ENVIRONMENTAL IMPACT STATEMENT
IN SUPPORT OF APPLICATION
TO THE
STATE OF NEW JERSEY
FOR
CAFRA AND TYPE B WETLANDS PERMITS

ARTIFICIAL ISLAND ACCESS ROAD
WIDENING PROJECT

LOWER ALLOWAYS CREEK TOWNSHIP
COUNTY OF SALEM
STATE OF NEW JERSEY

PREPARED BY
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
80 PARK PLAZA
NEWARK, NEW JERSEY 07101
201-430-7000

OCTOBER 1982

M P82 132/04 1-mw

SUMMARY

Public Service Electric and Gas Company and Lower Alloways Creek Township propose to widen an existing two lane roadway connecting the Village of Hancocks Bridge, New Jersey, with the three electric generating units sited on Artificial Island.

A third lane is urgently needed to relieve congestion and improve traffic safety for Artificial Island workers and members of the public. At present, approximately 6000 workers in 4000 vehicles arrive between 6:00 AM and 8:00 AM and depart between 3:30 PM and 6:30 PM. Average travel time between Hancocks Bridge and the Island increases to 25 minutes from the normal 10 minutes with delays of 60-75 minutes reported. Workers expend undetermined amounts of additional time waiting in parking lots for traffic to abate, or arriving early to avoid delays enroute. Accidents frequently occur; in 1981 fifty-eight were reported along the two roadway segments.

With the establishment of PSE&G's Nuclear Department and with Hope Creek Unit 1 construction and a 6 month long Salem refueling outage planned to start in mid-October, the Island worker population is expected to peak at 7500. When Hope Creek enters service, routine operation and scheduled outage maintenance there and at Salem Generating Station will involve 3100 workers.

For reasons detailed in this EIS, further staggering of work hours, pooling arrangements, and public transportation are not feasible. Establishing two lanes of travel in the rush hour direction is essential, and the road widening project appears to accomplish this best.

Impacts result primarily from filling certain wetland areas along the causeway portion of the road connecting Artificial Island with the mainland. It is proposed to mitigate this loss by preserving other wetlands of equal or better value.

Principal alternatives considered included two other routes involving new roadway construction, widening only the public portion of the access road, one-way traffic during peak periods, further staggering of starting and quitting times, and various pooling and busing arrangements.

To date, the only approval received for widening either the public or private roadway portion is the Riparian Grant (No. 68-12) which conveys adequate rights-of-way to accommodate the widening. For a list of required approvals, see Section 8.

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1.0 LOCATION

1.1 General Site Location Map

The site of the existing roadway and proposed widening is located within the New Jersey Coastal Zone boundary as delineated in Chapter 185, Laws of 1973, Section C.13.19-4, and is surrounded by coastal wetlands. Figure 1.1-1 is a map of the New Jersey Coastal Zone, and the specific site is located in the lower southwest corner of the state. Figure 1.1-2 shows the site is also in New Jersey's Bay and Shore Area. Figure 1.1-3 is an additional, more detailed map of the specific area in which the project lies. The wetland maps, copied from New Jersey Wetland Maps, are shown in Figures 2.1-3 thru 2.1-13.

1.2 General Site Description

The existing public and private roadway, extending for a distance of about 5.3 miles, is situated between the intersection of Alloway Creek Neck Road and Salem - Hancocks Bridge Road and the Salem Generating Station (see Figure 1.2-1). It is located on Artificial Island and passes through adjacent agricultural property in Lower Alloways Creek Township, Salem County, New Jersey. Philadelphia is about 30 miles north; and Salem, New Jersey, is 7.5 miles northeast of the Salem Generating Station. Approximately 3 miles of the road are on a causeway through tidal marshes between Artificial Island and the mainland. The remaining public roadway, approximately 2 miles, crosses agricultural and residential lands.

There are no major highways or railroads within about 7 miles of the generating station site. The only access by land to the generating station is the road constructed in 1968 to connect with Alloway Creek Neck Road about 3 miles to the east. Waterborne (barge) traffic has access to the stations by way of the Intracoastal Waterway channel maintained in the river and a secondary channel dredged to an unloading site at the southern end of the island.

The roadway passes through areas which are included on three USGS maps (see Figure 1.2-2). The terrain is either tidal wetland or suitable land for agricultural and industrial uses.

1.3 Ownership of Site and Adjacent Lots

For the privately owned roadway, Public Service Electric and Gas Company has a Deed of Easement from the United States of America and a Grant of Easement from the State of New Jersey for the right to construct, reconstruct, operate, and maintain the roadway, bridges, and transmission lines.

The ownership of the public roadway is held by Lower Alloways Creek Township.

The block and lot numbers and acreage of lots within 200 feet of the site are shown on the local tax maps (see Figures 1.3-1 thru 1.3-7). The names and addresses of adjacent property owners of record are listed on Table 1.3-1.

TABLE 1.3-1

ADJACENT PROPERTY OWNERS OF ARTIFICIAL ISLAND ACCESS ROAD

Sheet	Block	Lot	
5	18	8	Lower Alloways Creek Township (exempted), 1.5ac, F-2S, L9 Box 157 Hancocks Bridge, N.J. 08038
5	18	9	Lower Alloways Creek Township (exempted) Box 157 Hancocks Bridge, N.J. 08038
5	18	10	Friends, Society of .52ac, 18B Rd. 1 Woodstown, N.J. 08098 Buttonwood Ave.
5	18	11	Valentine, Elmer & Pauline P., 1.63ac., 1SF Alloway Creek Neck Rd. Hancocks Bridge, N.J. 08038 Alloway Creek Neck Road
5	18	12	Wilde, Jason J., Jr. & Mary M., 156' x 142; 2SS Buttonwood Ave. Hancocks Bridge, N.J. 08038 Buttonwood Ave.
5	18	13	Robinson, Virgil Jr. & Marcella, 96.3' x 143.7; S-1S Alloway Creek Neck Rd. Hancocks Bridge, N.J. 08038 Alloway Creek Neck Road 5
5	19	1	Fisher, William J. & Diana T., 125' x 260', F-2S Alloway Creek Neck Rd. Hancocks Bridge, N.J. 08038 Alloway Creek Neck Road 5
5	19	2	Shrier, Deborah, 60' x 270', 2SF Buttonwood Ave. Hancocks Bridge, N.J. 08038 Alloway Creek Neck Rd.

