ADD TO DATABASE CP&L 1979

BSEP-0001

316(a) Demonstration

Brunswick Steam Electric Plant
Southport, North Carolina

Volume XIX

Carolina Power & Light Company

Environmental Technology Section
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Plant and Area Description

The Brunswick Steam Electric Plant (BSEP) is a two-unit, 1,642-megawatt nuclear power plant located near Southport, North Carolina. Under full operation, as much as 68 m^3 (2,410 ft^3) per second of cooling water is withdrawn from the Cape Fear River in the vicinity of Buoy 19 (located 9.7 km (6 mi) from the mouth of the river). The water is primarily drawn from the Cape Fear River ship channel through a 4.8 km (3 mi) long intake canal. After passing through the plant's condensers, the water travels through a 9.7 km (6.0 mi) long discharge canal and is pumped 610 m (2,000 ft) offshore through subaqueous pipes into the Atlantic Ocean.

The ocean floor in the vicinity of the discharge pipes is sandy with no natural hard bottom outcroppings that would attract fish. The bottom is also devoid of attached vegetation. Tidal flow is the dominant influence in this area with the net flow to the west, away from the mouth of the Cape Fear River (CFS, Vol. I).

Thermal Monitoring Program

Permit 1738 issued on January 16, 1970, by the North Carolina Department of Water and Air Resources (now the Department of Natural Resources and Community Development) and the National Pollutant Discharge Elimination System (NPDES) permit, as amended, sets maximum limits for thermal discharge from BSEP into the open ocean. The restrictions are as follows:

1. "The facilities shall be effectively maintained and operated at all times so as to meet the temperature standards of $1\frac{1}{2}^{\circ}F$ increase above ambient water temperature during the months June through August and $4^{\circ}F$ increase above ambient water temperature during the months September through May, measured as a daily average one foot below the water surface with the maximum instantaneous increase not to exceed 150% of these values, except within the following defined mixing zones:

a. The temperature increase above ambient water temperature shall not exceed $7^{\circ}F$ outside an area of 60 acres included within the plume extending from the point of discharge.

b. The temperature increase above ambient water temperature shall not exceed those standards specified above outside an area of 1,000 acres having a boundary not closer than 500 feet to the beach."

To demonstrate compliance with these limitations, a monitoring program using triangulation from shore was devised to monitor the extent of the thermal plume. A grid of 27 stations covering 941 ha (2,326 ac) of ocean water was established. As conditions allowed the thermal plume was monitored at least twice monthly between January 1975 and August 1978 (Figure 1). Monitoring has continued in 1979 at the same intervals designated in 1978. Using the data from this program, it was possible to map the thermal plume produced by the plant under varying operating conditions and varying tide and wind conditions. Results reported in a Company report entitled "Ocean Thermal Plume Studies at the Brunswick

Steam Electric Plant, Southport, North Carolina, 1974-1978" (CFS, Vol. IV) demonstrate that in most cases thermal discharge was immediately dissipated by the ocean at the point of discharge. Only under near full power operating conditions for both units was there any observable thermal plume at the surface anywhere within the grid.

A number of conditions work to reduce the temperature of the thermal discharge. The wind increases the mixing rate by producing waves which increase the amount of water surface exposed to the air and thus the heat transfer to the air. Waves also increase the mixing of the water column and further distribute the heat. The strongest influence on the thermal plume, however, is the tide. The huge amounts of water moved by the tides through the grid rapidly dissipate the heat discharged by the plant.

The rapidly dissipated thermal discharge resulting from these conditions is well illustrated by some typical data collected while both units were at 100% power. Two runs were made in April 1978 at a time when the river water would be naturally warming faster than the ocean (thus a natural thermal addition in addition to plant effects). With both units at 100% power and a 15-22^{o}F rise across the condensers, only a 1-3^{o}F rise was observed at the station nearest to the discharge point (the discharge point within the 60-acre plume where the temperature rise allowed by state water quality standards is unrestricted) (Table 1). In late summer the rise across the condenser was measured at 18°F and only a 1-2°F rise was observed at the edge of the unrestricted 60-acre plume area (Table 1).

