are harvested in the area offshore of Hutchinson Island. In 1970, over $600,000 worth of the five species of fish mentioned above were landed in St. Lucie County.

9 - Hutchinson Island is an important nesting area for sea turtles. In [illegible]67, it was estimated that 5250 loggerhead turtle nests and 15[illegible] [illegible]en turtle nests occurred on the beaches of Hutchinson Isla[illegible].

10 - Insufficient data are available to predict the extent to which marine fouling may affect structures placed offshore of Hutchinson Island. However, barnacles, bryozoans and various bivalve molluscs are known to occur there.

II - DISCUSSION

A - GENERAL

Hutchinson Island is a bar and swale island approximately 22 miles long and a maximum of about 1 mile wide (Exhibit 1). Its principal axis is North-South, and it is located between the towns of Fort Pierce and Stuart, Florida. The western portion of the island consists primarily of a mangrove swamp. A line of sand dunes (El + 14 MSL max.) occurs on the eastern part of Hutchinson Island.

The slope of the sea bottom, from shore to El -30 feet (MLW) is about 1:70. The slope of the ocean floor becomes more gradual as the distance from shore increases. The mean slope of the bottom, from Hutchinson Island to El -120 feet (MLW), a distance of about 12 miles, is approximately 1:600.

B - PHYSICAL PARAMETERS

1 - Oceanography

a - Salinity

U. S. Coast and Geodetic Survey (USC & GS) salinity data (1) from Canova Beach, Florida, are shown in Exhibits 2 and 3. Canova Beach is located on the east coast of Florida at 28° 08' N, 80° 35' W, about 52 miles north of Fort Pierce, Florida. The period of record extends from 1950 to 1962.

The salinity of Atlantic Ocean water near Canova Beach is quite stable, ranging from a mean low value of 35.4 parts per thousand (ppt) for November to a mean high value of 36.6 ppt in May. Greatest variability in salinity occurs during October and November. This probably reflects the year-to-year variation in precipitation during the late fall.

The extent to which salinities offshore of Hutchinson Island vary is not known, but preliminary data (2) show that, during the summer of 1970, the waters (to 30 ft. depth) were not stratified with respect to salinity. In July of 1970, the salinity of Hutchinson Island water was 36.8 ppt. Presumably, the pattern of ocean water salinity offshore of Hutchinson Island resembles that seen at Canova Beach, except for areas offshore of the mouths of the St. Lucie and Ft. Pierce inlets, which connect the Indian River with the Atlantic Ocean.

Salinities at these inlets, are known to vary with the season. Larger differences are seen at St. Lucie inlet, as a result of discharges from Lake Okeechobee and natural runoff. Water discharged from Lake Okeechobee enters the South Fork of the St. Lucie River via the St. Lucie Canal, is conveyed to the Indian River and thence to the Atlantic Ocean through St. Lucie Inlet.

Witham et al observed a decrease in salinity during the summer of 1966. At their Station T-4 in the Indian River (p. 15, Ref. 3) average salinity decreased from about 32 ppt in May to 23 ppt in June and to a low of 15 ppt in July. In the previous summer, 1965, salinity measured at the same station (ibid) ranged from about 34 ppt in May to 28 ppt in October. Other investigators have also noted this phenomenon (4,5).

Even though the available evidence is limited, one may assume that salinity patterns offshore of Hutchinson Island will resemble those observed at Canova Beach, namely a rather constant salinity with minor fluctuations which reflect local meteorological conditions. In the immediate vicinity of the Fort Pierce and St. Lucie Inlets, greater variation in salinity occurs, with lower values resulting from freshwater runoff or discharges from Lake Okeechobee, and higher values resulting from evaporation in the Indian River.

b - Temperature

Temperature data taken at Canova Beach, Florida, are given in Exhibits 4 and 5. At this station, lowest temperatures occur in January (mean temperature 65.1 F). The highest mean temperature recorded, 82.2 F, occurred in September. An anomalous depression of temperature is seen in July, when the mean temperature decreased 0.4 F below that recorded for June and 1.9 F below the August temperature. This phenomenon has been recorded at both Daytona Beach and Canova Beach, and is explained by the USC & GS (1) as the result of summer upwelling which occurs along this section of the Florida coast.

Few ocean water temperature data are available for the Hutchinson Island area, and it is not known whether the midsummer temperature decreased documented for Canova Beach and Daytona Beach occurs at Hutchinson Island. In July 1970, a surface temperature of 82.6 F was recorded 2000 ft. off the midpoint of Hutchinson Island, where the water depth is 30 ft. Bottom temperature was the same and no thermocline was observed. (2)

Temperatures were recorded at some of the stations occupied during the 1969-1970 SCUBA survey of Hutchinson Island (6). In February 1969, temperatures ranged from a high of 71.8 F on the surface to a low of 68.0 F on the bottom (46 to 60 ft. depth). In only one case (6 miles offshore, 60 ft. depth) was the temperature differential greater than 1.0 F. At this station, the surface-to-bottom temperature differential was 3.0 F. At all other stations, the difference between surface and bottom temperature was 1.0 F or less.

During the June portion of the survey, the highest surface temperature observed was 87.0 F. The lowest bottom temperature measured was 79.0 F. Greatest differential between surface and bottom temperature at any station was 2.0 F, and the mean differential was 1.1 F.

The final temperature survey of that series was made on April 30, 1970. At this time, a definite temperature gradient between surface and bottom was observed. The maximum temperature differential was 6.6 F and the mean of the differences was 5.3 F. Because only two temperature determinations were made at each station (surface and bottom) it is not known whether the observed temperature differential represents a thermocline or a gradual diffusion of heat (the result of increasing solar radiation) from surface to the bottom of the water column. In view of the season (spring) and the fact that only minor temperature gradients were seen at other times of the year, the latter explanation appears more probable.

FP&L maintains a temperature monitoring station 2000 ft. offshore of the Hutchinson Island site. The recording thermometers installed at the station monitor surface and bottom water temperature (30 ft. depth). This surveillance station has been operational since September, 1970.

c - Currents

Although a definitive study of the currents offshore of Hutchinson Island has not yet been made, preliminary data (2) indicate that the prevailing current runs to the south at approximately 0.2 fps. In 1969, a current meter was installed 1500 ft. offshore of Big Mud Creek, a Hutchinson Island, 9 ft. beneath the water surface (7). The data gathered during this study show that the current flows in a southerly direction about 65 percent of the time, is slack 10 percent of the time, and flows north approximately 25 percent of the time. Maximum velocity recorded was 1.2 fps when the current flowed to the south, but velocities of 0.6 fps and less were most commonly observed. Velocity of the northerly current was never greater than 0.6 fps and was usually 0.2 fps.

d - Nutrients

Ocean water sampled offshore of Hutchinson Island was analyzed for orthophosphate, nitrate and copper (6). Orthophosphate levels were 0.02 and 0.03 parts per million (ppm), nitrate was present in low levels (0.01 ppm) as was copper (0.005 and 0.004 ppm). According to Barnes (8), surface water levels of phosphate in the N W Atlantic are usually between 0 and 0.14 μg - at. P/m^3 (0 to 0.004 ppm). The values of 0.002 and 0.003 ppm reported by Lackey (6) fall within this range.

In Reference 6, page 12, the authors state that nitrate (N) values were lower than those found for phosphate (P). A recent review of N:P ratios in coastal waters (9) states "There is, in short, an excess of phosphate, small but persistent and apparently ubiquitous, in the surface waters of the ocean, relative to the amount of nitrogen ....". This statement reiterates the commonly held dogma that nitrogen is the limiting macronutrient in sea water. (In natural fresh waters, the reverse holds true, phosphate is usually in short supply.) Nitrate is present in sea water in varying amounts, depending upon the character of the water mass, rate of phytoplankton growth and other factors. Sverdrup, Johnson and Fleming (10) consider a range of 0.001 to 0.6 ppm normal for sea water. The nitrate value reported for Hutchinson Island falls within this range.

The levels of copper found were considered high for sea water, but Sverdrup et al report that normal values for this element fall in the range of 0.001 to 0.01 ppm, which neatly brackets the values of 0.005 and 0.004 ppm reported by Lackey.

2 - Sediments

The sediments offshore of Hutchinson Island have been sampled and observed by a number of investigators. Test borings of the sea floor made by Law Engineering Testing Company (11) show that the nearshore surface sediments consist of fine sands which contain small amounts of fragmented shell. The most distant core was taken about 700 ft. from shore in approximately 20 ft. of water. At this station, the surface sediments consisted of a stiff sandy clay which contained shell fragments.

Observations of the ocean bottom were made by SCUBA divers on three occasions in 1969-1970 (6). Most of the observations were made about a line approximately 7.5 miles south of Fort Pierce Inlet and normal to the shoreline. Dives were made from 400 ft. to 6 miles offshore, in depths of 6 to 60 ft. In all cases and at all 62 stations, the bottom consisted of sand or sand which contained shell fragments. No coral outcrops were observed.

The nature of the surface sediments was examined in September, 1970 by Ebasco personnel (12). At the location of the FP&L continuous temperature monitoring station (2000 ft. offshore at 30 ft. depth, the sea floor of sand mixed with shell fragments, no coral or rock was seen. In March 1971, Ebasco personnel again examined the sediments at the temperature station. Generic analysis (13) indicated that the sediment consisted of about 40 per cent shell fragments and 60 per cent fine grey sand. After acidification with concentrated HCl, very little residue remained, less than 10 per cent of the original sample was not acid soluble calcium carbonate ($CaCO_3$). A sand sample from the beach immediately onshore of the temperature station was also treated with HCl. This sediment, which was of uniform size and contained no recognizable shell fragments, appeared to consist of approximately 50 per cent $CaCO_3$ and 50 per cent insoluble material, probably silicon dioxide (SiO_2).

C - BIOLOGICAL PARAMETERS

1 - Plankton

Information on the plankton of the Hutchinson Island area is contained in FP&L Ecology Report (6). Data from the Indian River show both high numbers of planktonic organisms per unit volume and high diversity (more than 90 species), indicating a fertile water mass which is highly productive.

Plankton tows were made at Fort Pierce and St. Lucie Inlets during both ebb and flood tides. The data given in Lackey's report (6) show that, at Fort Pierce Inlet, about as many plankters enter the Indian River on a flood tide as leave on the ebb. While data are not given for St. Lucie Inlet, Lackey states that numerically, the amount of plankton found in both inlets is similar.

Plankton studies were made at ten stations in the ocean offshore of Hutchinson Island. Organisms were present in limited numbers and low diversity when compared with the plankton present in the Indian River. Lackey states, "The biota is balanced and rather diverse, and represents a water of good quality, but poor in nutrients and of low productivity." Quantitative and qualitative plankton data are found in Reference 6.

Phyllosoma larvae (a planktonic stage) of the spiney lobster, *Panulirus argus*, have been taken in Ft. Lucie Inlet and the Indian River (3, 14). This larval form of the spiney lobster enters the estuary from the open sea and utilizes the estuary as a nursery ground and sanctuary.

2 - Benthos

a - Marine Angiosperms

None of the marine grasses found in Florida occur offshore of Hutchinson Island. Phillips (15) investigated the Indian River area and found sparse growths of turtle grass (Thalassia testudinum) at Fort Pierce and St. Lucie Inlets. Dense stands of *Diplanthera Wrightii* and manatee grass (*Syringodium filiforme*) were found in the Indian River and at both Fort Pierce and St. Lucie Inlets. *Diplanthera* occurs closest to shore, while *Syringodium*, which requires submersion, is found in deeper water. *Ruppia maritima* was collected in the St. Lucie Inlet area.

b - Infauna and Epifauna

Dr. W. E. S. Carr (6) studied bottom material from ten stations offshore of Hutchinson Island. The bottom sediments consisted of sand mixed with shell fragments; no silt, mud, rock or reef-forming coral was observed (see Section II-2-B of this report).

The benthic animals found in the study area represent a typical array of sublittoral bottom organisms. Polychaete worms, barnacles, amphipods, bryozoans, starfish, sand dollars, chitons, and slipper shells were the most commonly collected animals. Most of the other organisms observed were present in small numbers and were collected at less than half the stations.

Observations made by SCUBA divers during the course of this study confirm Dr. Carr's findings, namely that the ocean bottom is free of attached vegetation and that macroscopic organisms are not abundant.

Dives made by Ebasco personnel at the temperature station 2000 ft. offshore (12,13) provided additional observation which again confirm the findings of Carr.

In his study of Florida lancelets, Pierce (16) found few of these organisms on the east coast of Florida. While he did not sample the areas offshore of Hutchinson Island, he did find four specimens of Branchiostoma caribaeum inside St. Lucie inlet and one in the Indian River, one-half miles south of the highway bridge at Fort Pierce. Carr found this animal to be rare, and collected it at only one of the ten stations he sampled.

An extensive survey made by the National Marine Fisheries Service found that dredge tows between Fort Pierce and Jupiter Inlet (14 to 40 fathoms) produced catches of scallops (Pecten gibbus) of zero to one-half bushel per 30 minute tow. Further north, between Daytona Beach and Bethel shoal (13 to 49 fathoms), they dredged as much as 17 bushels per 30 minute tow (17).

St. Lucie County produces 100 percent of the calico scallops harvested in Florida. In 1970, this amounted to 194,508 pounds, valued at $194,508. This scallop is found well offshore (20-40 miles) and in deep waters.

Dives made in 1969-1970 (6) showed that scallops are rare in the immediate vicinity of Hutchinson Island.

Clams, particularly the hard clam (Mercenaria mercenaria) are found on the east coast of Florida. The hard clam spawns at 73 F (April through August). They are most commonly found from near the high tide line to a depth of 50 ft. They grow most rapidly from October to June, however, growth is reduced during the warm summer months (18). Those clams landed in St. Lucie County are harvested in the Indian River.

Shrimp, which constitute the single most valuable element of Florida's fishery resources, form an exceedingly small portion of the total fishery catch landed in St. Lucie County. In 1970, Florida shrimp landings (of all species) amounted to more than 30,000,000 pounds. Less than 8,000 pounds of shrimp were landed in St. Lucie County, a negligible fraction of the total landings (19).

3 - Fishes

Fish populations in the area offshore of Hutchinson Island have not been rigorously examined from either a qualitative or quantitative standpoint. The available data are sparse and most records deal with species of economic importance. Springer (4) investigated the fish of the lower St. Lucie and Indian Rivers, but confined his sampling to waters west of Hutchinson Island. Gunter and Hall (5) also sampled the ichthyofauna of the St. Lucie River, but confined their studies to the area inland of Sewall Point (see Exhibit 1).

St. Lucie County landings of the five species of fish discussed below (excluding Cynoscion nebulosus) constituted slightly more than 15 percent of the dockside value of Florida's east coast fin fish catch, and nearly 5 percent of the state wide total (1970 data). If one includes the value of other marine organisms landed in St. Lucie County (groupers, king whiting, mullet (20,21) snapper, spot, hard clams and calico scallops), it is immediately apparent that both the inland and oceanic waters of the Hutchinson Island area are quite productive.

Other fish, such as ladyfish (Elops saurus, 22), snook (Centropomus undecimalis, 23) and the various species of billfish, are taken primarily by sports fishermen. As stated in Ref. 24, St. Lucie County is the northern-most county on Florida's east coast with an extensive winter sports fishery. While the value of this fishery has not been determined, it presumably forms a significant portion of the income St. Lucie County derives from its tidal water.

Five species of fish, king mackerel, Spanish mackerel, gray trout, bluefish and pompano, are discussed below. These fish were chosen for detailed discussion because they are found in the ocean offshore of Hutchinson Island (pompano also occur in the Indian River) and because they form an important constituent of the St. Lucie County fin fishery.

Mackerels

The Spanish mackerels (genus Scomberomorus) form the nucleus of the St. Lucie County fin fishery. A number of scientists have studied this group of fish and as a result, it is reasonably well known. Klima (25) investigated both the biology and fishery for Spanish mackerel (Scomberomorus maculatus) in southern Florida. Generally, this fish is abundant in Florida waters from October through February or March. In southeastern Florida, the Spanish mackerel spawns in coastal waters from August to December. This fish moves north in the spring, and is found as far north as the Gulf of Maine (where it is sparse and rare). Spanish mackerel remain in the north until September, when they move south.

Beaumariage (27) has synopsized much of the literature dealing with the Spanish and king mackerels. His data show that Spanish mackerel from the east coast of Florida are essentially spawned out by the end of September. King mackerel (Scomberomorus cavalla) which occur in the same area spawn later in the year, beginning in September and ending in October. Larvae (3-7 mm total length) of both Spanish and king mackerel were captured in plankton tows made off Cape Kennedy during September. The small size of these larvae indicates that the eggs from which they were hatched were spawned near the point where the collection was made, offshore of Cape Kennedy.

Wollam (27) has investigated the distribution of larval and juvenile forms of king and Spanish mackerel in the western north Atlantic. Although most of the specimens he examined were captured in the Gulf of Mexico (including all the Spanish mackerel), 22 king mackerel were obtained during September from stations located about 70 miles East Northeast of Cape Kennedy. Wollam believes that the southern portion of the range of the king mackerel is not an important spawning area, due to the paucity of larvae and juveniles which have been collected there. He also states that the larvae which have been observed are the result of spawning of resident (non-migratory) fish.

In an effort to determine the migratory patterns of king mackerel, Moe (28) tagged 128 king mackerel offshore of Jupiter inlet in 25-30 fathoms of water (26° 56' N, 79° 58' N). No tags were returned.

A survey of offshore fishing grounds in Florida (24) showed that both Spanish and king mackerel (as well as other fish) were caught in two areas offshore of Hutchinson Island. According to this report, St. Lucie County is the northernmost of Florida's east coast counties with a major winter sport fishery.

National Marine Fisheries Service (NMFS) landings data show that about 994,900 pounds of king mackerel were landed in St. Lucie County during 1970 (19). This amounts to about 33 percent of the kingfish landed on Florida's east coast and nearly 19 percent of the total Florida landings of S. cavalla, with a dockside value of more than $302,000.