Table 1.3-1 (Cont'd)

Sheet	Block	Lot	
5	19	3	Ridgway, Edwin W., 60' x 230', Irreg. 18 Grange St. Woodstown, N.J. 08098 Alloway Creek Neck Road 5
5	19	4	Pancoast, Nancy, 80' x 220', F-1S Buttonwood Ave. Hancocks Bridge, N.J. 08038 Alloway Creek Neck Road
5	19	5	Pancoast, Nancy Fay, 64ac.F-2S Buttonwood Ave. Hancocks Bridge, N.J. 08038 Alloway Creek Neck Road
5	19	6	Levitsky, Stephen Lee, 120' x 160', F-2S P.O. Box 218 Hancocks Bridge, N.J. 08038 Alloway Creek Neck Rd.
5	19	7	Nielson, William F. & Lucille, lac.,2SF Alloway Creek Neck Rd. Hancocks Bridge, N.J. 08038 Alloway Creek Neck Rd.
5	19	8	Township of Lower Alloways Creek (exempted), 2.42ac Box 157 Hancocks Bridge, N.J. 08038 RR Main Street
5	19	9	Ridgway, John P. Jr. & Jean M., lac., 2SF, 6.52ac., QFARM RD. 3 Quinton-Hancocks Bridge Road Salem, N.J. 08079 Hancocks Bridge-Hamersville Road
6	20	3	Ridgway, John P. Jr. & Jean M., 8.81ac RD. 3 Quinton-Hancocks Bridge Road Salem, N.J. 08079 Locust Island Road
10	28	17	Powell, Jere W., 138.29 ac. Box 219 Kendell at Longwood Kennett Square, PA 19348 Poplar St.

Table 1.3-1 (Cont'd)

Sheet	Block	Lot	
10	28	20	Harris, Frank Warren & Jean Grosscup h/w, lac., 1SF, 82.33ac., QFARM RD 3 Box 261 Bridgeton, NJ 08302
10	28	21.01	Moncrief, Kenneth L. & Sarah, 51.91ac., QFARM, lac., 2SF Wiley Rd. Route 40 Carneys Point, N.J. 08069 Alloway Creek Neck Rd.
10	28	18	Emmons, Charles, .57ac., F-2S Alloway Creek Neck Rd. Hancocks Bridge, NJ 08038 Alloway Creek Neck RD 10
10	28	19	Powell, Amy H., .26ac. Kendell at Longwood Box 219 Kennett Square, PA 19348 Alloway Creek Neck Road 10
10	28	21.02	Hockel, Elizabeth J., 16.02ac 1237 Hillsboro Mile 506 Hillsboro Beach, FL. 33062 Alloway Creek Neck Rd.
10	28	21.03	Bush, Kenneth L., 10.54ac 2100 Pleasant Hill Rd. 76 Kissimmee, FL. 32741 Alloway Creek Neck Rd.
10	28	23	Robin, Dunlap; Raymond L. Dunlap; Thomas Harris; Samuel A. William, 2SB 2425 Old County Rd. Newark, DE 19711 Alloway Creek Neck Rd.
11	29	1	Yerkes, Elizabeth H., lac., 2SB, 88 1/4 ac, QFARM P.O. Box 49 Salem, N.J. 08079 Alloway Creek Neck Road 11
11	29	4	Robin, Dunlap; Raymond L. Dunlap; Thomas Harris; Samuel A. William, 34.59 ac. 2425 Old County Rd. Newark, DE 19711 Alloway Creek Neck Rd.

Table 1.3-1 (Cont'd)

Sheet	Block	Lot	
11	29	4.01	Eichelberger, Robert K., lac, 2SF, 5ac, QFARM P.O. Box 211 Hancocks Bridge, N.J. 08038; Alloway Creek Neck Rd.
11	29	5	Erdner, Larry, 79.67 ac Rd. 3 Box 292 Holly Lane Woodstown, NJ 08098 Alloway Creek Neck Rd.
11	29	5A	Mahan, Harry L. & Elizabeth M., 2SF, 4.36 ac. Alloway Creek Neck Rd. Hancocks Bridge, NJ 08038 Alloway Creek Neck Rd.
11	29	7	Symes, Harry L., 49 1/2 ac. RD 3 Salem-Pennsville Road Salem, NJ 08079 Alloway Creek Neck Rd. 4
11	29	8A	Parris, George M. Sr. & Betty Lou J., lac., 2SF, 10 1/2 ac., QFARM P.O. Box 51 Hancocks Bridge, NJ 08038 Alloway Creek Neck Rd.
11	29	9	Ridgway, Lucius H. Jr. & Barbara, 1SM, QFARM (10.49ac) P.O. Box 141 Hancocks Bridge, NJ 08038 Alloway Creek Neck Rd.
11	29	9A	Fulcher, Joyce, 1.14ac., 2SF RD 3 Alloway Creek Neck Rd. Hancocks Bridge, NJ 08038 Alloway Creek Neck Rd.
11	29	9C	Wilson, Flora L., 1.17ac, 1SF Alloway Creek Neck Rd. Hancocks Bridge, NJ 08038 Alloway Creek Neck Rd.
11	29	9D	Reid, C. Van Dyke, 1.17ac Rd. 1 East Lake Rd. Woodstown, NJ 08098 Alloway Creek Neck Road

Table 1.3-1 (Cont'd)

Sheet	Block	Lot	
11	29	10	Wood, Richard M. & Florence E., 72.63ac, 2SF RD 3 Box 376 Salem, NJ 08079 Alloway Creek Neck Rd.
11	29	10.01	Finlaw, Charles S. Sr. & E. Susan, 3.25ac., 2SF P.O. Box 202 Hancocks Bridge, NJ 08038 RR Main St. Hancocks Bridge
11	29	11	Ridgway, John P. Jr. & Jean M., 219.91ac RD 3 Hancocks Bridge-Hamersville Road Salem, NJ 08079 Hancocks Bridge-Hamersville Road
15	35	3	Yerkes, Elizabeth H., 2SF, 81.07ac, QFARM P.O. Box 49 Salem, NJ 08079 RR Alloway Creek Neck 15
15	35	4	Hinchman, Richard E. Jr. & Nancy R., 89.75ac Poplar St. Hancocks Bridge, NJ 08038 Alloways Creek Neck Rd. 15
15	35	6	Smith, Edward S. & Phllis G. 1/3, 283ac Sheets, Donald L. 1/3, Sheets, Clayton F. 1/3 RD 3 Salem, NJ 08079 Hope Creek 15
16	36	1	Hinchman, Richard E. Jr. & Nancy R., lac., 2SF, 144.96ac, QFARM Poplar St. Hancocks Bridge, NJ 08038
16	36	1.01	Hinchman, Don L. & Sherri L., 1.15ac, Alloway Creek Neck Rd. Hancocks Bridge, NJ 08038