The highest temperature ever recorded at the point of ocean discharge was 34.4°C (93.9°F) on August 7, 1978; however, at the closest survey point, No. 14, the temperature was 29.8°C (85.6°F) (CFS, Vol. IV). Both generating units were at 100% power levels. A comparison of the key temperatures taken during the survey follows (CFS, Vol. IV, App. A).

Intake River Temperature	-	29.5°C (85.1°F)
Approximate Discharge Canal Temperature (Data taken from BSEP BOP Log, Operational Data)	-	39.5°C (103.1°F)
ΔT - Temperature Increase	-	10.0°C (18.0°F)
Ocean Discharge at Outfall Pipe	-	34.4°C (93.9°F)
Thermal Plume No. 14 Closest to Discharge Edge of 50 Acres	-	29.8°C (85.6°F)
Ocean Ambient Average of Sample Points 1, 9, 19, & 27	-	29.5°C (85.1°F)

In this case of the highest extreme in waste heat and naturally high temperatures, the temperature increase above ocean ambient is 0.3°C (0.5°F) at the sample point directly in front of the ocean outfall (Sample Point 14). Thus the 1½°C (0.8°F) 1,000-acre limit established in Permit 1738 is not exceeded even within the 60-acre area around the ocean outfall (CFS, Vol. IV).

These typical temperature differences mentioned are indicative of calmer weather when it was possible to collect data. Rougher weather would have dissipated the heat even more rapidly.

Impact of the Thermal Discharge

The impact of the thermal discharge on the fish and shellfish of the nearshore ocean area has been studied since 1973. Those involved in these studies have concluded that the thermal additions of the Brunswick Steam Electric Plant have not adversely effected the fauna of the area.

Dr. B. J. Copeland of North Carolina State University conducted thermal studies on the thermal tolerances of some of the more abundant organisms of the nearshore ocean area. Dr. Copeland tested the temperature increase necessary to cause equilibrium loss in brown shrimp, white shrimp, and croaker. The general conclusion from this work is that those organisms might experience problems at the point of discharge if they choose to stay there during the short period of the year when ambient temperatures exceed 30°C (86°F). In most of the plume, however, these organisms would not suffer equilibrium loss (Copeland 1976). There are few periods that ambient temperatures are at this level, based on data collected thus far (CFS, Vol. IV). There is no basis for concluding that these species would remain in the small thermal plume at the point of maximum temperatures.

Dr. R. G. Hodson, also of North Carolina State University, conducted studies on the temperature tolerance of spot (CFS, Vol. XII), another of the dominant organisms listed by Dr. Schwartz of the University of North Carolina (CFS, Vol. XIV & XV). Dr. Hodson concluded that spot would expenience equilibrium loss at temperatures above 35°C (95°F).

Thermal plume monitoring, however, has never recorded a temperature as high as 35°C even directly in the ocean discharge point (CFS, Vol. IV, Appendix-A). On occasion this temperature may be reached, but it would only be in a small area. The potential problem of lethal temperatures is further reduced by the fact that spot, like other nektonic organisms, could easily swim away from any small hot spots. This potential problem is even further reduced by the fact that spot, like most of the other species, are not typically found in the nearshore ocean area during the late summer months.

Dr. Copeland has also conducted an intensive study on the larvae and postlarvae of the Cape Fear estuary. Concerning the influence of the outfall on larval forms he concluded that the general westward drift of water in this area and the apparent source of larvae and post-larvae from further offshore and to the east, indicates that the thermal plume should not influence those organisms destined for the Cape Fear estuary (Copeland 1976).

Dr. Copeland also stated, "I know of no studies in the temperate zone, nearshore ocean environment where thermal discharges of this nature have affected the propagation of an indigenous population. In areas where the temperature locating is in a more restricted area (i.e., less dispersion), effects have also been reported; and under any circumstances, compared to the receiving body of water, the area affected by the artificial heat load is small" (Copeland 1976).

Nearshore Ocean Nektonic Fauna

Studies conducted from 1973-1978 by Dr. F. J. Schwartz of the University of North Carolina show that the most abundant species collected in the nearshore ocean area include a number of species that spawn many miles offshore, but whose larvae utilize nursery areas within the estuary (Tables 2 through 7). These species include spot, croaker, menhaden, penaeid shrimp, pinfish, flounder, and spotted hake. As the water temperatures cool during the late fall and winter, these species retreat to the naturally warmer ocean waters. Other dominant species that are known to utilize the lower estuary or nearshore ocean area as a spawning area or a nursery ground include weakfish, bay anchovy, blue crab, stardrum, and southern kingfish (CFS, Vols. XIV & XV). The southern kingfish almost exclusively uses the nearshore surf zone as a nursery area while the other four species use the lower estuary in addition to the nearshore ocean.