In 1970, more than 1,242,000 pounds of Spanish mackerel were landed in St. Lucie County (19). Over 42 percent of the Spanish mackerel landed on the east coast of Florida were produced in St. Lucie County; this was 12 percent of the total Florida landing of S. maculatus, with a value of $178,000. Older data (25) reveal that the average annual landing of Spanish mackerel in St. Lucie County ranged from 100,000 to 500,000 pounds (1954-1957).

Sea Trout

The gray sea trout (Cynoscion nothus) is of commercial importance in St. Lucie County. It is found in greatest abundance during the late winter and spring of the year in onshore oceanic waters. C. nothus is fished commercially only on the east coast of Florida, and a large portion (27.2 percent) of the total catch is landed in St. Lucie County. In 1970, over 77,000 pounds of gray sea trout were wholesaled in St. Lucie County at an average price of \$.159 per pound, for a dockside value of nearly \$12,300 (19).

Tabb has investigated the fishery for and biology of the spotted sea trout, (Cynoscion nebulosus, a related species (29,30). From 1951 to 1957, the average annual production of this fish in the Indian River area was 126,000 pounds. The spotted sea trout spawns from April to July in the deep holes and channels of the Indian and Banana Rivers. It feeds primarily on shrimp and small fish and is fished commercially in the Indian River.

Bluefish

The bluefish, Pomatomus saltatrix, is found on the east coast of North America from Cape Florida to Nova Scotia. It is a pelagic fish, and migrates to the north as the water temperature increases in the spring and early summer. Data obtained from a tagging program (31) show that bluefish on the east coast of Florida migrate to the north during the months of February through April. Bluefish are known to spawn off the east coast of Florida in 60-300 foot waters, then migrate north during the spring and summer (32). During this period of northward travel, bluefish are assumed to remain near the coast. Information from commercial fishermen in Martin and St. Lucie Counties confirms this assumption (33).

Blue are taken on both coasts of Florida. Of the more than 2,000,000 pounds taken in 1970, more than 75 percent were taken on the east coast. St. Lucie County produced 725,144 pounds, nearly 41 percent of the east coast landings, and 31 percent of the total poundage of bluefish landed in all of Florida. Dockside prices ranged from \$.073 to \$.123 per pound, for an annual wholesale price of \$80,330 for the bluefish landed in St. Lucie County (19).

Pompano

The pompano, Trachinotus carolinus, is found on the east coast of the United States, as far north as Cape Cod. It is very common on both coasts of Florida and supports a fishery of considerable value. In St. Lucie County, pompano are found both in the ocean and the Indian River. They feed on small bivalve molluscs and small crustaceans which occur around the inlets and in the ocean surf.

While Florida's east coast produced only 20.4 percent of the State's 1970 pompano harvest, landings of this fish in St. Lucie County amounted to 16 percent of the east coast production and nearly 3.5 percent of the statewide total. At 1970 prices ($1.010 to 1.280 per pound), the pompano landed in St. Lucie County were valued at $39,465 (19).

4 - Turtles

Two species of sea turtle are known to nest on the beaches of Hutchinson Island. Historically, the green turtle (Chelonia mydas) was very abundant in the Indian River and presumable nested in large numbers on the ocean shore of Hutchinson Island. However, intensive and exploitive fishing for this turtle has resulted in its near extermination in Florida and over much of its Caribbean range.

Carr and Ingle (34) reported one incident of a green turtle nesting on Hutchinson Island. The animal laid 130 eggs on June 27, 1958, of which 80 hatched two months later, on August 24, 1958.

In 1967, Routa (35) made an extensive survey of sea turtle nesting activity on Hutchinson Island. He observed three separate 1-mile stretches of beach during May through August 1967. Turtles, primarily loggerheads (Carretta caretta), began nesting in the first week of May and continued through the last week in August. Peak nesting activity occurred in the last week of June, just after the summer solstice. A total of 705 nests were seen on the three miles of beach surveyed. Of these, one nest was positively identified as that of a green turtle and another tentatively attributed to that species.

An estimate of 5265 nests was calculated for the entire length of Hutchinson Island in 1967. Nearly all of the nests were made by loggerheads, only 15 of these could be assigned to the now rare green turtle.

Since 1956, the staff of the House of Refuge located on the southern tip of Hutchinson Island has been transplanting, hatching and releasing turtles from eggs laid in nests on the beach (36). This organization, in conjunction with Dr. A. Carr of the University of Florida has been instrumental in preserving the green turtle as a native Florida animal.

5 - Marine Fouling

Presently, very little is known about the marine organisms which would foul any man-made structure placed offshore of Hutchinson Island.

In September 1970, Ebasco personnel made a SCUBA dive at the FP&L temperature monitoring station. At this time, the station had been installed less than three weeks, but marine growth was visible on all submerged portions of the station. Colonial hydroids, filamentous algae and juvenile barnacles (Balanus spp.) were observed on various portions of the temperature monitoring installation (12).

In January 1971, FP&L installed a marine fouling station in the immediate vicinity of the temperature recording installation. On March 6, 1971, the first fouling panel (a section of 12 in. I.D. reinforced concrete pipe 2 ft. long) was recovered after 35 days of submersion. The pipe section was examined in detail (13) and the following results were obtained:

Outside of pipe: The outside of the pipe was noticeably less fouled than the inside. Fouling organisms were not evenly distributed over the outer surface of the pipe, but varied from scarce on the uppermost surface to abundant on the bottom surface. An area of 100 cm^2 (about 16 in^2) of the most heavily fouled portion of the outer surface of the pipe section was examined in detail for fouling organisms. The following data were collected:

1) 42 tube worms (probably Spirorbis spp) avg. diameter = 1 mm, avg. length = 10 mm.

2) Approximately 1200 balanoid barnacles

   18 were 5 mm or greater in diameter, most of the rest were 1 mm or less in diameter and 0.5 mm in height (possibly 2 different "sets" of barnacles). These barnacles have not been positively identified, but probably are Balanus amphitrite and B. improvisus.

3) 4 Anomia (a flat clam), avg. diameter = 6 mm, avg. height = 2 mm.

4) Sparse to moderate growth of filamentous algae, 25 mm long.

5) 4 patches of encrusting bryozoans about 10 mm dia and 0.5 mm thick.

Inside of pipe: The inner surface of the pipe section was more uniformly covered with organisms than was the outside. Density of settlement was also more uniform. The upper portion of the inner surface had no organisms attached to it, due to abrasion of the pipe section against the device on which it had been "strung." Two 100 cm^2 areas on the most heavily fouled portion of the inner surface were examined. The first was scraped clean of organisms and the collected material was preserved in isopropyl alcohol. Organisms on the second area were enumerated and identified. The types and numbers of organisms per 100 cm^2 are given below.

1) 75 tube worms

2) 2 encrusting bryozoans

3) 3 Anomia

4) About 900 balanoid barnacles; these barnacles were very uniform in size, about 5 mm dia. and 3 mm ht.

5) A few erect and branching bryozoans on the entire inner surface of the pipe.

Panels from the fouling station will be examined on a monthly basis. Both the monthly fouling rate and the cumulative rate will be determined.

Information from other sources (37,38) suggest that barnacles, hydroids, tube worms, bryozoans and the bivalves Ostrea, Isognomon Crepidula and Anomia will be the most probable causes of fouling in the area offshore of Hutchinson Island.

Mytilus edulis, a prime fouling organism on the Pacific Coast and on the Northeast coast of the United States is not reported to occur south of Cape Kennedy and thus is not anticipated at the Hutchinson Island fouling station.

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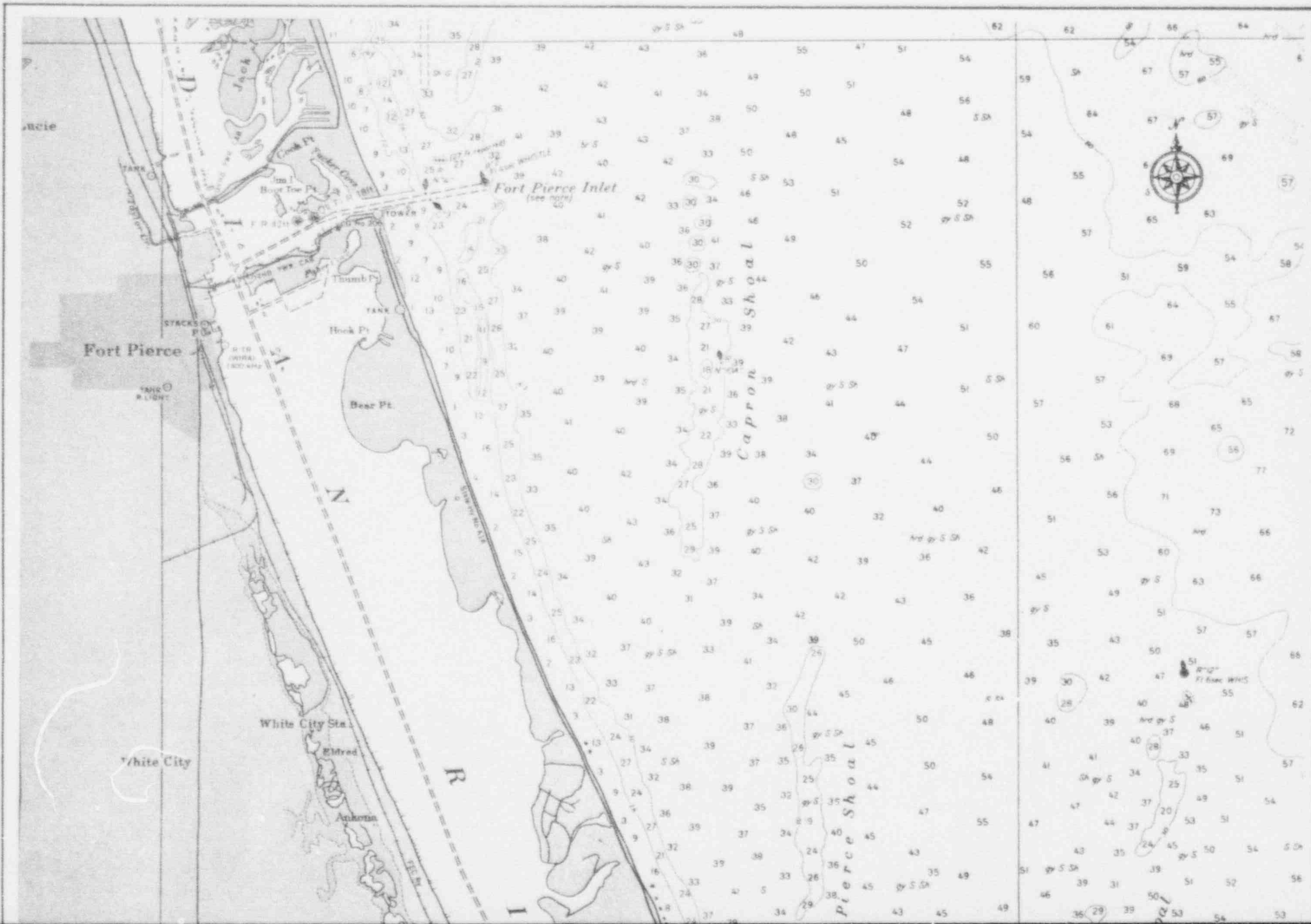
1952 Marine Fouling and its Prevention U. S. Naval Institute, Annapolis, Maryland.

38) Personal Communication
1970 B. J. Merrill
Battelle Memorial Laboratory,
Daytona Beach, Florida



Fort Pierce Inlet
Capron Shoal
Pierce Shoal
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White City
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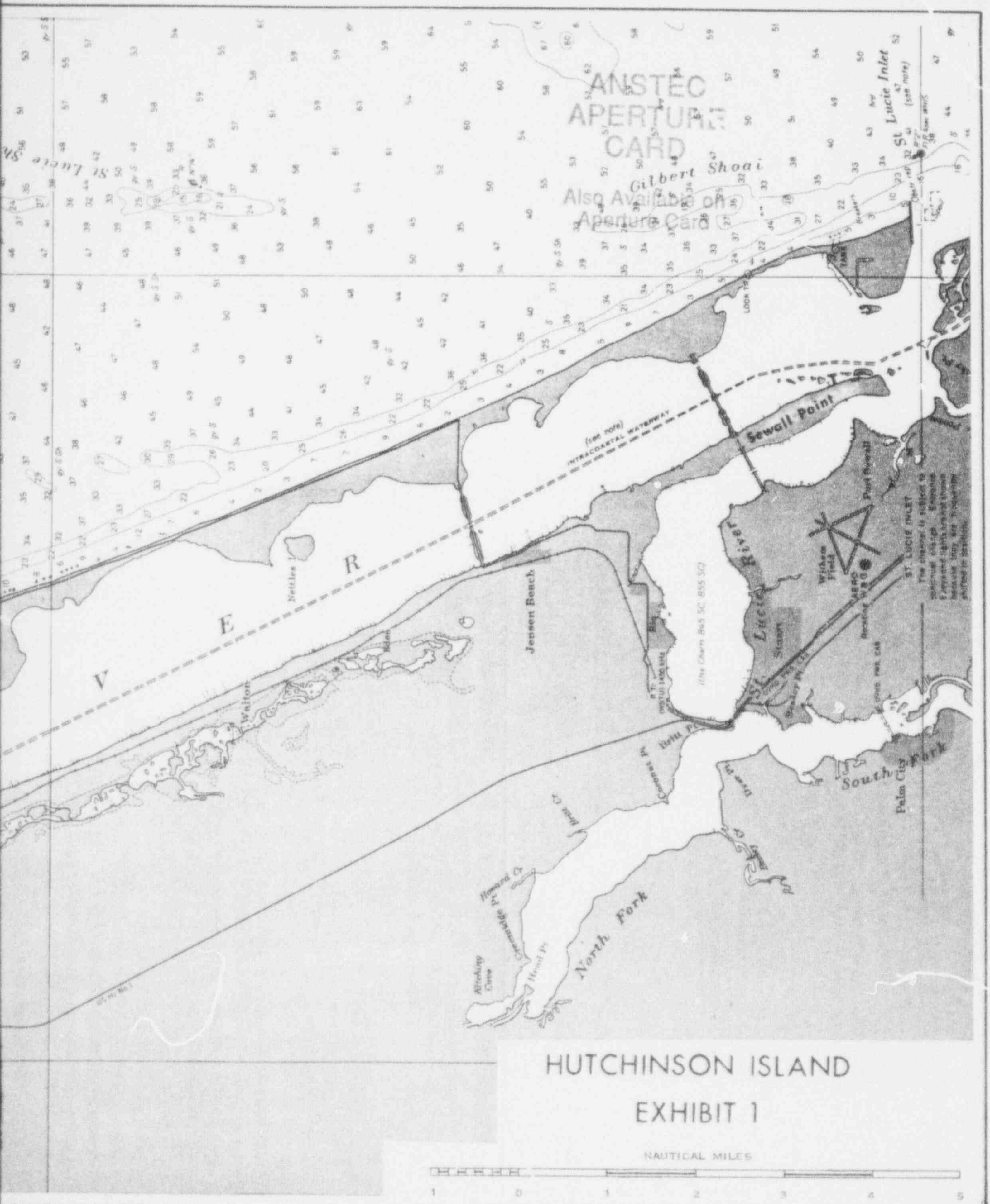
Eldred
Ankona
Bear Pt.
Hook Pt
Thumb Pt
Cook Pt
Jack



ANSTEC
APERTURE
CARD

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HUTCHINSON ISLAND

EXHIBIT 1

9406140015-21

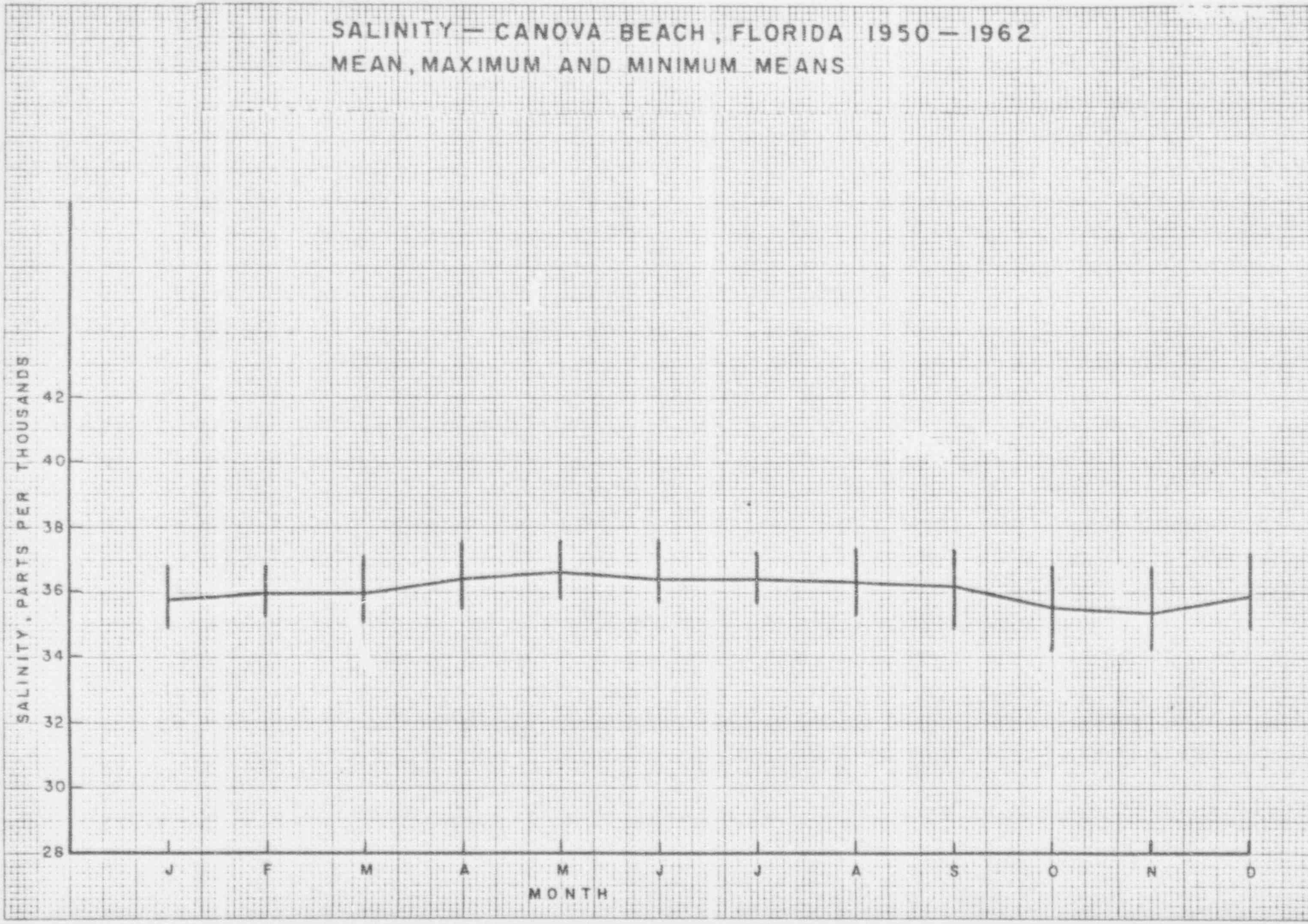

SALINITY — CANOVA BEACH, FLORIDA 1950 — 1962
MEAN, MAXIMUM AND MINIMUM MEANS
SALINITY, PARTS PER THOUSANDS
42
40
38
36
34
32
30
28
J
F
M
A
M
J
J
A
S
O
N
D
MONTH

EXHIBIT 2

EXHIBIT 3

SALINITY OF ATLANTIC OCEAN WATER AT CANOVA BEACH,
FLORIDA, 1950-1962, GIVEN IN PARTS PER THOUSAND (ppt).