Table 1.3-1 (Cont'd)

Sheet	Block	Lot	
16	36	5	State of New Jersey, 373ac. Trenton, NJ Alloway Creek Neck Road, RD 16
16	29	1.01	Yerkes, Elizabeth N., QFARM, 88 1/4 ac. P.O. Box 49 Salem, NJ 08079 Alloway Creek Neck Rd. 11
16	29	1	Yerkes, Elizabeth H., lac, 2SB P.O. Box 49 Salem, NJ 08079 Alloway Creek Neck Rd. 11
21	26	3	United States Government, 1722.0 ac. Department of the Army Washington, D.C.
21	26	6	Public Service Electric and Gas Co. (Riparian Grant), 0.64 ac. 80 Park Plaza Newark, N.J. 07101
21	49	1	State of New Jersey, 757.12ac Trenton, NJ 08601 RR Alloway Creek Neck RD 21
21	49	3	Public Service Electric & Gas Co. (Riparian Grant), 0.46 ac. 80 Park Plaza Newark, NJ 07101

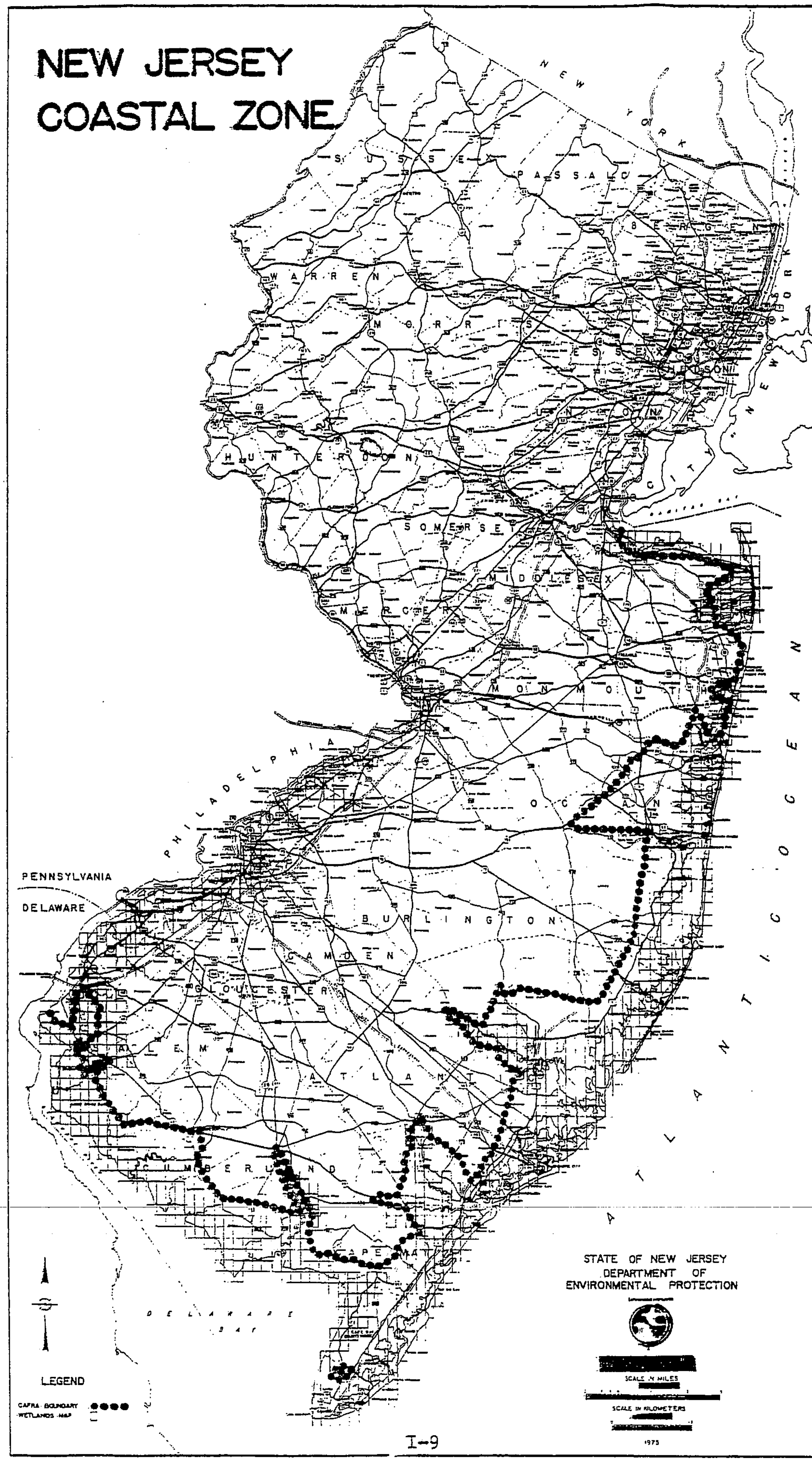
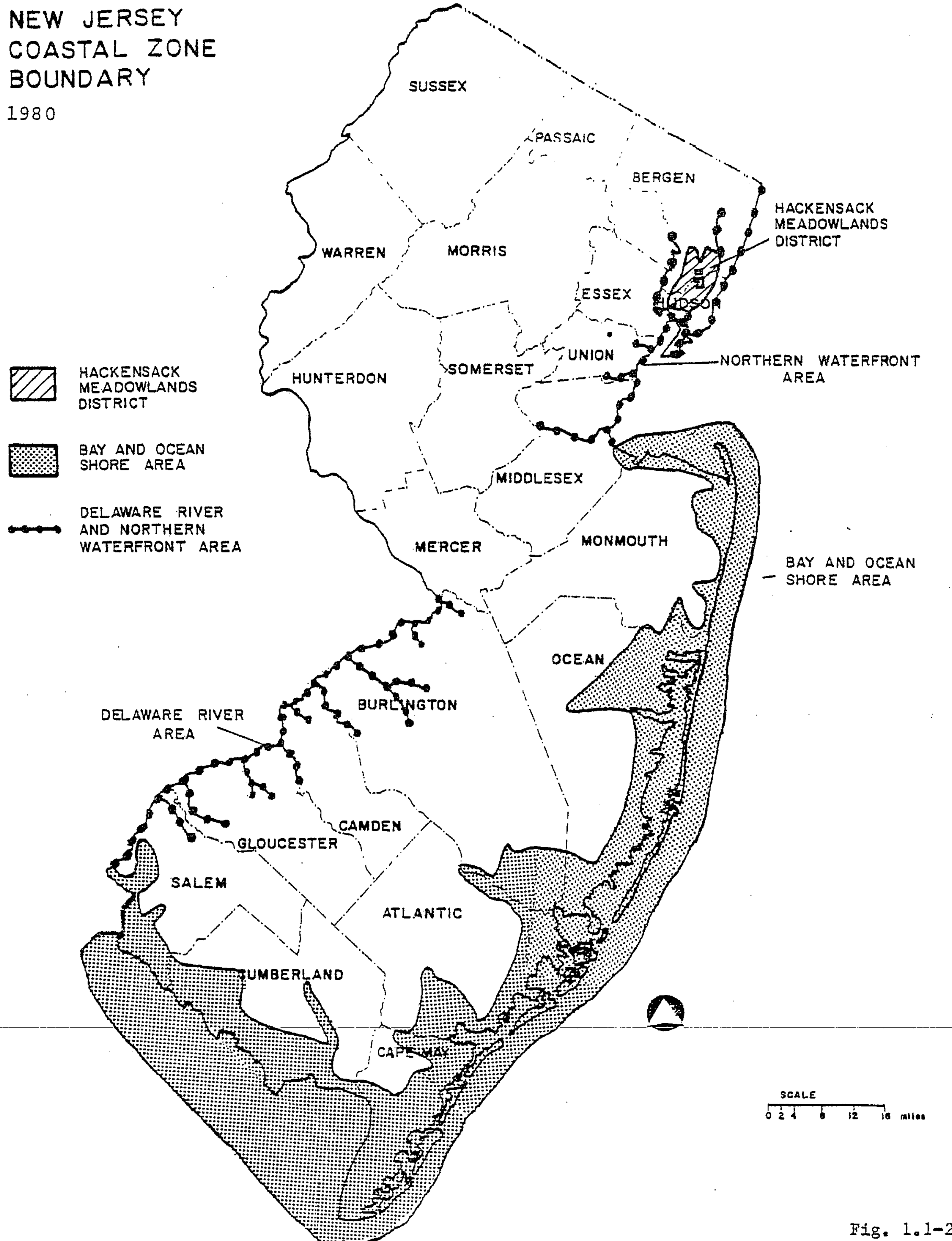
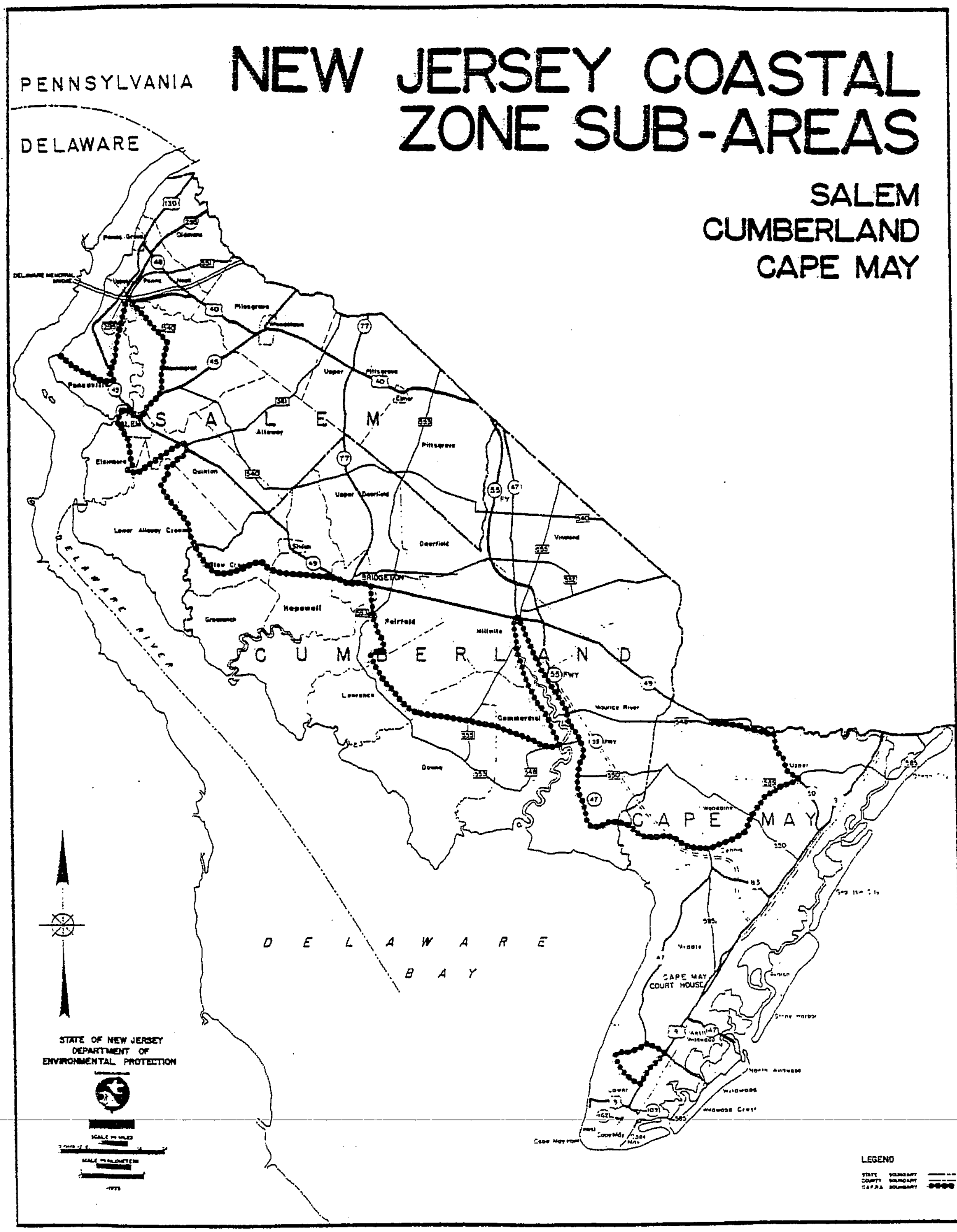

NEW JERSEY
COASTAL ZONE
SUSSEX
PASSAIC
BERGEN
WARREN
MORRIS
ESSEX
HUDSON
UNION
HUNTERDON
SOMERSET
MIDDLESEX
MERCER
MONMOUTH
OCEAN
BURLINGTON
CAMDEN
GLOUCESTER
SALEM
ATLANTIC
CUMBERLAND
CAPE MAY
NEW YORK
PHILADELPHIA
PENNSYLVANIA
DELAWARE
ATLANTIC OCEAN
DELAWARE BAY
STATE OF NEW JERSEY
DEPARTMENT OF
ENVIRONMENTAL PROTECTION
LEGEND
CAFRA BOUNDARY
WETLANDS MAP
SCALE IN MILES
SCALE IN KILOMETERS
1975