The studies conducted since 1973 by Dr. Schwartz have dealt with the juvenile and adult organisms of this area. By plotting the temperature against species abundance, he has determined that during the summer most fishes move to deeper cooler water when the natural water temperature exceeds 28°C (82°F). In the winter fishes move to warmer offshore waters when the natural water temperature drops below 10°C (50°F) (CFS, Vols. XIV & XV).

Cold shock and heat shock occur in situations where fish are trapped in a discharge canal or enclosed area and, consequently, cannot escape the sudden change in temperature produced by a start-up or shutdown of a power plant. The BSEP discharge canal is closed, and organisms cannot enter it from the ocean. In the area of the ocean discharge, the heated water is immediately diluted even directly at the upwelling or point of discharge. As noted earlier, temperatures in the surrounding areas are only slightly above ambient. This small rise is not enough to cause heat shock or cold shock when the thermal discharge is interrupted.

From 1975 when the first thermal discharge was released in the ocean until the present, CP&L personnel, contractors, and the public have reported no fish kills or other negative biological activity in the nearshore ocean at the discharge outfall.

Temperature Rise Associated With Reduced Flows

CP&L has proposed a flow minimization plan during certain periods of the year in order to reduce entrainment (CP&L, Volume XVIII). If this plan were followed, operating at reduced flow rates would increase the temperature rise across the condensers from the 32°F maximum which currently is allowed in the NPDES permit to 46°F. This is the outside bounding case and allows for instrument error and other operating margins. The calculated maximum condenser rise for full load operation at reduced flows is 42°F (Figure 2).

Analysis of the thermal discharge under proposed conditions of reduced flow indicates that the plume area exceeding the 4°F temperature rise above ambient temperature for September through May would fall within the mixing zone currently defined for the BSEP by the North Carolina Department of Natural Resources and Community Development. In the case of the limiting 1½°F rise above ambient temperatures in June through August, the 1,000-acre limit on the boundary of the mixing zone also should be met under the proposed conditions of reduced flow. An adjustment, however, may be necessary in the permit condition which establishes a 500-foot minimum distance between the edge of the mixing zone and the shoreline since the 1½°F isotherm may, under certain conditions, reach the shoreline. Confirmation of this would require field verification.

Dr. J. H. Carpenter of the University of Miami has conducted dye tracer studies in the nearshore ocean in the vicinity of the ocean discharge (CFS, Vol. I). In reference to the higher discharge temperatures caused by reduced flow rates, he has concluded that variations in the discharge temperature would change the temperatures in the immediate outfall area but as long as the total amount of heat released is the same (higher temperatures corresponding to lower water flow rates), the temperature increases in the area away from the outfall would not be modified.

As documented by Dr. Carpenter, hydrological movement of the Cape Fear estuary and nearshore ocean is very dynamic with a very large exchange rate. As much as 63% of the water expelled on an ebb tide does not return to the estuary but is flushed into the ocean and becomes part of the southward longshore drift. Also, the longshore drift moves large quantities of water from the east across the sampling grid and continues westerly along the coast (CFS, Vol. I). Normal tide changes range from 3½ - 5 feet vertically between low and high tide (CFS, Vol. II).

The water taken into the estuary is carried by currents from the east, along the shoals of Baldhead Island (Figure 1). The flood tide enters the river mouth with greater flows in the ship channel and the eastern estuary. The water distributes itself through the estuary. As the tide starts to ebb, the flow is concentrated in the ship channel and the western edges of the river. At the river mouth the water flows out the ship channel and around the tip of Oak Island. The river water moves westerly, passing through the ocean discharge sampling grid and down the coastline (CFS, Vol. 1).