Month	Mean	Mean Maximum	Mean Minimum
January	35.8	36.8	34.9
February	36.0	36.8	35.3
March	36.0	37.1	35.1
April	36.4	37.5	35.5
May	36.6	37.6	35.8
June	36.4	37.6	35.7
July	36.4	37.2	35.7
August	36.3	37.3	35.3
September	36.2	37.3	34.9
October	35.5	36.8	34.2
November	35.4	36.8	34.2
December	35.9	37.2	34.9

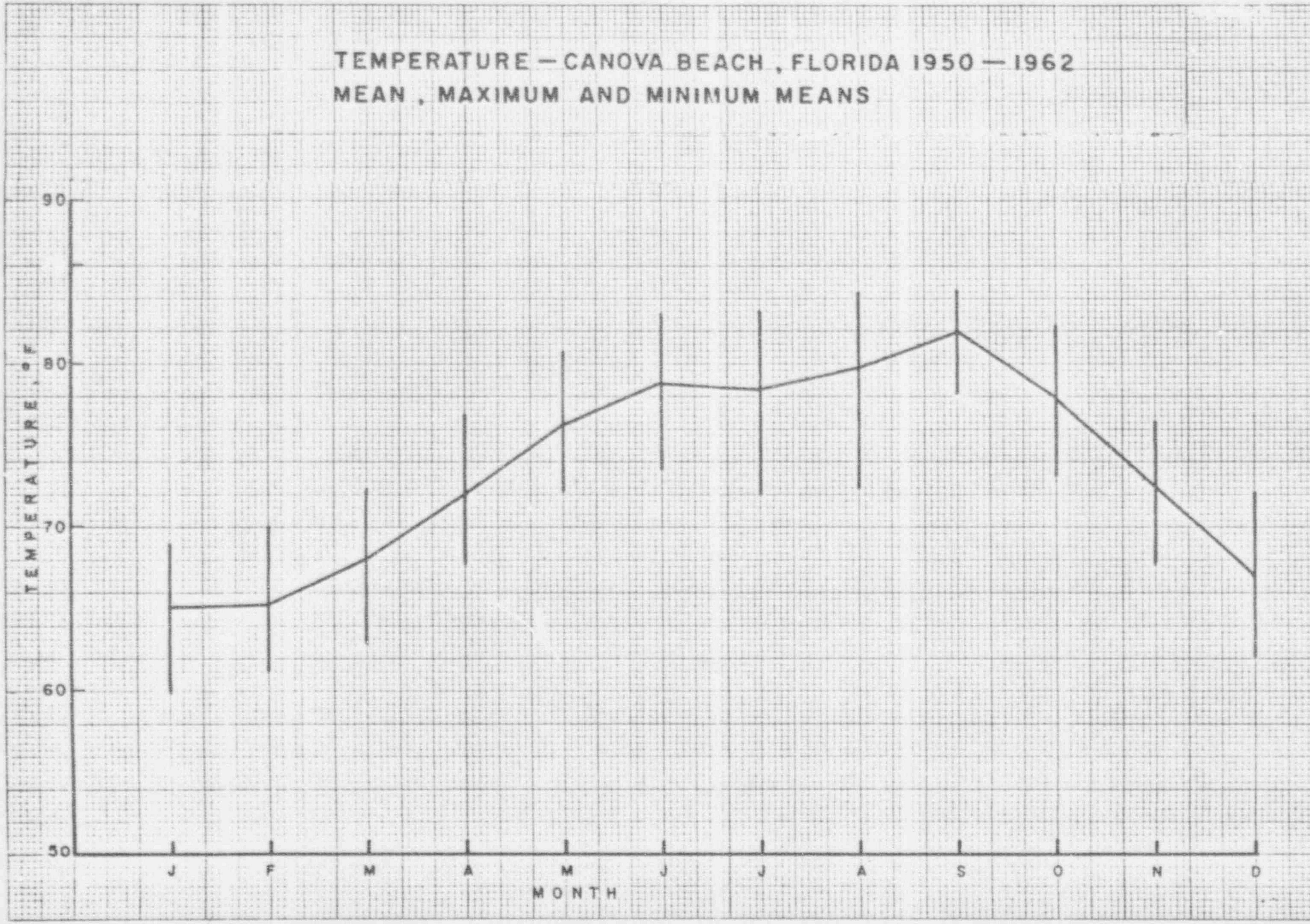

TEMPERATURE — CANOVA BEACH, FLORIDA 1950 — 1962
MEAN, MAXIMUM AND MINIMUM MEANS
TEMPERATURE, °F
90
80
70
60
50
J
F
M
A
M
J
J
A
S
O
N
D
MONTH

EXHIBIT 4

EXHIBIT 5

TEMPERATURE F. OF ATLANTIC OCEAN WATER
AT CANOVA BEACH, FLORIDA, 1950-1962

Month	Mean	Mean Maximum	Mean Minimum	Maximum	Minimum
January	65.1	69.1	59.9	74	51
February	65.7	70.0	61.4	75	54
March	68.2	72.4	63.3	76	58
April	72.2	77.2	67.6	80	64
May	76.5	81.2	72.0	86	68
June	79.2	83.3	73.8	85	70
July	78.8	83.6	72.3	86	62
August	80.1	84.7	72.6	87	62
September	82.2	84.8	78.6	87	72
October	78.3	82.7	73.7	85	70
November	73.2	77.0	68.1	80	61
December	67.8	72.4	62.6	76	59

APPENDIX 5

PERMITS AND LICENSES

APPENDIX 5

Exhibit A.

The St Lucie County

BOARD of COUNTY COMMISSIONERS

P. O. BOX 700

Fort Pierce, Florida
33450

W. R. McCAIN, District No. 1 • E. E. GREEN, District No. 2 • JOHN B. PARK, District No. 3 • MARJORIE SILVER, District No. 4 • CODY L. BAILEY, District No. 5

July 9, 1968

DIVISION

Mr. R. D. Hill, V-Pres.
Florida Power and Light Company
P O Box 31
West Palm Beach, Florida

Dear Mr. Hill:

This is to confirm that following the public hearing held July 2, 1968 the Board of County Commissioners, by motion and resolution, granted the petition of Florida Power & Light Company for a change in zoning classification for property on Hutchinson Island.

The following described property is now zoned PS-1 (public service district):

> All of Fractional Sections 8 and 9 less the North 583.71 feet as measured along the Atlantic Ocean and less the South 200 feet of the North 783.71 feet lying East of A1A right of way; and all of Fractional Sections 15, 16 and 17 all being in Township 36 South, Range 41 East, St. Lucie County, Florida.

Very truly yours,

BOARD OF COUNTY COMMISSIONERS
ST LUCIE COUNTY, FLORIDA

By *W. R. McCain*

W. R. McCain, Chm.

mld

County Commission

of

St. Lucie County, Florida

PERMIT

For Building, Alteration, Repair, Removal, or Demolition

No. 9870 Date 7-20-70

This is to certify that Florida Power + Lite Co

has permission to Construct Circulating water System Intake structure

Contractor: Ebasco Services, Inc

Lot ______ Block ______ Unit ______ Sec. ____ T ____ R ____

Hutchinson Island

S/D ______ Zoned RS-1

Street or Road So A1A S/o Big Mud Creek

Dimensions: Building ______

Plot ______

Setback: Front ______ Back ______ Sides ______

Fee Paid 262.00 Estimated Cost 146,400

Mary Foy

For Zoning Director

VOID AFTER 90 DAYS IF CONSTRUCTION HAS NOT COMMENCED

County Commission
of
St. Lucie County, Florida

PERMIT

For Building, Alteration, Repair, Removal, or Demolition

No. 10461 Date 1-VI-71

This is to certify that Florida Power + Lite

has permission to

Construct temporary Warehouse

Contractor: Ebasco Services, Inc

Lot ______ Block ______ Unit ______ Sec. 16 T 37 R 41

S/D ______ Zoned RSI

Street or Road So A1A s/o Big Mud

Dimensions: Building 2400 □'

Plot acreage

Setback: Front ______ Back ______ Sides ______

Fee Paid 15.00 Estimated Cost 4600

Mary Foy
For Zoning Director

VOID AFTER 90 DAYS IF CONSTRUCTION HAS NOT COMMENCED

County Commission
of
St. Lucie County, Florida

PERMIT

For Building, Alteration, Repair, Removal, or Demolition

No. 10462 Date 1-VI-71

This is to certify that Florida Power + Lite

has permission to

Construct WF maintenance Bldg

Contractor: Ebasco Services, Inc

Lot ______ Block ______ Unit ______ Sec. ______ T ______ R ______

S/D ______ Zoned ______

Street or Road So A1A - s/o Big Mud

Dimensions: Building 900 □'

Plot ______

Setback: Front ______ Back ______ Sides ______

Fee Paid 6.00 Estimated Cost 2,000

Mary Foy
For Zoning Director

VOID AFTER 90 DAYS IF CONSTRUCTION HAS NOT COMMENCED

County Commission

of

St. Lucie County, Florida

PERMIT

For Building, Alteration, Repair, Removal, or Demolition

No. 9782 Date 6-26-70

This is to certify that Fla Power + Lite Co

has permission to

Construct Reactor auxiliary Building Base Slab

Contractor: Ebasco Services, Inc

Lot ____ Block ____ Unit ____ Sec. ____ T ____ R ____

Sec 16-37-41

S/D ____ Zoned PS1

Street or Road So A1A S/o Big Mud

Dimensions: Building ____

Plot ____

Setback: Front ____ Back ____ Sides ____

Fee Paid 370.00 Estimated Cost 255,000

Mary Day

For Zoning Director

VOID AFTER 90 DAYS IF CONSTRUCTION HAS NOT COMMENCED

APPENDIX 5

Exhibit B.

SOUTHERN
JUL 3 1969
NUCLEAR ENGINEERING

RULES
OF THE
FLORIDA AIR AND WATER POLLUTION CONTROL COMMISSION
CHAPTER 28-5
POLLUTION OF WATERS

28-5.01 **Declaration and intent.**—The Florida Air & Water Pollution Control Commission, in order to more properly protect the waters of the State of Florida, declares that the presence of pollutants in excess of concentrations hereinafter provided is harmful to the waters of this State and the presence of such excessive concentrations is deemed to be prima facie evidence of pollution of the waters of the State of Florida and the same is expressly prohibited.

The policy inherent in the standards shall be to protect water quality existing at the time these water quality standards were adopted or to upgrade or enhance water quality within the State of Florida. In any event where a new or increased source of pollution poses a possibility of degrading existing high water quality, such project development shall not be issued a Commission permit until the Commission is satisfied that such development will not be detrimental to the best interests of the State and necessary to its social and economic development. In administering the policy, high quality receiving waters will be protected by requiring as a part of the initial project design the highest and best practicable treatment available under existing technology.

The Commission recognizes and will protect the interest of the Federal Government in interstate and coastal waters in accordance with the Federal Water Pollution Control Act, as amended. The Commission further shall consult with the U. S. Department of the Interior on all matters affecting the Federal interest in a cooperative effort.

It is the intent of the State of Florida to review Class V stream classifications periodically as often as necessary, and as water quality of such areas improves, hearings will be held and reclassification shall be established. It is expected that in all instances presently classified as Class V. Waters, there shall be decided and definitive enhancement not later than January 1, 1973.

General Authority 403.061 FS; Law Implemented 403.021, 403.061, 403.101(1), 403.182, 403.261 FS
History.—(Former 170C-5.01), Amended 3-21-68, 1-17-69

28-5.02 **Minimum conditions of all waters; times and places.**—

The following minimum conditions are applicable to all waters, at all places and at all times. Within the territorial limits of this state all such waters shall be free from:

(1) Settleable Substances—substances attributable to municipal, industrial, agricultural, or other discharges that will settle to form putrescent or otherwise objectionable sludge deposits.

(2) Floating Substances—floating debris, oil, scum, and other floating materials attributable to municipal, industrial, agricultural, or other discharge in amounts sufficient to be unsightly or deleterious.

(3) Deleterious Substances—materials attributable to municipal, industrial, agricultural, or other discharges producing color, odor, or other conditions in such degree as to create a nuisance.

(4) Toxic Substances—substances attributable to municipal, industrial, agricultural or other discharges in concentrations or combinations which are toxic or harmful to humans, animal, plant, or aquatic life.

(5) Wastewaters discharged to coastal wa-

ters will receive the best practicable treatment. Where less than secondary treatment is prescribed, it must be demonstrated to the satisfaction of the State of Florida that the lesser degree of treatment will cause no interference with beneficial water uses.

Where preliminary treatment is prescribed for wastewater discharges to the ocean along the Southeastern coast of Florida; i.e. Palm Beach County southward through Monroe County, the following requirements will be met:

Waters shall be free of all floatable solids, including but not limited to grease, so that all territorial waters (water along the shore as well as open seas) are protected for aesthetic and recreational and public health uses. Floatable solids shall be defined as those solids that float not only at the point of discharge but at any other point within the territorial limits of the United States.

The above requirements may be accomplished by the following processes: screening (coarse and fine), comminution, sedimentation, floatation, centrifugation, and the addition of chemicals. Where less than secondary treatment is proposed, ocean outfalls, with diffusion devices, shall be installed to terminate at the Gulf Stream.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101(1) FS
History.—(Former 170C-5.02), Amended 3-21-68, 1-17-69

28-5.03 **Water quality testing.**—Tests or analytical procedures to determine compliance or noncompliance with water quality criteria provided by this chapter shall be in accordance with methods given in the latest edition of Standard Methods for the Examination of Water and Wastewater, published by the American Public Health Association, American Water Works Association and Water Pollution Control Federation; and a copy of same shall be available for public inspection at the offices of the Air & Water Pollution Control Commission. Where other tests or analytical procedures are found to be more satisfactory, such tests or procedures will be used only upon the acceptance and approval by the regulatory agency.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101 FS
History.—(Former 170C-5.03)

28-5.04 **General water quality.**—

(1) Sewage, Industrial Wastes or Other Wastes—Any industrial wastes or other wastes shall be effectively treated by the latest modern technological advances as approved by the regulatory agency.

All discharges from municipal and privately owned domestic waste plants will comply with the Water Quality Standards of the State of Florida with 90% treatment or better as expeditiously as possible, but not later than January 1, 1973.

The degree of treatment for industrial waste has been further defined as follows: That which provides an effluent equivalent to that produced by the highest quality municipal waste treatment, but in no case shall the efficiency be less than 90% organic removal. In some cases, due to waste characteristics, it will be necessary that the efficiency exceed 90%. In the case of inorganic wastes, waste treatment shall have similar efficiencies. The 90% organic and inorganic removal factor shall be applied against the total untreated waste produced by a given plant. All discharges from industrial waste treatment plants shall attain such treatment efficiency as expeditiously as possible, but not later than January 1, 1973.

(2) Chemical Constitutents and Compounds—Presence of certain other elements, organic and inorganic compounds are recognized to affect water quality and aquatic life. These substances often occur naturally in streams or lakes and may be difficult to measure accurately and their effects are usually indirect or accentuated when found in combination with substances or conditions listed in the established criteria.

(3) When any of the constitutents listed below occur in any amounts in any individual body of water, they shall be suspected of degrading the quality of the particular lake or stream. As improvement in analytical technique dictate, exact numerical threshold criteria may be established, but the same shall not be limited to the following:

Sulfates	Free Mineral Acids
Sulfides	Nitrates
Nickel	Phosphates
Aluminum	Potassium

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101 FS
History.—(Former 170C-5.04), Amended 3-21-68

28-5.05 **Water quality standards; specifics.**—

(1) The criteria of water quality hereinafter provided will be applied only after reasonable opportunity for mixture of wastes with receiving waters has been afforded; the reasonableness of the opportunity for mixture of wastes and receiving waters shall be determined on the basis of the physical characteristics of the receiving waters and the methods in which the discharge is physically made shall be approved by the regulatory agency.

(2) The following water quality standards shall be the criteria for pollution when concentrations exceed following limitations:

(a) Fluorides—shall not exceed 1.4 to 1.6 mg/l as fluoride ion, depending on annual average daily air temperature for at least a five-year period for sources of Class I public water supplies measured immediately above or adjacent to raw water intake.

(b) Fluorides—for waters not used for public water supplies, shall not exceed 10.0 mg/1 as fluoride ion or will not interfere with other beneficial uses.

(c) Chlorides—chlorides shall not exceed two hundred fifty (250) mg/1 in streams considered to be fresh water streams; in other waters of brackish or saline nature the chloride content shall not be increased more than ten per cent (10%) above normal background chloride content.

(d) Turbidity—shall not exceed fifty (50) Jackson units as related to standard candle turbidimeter above background.