Fig. 1.1-1



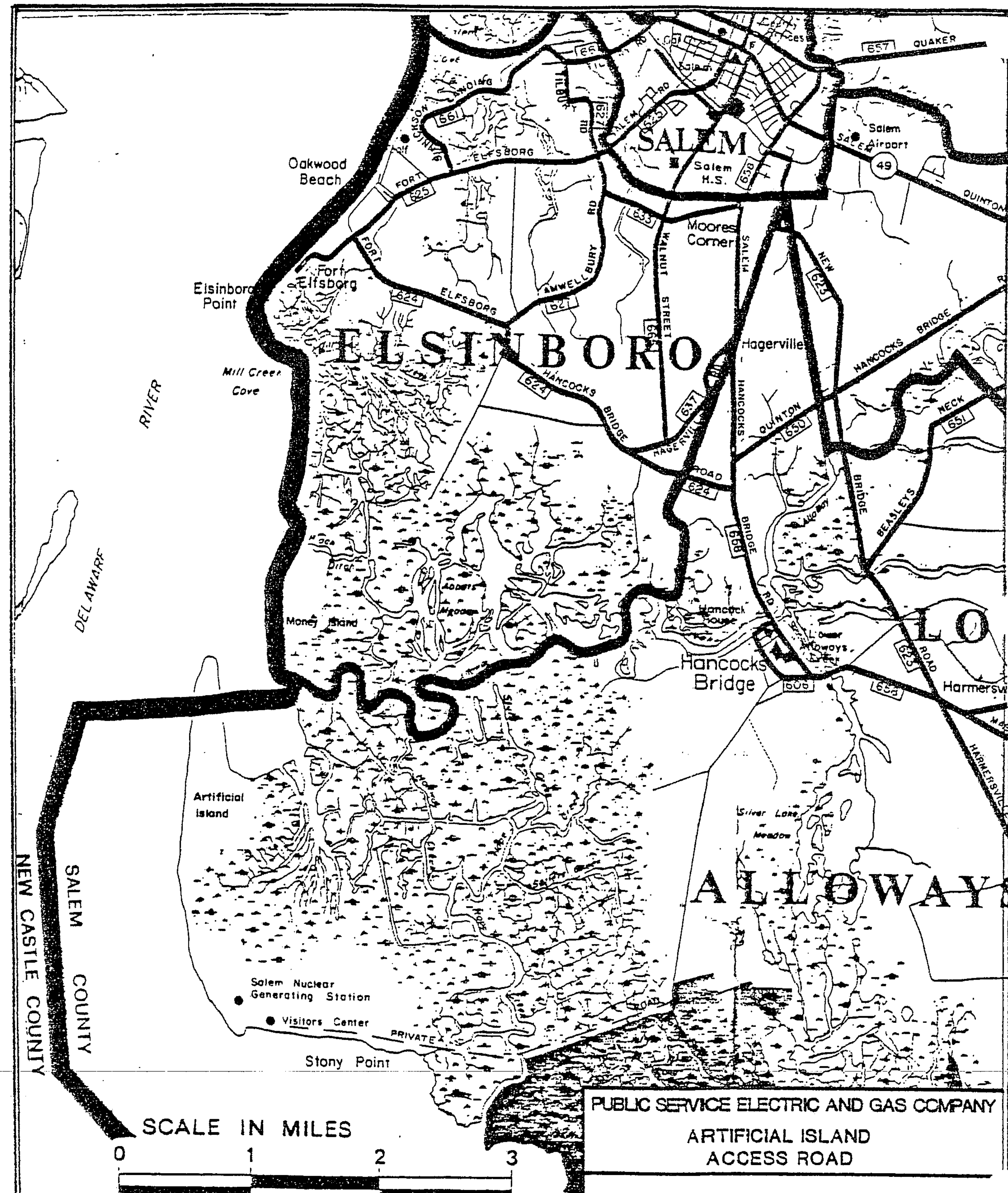
NEW JERSEY
COASTAL ZONE
BOUNDARY
1980
HACKENSACK MEADOWLANDS DISTRICT
BAY AND OCEAN SHORE AREA
DELAWARE RIVER AND NORTHERN WATERFRONT AREA
SUSSEX
PASSAIC
BERGEN
WARREN
MORRIS
ESSEX
HUDSON
UNION
HUNTERDON
SOMERSET
MIDDLESEX
MERCER
MONMOUTH
OCEAN
BURLINGTON
CAMDEN
GLOUCESTER
SALEM
ATLANTIC
CUMBERLAND
CAPE MAY
HACKENSACK MEADOWLANDS DISTRICT
NORTHERN WATERFRONT AREA
BAY AND OCEAN SHORE AREA
DELAWARE RIVER AREA
SCALE
0 2 4 8 12 16 miles

Fig. 1.1-2



NEW JERSEY COASTAL ZONE SUB-AREAS
SALEM
CUMBERLAND
CAPE MAY
PENNSYLVANIA
DELAWARE
S A L E M
C U M B E R L A N D
C A P E M A Y
D E L A W A R E B A Y
DELAWARE RIVER
BRIDGETON
CAPE MAY COURT HOUSE
STATE OF NEW JERSEY
DEPARTMENT OF
ENVIRONMENTAL PROTECTION
LEGEND