Discussion

The Brunswick Steam Electric Plant withdraws as much as 68 m^3 (2,410 ft^3)/second of cooling water from the Cape Fear River and discharges into the nearshore ocean area to the west of the mouth of the Cape Fear River. Thermal monitoring from 1975-1978 has shown that a sufficient temperature rise to map a thermal plume is present only when the plant is at or near full power production. Temperature elevations within the 60 acres around the discharge point during peak production are only on the magnitude of 1-3°F. Factors that influence the dissipation of heat include wind, waves, and the tremendous tidal flow that is present in this area (CFS, Vol. IV).

As part of a plan to reduce impingement and entrainment impact of the plant on the Cape Fear estuary, it has been proposed that the flow rates be reduced during certain parts of the year. As a result, the temperature of the discharge water will be elevated, the total amount of water will be decreased, and the total heat will be unchanged. This may produce higher temperatures in the immediate vicinity of the discharge outfall, but the temperature increases in the areas away from the outfall would not be modified.

The elevated temperature would not have an impact on the fish and shellfish in this area. These forms are highly motile and would simply move out of the area of elevated temperature. The discharge would not impact the larvae forms entering the Cape Fear estuary, as they would be coming from the east. The ocean bottom near the discharge is sandy and has no rock outcroppings, hard bottoms, or beds of vegetation that would attract marine organisms.

Impacts due to thermal discharges are usually present in enclosed systems, such as open discharge canals, coves or lakes, or in the tropics where normal summertime temperatures approach the lethal limits of the local fauna. These conditions are not present at BSEP. The discharge area is the open ocean, which offers ample room for the organisms to avoid localized "hot spots." Also, the majority of the organisms of this area are more tropical in nature and their distributional ranges extend hundreds of miles south into even warmer waters.

The information and data gathered and analyzed by CP&L investigators (CFS, Vols. I-XX) is similar to the information reported by the Utility Water Act Group (UWAG 1978) to the United States Environmental Protection Agency on effects of ocean-sited plants.

UWAG reported on methods for evaluating thermal plume effects on fish distribution, fish mortality, and fish movement patterns. To evaluate fish distribution effects, fish collections have been made by trawl and gill nets. The fish were then examined for differences in relative abundance (usually expressed as a catch per unit of effort) between in-plume and out-of-plume stations. The fish distribution studies revealed that most fish species at marine power plant sites do not display differences in relative abundances between stations in the vicinity of thermal discharges and those in control areas. Although differences were detected between discharge and control abundances in some studies, these differences varied seasonally, were species specific, and were sometimes atrributable to substrate differences (e.g., rip-rap) rather than the power plant thermal discharge. The overall survey of marine fish assemblages near coastal power plants indicates that fishes are not generally excluded from regions near thermal discharges. Consequently, the fish assemblages observed in the immediate vicinities of marine thermal discharges were representative of those normally occurring in coastal marine areas.

In general, marine fish display avoidance reactions to lethal temperatures. Therefore, although very restricted areas of plumes may approach potentially lethal temperatures, lethal effects would not be expected. This projection is substantiated by the lack of observed fish kills and the occurrence of normal fish abundances in the vicinities of coastal thermal discharges.

In the reviewed studies, there was no evidence that marine fish migrations were blocked by thermal discharges. Although marine fish commonly display longshore migrations, the surface nature of coastal plant plumes and lack of potential for complete channel blockage suggest that the thermal plumes would not interrupt any normal fish movement patterns (UWAG 1978).

The thermal discharges from existing marine power plants (all with once-through cooling) have not been shown to result in adverse impacts on marine nekton communities. Localized changes in nekton distribution were observed, but these do not represent adverse impacts on fish populations. The lack of adverse impacts on nekton communities is further evidenced by the continuing occurrence of rich and diverse fish communities near marine-sited power plants which have been operating for years.

As there are many thousands of acres of ocean water available at the point of discharge, the relatively small acreage (Figure 2) (60-1,000 acres) of potential influence by the BSEP discharge is negligible.

Conclusions

The combination of these factors leads to the conclusion that the Brunswick Steam Electric Plant will not have a biological impact in the discharge area and will assure the protection of a balanced, indigenous population of fish and shellfish, etc., in the nearshore ocean area.