(e) Dissolved Oxygen—shall not be artificially depressed below the values of four (4.0) ppm (unless background information available to the regulatory agency indicates prior existence under unpolluted conditions of lower values.) In such cases, lower limits may be utilized after approval by the regulatory authority.

(f) BOD—shall not be altered to exceed values which would cause dissolved oxygen to be depressed below the limit listed above and, in no case, shall it be great enough to produce nuisance conditions.

(g) Temperature—shall not be increased so as to cause any damage or harm to the aquatic life or vegetation of the receiving waters or interfere with any beneficial use assigned to such waters.

(h) Dissolved Solids—not to exceed five hundred (500) mg. per liter as a monthly average or exceed one thousand (1,000) mg. per liter at any time.

(i) Specific Conductance—shall not be increased more than one hundred per cent (100%) above background levels or to a maximum level of 500 micromhos per centimeter (cm) for streams considered to be fresh water streams.

(j) Radioactive Substances, Gross Beta Activity—(in known absence of strontium—90 and alpha emitters), not to exceed one thousand (1,000) micromicrocuries at any time. See also Chapter 170C-1.

(k) Cyanide or Cyanates—none detectable.

(l) Copper—shall not exceed 0.5 mg/1

(m) Zinc—shall not exceed 1.0 mg/1

(n) Chromium—shall not exceed 0.50 mg/1 hexavalent or 1.0 mg/1 total chromium in effluent discharge and shall not exceed 0.05 mg/1 after reasonable mixing in the receiving stream.

(o) Phenolic type compounds calculated or reported as phenol—shall not exceed 0.001 mg/1

(p) Lead—shall not exceed 0.05 mg/1

(q) Iron—shall not exceed 0.30 mg/1

(r) Arsenic—shall not exceed 0.05 mg/1

(s) Oils and Greases—shall not exceed fifteen (15) mg/1, or that no visible oil, defined as iridescence, be present to cause taste and odors, or interfere with other beneficial uses.

(t) pH—of receiving waters shall not be caused to vary more than one (1.0) unit above or below normal pH of the waters; and lower value shall be not less than six (6.0), and upper value not more than eight and one-half (8.5). In cases where pH may be, due to natural background or causes, outside limits stated above, approval of the regulatory agency shall be secured prior to introducing such material in waters of the state.

(u) Detergents—shall not exceed one-half (0.5) mg/1

(3) Exceptions—in cognizance of the fact that certain waters of the state, due to natural causes, may not fall within desired or prescribed limitations outlined above, the Commission is empowered to authorize exceptions to limitations upon presentation of good and sufficient evidence. In no case shall it be lawful to authorize disposition or introduction of materials in waters of the state which will cause material harm or damage to said waters.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101 FS
History.—(Former 170C-5.05), Amended 3-21-68, 1-17-69

28-5.06 Classification of waters, usage.—

The waters of Florida are classified according to their usage as follows:

Class I—Public Water Supplies

Class II—Shellfish Harvesting

Class III — Recreation — Propagation and management of fish and wildlife

Class IV—Agricultural and industrial water supply

Class V—Navigation, utility and industrial use

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101(1) FS
History.—(Former 170C-5.06)

28-5.07 Criteria: Class I waters—public water supply.—

The following criteria are for classification of any waters from which water is withdrawn for treatment and distribution as a potable supply.

(1) Sewage, Industrial Wastes, or Other Wastes—any industrial wastes or other wastes shall be effectively treated by the latest modern technological advances as approved by the regulatory agency.

(2) Odor—threshold odor number not to exceed 24 at 60°C as a daily average.

(3) pH—of receiving waters shall not be caused to vary more than one (1.0) unit above or below normal pH of the waters; and lower value shall not be less than six (6.0), and the upper value not more than eight and one-half (8.5). In cases where pH may be, due to natural

background or causes, outside limits stated above, approval of the regulatory agency shall be secured prior to introducing such material in waters of the state.

(4) Dissolved Oxygen—shall not be artificially depressed below the values of four (4.0) ppm (unless background information available to the regulatory agency indicates prior existence under unpolluted conditions of lower values.) In such cases, lower limits may be utilized after approval by the regulatory authority.

(5) Toxic Substances—free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations or combinations which are toxic or harmful to humans, animal or aquatic life.

(6) Bacteriological Quality—coliform group not to exceed 1,000 ml as a monthly average, (either MPN or MF counts); nor to exceed this number in more than 20% of the samples examined during any month; nor exceed 2,400 per 100 ml (MPN or MF count) on any day.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101 FS
History.—(Former 170C-5.07), Amended 1-17-69

28-5.08 **Criteria: Class II waters—shellfish harvesting.—**

The following criteria are for classification of waters in areas to be utilized for shellfish harvesting:

(1) Bacteriological Quality, Coliform Group—areas classified for shellfish harvesting, the median coliform MPN (Most Probable Number) of water cannot exceed seventy (70) per hundred (100) ml., and not more than ten (10) per cent of the samples ordinarily exceed an MPN of two hundred and thirty (230) per one hundred (100) ml. in those portions of areas most probably exposed to fecal contamination during most unfavorable hydrographic and pollutional conditions.

(2) Sewage, Industrial Wastes, or Other Wastes—any industrial wastes or other wastes shall be effectively treated by the latest modern technological advances as approved by the regulatory agency.

(3) pH—of receiving waters shall not be caused to vary more than one (1.0) unit above or below normal pH of the waters; and lower value shall be not less than six (6.0) and upper value not more than eight and one-half (8.5). In cases where pH may be, due to natural background or causes, outside limits stated above, approval of the regulatory agency shall be secured prior to introducing such material in waters of the state.

(4) Temperature—shall not be increased so as to cause any damage or harm to the aquatic life or vegetation of the receiving waters or interfere with any beneficial use assigned to such waters.

(5) Dissolved Oxygen—shall not be artificially depressed below the values of four (4.0) ppm (unless background information available to the regulatory agency indicates prior existence under unpolluted conditions of lower values.) In such cases, lower limits may be utilized after approval by the regulatory authority.

(6) Toxic Substances—free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations or combinations which are toxic or harmful to humans, animal or aquatic life.

(7) Odor—threshold odor number not to exceed 24 at 60°C as a daily average.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101 FS
History.—(Former 170C-5.08), Amended 3-21-68, 1-17-69

28-5.09 **Criteria: Class III waters—recreation—propagation and management of fish and wildlife.—**

The following criteria are for classification of waters to be used for recreational purposes, including such body contact activities as swimming and water skiing; and for the maintenance of a well-balanced fish and wildlife population. All coastal and beach waters, including off-shore waters, not otherwise classified shall be classified as Class III; however, waters of the open ocean shall be maintained at a dissolved oxygen of not less than five (5.0) ppm. Streams specifically listed in Section 28-5.21 by a separate listing designated as "Special Stream Classification" shall similarly be maintained at a minimum dissolved oxygen of five (5.0) ppm.

(1) Sewage, industrial wastes, or other wastes—any industrial waste or other wastes shall be effectively treated by the latest modern technological advances as approved by the regulatory agency.

(2) pH—of receiving waters shall not be caused to vary more than one (1.0) unit above or below normal pH of the waters; and lower value shall be not less than (6.0), and upper value not more than eight and one-half (8.5). In cases where pH may be, due to natural background or causes outside limits stated above, approval of the regulatory agency shall be secured prior to introducing such material in waters of the state.

(3) Dissolved Oxygen—shall not be artificially depressed below the values of four (4.0) ppm (unless background information available to the regulatory agency indicates prior existence under unpolluted conditions of lower values). In such cases, lower limits may be utilized after approval by the regulatory authority.

(4) Bacteriological—coliform group not to exceed 1,000 per 100 as a monthly average, (either MPN or MF counts); nor to exceed this

number in more than 20% of the samples examined during any month; nor exceed 2,400 per 100 ml (MPN or MF count) on any day. This criteria shall apply only to waters used for body contact activities.

(5) Toxic substances—free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations or combinations which are toxic or harmful to humans, animal or aquatic life.

(6) Deleterious—free from materials attributable to municipal, industrial, agricultural, or other discharges producing color, odor or other conditions in such degree as to create a nuisance.

(7) Turbidity—shall not exceed fifty (50) Jackson units as related to standard candle turbidimeter above background.

(8) Temperature—shall not be increased so as to cause any damage or harm to the aquatic life or vegetation of the receiving waters or interfere with any beneucial use assigned to such waters.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101 FS
History.—(Former 170C-5.09), Amended 3-21-68, 1-17-69

28-5.10 Criteria: Class IV waters—agricultural and industrial water supply.—

The following criteria are for classification of waters to be used for agricultural or stock watering, or industrial water supply.

(1) Sewage, industrial wastes or other wastes—none which are not effectively treated or controlled to the satisfaction of the regulatory agency.

(2) pH—not more than one (1.0) unit from the normal or not less than six (6.0) nor greater than 8.5.

(3) Temperature—shall not be increased so as to cause any damage or harm to the aquatic life or vegetation of the receiving waters or interfere with any beneficial use assigned to such waters.

(4) Dissolved oxygen—shall not be depressed below the values of four (4.0) ppm (unless background information available to the regulatory agency indicates prior existence under unpolluted conditions of lower values). In such cases, lower limits may be utilized after approval by the regulatory authority.

(5) Color, odor, and taste producing substances and other deleterious substances, including other chemical compounds, attributable to domestic wastes, industrial wastes, and other wastes—only such amounts as will not render the waters unsuitable for agricultural irrigation, livestock watering, industrial cooling, industrial process water supply purposes and fish survival.

(6) Turbidity—shall not exceed fifty (50) Jackson units as related to standard candle turbidimeter above background.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101 FS
History.—(Former 170C-5.10), Amended 3-21-68, 1-17-69

28-5.11 Criteria: Class V waters—navigation, utility and industrial use.—

The following criteria are for classification of waters which will be suitable for navigation and any other uses except for waters previously classified in this Chapter:

(1) Sewage, Industrial or Other wastes—none which are not effectively treated or controlled to the satisfaction of the regulatory agency.

(2) pH—not lower than 5.0 nor greater than 9.5 except certain swamp waters which may be as low as 4.5.

(3) Dissolved oxygen—sufficient to be aerobic. The term "aerobic" is defined as "being not less than one (1.) ppm with an average value of not less than two (2.0) ppm."

(4) Odor producing substances—only in such amounts that will not unreasonably interfere with the use of the water for the designated purpose of this classification.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101 FS
History.—(Former 170C-5.11), Amended 3-21-68

28-5.12 Definitions.—

(1) Definitions of technical terms used shall be in accordance with the glossary—water and sewage control engineering, standard methods for the examination of water and wastewater and the condensed chemical dictionary.

(2) Drainage well shall be considered to have the same meaning as absorbing well.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.101 FS
History.—(Former 170C-5.12)

28-5.13 Drainage wells, permits.—Before any municipal or private corporation or persons shall use an existing well or sink, drive or drill a new well for discharge of sewage or surface water, the owner of existing well or well drilling contractor and owner of property in the case of a new well shall apply to the Commission for written permit authorizing drilling and use of said well.

General Authority 403.061 FS; Law Implemented 403.021, 403.031, 403.061, 403.182 FS
History.—(Former 170C-5.13)

28-5.14 Drainage well, applications.—

Application for drainage well permit shall be on form supplied by the Commission and accompanied by the following data:

(1) Completed report of inspection by county or regional sanitary engineer.

(2) Location and depth of well and depth of casing of all water supply wells within one (1) mile radius of proposed well.

(3) Nature of waters to be discharged into proposed drainage well including analysis

thereof, source, estimated quantity and pertinent bacteriological analyses if deemed necessary by the Commission.

(4) If transmittal ditches or depressions are used to allow flow of surface or other waters to the well, a complete drawing of drained area shall be supplied and considered a part of drainage structure.

(5) If drainage well or drainage structure will present possible pollution hazard to underground water or water supply wells within one (1) mile thereof, additional data may be requested.

(6) All applications shall be signed by the well drilling contractor and owner of property where proposed well or drainage structure is located or his duly authorized agent.

(7) In all cases except for wells to receive condenser cooling waters or where receiving aquifer or aquifers contain fifteen hundred (1500) parts per million or more of chlorides, bacteriological examination must be made of water from all water supply wells within one (1) mile radius that are drilled to approximate depth of proposed drainage well. The bacteriological survey shall be conducted in following manner:

(a) Samples shall be collected from each well for the first three (3) days of each week for period of four (4) weeks.

(b) Duplicate samples shall be collected in each case after well has been pumped at least twenty (20) minutes. Whenever a drainage well installation is approved following preliminary bacteriological survey of neighboring water supply wells, an identical survey of the same well shall be conducted following opening of drainage well.

General Authority 403.061 FS; Law Implemented 403.021, 403.061, 403.101, 403.182 FS
History.—(Former 170C-5.14)

28-5.15 **Effective date of permits.**—No permit for operation or drilling of a drainage well shall become effective or operative until filed with the clerk of the circuit court as required in Section 387.03 FS.

General Authority 403.061 FS; Law Implemented 403.021, 403.061, 403.182 FS
History.—(Former 170C-5.15)

28-5.16 **Drainage wells, drilling requirements.**—

(1) A log showing various strata pierced by the well shall be forwarded to the Commission within two (2) days after completion of drilling operation.

(2) Samples of strata formations pierced in drilling shall be forwarded to the state geologist, P. O. Drawer 631, Tallahassee, when drilling is completed.

(3) If casing is used within the well it shall be first-quality lap-welded pipe only. Use of butt welded pipe is prohibited.

(4) Practice of dynamiting clogged wells shall not be resorted to except upon written permission of the Commission.

General Authority 403.061 FS; Law Implemented 403.021 403.061, 403.101, 403.182 FS
History.—(Former 170C-5.16)

28-5.17 **Drainage well permit revocation or modification.**—Drainage well permits are revocable or subject to modification by the Commission in accordance with provisions of Section 387.03 and Sections 120.20 through 120.28 FS. Pumping into drainage wells unless specifically authorized in permit will constitute violation of permit and be cause for permit revocation.

General Authority 403.061 FS; Law Implemented 403.021, 403.061, 403.182 FS
History.—(Former 170C-5.17)

28-5.18 **Test wells and borings.**—Test wells or borings shall be filled with concrete within five (5) days after completion of testing purposes for which it was drilled. Such test wells or borings shall not be used as drainage wells unless permit has been obtained in accordance with this chapter. Failure to obtain permit prior to drilling of said well or boring shall bar future use except for testing purposes not connected with drainage in any manner whatsoever.

General Authority 403.061 FS; Law Implemented 403.021, 403.061, 403.101, 403.182 FS
History.—(Former 170C-5.18)

28-5.19 **Abandoned wells.**—Within ten (10) days after abandonment of drainage wells they shall be backfilled from bottom to top with neat cement grout.

General Authority 403.061 FS; Law Implemented 403.021, 403.061 FS
History.—(Former 170C-5.19)

28-5.20 **Pollution surveys.**—Surveys of surface waters including treatment plant effluents shall be made in accordance with good sanitary engineering practice and shall be of sufficient scope to provide information as requested by the Commission in cases where the Commission deems such survey necessary to provide information relative to request for additional loading on sewage treatment plant or evaluate effect of such existing facilities on receiving waters. Such surveys shall take into account factors such as physical, chemical, biological and bacteriological which are pertinent. note

General Authority 403.061 FS; Law Implemented 403.021, 403.061, 403.101, 403.182 FS
History.—(Former 170C-5.20)

28-5.21 **Classified waters.**—Pursuant to the criteria of water classification, Sections 28-5.06 through 28-5.11, inclusive, the waters of the State of Florida are classified by river basins or sub-basins (classifications are not printed in the Code pursuant to Section 120.051(1)(e), Florida Statutes, but as filed are of full force and effect.)

General Authority 403.061 FS; Law Implemented 403.021, 403.061 FS
History.—(Former 170C-5.21)

APPENDIX 5

Exhibit C.

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

JAN 17 1969

Dear Governor Kirk:

I am pleased to inform you that I have approved the water quality standards of the State of Florida based upon my determination that they are consistent with the protection of the public health and welfare, the enhancement of the quality of the water, and the purposes of the Federal Water Pollution Control Act, as provided by Section 10(c)(3) of that Act. Accordingly, the standards as approved are those applicable under the Act to the interstate waters of Florida.

I am particularly pleased to note that your State has adopted as part of its enforceable standards a statement designed to control degradation of high quality waters. Preservation of these waters will provide enjoyment for many generations, not only for the people of Florida but for the Nation, as they participate in the water based recreation for which Florida is famous. Furthermore, your Air and Water Pollution Control Commission is to be commended for its action in establishing a special classification for high quality recreational waters. Such action will provide a high degree of protection for this valuable resource. We look forward to receiving a list of the streams assigned this classification as soon as necessary administrative procedures are completed. As additional high quality waters are identified through expanded stream monitoring, I hope that these streams will also be assigned special criteria.

Review of the initial Florida water quality standards submission revealed a few issues which had to be resolved by our respective water pollution control agencies before the criteria and implementation plan could be approved as Federal standards. After discussions were held between officials of these agencies, revised standards were adopted by your Air and Water Pollution Control Commission. I am pleased to note that the revised standards have substantially resolved these issues and I wish to commend the Commission for its cooperation and efforts in establishing an effective pollution control program during its first year of operation. There are, however, a few areas remaining in which I believe the standards can be strengthened and these areas are identified in the following paragraphs.

I am approving the narrative temperature criteria established for all interstate and coastal waters. However, we believe that maximum protection of water uses cannot be provided without the use of numerical temperature criteria. Therefore, I request that the present criteria be augmented by the establishment of numerical temperature criteria to provide fuller protection of water uses. I would like to see these criteria established within the next year if possible and by December, 1970, at the latest. In this regard, I recognize that Florida has unique water temperature problems requiring extensive study to determine reasonable temperature criteria. I understand that a joint State-Federal Water Pollution Control Administration study of temperatures in Biscayne Bay and other Florida waters is currently underway and will provide the necessary data for establishment of numerical criteria. Until such criteria are established, we would expect to cooperate with the Commission, in the spirit of the non-degradation policy, in the establishment of temperature requirements for any significant source of heat discharge to interstate and coastal waters so that we may protect the Federal interest in such cases.