Fig. 1.1-3



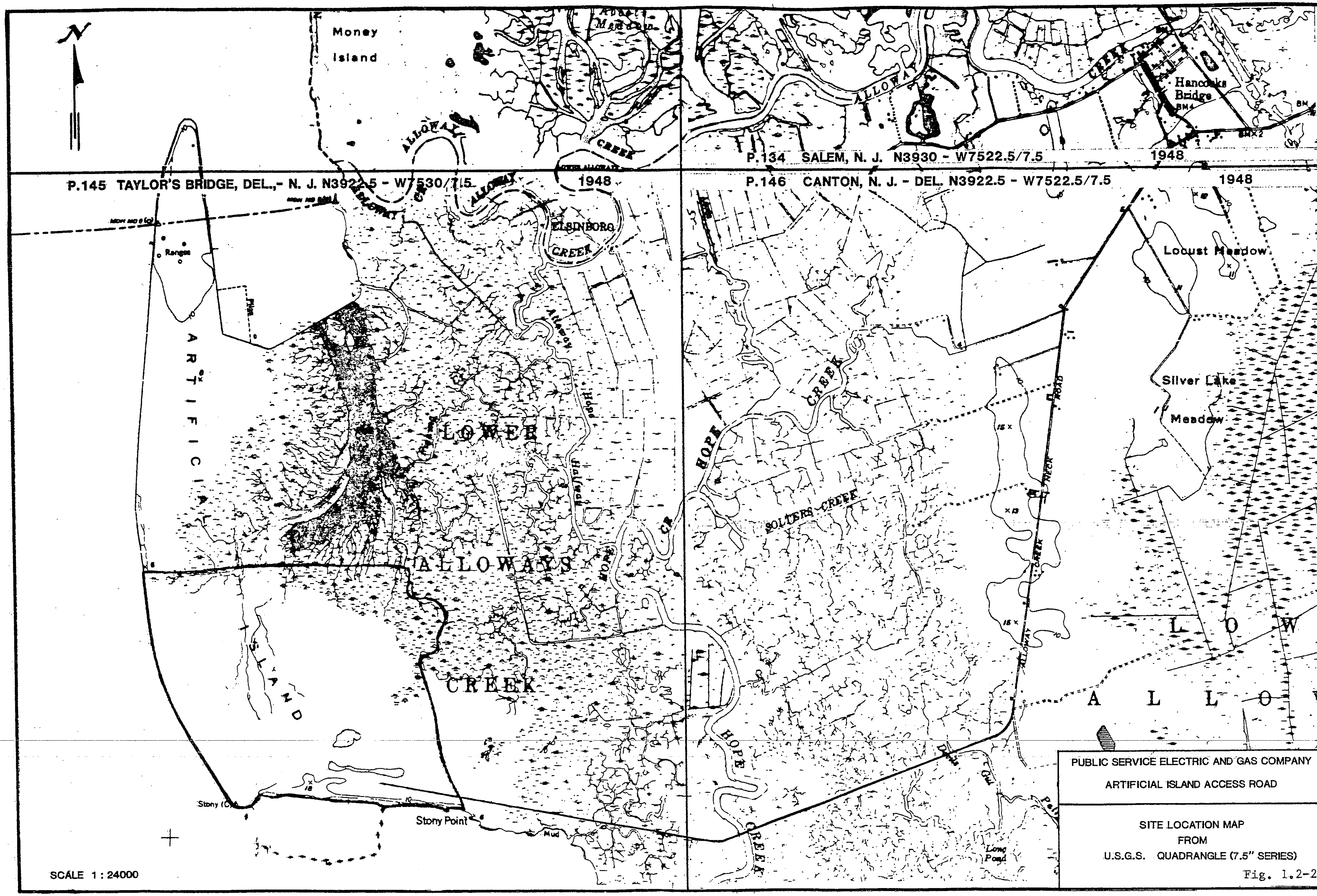
SALEM COUNTY MAP
BOARD OF CHOSEN FREEHOLDERS

PUBLIC SERVICE ELECTRIC AND GAS COMPANY

ARTIFICIAL ISLAND
ACCESS ROAD

SITE LOCATION MAP

Fig. 1.2-1

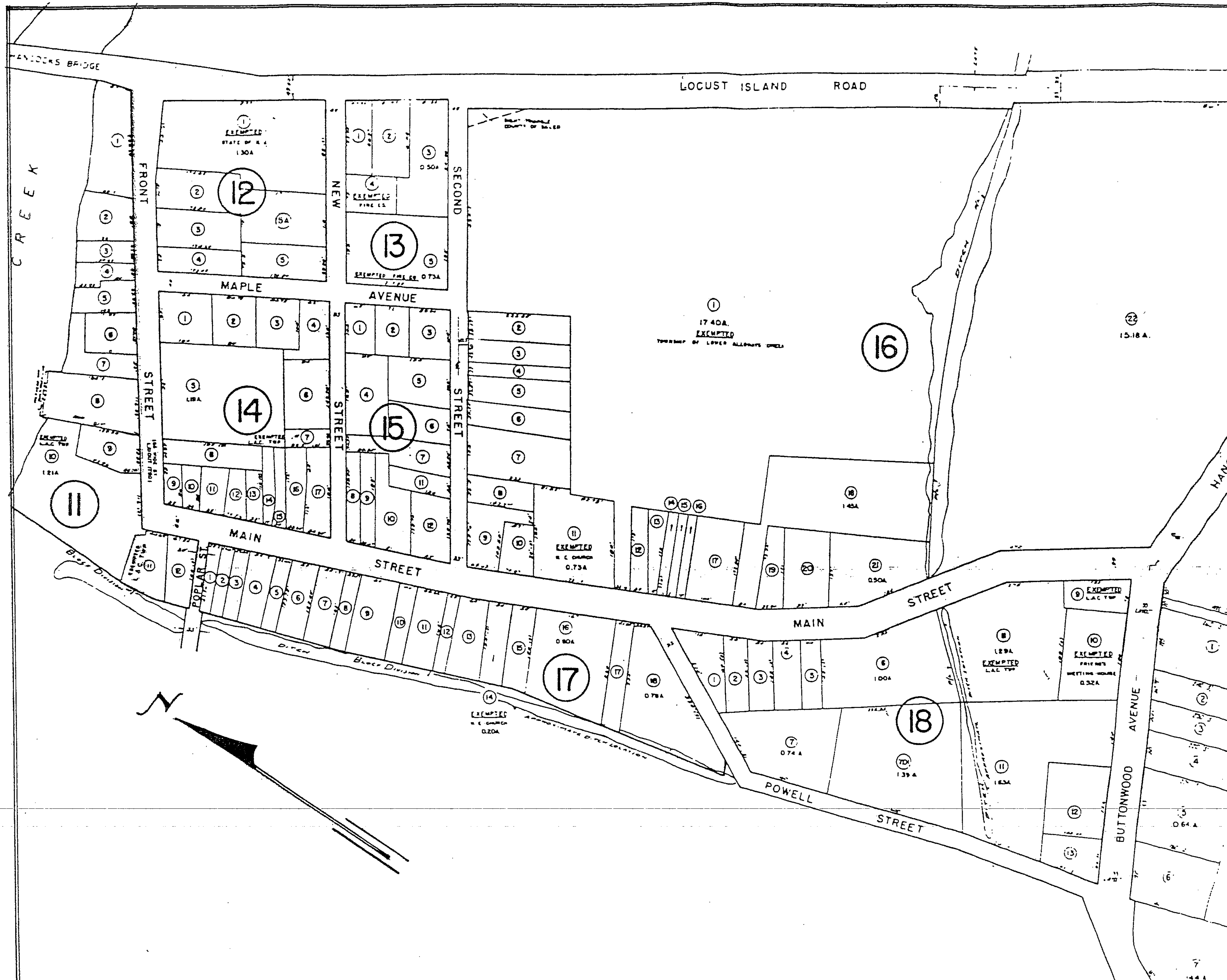


PUBLIC SERVICE ELECTRIC AND GAS COMPANY

ARTIFICIAL ISLAND ACCESS ROAD

SITE LOCATION MAP FROM U.S.G.S. QUADRANGLE (7.5" SERIES)