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Table 1 Maximum Temperature Difference (°C) Between the Edge of a Hypothetical 60-acre Area and Ambient

Date	Run	Power Level Unit II	Power Level Unit I	Highest Temperature at Edge of 60-acre Area*	Ambient	Temp. Increase Above Ambient °C	Temp. Increase Above Ambient °F
1975							
October	1	55%	0	24.5 (Station 13)	23.8	0.7	(1.3)
	2	60%	0	24.2 (Stations 14 & 23)	23.9	0.3	(0.5)
November	1	96%	0	20.9 (Station 15)	20.1	0.8	(1.4)
	2	56%	0	21.6 (Station 24)	20.9	0.7	(1.3)
December	1	68%	0	16.0 (Station 24)	15.1	0.9	(1.6)
	2	0	0	15.2 (Station 13)	14.5	0.7	(1.3)
1976							
January	1	48%	0	11.8 (Station 15)	10.8	1.0	(1.8)
	2	48%	0	11.2 (Station 23)	10.5	0.7	(1.3)
February	1	84%	0	11.0 (Station 15)	9.9	1.1	(2.0)
	2	91%	0	14.4 (Station 14)	13.2	1.2	(2.2)
March	1	82%	0	14.0 (All Stations)	14.0	0	(0)
June	1	55%	0	23.7 (Station 23)	23.2	0.5	(0.9)
	2	53%	0	23.5 (Station 23)	23.2	0.3	(0.5)
July	1	45%	0	25.9 (Station 24)	25.7	0.2	(0.4)
	2	45%	0	26.7 (Station 14)	26.2	0.5	(0.9)
August	1	93%	0	26.9 (Station 14)	26.5	0.4	(0.7)
	2	90%	0	26.5 (Station 15)	25.8	0.7	(1.3)
September	1	49%	0	25.0 (Stations 22-24)	24.8	0.2	(0.4)
	2	65%	0	24.7 (Station 22)	24.5	0.2	(0.4)
October	1	84%	0	22.3 (Station 14)	21.7	0.6	(1.1)
	2	91%	0	21.2 (Stations13-15)	20.5	0.7	(1.3)
December	1	53%	18%	10.8 (Stations 14, 22, & 23)	10.8	0	(0)
1977							
January	1	81%	68%	5.7 (Station 15)	4.6	1.1	(2.0)
February	1	87%	68%	5.5 (Station 14)	4.6	0.9	(1.6)
	2	87%	68%	5.5 (Station 15)	4.9	0.6	(1.1)
March	1	61%	99%	14.3 (Station 15)	13.2	1.1	(2.0)
	2	68%	99%	14.0 (Stations 14 & 15)	13.0	1.0	(1.8)
April	1	72%	91%	19.6 (Station 22)	18.4	1.2	(2.2)
	2	69%	99%	20.0 (Station 14)	19.1	0.9	(1.6)
June	1	83%	0	27.5 (Stations 13-15, 23, 24)	27.1	0.4	(0.7)
July	1	58%	71%	31.3 (Station 14)	30.3	1.0	(1.8)
	2	58%	71%	31.5 (Station 24)	30.5	1.0	(1.8)
	3	52%	43%	27.5 (Station 14)	26.5	1.0	(1.8)
	4	0	38%	26.5 (Station 14)	25.9	0.6	(1.1)
August	1	86%	60%	31.3 (Station 14)	29.6	1.7	(3.1)
	2	26%	99%	28.0 (Station 14)	27.6	0.4	(0.7)
	3	25%	100%	28.5 (Station 14)	27.5	1.0	(1.8)
1978							
Nonsummer (April)	1	100%	100%	20.9 (Station 14)	19.3	1.6	(2.9)
	2	100%	100%	20.2 (Station 15)	19.3	0.9	(1.6)
Summer (August)	1	100%	100%	30.6 (Station 24)	29.5	1.1	(2.0)
	2	100%	100%	29.6 (Station 23)	28.5	1.1	(2.0)

*The maximum temperature is the highest temperature of the six stations (13, 14, 15, 22, 23, and 24) closest to the discharge boil.