The bacteriological criteria I am approving provide protection for assigned water uses. However, a number of Southeastern States including your neighboring States have elected to adopt bacteriological criteria based on fecal coliform concentrations, a basis which we believe is a better index of the suitability of waters for assigned uses than total coliform criteria. Therefore, I suggest that you may want to consider developing local expertise in fecal coliform test procedures with a view toward future conversion of your bacteriological criteria to a fecal coliform basis. In this regard, a cooperative State-Federal Water Pollution Control Administration bacteriological study of various recreational waters in the Southeast is nearing completion and may provide results of value in the establishment of fecal coliform criteria for your State.

I am gratified that Florida has chosen to classify the majority of its waters for recreation and other higher uses. I am approving the classification of the limited number of waters designated for industrial use, such as portions of the St. Marys and Miami Rivers, with the understanding that these waters will be reviewed periodically by the Commission and that they will be reclassified for recreation or other higher uses when necessary water quality improvements are achieved as a result of the implementation of waste treatment plans.

I note that the standards contain a provision allowing exceptions to the water quality criteria to be granted in cases where natural conditions prevent water quality from meeting assigned criteria. Ideally, the assigned criteria should reflect natural conditions or water quality that can be attained when all waste sources provide adequate waste treatment. As additional water quality data is obtained through the operation of monitoring programs, I recommend that water quality criteria be adjusted and refined to eliminate the need to grant exceptions to the criteria.

Successful implementation of the standards is the key to accomplishing our mutual goals of protecting and enhancing the quality and productivity of Florida's interstate waters. Adherence to the degree of treatment specified and the time schedule proposed in the implementation plan is very important if the objectives of the water quality standards program are to be met. In this regard, we understand that a complete and updated implementation plan will be submitted by the Commission in the near future. I would like to see this plan submitted as soon as possible and by July, 1969, at the latest.

The annual State program plan, which the Commission prepares and submits to the Federal Water Pollution Control Administration in connection with our grant program, can provide a basis for updating information on the status of implementing the standards.

Lastly, it is evident that our waste treatment and water pollution control technology will advance and knowledge of water quality requirements for water uses will improve, and the collection of water quality data will make more information available to assure more accurate assignment of water quality criteria. As this new knowledge becomes available, we will further expect to cooperate with the State of Florida in making necessary amendments to the standards that have been theretofore approved. It will be our pleasure to continue to work together to protect, upgrade, and enhance the quality of the water of your State.

Sincerely yours,

Assistant Secretary of the Interior

Honorable Claude R. Kirk, Jr.
Governor of Florida
Tallahassee, Florida 32304

APPENDIX 5

Exhibit D.

STATE OF FLORIDA
DEPARTMENT OF
AIR & WATER POLLUTION CONTROL
SUITE 300, TALLAHASSEE BANK BUILDING
315 SOUTH CALHOUN STREET, TALLAHASSEE, FLORIDA 32301
TELEPHONE (904) 224-8151

VINCENT D. PATTON
EXECUTIVE DIRECTOR

NATHANIEL P. REED
CHAIRMAN

February 12, 1971

St. Lucie County IW
Florida Power & Light Company
Hutchinson Island Nuclear Power Plant

Mr. A. M. Davis, Vice President
Florida Power & Light Company
P.O. Box 3100
Miami, Florida 33101

Dear Mr. Davis:

This will acknowledge receipt of your letter of January 20, 1971 requesting our issuance of a Water Quality Certification for Hutchinson Island Unit No. 1, in conjunction with section 21 (b) (8) of the Federal Water Pollution Control Act as amended.

We herewith certify of there being reasonable assurance that the thermal discharge from Unit No. 1 will not violate Florida Water Quality regulations as set forth in Chapter 17-3 FAC., provided the zone of thermal influence in the Atlantic Ocean is minimized as a result of a suitable outfall length, dimensions, and configuration (with consideration given to diffusors). Such optimum outfall conditions are to be based upon an Ebasco Services Inc. model study, uncompleted at the time of our construction permit issuance.

If we can be of further assistance please let us know.

Very truly yours,

David H. Scott

David H. Scott, Chief
Bureau of Permitting

DHS:wch

cc: Mr. Nathaniel P. Reed
cc: Mr. Vincent D. Patton
cc: Mr. Donald G. Frier
cc: Mr. Frank S. Kleeman
cc: Mr. Harold L. Price

CHARLES M. DAVIS
BOARD MEMBER

JOHN P. ROBERTS
BOARD MEMBER

JAY E. SCHENCK
BOARD MEMBER

A. D. VINCENT
BOARD MEMBER

FLORIDA POWER & LIGHT COMPANY
P. O. BOX 3100, MIAMI, FLA. 33101

Jan. 20, 1971

Florida Department of Air & Water
Pollution Control,
315 S. Calhoun St.,
Tallahassee, Fla. 32301

Gentlemen:

In reference to the construction permit for our Hutchinson Island Unit No. 1, for which an application was pending on the date of the enactment of the Act and for which a construction permit was issued within the interim exemption period (July 1, 1970).

Under Section 21(b)(8) of the Federal Water Pollution Control Act, as amended, we request the issuance of a Water Quality Certification for the construction of this plant.

Sincerely,

A. M. Davis
Vice President

AMD:hhm
encl.

APPENDIX 5

Exhibit E.

DEPARTMENT OF THE ARMY

NOTE.—It is to be understood that this instrument does not give any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of Federal, State, or local laws or regulations, nor does it obviate the necessity of obtaining *State assent* to the work authorized. (See *Cummings v. Chicago*, 188 U.S., 410.)

PERMIT

SAJSP Permits (69-55)

District Engineer, Corps of Engineers.
Jacksonville, Florida
15 May ______________, 1969

Florida Power & Light Company
P. O. Box 3100
Miami, Florida 33101

Gentlemen:

Referring to written request dated 10 February 1969,

I have to inform you that, upon the recommendation of the Chief of Engineers, and under the provisions of Section 10 of the Act of Congress approved March 3, 1899 (30 Stat. 1151; 33 U.S.C. 403), entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," you are hereby authorized by the Secretary of the Army.

to dredge an access channel, dredged material to be deposited on your upland
(Here describe the proposed structure or work.)

at Hutchinson Island,

in Intracoastal Waterway, Jacksonville to Miami, Indian River, and Big Mud Creek,
(Here to be named the river, harbor, or waterway concerned.)

xx in Sections 8 and 17, Twp. 36 S., Rge. 41 E., in St. Lucie County, Florida,
(Here to be named the nearest well-known locality—preferably a town or city—and the distance in miles and tenths from some definite point in the same, stating whether above or below or giving direction by points of compass.)

in accordance with the plans shown on the drawing attached hereto marked:
(Or drawings; give file number or other definite identification marks.)

Hutchinson Island Plant

subject to the following conditions:

Incl 1

(a) That the work shall be subject to the supervision and approval of the District Engineer, Corps of Engineers, in charge of the locality, who may temporarily suspend the work at any time, if in his judgment the interests of navigation so require.

(b) That any material dredged in the prosecution of the work herein authorized shall be removed evenly and no large refuse piles, ridges across the bed of the waterway, or deep holes that may have a tendency to cause injury to navigable channels or to the banks of the waterway shall be left. If any pipe, wire, or cable hereby authorized is laid in a trench, the formation of permanent ridges across the bed of the waterway shall be avoided and the back filling shall be so done as not to increase the cost of future dredging for navigation. Any material to be deposited or dumped under this authorization, either in the waterway or on shore above high-water mark, shall be deposited or dumped at the locality shown on the drawing hereto attached, and, if so prescribed thereon, within or behind a good and substantial bulkhead or bulkheads, such as will prevent escape of the material in the waterway. If the material is to be deposited in the harbor of New York, or in its adjacent or tributary waters, or in Long Island Sound, a permit therefor must be previously obtained from the Supervisor of New York Harbor, New York City.

(c) That there shall be no unreasonable interference with navigation by the work herein authorized.

(d) That if inspections or any other operations by the United States are necessary in the interest of navigation, all expenses connected therewith shall be borne by the permittee.

(e) That no attempt shall be made by the permittee or the owner to forbid the full and free use by the public of all navigable waters at or adjacent to the work or structure.

(f) That if future operations by the United States require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army, it shall cause unreasonable obstruction to the free navigation of said water, the owner will be required upon due notice from the Secretary of the Army, to remove or alter the structural work or obstructions caused thereby without expense to the United States, so as to render navigation reasonably free, easy, and unobstructed; and if, upon the expiration or revocation of this permit, the structure, fill, excavation, or other modification of the watercourse hereby authorized shall not be completed, the owners shall, without expense to the United States, and to such extent and in such time and manner as the Secretary of the Army may require, remove all or any portion of the uncompleted structure or fill and restore to its former condition the navigable capacity of the watercourse. No claim shall be made against the United States on account of any such removal or alteration.

(g) That the United States shall in no case be liable for any damage or injury to the structure or work herein authorized which may be caused by or result from future operations undertaken by the Government for the conservation or improvement of navigation, or for other purposes, and no claim or right to compensation shall accrue from any such damage.

(h) That if the display of lights and signals on any work hereby authorized is not otherwise provided for by law, such lights and signals as may be prescribed by the U.S. Coast Guard, shall be installed and maintained by and at the expense of the owner.

(i) That the permittee shall notify the said district engineer at what time the work will be commenced, and as far in advance of the time of commencement as the said district engineer may specify, and shall also notify him promptly, in writing, of the commencement of work, suspension of work, if for a period of more than one week, resumption of work, and its completion.

(j) That if the structure or work herein authorized is not completed on or before the 31st day of December, 1972, this permit, if not previously revoked or specifically extended, shall cease and be null and void.

(k) That the permittee shall comply promptly with any regulations, conditions, or instructions affecting the work hereby authorized if and when issued by the Federal Water Pollution Control Administration and/or the State water pollution control agency having jurisdiction to abate or prevent water pollution. Such regulations, conditions, or instructions in effect or prescribed by the Federal Water Pollution Control Administration or State agency are hereby made a condition of this permit.

By authority of the Secretary of the Army:

for JOHN F. McELHENNY
Colonel, Corps of Engineers
District Engineer

ENG FORM JUNE 1968 1721

Replaces edition of 1 Sep 49, which is obsolete. (ER 1145-2-303)

U.S. GOVERNMENT PRINTING OFFICE

APPENDIX 5

Exhibit F.

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
FEDERAL BUILDING, P. O. BOX 4970
JACKSONVILLE, FLORIDA 32201

SAJVK Permits (69-55) 12 August 1970

Mr. A. M. Davis, Vice President
Florida Power and Light Company
P. O. Box 3100
Miami, Florida 33101

Dear Mr. Davis:

In response to your letter of 7 August 1970, this office will interpose no objection to your proceeding with the dredging of an additional 800,000 cubic yards from the Big Mud Creek portion of the dredging area shown on our Permit No. 69-55 dated 15 May 1969. This waiver of objections is furnished in view of the approval of the additional dredging by the Trustees of the Internal Improvement Trust Fund and a letter from Mr. Nathaniel Reed of the Department of Air and Water Pollution Control at Tallahassee.

Your attention is invited to the fact that this increase now doubles the amount of estimated material which was shown on your permit. We do not feel that any further increase of this quantity can be allowed without the formality of a public notice and a formal modification of the permit.

Sincerely yours,

A. L. McKNIGHT
Chief, Operations Division

APPENDIX 5

Exhibit G.

For Office use:
Permit No. 253.123-190
Date 1/28/69

TRUSTEES OF THE INTERNAL IMPROVEMENT FUND

STATE OF FLORIDA

WHEREAS, application by: Florida Power & Light Company
Post Office Box 3100
Miami, Florida

for a permit under the provisions of Chapter 253, Florida Statutes, to perform certain works in the navigable waters of the State of Florida, was approved by said Trustees at the meeting of January 28, 1969.

NOW, THEREFORE, this permit authorizes the above named applicant, hereinafter called Permittee, to perform such works subject to the conditions contained herein:

To construct a barge access channel from the Intracoastal Waterway in the Indian River in Sections 8 and 17, T 36 S, R 41 E, to applicant's upland.

1. The proposed work shall be done in the area designated on the map printed on the reverse side hereof;
2. All dredging shall be done in such a manner as to prevent or minimize dispersion of silt and debris and destruction of marine resources in the public waters;
3. If the dredging is being done in other than a meandered body of fresh water, only sand shall be removed. No oyster bars or shell deposits shall be disturbed or undermined by dredging or other operations pursuant to this permit;
4. The use of draglines or dredges with cutter heads is prohibited in fresh water lakes without special approval in writing from the Trustees of the Internal Improvement Fund. The impermeable seal or strata shall not be disturbed;
5. Material removed in construction shall be placed upon the adequately diked spoil disposal area or areas designated on said map.
6. The material removed shall be used only for the improvement of upland property owned by the Permittee and shall not be sold. Under no circumstances shall the Permittee remove more material than authorized by this Permit without specific approval of the Trustees of the Internal Improvement Fund;
7. No fill shall be made on the water side of the original natural ordinary or mean high water mark. This permit conveys no title to land or water, and does not constitute authority for the reclamation of water bottom; unless herein provided;
8. Extreme care shall be exercised to prevent any adverse or undesirable effects from this work on the property of others. This Permit authorizes no invasion of private property or rights in property.
9. This permit is granted subject to the rights of the United States in navigable water, and shall be subject, further, to the rights of the public in boating, bathing, fishing, and other rights for which purposes the waters and submerged land thereunder are held by the State. This Permit does not relieve the Permittee from requirement of permit from the U.S. Army Corps of Engineers nor from necessity of compliance with all applicable local laws, ordinances, and zoning or other regulations;
10. Permittee, in accepting this Permit, covenants and agrees to comply with and abide by the provisions and conditions herein and assumes all responsibility and liability and agrees to save the Trustees of the Internal Improvement Fund harmless from all claims of damage arising out of operations conducted pursuant to this Permit;
11. This Permit is granted subject, further, to the following special terms and conditions:

If the work authorized is not completed on or before the 28th day of January, 1972, this authorization, if not previously revoked or specifically extended, shall cease and be null and void.

12. A copy of this permit shall be posted in a conspicuous place on the equipment being used in the dredging operation or shall be readily available for inspection at the project site by all duly constituted law enforcement officers having jurisdiction; This Permit shall become effective upon acceptance by the Permittee and receipt of the executed copy by the Trustees of the Internal Improvement Fund, Elliot Building, Tallahassee, Florida 32304.

Accepted this 7th day of February, A.D., 19 69

TRUSTEES OF THE INTERNAL IMPROVEMENT FUND

By Randolph Hodges
Director

Florida Power & Light Company
PERMITTEE

By A M Davis Vice President
NAME & TITLE

(1-69)

DRAWN BY	KCJ
CHECKED	
CORRECT	W.H. Rivers Jr.

APPROVED:

H. W. Hunter

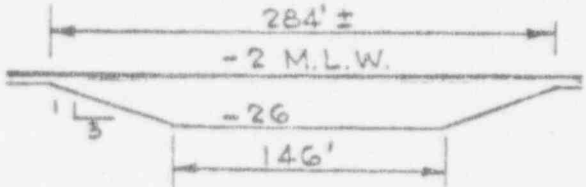
CHIEF ENGINEER

PLAN

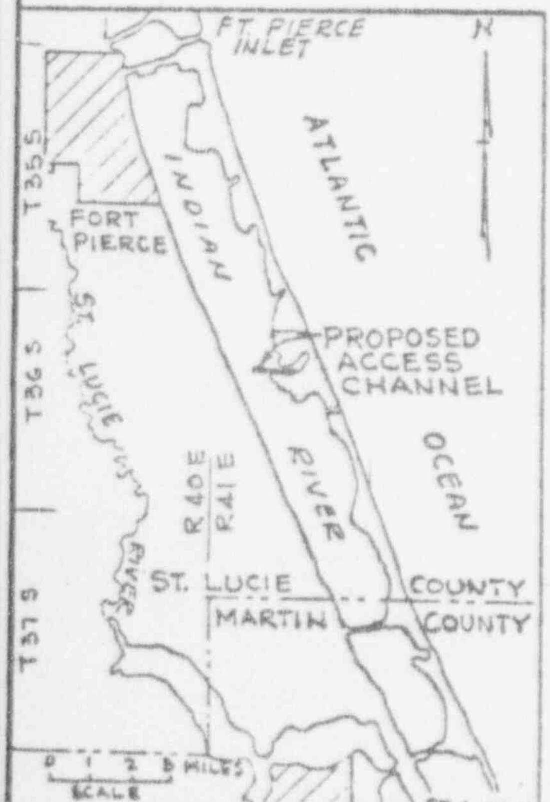
FROM NAUTICAL CHART 845-SC
INTRACOASTAL WATERWAY

0 1/2 1
SCALE - STATUTE MILE

NOTES:
1. SPOIL TO BE DEPOSITED ON APPLICANT'S PROPERTY APPROX. 1,500,000 CU.YD.
2. ATLANTIC OCEAN M.L.W. 0.00 = MINUS 1.85 U.S.C.&G.S. DATUM M.S.L.



CROSS SECTION
FULL LENGTH OF CHANNEL
SCALE 1" = 100'



LOCATION SKETCH

HUTCHINSON ISLAND PLANT
PROPOSED ACCESS CHANNEL IN
INDIAN RIVER SOUTH OF FT. PIERCE
ST. LUCIE COUNTY, FLORIDA
APPLICATION BY
FLORIDA POWER & LIGHT COMPANY
DATE - SEPT. 26, 1968 SCALE - SHOWN
A-48828

APPENDIX 5

Exhibit H.

For Office Use: DREDGE ONLY

Permit No. 253.123-585

Date June 18, 1970

STATE OF FLORIDA

BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

WHEREAS, application by: Florida Power and Light Company
c/o A. M. Davis, Vice President
Post Office Box 3100
Miami, Florida

for a permit under the provisions of Chapter 253, Florida Statutes, to perform certain works in the navigable waters of the State of Florida, was approved by said State of Florida Board of Trustees of the Internal Improvement Trust Fund at the meeting of June 16, 1970,

NOW, THEREFORE, this Permit authorizes the above named applicant, hereinafter called Permittee, to perform such works subject to the conditions contained herein: to dredge Big Mud Creek in Sections 8 and 17, Township 36 South, Range 41 East, to a depth of minus -40 feet, St. Lucie County, Florida. Seven Hundred Thousand (700,000) cubic yards of material is to be removed.