Fig. 1.2-2



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

LOWER ALLOWAY CREEK TOWNSHIP
TAX MAP (SHEET 5)

SCALE 1" - 200'

Fig. 1.3-1

PUBLIC SERVICE ELECTRIC AND GAS COMPANY

ARTIFICIAL ISLAND

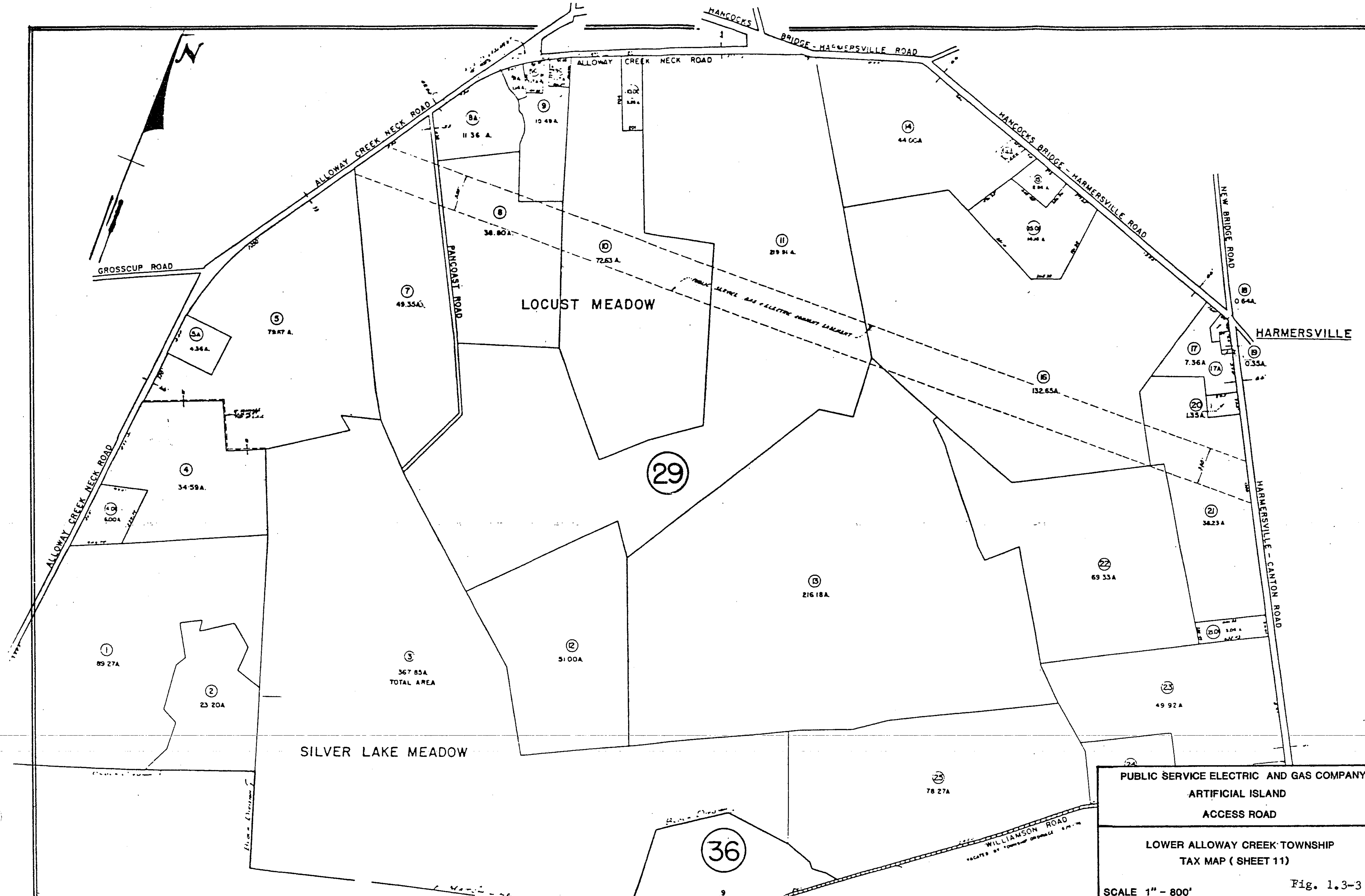
ACCESS ROAD

LOWER ALLOWAY CREEK TOWNSHIP

TAX MAP (SHEET 10)

SCALE 1" – 800'