Table 2

Rank Catch and Percent of Total Catch by Large Trawl in the Ocean of the Top 15 Fish Species, 1973

Species	Catch	%
Brevoortia tyrannus	8,217	29.53
Micropogonias undulatus	929	3.35
Stellifer lanceolatus	902	3.33
Anchoa mitchilli	958	3.46
Leiostomus xanthurus	5,729	20.59
Urophycis regius	2,134	7.67
Scophthalmus aquosus	2,146	7.72
Lagodon rhomboides	68	0.24
Trinectes maculatus	813	2.92
Etropus crossotus	139	0.50
Prionotus tribulus	636	2.29
Pomatomus saltatrix	7	0.01
Anchoa hepsetus	440	1.58
Peprilus alepidotus	497	1.79
Cynoscion regalis	545	2.02
TOTAL including unlisted species	27,706	

Table 3

Rank Catch and Percent of Total Catch by Large Trawl in the Ocean of the Top 15 Fish Species, 1974

Species	Catch	%
Leiostomus xanthurus	20,063	42.42
Stellifer lanceolatus	4,084	8.64
Micropogonias undulatus	7,334	15.51
Lagodon rhomboides	261	0.55
Brevoortia tyrannus	290	0.62
Cynoscion regalis	1,581	3.35
Anchoa mitchilli	997	2.11
Bairdiella chrysoura	388	0.82
Trinectes maculatus	967	2.05
Etropus crossotus	648	1.37
Menticirrhus americanus	1,299	2.75
Pomatomus saltatrix	172	0.36
Larimus fasciatus	1,169	2.47
Anchoa hepsetus	769	1.64
Opisthonema oglinum	955	2.02
TOTAL including unlisted species	47,266	

Table 4

Rank Catch and Percent of Total Catch by Large Trawl in the Ocean of the Top 15 Fish Species, 1975

Species	Catch	%
Stellifer lanceolatus	2,930	7.90
Micropogonias undulatus	2,927	7.89
Brevoortia tyrannus	936	2.52
Leiostomus xanthurus	5,695	15.36
Anchoa mitchilli	3,501	9.44
Cynoscion regalis	2,628	7.09
Lagodon rhomboides	2,461	6.64
Urophycis regius	2,778	7.49
Bairdiella chrysoura	90	0.24
Symphurus plagiusa	812	2.19
Trinectes maculatus	727	1.96
Etropus crossotus	862	2.32
Pomatomus saltatrix	83	0.22
Scophthalmus aquosus	1,510	4.07
Menticirrhus americanus	1,075	2.90
TOTAL including unlisted species	37,080	

Table 5

Rank Catch and Percent of Total Catch by Large Trawl in the Ocean of the Top 15 Fish Species, 1976

Species	Catch	%
Micropogonias undulatus	95,290	55.67
Stellifer lanceolatus	9,104	5.32
Leiostomus xanthurus	18,415	10.76
Brevoortia tyrannus	1,655	0.97
Anchoa mitchilli	461	0.27
Lagodon rhomboides	3,988	2.33
Cynoscion regalis	13,402	7.83
Larimus fasciatus	9,270	5.42
Bairdiella chrysoura	2,698	2.16
Trinectes maculatus	1,260	0.74
Symphurus plagiusa	1,012	0.59
Etropus crossotus	975	0.57
Urophycis regius	502	0.29
Scophthalmus aquosus	1,625	0.95
Peprilus triacanthus	2,627	1.54
TOTAL including unlisted species	171,176	

Table 6

Rank Catch and Percent of Total Catch by Large Trawl in the Ocean of the Top 15 Fish Species, 1977

Species	Catch	%
Brevoortia tyrannus	3,288	13.15
Leiostomus xanthurus	6,966	27.87
Micropogonias undulatus	3,336	13.34
Stellifer lanceolatus	791	3.16
Urophycis regius	431	1.72
Cynoscion regalis	1,226	4.90
Lagodon rhomboides	890	3.56
Anchoa mitchilli	339	1.36
Trinectes maculatus	579	2.32
Pomatomus saltatrix	8	3.20
Scophthalmus aquosus	1,215	4.86
Peprilus triacanthus	1,056	4.22
Symphurus plagiusa	630	2.52
Bairdiella chrysoura	44	0.18
Etropus crossotus	215	0.86
TOTAL including unlisted species	24,998	

Table 7

Rank Catch and Percent of Total Catch by Large Trawl in the Ocean of the Top 15 Fish Species, 1978