1. The proposed work shall be done in the area designated on the map printed on the reverse side hereof;
2. All dredging shall be done in such a manner as to prevent or minimize dispersion of silt and debris and destruction of marine resources in the public waters;
3. If the dredging is being done in other than a meandered body of fresh water, only sand shall be removed. No oyster bars or shell deposits shall be disturbed or undermined by dredging or other operations pursuant to this Permit;
4. The use of draglines or dredges with cutter heads is prohibited in fresh water lakes without special approval in writing from the State of Florida Board of Trustees of the Internal Improvement Trust Fund. The impermeable seal or strata shall not be disturbed;
5. Material removed in construction shall be placed upon the adequately diked spoil disposal area or areas designated on said map;
6. The material removed shall be used only for the improvement of upland property owned by the Permittee and shall not be sold. Under no circumstances shall the Permittee remove more material than authorized by this Permit without specific approval of the State of Florida Board of Trustees of the Internal Improvement Trust Fund;
7. No fill shall be made on the water side of the original natural ordinary or mean high water mark. This Permit conveys no title to land or water, and does not constitute authority for the reclamation of water bottom unless herein provided;
8. Extreme care shall be exercised to prevent any adverse or undesirable effects from this work on the property of others. This Permit authorizes no invasion of private property or rights in property;
9. This Permit is granted subject to the rights of the United States in navigable water, and shall be subject, further, to the rights of the public in boating, bathing, fishing, and other rights for which purposes the waters and submerged land thereunder are held by the State. This Permit does not relieve the Permittee from requirement of permit from the U.S. Army Corps of Engineers nor from necessity of compliance with all applicable local laws, ordinances, and zoning or other regulations;
10. Permittee, in accepting this Permit, covenants and agrees to comply with and abide by the provisions and conditions herein and assumes all responsibility and liability and agrees to save the State of Florida Board of Trustees of the Internal Improvement Trust Fund harmless from all claims of damage arising out of operations conducted pursuant to this Permit;
11. This Permit is granted subject, further, to the following special terms and conditions:

    If the work authorized is not completed on or before the 18th day of June, 1973, this authorization, if not previously revoked or specifically extended, shall cease and be null and void.

    Spoil area will be diked to prevent silt from returning to the waters and dredging will be done so that the turbidity of the water will not exceed 50 Jackson units.

12. A copy of this Permit shall be posted in a conspicuous place on the equipment being used in the dredging operation or shall be readily available for inspection at the project site by all duly constituted law enforcement officers having jurisdiction. This Permit shall become effective upon acceptance by the Permittee and receipt of the executed copy by the State of Florida Board of Trustees of the Internal Improvement Trust Fund, Elliot Building, Tallahassee, Florida 32304.

Accepted this 18th

day of June,

A.D., 19 70

Florida Power & Light Company

PERMITTEE

By A M Davis

NAME & TITLE

A. M. Davis, Vice President

STATE OF FLORIDA BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

By James W Apthorp

Executive Director

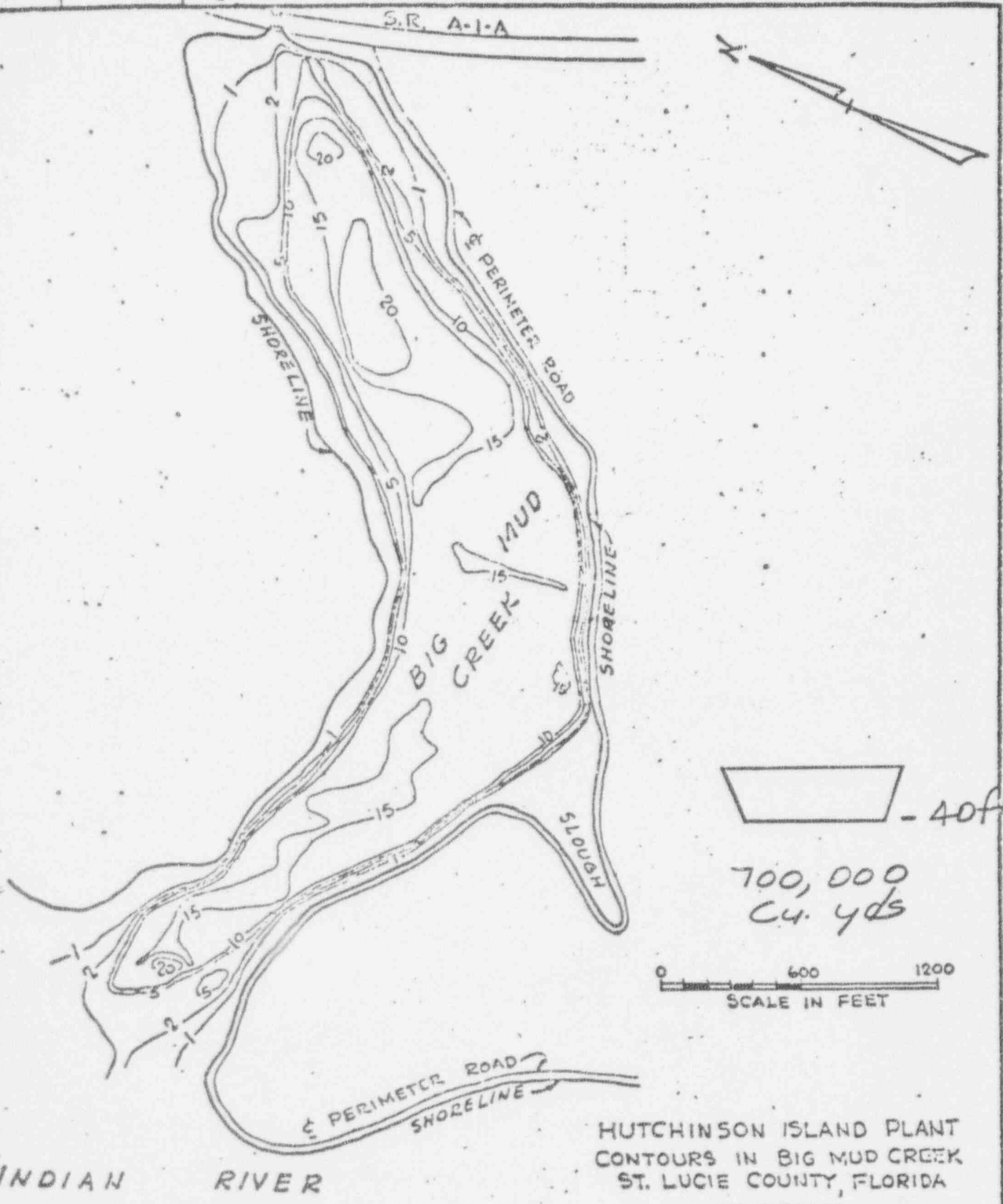
At the Trustees' option applicant may be required to furnish a cross-section profile map with certification executed by a Florida Registered Professional Engineer or Land Surveyor, stating quantity of fill material excavated pursuant to this permit, such certification to be furnished within 90 days after completion of project or expiration of permit, whichever is earlier.

BH7 (7-69)

DRAWN BY	
CHECKED	
CORRECT	

APPROVED:

CHIEF ENGINEER



NOTE:
CONTOURS OF BOTTOM AFTER DREDGING AS OF JUNE 1, 1970

HUTCHINSON ISLAND PLANT
CONTOURS IN BIG MUD CREEK
ST. LUCIE COUNTY, FLORIDA

APPLICATION BY
FLORIDA POWER & LIGHT COMPANY
DATE JUNE 8, 1970 SCALE SHOWN
SHEET 2 OF 2 A-54475

APPENDIX 5

Exhibit I.

For Office Use. DREDGE ONLY

Permit No. 253.123-623A

Date March 4, 1971

STATE OF FLORIDA

BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

WHEREAS, application by: Florida Power and Light Company
c/o Mr. A. M. Davis, Vice President
Post Office Box 3100
Miami, Florida 33101

for a permit under the provisions of Chapter 253, Florida Statutes, to perform certain works in the navigable waters of the State of Florida, was approved by said State of Florida Board of Trustees of the Internal Improvement Trust Fund at the meeting of

NOW, THEREFORE, this Permit authorizes the above named applicant, hereinafter called Permittee, to perform such works subject to the conditions contained herein: to dredge Big Mud Creek in Sections 8, 9, 16, and 17, Township 36 South, Range 41 East, to a depth of minus -55.0 feet, St. Lucie County, Florida. An additional 1,600,000 cubic yards of material is to be removed. Also, to dredge a 200 foot wide channel into the uplands in private ownership in Section 16 and 17, Township 36 South, Range 41 East.

At the Trustees' option applicant may be required to furnish a cross-section profile map with certificate executed by a Florida Registered Professional Engineer or Land Surveyor, stating quantity of fill material excavated pursuant to this permit, such certification to be furnished within 90 days after completion of project or expiration of permit, whichever is earlier.

1. The proposed work shall be done in the area designated on the map printed on the reverse side hereof;

2. All dredging shall be done in such a manner as to prevent or minimize dispersion of silt and debris and destruction of marine resources in the public waters;

3. If the dredging is being done in other than a meandered body of fresh water, only sand shall be removed. No oyster bars or shell deposits shall be disturbed or undermined by dredging or other operations pursuant to this Permit;

4. The use of draglines or dredges with cutter heads is prohibited in fresh water lakes without special approval in writing from the State of Florida Board of Trustees of the Internal Improvement Trust Fund. The impermeable seal or strata shall not be disturbed;

5. Material removed in construction shall be placed upon the adequately diked spoil disposal area or areas designated on said map;

6. The material removed shall be used only for the improvement of upland property owned by the Permittee and shall not be sold. Under no circumstances shall the Permittee remove more material than authorized by this Permit without specific approval of the State of Florida Board of Trustees of the Internal Improvement Trust Fund;

7. No fill shall be made on the water side of the original natural ordinary or mean high water mark. This Permit conveys no title to land or water, and does not constitute authority for the reclamation of water bottom unless herein provided;

8. Extreme care shall be exercised to prevent any adverse or undesirable effects from this work on the property of others. This Permit authorizes no invasion of private property or rights in property;

9. This Permit is granted subject to the rights of the United States in navigable water, and shall be subject, further, to the rights of the public in boating, bathing, fishing, and other rights for which purposes the waters and submerged land thereunder are held by the State. This Permit does not relieve the Permittee from requirement of permit from the U.S. Army Corps of Engineers nor from necessity of compliance with all applicable local laws, ordinances, and zoning or other regulations;

10. Permittee, in accepting this Permit, covenants and agrees to comply with and abide by the provisions and conditions herein and assumes all responsibility and liability and agrees to save the State of Florida Board of Trustees of the Internal Improvement Trust Fund harmless from all claims of damage arising out of operations conducted pursuant to this Permit;

11. This Permit is granted subject, further, to the following special terms and conditions:

If the work authorized is not completed on or before the 3rd day of March 1974, this authorization, if not previously revoked or specifically extended, shall cease and be null and void.

Dredging must be done in such a way that turbidities in the area do not exceed 50 Jackson Units above base.

This permit is not valid unless seal of Board of Trustees of the Internal Improvement Trust Fund appears on the Attachment hereto.

12. A copy of this Permit shall be posted in a conspicuous place on the equipment being used in the dredging operation or shall be readily available for inspection at the project site by all duly constituted law enforcement officers having jurisdiction. This Permit shall become effective upon acceptance by the Permittee and receipt of the executed copy by the State of Florida Board of Trustees of the Internal Improvement Trust Fund, Elliot Building, Tallahassee, Florida 32304.

Accepted this 15th day of March, A.D., 1971

FLORIDA POWER & LIGHT CO.

A M Davis

PERMITTEE

By A. M. DAVIS VICE PRESIDENT

NAME & TITLE

STATE OF FLORIDA BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

By Fred Vidzes

Executive Director

NOTE: The Permittee is required to obtain a valid certificate issued pursuant to Section 21(b)(1), Water Quality Improvement Act of 1970, (Public Law 91-224), by the State of Florida Department of Air and Water Pollution Control before engaging in activities authorized by this permit.

BH7 (7-69)

APPENDIX 6

DOCUMENTS REGARDING HISTORICAL SITES

DOCKET NO. 5 - 335

ADVISORY COUNCIL ON HISTORIC PRESERVATION

U.S. DEPARTMENT OF THE INTERIOR • NATIONAL PARK SERVICE • WASHINGTON, D.C. 20240

March 12, 1969

Mr. Peter A. Morris
Director, Division of Reactor Licensing
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Morris:

I am responding to your letter of February 6, 1969, regarding an application filed by The Florida Power and Light Company for a construction permit and facility license to authorize construction and operation of a pressurized water nuclear reactor on the applicant's 1132-acre site.

Since no properties are affected which are listed on the National Register, The Advisory Council on Historic Preservation has no comments to make.

Sincerely yours,

Robert R. Garvey, Jr.
Executive Secretary

DOCKETED USAEC
MAR 1 1969
REGULATORY MAIL SECTION DOCKET CLERK

THE COUNCIL is charged by the Act of October 15, 1966, with advising the President and Congress in the field of Historic Preservation, recommending measures to coordinate governmental with private activities, advising on the dissemination of information, encouraging public interest and participation, recommending the conduct of special studies, advising in the preparation of legislation, and encouraging specialized training and education. The Council also has the responsibility to comment on Federal or Federally-assisted undertakings that have an effect on cultural property listed in the National Register.

STATE OF FLORIDA

BOARD OF ARCHIVES AND HISTORY

ROBERT WILLIAMS
EXECUTIVE DIRECTOR
401 E. GAINES STREET
TALLAHASSEE 32301
TELEPHONE: 224-4159

June 17, 1969

THE BOARD
CLAUDE R. KIRK, JR., GOVERNOR
TOM ADAMS, SECRETARY OF STATE
EARL FAIRCLOTH, ATTORNEY GENERAL
FRED O. DICKINSON, JR., COMPTROLLER
BROWARD WILLIAMS, TREASURER
FLOYD T. CHRISTIAN, SUPERINTENDENT OF PUBLIC INSTRUCTION
DOYLE CONNER, COMMISSIONER OF AGRICULTURE

Mr. Norris Kincaid
Florida Power and Light Company
General Office Building
Miami, Florida 33101

Dear Mr. Kincaid:

The enclosed archaeological survey report from A. R. Saltus covers only those areas of planned construction. Please note the field map indicating the presence of significant archaeological remains bordering Blind Creek. Should the Florida Power and Light Company plan development in this area, the Florida Board of Archives and History would require adequate time for archaeological field research. The Hammock areas situated between Big Mud Creek and Blind Creek are to date unsurveyed. We plan to complete our surface reconnaissance within the next few weeks.

The Florida Power and Light Company's cooperation in these sites of historic significance is truly appreciated. It is only through such interest and cooperation that Florida's rapidly disappearing historic heritage can be properly researched and interpreted.

Very sincerely,

L. Ross Morrell

L. Ross Morrell
State Archaeologist

LRM/sr

Enclosure

STATE OF FLORIDA

BOARD OF ARCHIVES AND HISTORY

ROBERT WILLIAMS
EXECUTIVE DIRECTOR
401 E. GAINES STREET
TALLAHASSEE 32301
TELEPHONE: 224-4159

May 28, 1969

THE BOARD
CLAUDE R. KIRK, JR., GOVERNOR
TOM ADAMS, SECRETARY OF STATE
EARL FAIRCLOTH, ATTORNEY GENERAL
FRED O. DICKINSON, JR., COMPTROLLER
BROWARD WILLIAMS, TREASURER
FLOYD T. CHRISTIAN, SUPERINTENDENT OF PUBLIC INSTRUCTION
DOYLE CONNER, COMMISSIONER OF AGRICULTURE

Ross Morrell
State Archeologist
Board of Archives and History
401 E. Gaines Street
Tallahassee, Florida 32301

Dear Ross:

The area in which Florida Light and Power is to construct their power plants has been site surveyed. This area lies on the peninsula between Herman's Bay on the South and Big Mud Creek to the North. All of this area will not be under construction. The area from Mud Creet to 2,300' South and A1A to 2,400 feet West, incompasses the construction area. No habitation is evident with much of the area under one to two feet of water, lying on top of 3 to 5 feet of black muck. One small hammock tounges into the area rising two to three feet above the water level. Very few oaks are in the area with vegetation mostly of palm and low shrubs and vines.

The remainder of Florida Light and Power's land as yet has not been completely surveyed. North of Blind Creek there is a large midden and sterile mounds West of A1A. On the East end of this same hammock, which is divided by A1A, there is a long high (4 to 8 foot elevation) mound with a high burial mound at one end. The burial mound was destroyed during the Naval occupation of this area in WW II. The long mound however, still exists with smaller mounds slightly to the West, yet still East of A1A. Aerials of the burial mound, as it was before WW II, are available.

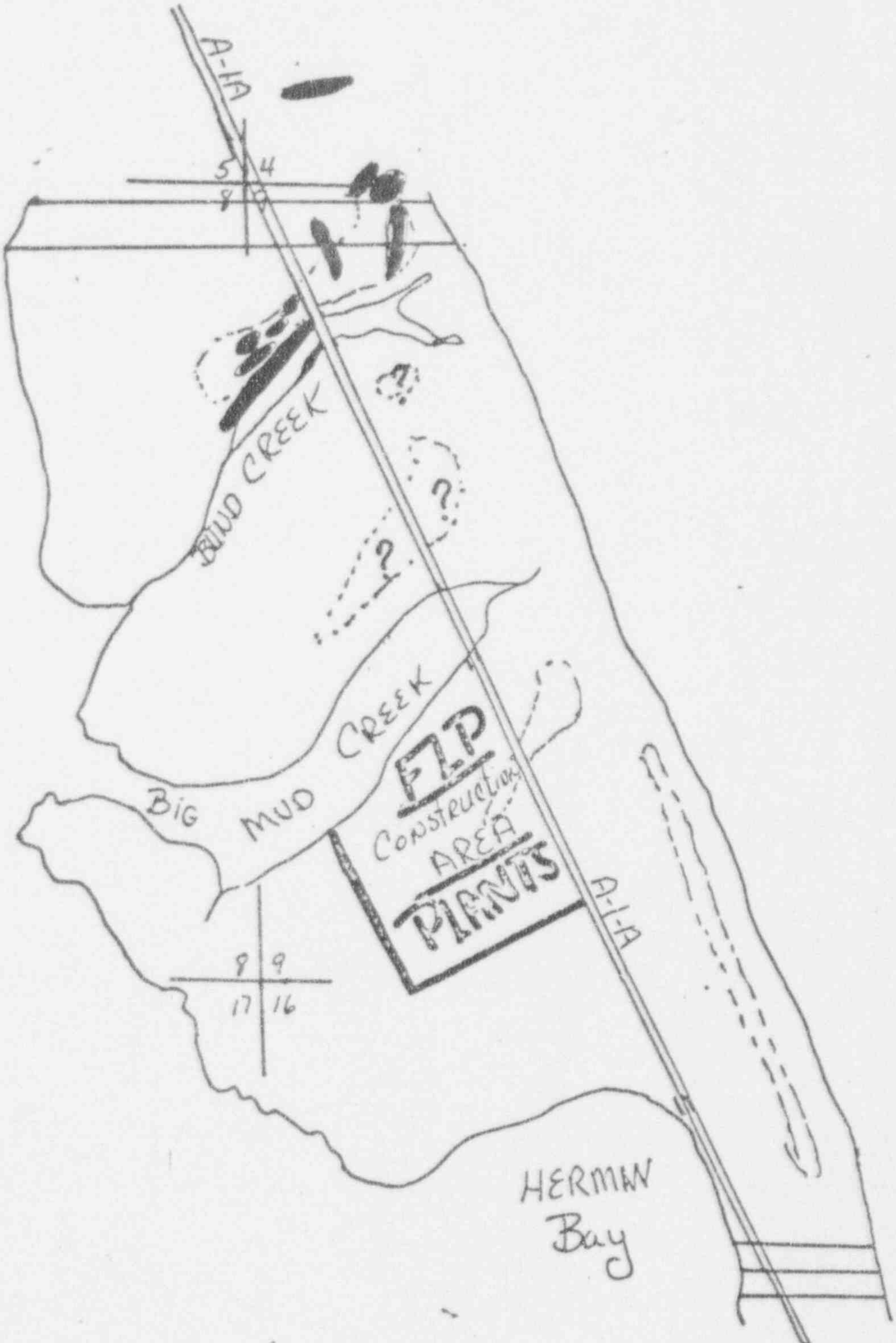
The area between Blind Creek and Big Mud Creekhas yet to be done completely. When this is completed a detailed report will follow. It seems appropriate to inform you that no historical damage will be done by this project as planned to date.

Respectfully,

Allen R. Saltus

Allon R. Saltus Jr.

Hutchinson Island



···- hammock

midden.

mounds

FLORIDA POWER & LIGHT COMPANY
HUTCHINSON ISLAND PLANT
UNIT NO. 2

ENVIRONMENTAL REPORT

MAY 20, 1971

DOCKET NO. 50-389

TABLE OF CONTENTS

1.0 INTRODUCTION

The second nuclear unit for the Hutchinson Island site was announced on May 3, 1971. The new unit will also be a 850 Mwe unit identical in every respect to the first unit. The companies involved will be the same, with Combustion Engineering furnishing the nuclear steam supply system and Ebasco Services, Inc. serving as the Engineer-Constructor. The plant is scheduled for commercial operation in 1976.

The site preparation work for Unit No. 2 which would effect the environment is now more than half completed as part of the construction of Unit No. 1. The environmental impact of Unit No. 2 during the construction phase will, therefore, be quite limited and, in total, considerably less than if a new site had been chosen during the operating phase. The only new effect will be the use of additional condenser cooling water during the operation of both units. The release of radioactivity from the new unit will increase the total but the releases from the individual units will be held to so low a level that the total from both will be negligible.

Because the units are identical, and because the new unit will be sited immediately adjacent to Unit No. 1, most of the environmental information provided for Unit No. 1 applies directly to the second unit. Background information concerning the environmental baseline, geology, meteorology and environmental effects given in the Unit No. 1 Environmental Report holds without modification for the second unit. This submittal follows the "Draft Guide for the Preparation of Environmental Reports for Nuclear Power Plants (February 1971)," and fulfills the requirements of 35 FR 18469 "Implementation of the National Environmental Policy Act of 1969" and of Appendix D, 10 CFR 50.

2.1 GENERAL

2.1.1 LOCATION OF THE FACILITY

The second nuclear unit at Hutchinson Island will occupy only a very few acres of the 1132 acres of the total site area. It will be located immediately adjacent to and south of Unit No. 1. All the information given in the corresponding section of the Unit No. 1 Environmental Report will apply to the second unit.

2.1.2 PHYSICAL CHARACTERISTICS OF THE FACILITY

The Unit No. 2 reactor and plant will be identical with that described in Section 2.1.2 of the Unit 1 Environmental Report as will be seen from a plot plan of the two units, Fig. 2.1.2-1A. The construction and operation of the second unit will have very limited additional effects on the environment. No additional dredging will be required for foundation fill or for the preparation of channels for barge delivery of the heavy components. Little or no additional dewatering for the Unit No. 2 foundations will be required. This dewatering is the only construction operation having any potential affect on the Indian River.

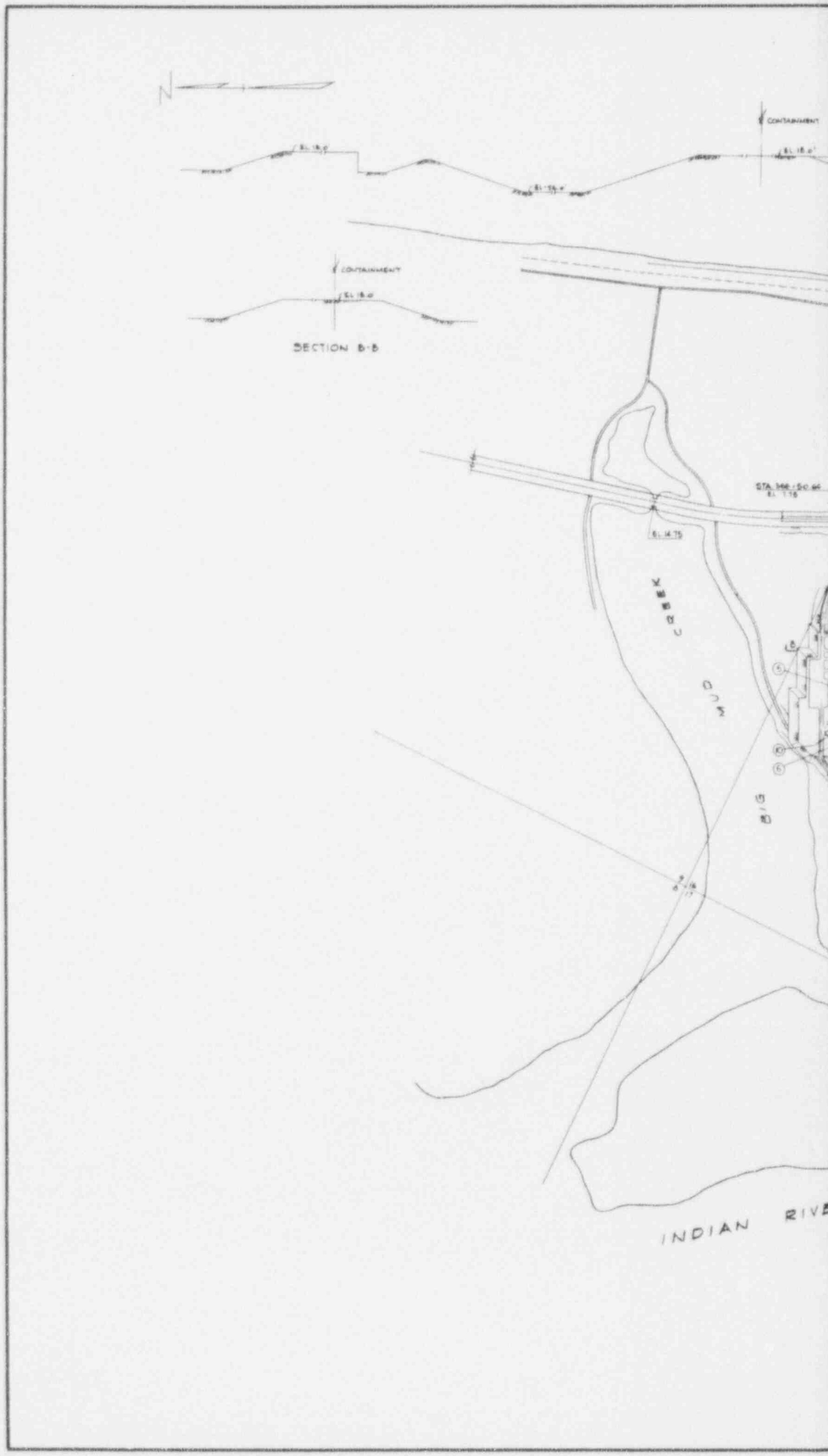
The cooling water intake and discharge structures are identical to those for Unit No. 1 and the total system will now be of twice the capacity required for the first unit. Additional construction effort on the Atlantic side will be required for the installation of the circulating water system. The amount of heated cooling water discharged will be doubled during normal operation of both units. The total release of radioactive effluents, both gaseous and liquid, will also be increased up to a factor of 2.

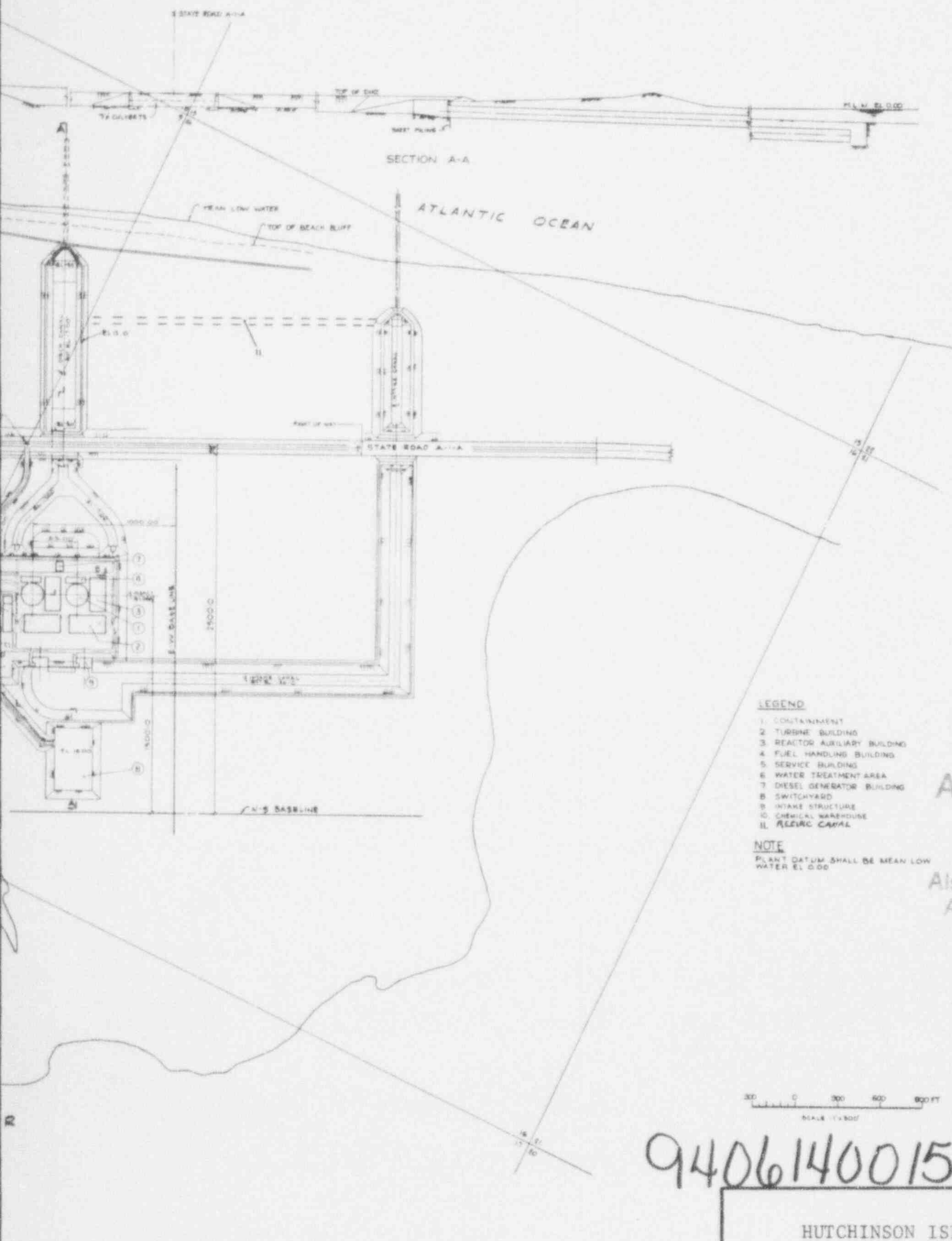
The traffic related to construction will be continued over a longer period of time.

The operation of Unit No. 2 will not have any affect on recreational facilities in the area nor on wildlife preserves. Aside from the power produced the second unit will have no discernable effect on land use as regards the future development of agriculture, industry, and tourism.

2.1.3 ENVIRONMENT IN THE AREA

The information provided for the Unit No. 1 Environmental Report on Climatology and Meteorology (Section 2.1.3.1), Geology and Topography (Section 2.1.3.2), Hydrology (Section 2.1.3.3), Population and Land Use (Section 2.1.3.4), and the Environmental Baseline (Section 2.1.3.5) is the same for Unit No. 2.


CONTAINMENT
CONTAINMENT
SECTION B-B
EL 14.75
CREEK
MUD
BIG
INDIAN RIVE



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HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
SITE PLOT PLAN FOR UNITS
NO. 1 & NO. 2
FIG. 2.1.2-1A

2.1.4 ELECTRICAL POWER SUPPLY AND DEMAND

The tremendous growth of population in the Company's service area and the resulting heavy demand on the generating capacity of the Florida Power & Light system were discussed in detail in Section 2.1.4 of the Unit No. 1 Environmental Report for the period up to 1975. All present indications are that the growth pattern will continue through the decade. The projected peak loads for the period 1975-1977 are given in Table 2.1.4-1A which includes the tentatively planned generating capacity additions and the estimated percentage reserves. As noted in the Environmental Report for Hutchinson Island Unit No. 1, after completion of that unit in 1974 the percentage reserve capacity in 1975 is still low. The scheduled addition of Hutchinson Island Unit No. 2 in 1976 moderately increases this reserve capacity. If Hutchinson Island Unit No. 2 does not go on the line in 1976 the reserve would fall by about one-half.

TABLE 2.1.4-1A

FLORIDA POWER & LIGHT COMPANY

PROJECTED SUMMER PEAK LOAD AND TENTATIVELY PLANNED GENERATION EXPANSION

1975-1977

Year	Projected 15-Minute Peak Load - MW	Capability Addition-MW	Total Capability-MW	Percent Reserve
1975	9600	800	10719	11.7
1976	10740	1650	12369	15.2
1977	11920	1600	13969	17.2

2.2 ENVIRONMENTAL APPROVALS AND CONSULTATION

The proposed construction of Unit No. 2 will have the following effects on permits, licenses, and approvals:

Zoning

The present zoning permit, dated July 9, 1968, from the St. Lucie County Commission (included as Exhibit A in Appendix 5 of the Unit No. 1 Environmental Report) provides for the rezoning of the site as a Public Service District. Such a zoning designation will cover the second unit and no new applications or changes are anticipated at this time.

Planning

Discussions will be held with the appropriate planning organizations in the near future regarding Unit No. 2. These organizations will include both the State and County planning offices.

Water Quality

Application for a certification from the Florida Department of Air and Water Pollution Control covering the second unit will be made in the near future.

Dredging

The access channel into Big Mud Creek, which will be used for the delivery of heavy components for Unit No. 1, will also be used for similar purposes in Unit No. 2. No new dredging permits will be required from the Corps of Engineers or from the Trustees of the Internal Improvement Fund of the State of Florida for channels or fill.

2.3 ENVIRONMENTAL IMPACT OF THE PROPOSED FACILITY

2.3.1 LAND USE COMPATIBILITY

Most aspects of land use will remain the same whether there are one or two units at the Hutchinson Island site. The nearly two miles of beach will be left in its natural state for the enjoyment of the public, and plans concerning wildlife preserves will remain unchanged. By comparison with the corresponding section of the Unit No. 1 Environmental Report, the effects of the second unit on land use are as follows:

a. Industrial Operations

There will be no additional effects on local industrial operations.

b. Transportation

The construction of the second unit will merely extend the construction period at the site. For an additional two years there will be increased truck traffic on State Road A1A and connecting arteries to the Florida Turnpike. There will be additional shipments of heavy components through the inland waterway and the Big Mud Creek channel. This construction transport will end upon completion of Unit No. 2. The number of employees required at the plant for routine operation will increase, but there will still be less than 100 total operating staff for both units. Passenger-car traffic necessary to get these employees to and from the site will still have a very limited effect, if any, on the local highways. Truck transport for the refueling period will possibly be required for an additional four months out of each year, as both units may not be refueled simultaneously. Here again, the number of trucks involved and the number of trips will be quite limited.

c. Recreational Uses

There will be no changes in plans for recreational use of the property outside the plant area.

d. Wildlife Preserves

Plans for such preserves remain unchanged.

e. Population Distribution

The less than 100 families involved for the permanent staff of both plants is expected to have little noticeable effect on the population growth of St. Lucie County.

f. Waterways

No additional channels will be required. The use of waterways will be temporary, as discussed above. There is, however, a possibility now under consideration that the refueling casks and other components will be transported by barge through the inland waterway.

g. Military Installation and Concentrations of Hazardous Materials

The situation remains as described in the corresponding section of the Unit No. 1 Environmental Report.

2.3.1.1 Impact of the Facility

The situation as described in the Unit No. 1 Environmental Report remains unchanged, as does Section 2.3.1.2, Preservation of the Environment, and Section 2.3.1.3, Historic Sites.