Species	Catch	%
Brevoortia tyrannus	3,348	13.99
Leiostomus xanthurus	6,031	25.21
Cynoscion regalis	5,582	23.33
Urophycis regius	1,446	6.04
Micropogonias undulatus	811	3.39
Stellifer lanceolatus	370	1.55
Anchoa mitchilli	632	2.64
Lagodon rhomboides	569	2.38
Bairdiella chrysoura	178	0.74
Scophthalmus aquosus	1,776	7.42
Trinectes maculatus	256	1.07
Pomatomus saltatrix	19	0.08
Symphurus plagiusa	302	1.26
Paralichthys lethostigma	6	0.03
Paralichthys dentatus	151	0.63
TOTAL including unlisted species	23,923	

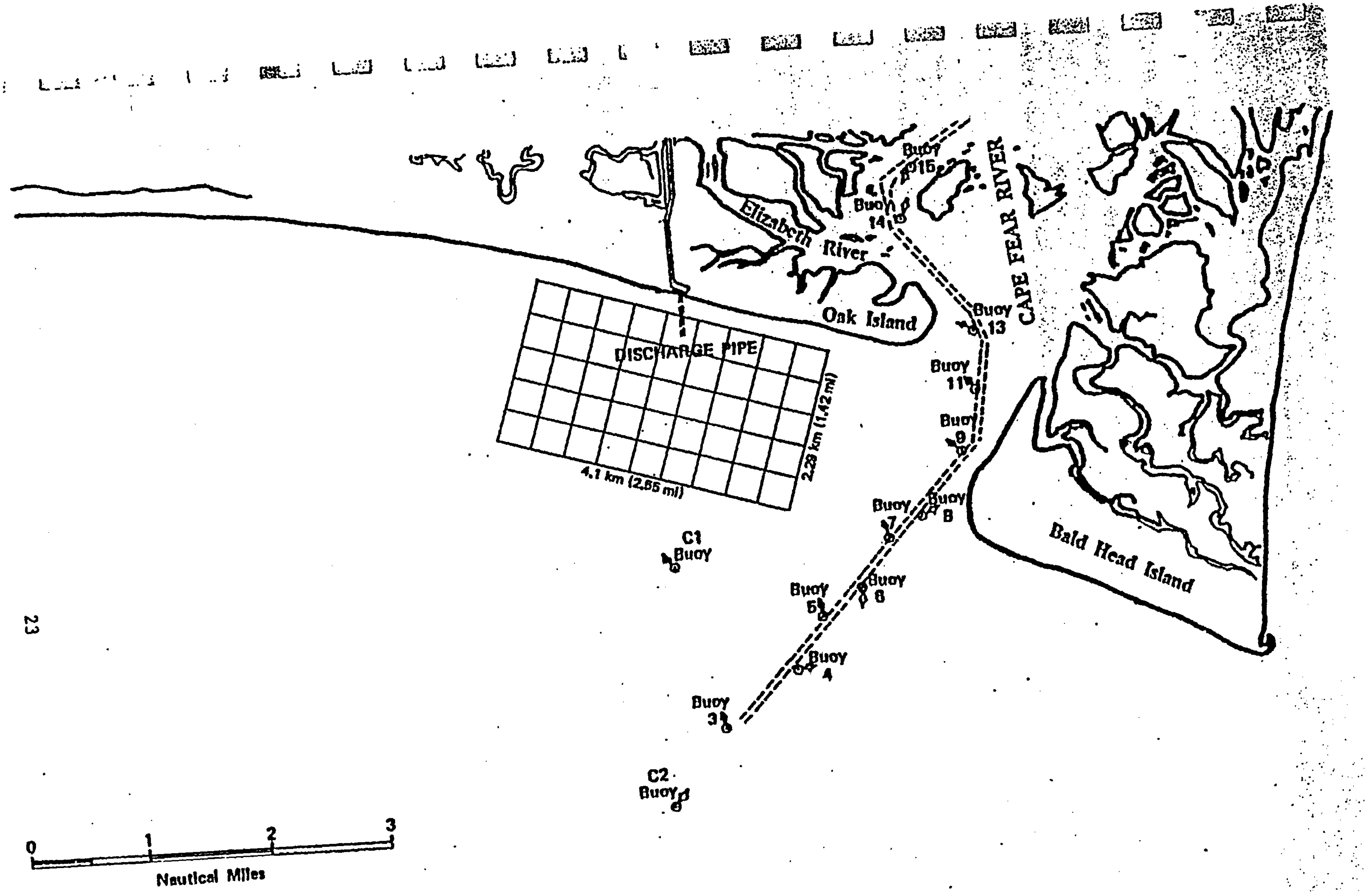

Figure 1. BSEP OCEAN DISCHARGE GRID LOCATION

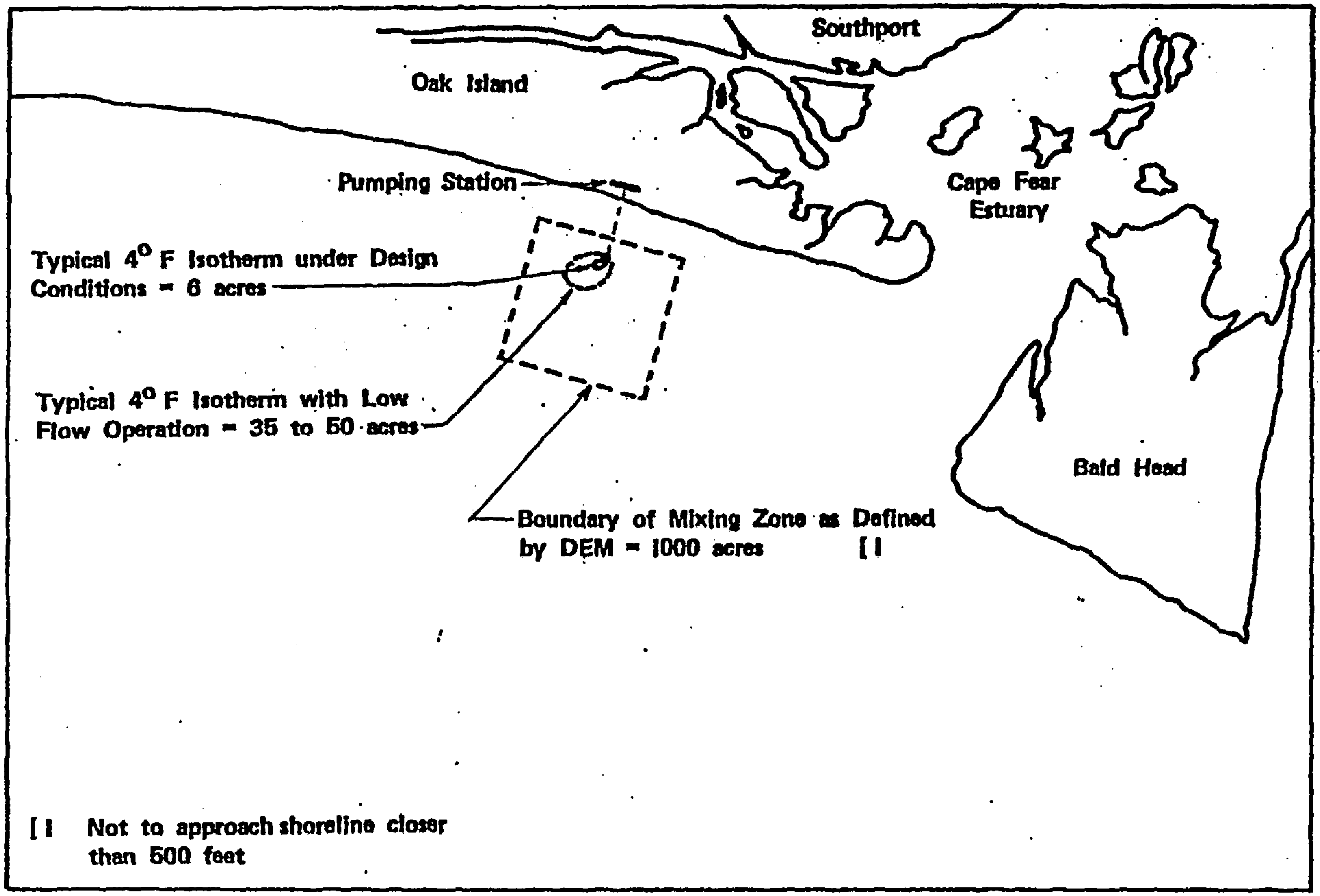

Figure 2 THERMAL PATTERNS FOR BSEP OCEAN DISCHARGE