2.3.2 WATER USE COMPATIBILITY

The proposed operation of the second unit at Hutchinson Island will increase the fresh water requirements approximately one-and-one half times, and will be purchased from the City of Fort Pierce Municipal System. The fresh water sources available to the City are so large that this additional requirement provides no difficulties.

The data on seawater temperatures and currents provided in the Unit No. 1 Environmental Report (Section 2.3.2.1), remain unchanged.

2.3.2.2 Impact of Water Use

The maximum increase in the quantity of condenser cooling water discharged to the ocean as a result of the operation of Unit No. 2 will be no more than twice the quantity discharged by Unit No. 1 during normal operation. There are periods of time during unit refueling and condenser maintenance when the quantity of water discharged is significantly less than twice the "design" flow of a single unit. The biological and ecological effect of such an increased discharge is discussed in Section 2.3.6 of this report. The intake and discharge canals and pipe lines will now be sized for both units, but the use of the beach by the public will not be changed.

2.3.2.3 Temperature Effects

The data given in this section of the Unit No. 1 report provided relative ideas as to the magnitude of the Atlantic Ocean as a heat sink as compared with the relatively minute amount of heat discharged into it.

Even though the thermal release to the circulating water system with both units in operation at maximum load will be doubled, the total number of Btu's discharged to the ocean per hour still remains equivalent to the energy received in one hour of sunlight on four square miles of the ocean's surface. Since there are more than 33,000,000 square miles of Atlantic Ocean surface, it will be seen that the contribution of heat from the nuclear units is again an extremely minute fraction and the total amount of water pumped through both plants in one year still remains of the order of only one one-hundredth-millionth of the volume of the heat sink into which it is discharged.

2.3.3 HEAT DISSIPATION

The Cooling Water System for Unit No. 2 will be essentially the same as that provided for Unit No. 1. The description of the System for the first unit, as presented in Section 2.3.3.1 of the Environmental Report for Unit No. 1, also applies to Unit No. 2. The only difference is that the additional two port Y-type high velocity jet discharge will be located further away from shore than the discharge for Unit No. 1. This is to ensure that the discharge from the second unit will not be influenced by the Unit No. 1 discharge jets. The additional intake pipes will be located at essentially the same area as those provided for the first unit. Except for the sharing of common intake and discharge canals and culverts, the two systems will be separate.

Because the discharge orifices for the two units are physically separated, the water discharged (2280 cfs) will have no effect on the maximum surface temperature rise above ambient. The areas enclosed by the 3°F and 1.5°F will be approximately 50 acres and 800 acres, respectively, during operation of both units. These isotherms are shown in Figure 2.3.3-1A.

As indicated in Section 2.3.3.6 of the Environmental Report for Unit No. 1, a 21(b) water quality certification has been obtained for that unit. An application for a similar certification for Unit No. 2 will be applied for in the near future.

2.3.4 CHEMICAL DISCHARGE

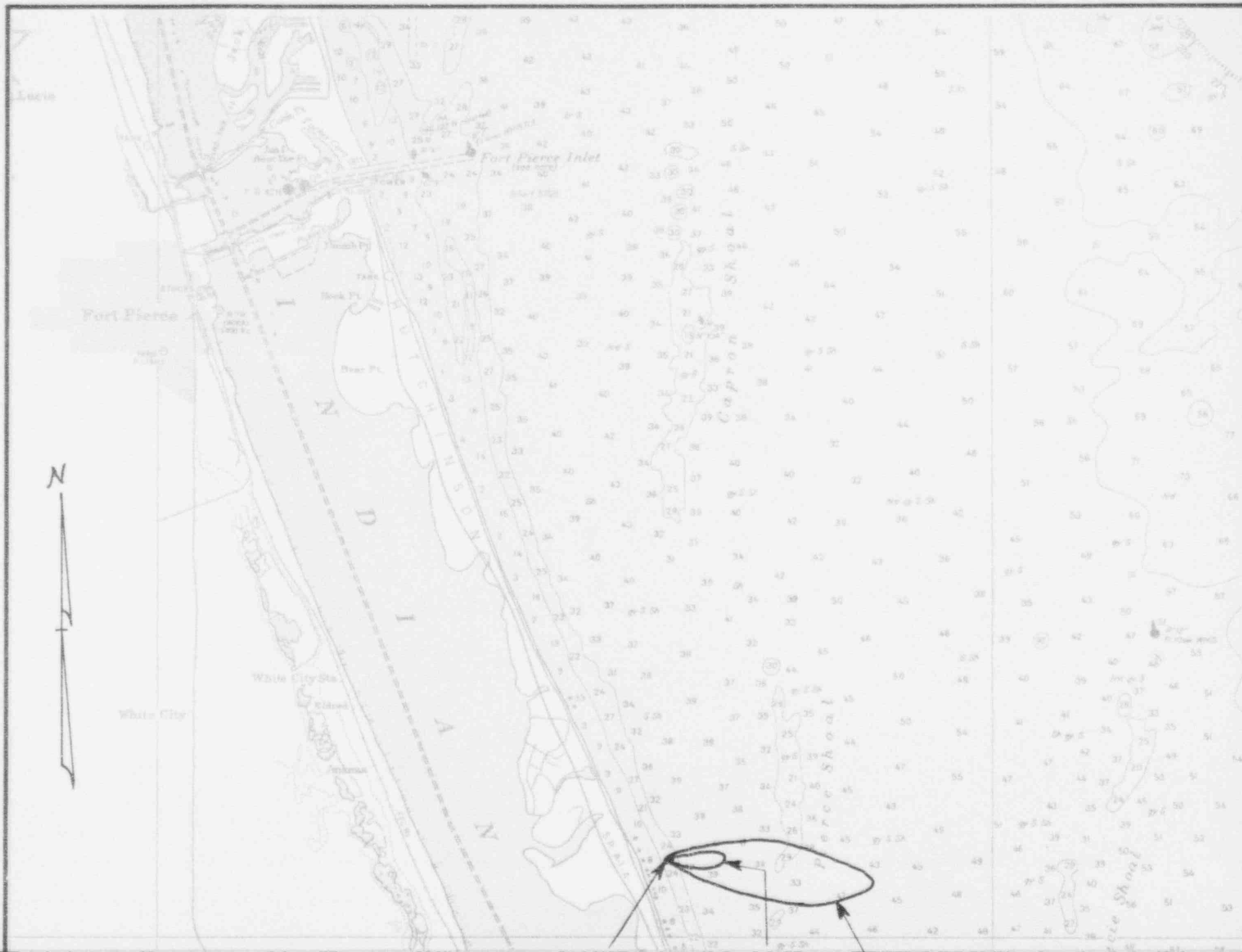
The chemical discharge will be handled similarly to that of Unit No. 1. The quantities of chemicals used and the method of treatment will be the same.

2.3.5 SANITARY WASTES

As in the case with Unit No. 1, portable chemical toilets will be used during the construction phase. When the plant achieves operating conditions, the sanitary wastes will be treated through septic tanks and their associated leaching fields which will be located above the local water table.

2.3.6 BIOLOGICAL IMPACT

The only important additional impact on the environment will be due to the additional cooling water release and the additional radioactivity release from the second plant. Since the radioactivity releases from both plants will be maintained as low as practicable and actually approaching zero, the total, as discussed elsewhere, will have little effect. The doubling of the thermal release is then the most important aspect of the second


Lucie
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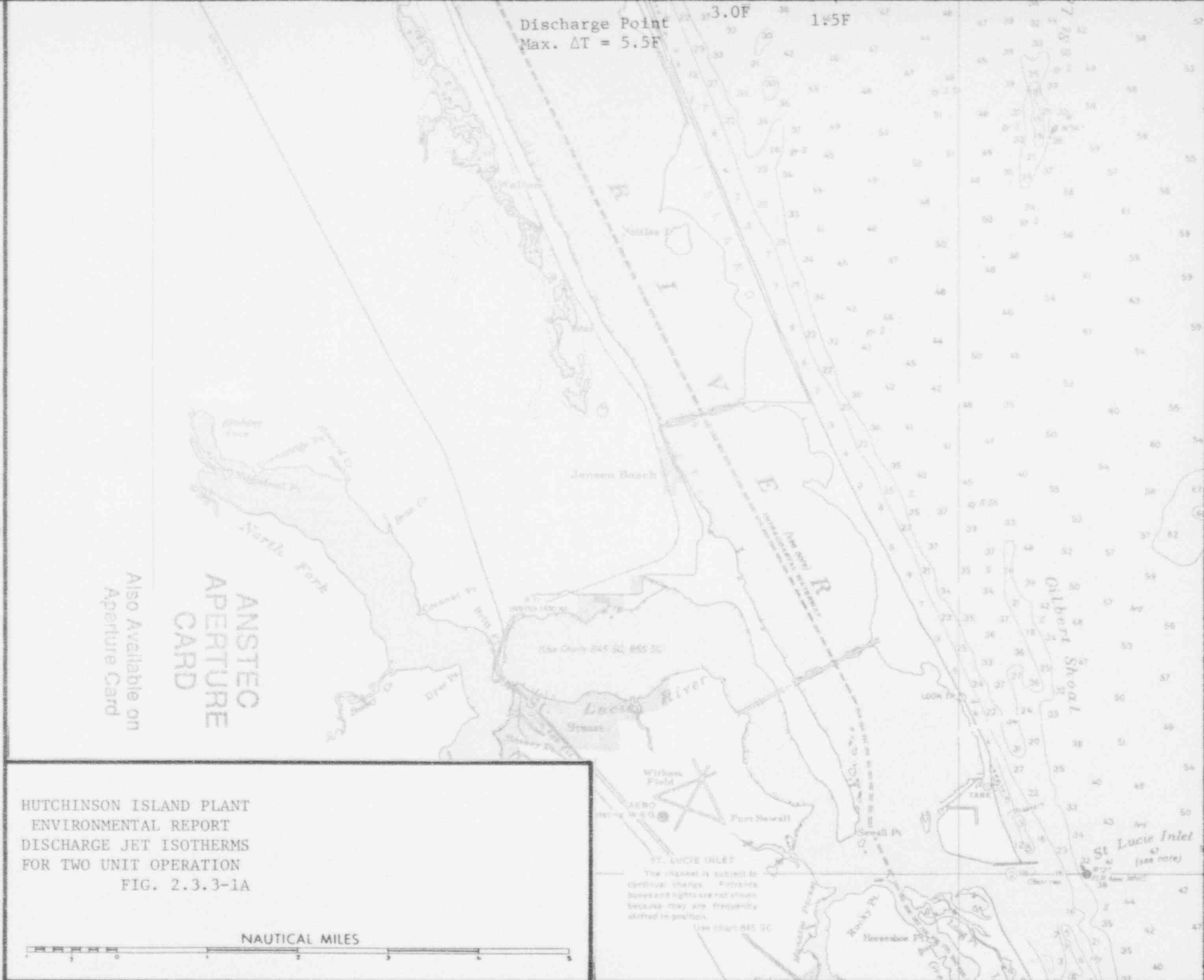

HUTCHINSON ISLAND PLANT
ENVIRONMENTAL REPORT
DISCHARGE JET ISOTHERMS
FOR TWO UNIT OPERATION
FIG. 2.3.3-1A

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plant as concerns biological impact. The information given in the corresponding section of the Unit No. 1 report is valid for the second unit, particularly as regards Section 2.3.6.1 Environmental Evaluation. In Section 2.3.6.3 Studies to Resolve Environmental Impact Questions, the most important study is that concerned with the effect of the cooling water system. The study described for Unit No. 1 is of sufficient scope to clarify the effects of passage of plankton through the condenser. Work on this study will be emphasized, as the results will have equal bearing on the second unit. The other studies concerning offshore ecology, sea turtle nesting, fish diversion, the radiological surveys and monitoring were also originally of broad scope but will be expanded where necessary to cover Unit No. 2.

2.3.7 RADIOACTIVE DISCHARGES

The radwaste system (Waste Management System) for Unit No. 2 will be identical to that being provided for Unit No. 1 and will be located in a separate auxiliary building. Therefore, the description of the system presented in the Unit No. 1 Environmental Report is applicable to the second radwaste system.

A plant vent, located on the shield building at the 140 ft. elevation, will provide for the release of gaseous effluents. Liquid effluents will be discharged through separate monitored lines into a common discharge canal and solid wastes will be treated in a separate area located in the auxiliary building.

Besides the extra equipment required for the additional radwaste system, the only difference that such an addition will make is to, at most, double the annual amount of radioactivity discharged to the environment when compared to the discharges from Unit No. 1. External annual doses received at the site boundary and at the west bank of the Indian River from gaseous releases are anticipated to, at most, double as a result of two unit operation, to approximately one mrem and one half of a mrem, respectively.

A negligible effect is expected from the additional radioactivity released in liquid effluents to the Atlantic Ocean. This is because the circulating water discharge from each unit will be into the same canal as the radioactive effluent. Thus, while the release of activity will be, at most, doubled, so will the circulating water flow. Hence, the concentration of activity discharged into the ocean will remain essentially the same as for one unit operation and the activity change received by members of the marine food chain (finfish and shellfish) will be undetectible.

The doses resulting from the other pathways to man discussed in the Unit No. 1 Environmental Report, including direct external radiation exposure from ocean water and the air-grass-milk-child and air-soil-food crop-man pathways, could, at most, be expected to be doubled and, as such, are not expected to result in any measurable exposure hazard. The radiological monitoring program to be conducted in the vicinity of the Hutchinson Island site will provide information to assure that this is indeed the case.

Concerning the discussion of radiological effects on commercial seafood species, it is again concluded that the anticipated releases of radioactivity from the facility will have a minimal radiological effect, because the concentrations of liquid activity releases will remain virtually unchanged.

In summary, the addition of a second unit at the Hutchinson Island site will result in an insignificantly increased radiological impact. The anticipated concentrations of both liquid and gaseous activity released to the environment are still expected to be less than 1% of the MPC limits.

2.3.8 CONSTRUCTION EFFECTS

Appropriate attention has been given to minimizing the ecological and biological effects of construction work on the Indian River and the Atlantic beach. Little or no additional area at the plant site will require development, as the land now prepared can be used for construction of the second unit. A very little amount of dewatering for the foundations of the second unit will be necessary, but this dewatering will be small in comparison with that required for the site preparation of the first unit. No additional dredging for access channels will be necessary. The construction schedule calls for work to start late in 1971, and for it to continue through early 1976. Once the foundations are prepared, however, there will be little or no discharges or other effects on Big Mud Creek. On the Atlantic side, the construction of the intake and discharge pipe lines will require somewhat less than twice the effort than that required for Unit No. 1 alone. The major effect then will be that construction efforts and the disturbance of silt and other littoral effects on the Atlantic beach will be greater and slightly more prolonged. From the environmental standpoint, this effort is expected to have less total effect than that of any of the several beach restorations now under way along the Florida coast.

2.3.9 AESTHETICS

The description in Section 2.3.9 of Unit No. 1 Environmental Report applies equally to Unit No. 2 regarding the aesthetic aspects of plant architecture and site appearance of Florida Power & Light Company facilities. Because this second unit will be placed directly beside the first, it will be easily screened by the intensive landscaping which will surround the plant area. The fact that there are two units at the site will probably only be obvious from the air. Passersby on Route A1A probably will not be conscious of the existence of more than one plant.

2.4 ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

The statements made in Section 2.4 of Unit No. 1 Environmental Report regarding conformance with the letter and spirit of Section 101(b), of the National Environmental Policy Act of 1969, are equally true for the Hutchinson Island site with two nuclear units. The power output will be doubled with both units in operation and the impact on the environment is believed to be less than it would be if the second unit were built at a new site.

2.5 ALTERNATIVES

The alternatives discussed in detail in Section 2.5 of the Unit No. 1 Environmental Report also hold for the second unit, regarding the impracticability of securing power from other systems; the selection of a nuclear unit rather than a fossil unit; and the choice of the ocean water cooling system.

A new alternative was considered whether to build a new unit at the Hutchinson Island site or to select a new site at another location in this load center. There is no question that placing the new unit on a site which development was already well under way would have far less environmental impact than would preparing an entirely new site.

P.O. BOX 3100 MIAMI, FLORIDA 33101

FPL
FLORIDA POWER & LIGHT COMPANY

June 5, 1973

RECEIVED
JUN 6 1973
U.S. ATOMIC ENERGY COMMISSION
Regulatory
Mail Section

Mr. William H. Regan, Jr., Chief
Environmental Projects Branch No. 4
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Regan:

Re: AEC Docket No. 50-335 -
St. Lucie Unit No. 1 (formerly Hutchinson Island)
Environmental Report

Enclosed herewith are two hundred (200) copies of Supplement No. 9 to Florida Power & Light Company's "Hutchinson Island Environmental Report" for our St. Lucie Plant Unit No. 1. One hundred (100) additional copies are being held as requested and will be forwarded upon request.

The following matters are addressed:

A. Condenser Cooling Water System. Revision and expansion of Section 2.3.3, Heat Dissipation, Supplement No. 7, to cover:

1. Increased diameter ocean intake lines and enlarged, divided velocity caps are provided to give additional margin for marine fouling and flow capacity, minimize the disruption of the sand dune and ocean bottom areas during a single construction operation, and to reduce the installation cost.

2. Elimination of the gate control structure and replacement of its function by two lines connected directly to the ocean intake lines.

3. Extension of the ocean discharge line, widening of the headwall structure and installation of a second discharge line stub in the headwall to permit independent pipeline construction to minimize canal and dune disruption when the future second line is installed, and also to reduce the cost of dewatering and reexcavation.

B. Steam Generator Blowdown Processing. In consideration of the AEC Draft Environmental Statement, St. Lucie Unit No. 1, September 1972 and the AEC letter of March 19, 1973, additional radioactive waste processing capability for steam generator blowdown will be provided.

Changes made 8/21/73

3668

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REGULATORY OPERATIONS
REGION II
ATLANTA, GA.
JUN 11 10 50 AM '73

2.6 SHORT-TERM USES VS. LONG-TERM PRODUCTIVITY

The conclusions reached in the Unit No. 1 Environmental Report apply equally well to the second unit.