Fig. 1.3-2

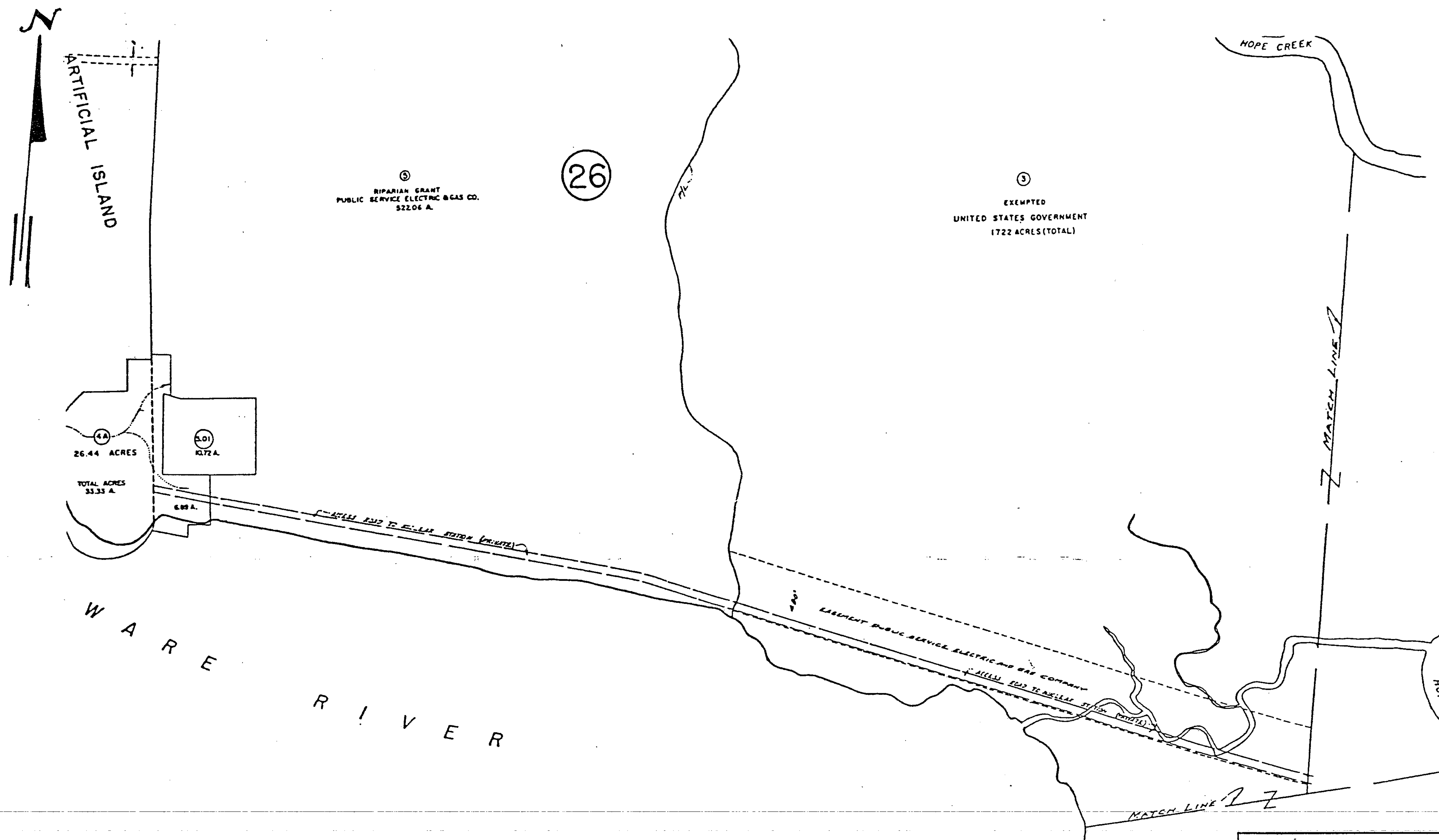


PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

LOWER ALLOWAY CREEK TOWNSHIP
TAX MAP (SHEET 11)

SCALE 1" - 800'

Fig. 1.3-3



PUBLIC SERVICE ELECTRIC AND GAS COMPANY

ARTIFICIAL ISLAND

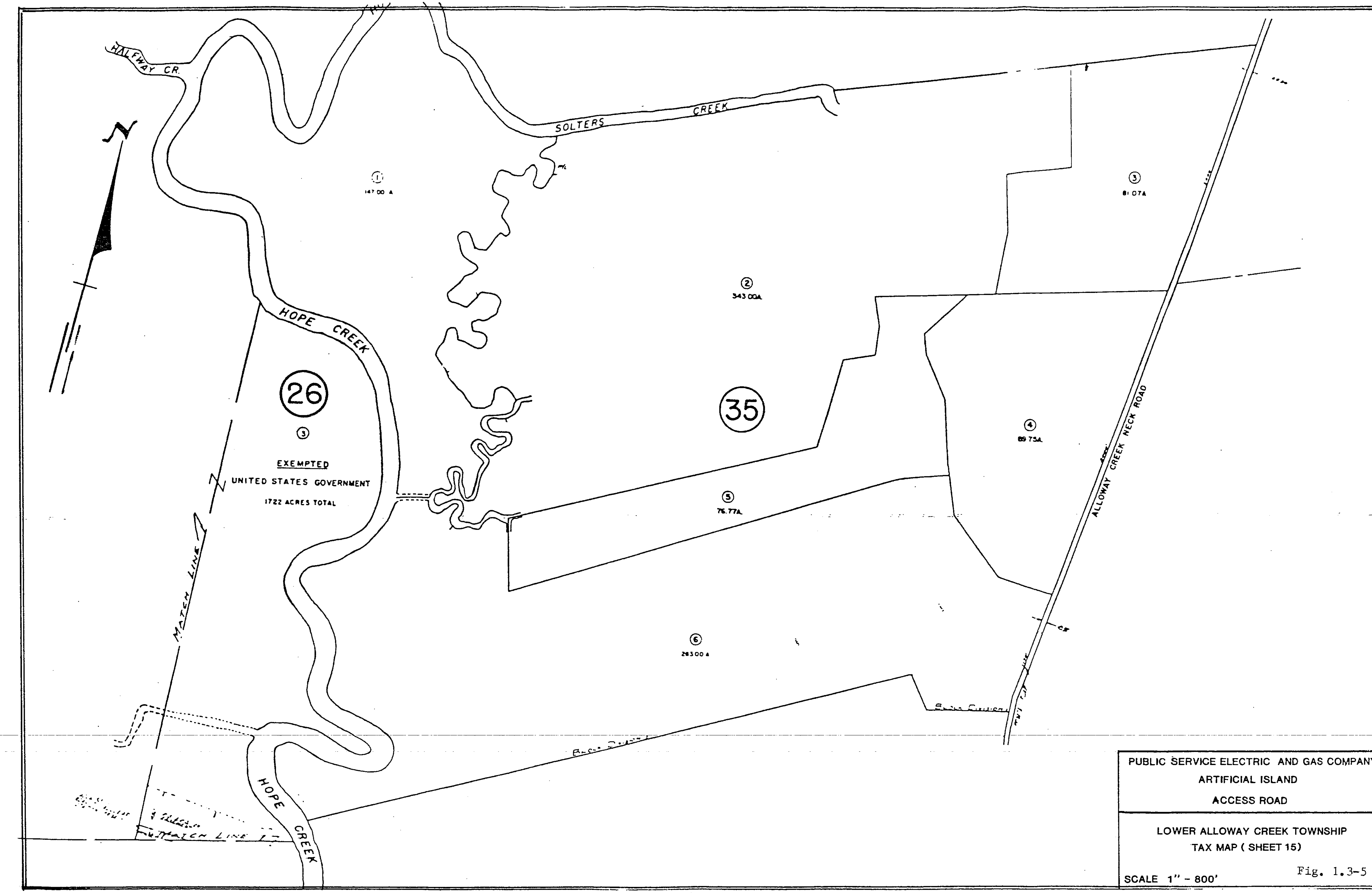
ACCESS ROAD

LOWER ALLOWAY CREEK TOWNSHIP

TAX MAP (SHEET 14)

SCALE 1" – 800'

Fig. 1.3-4

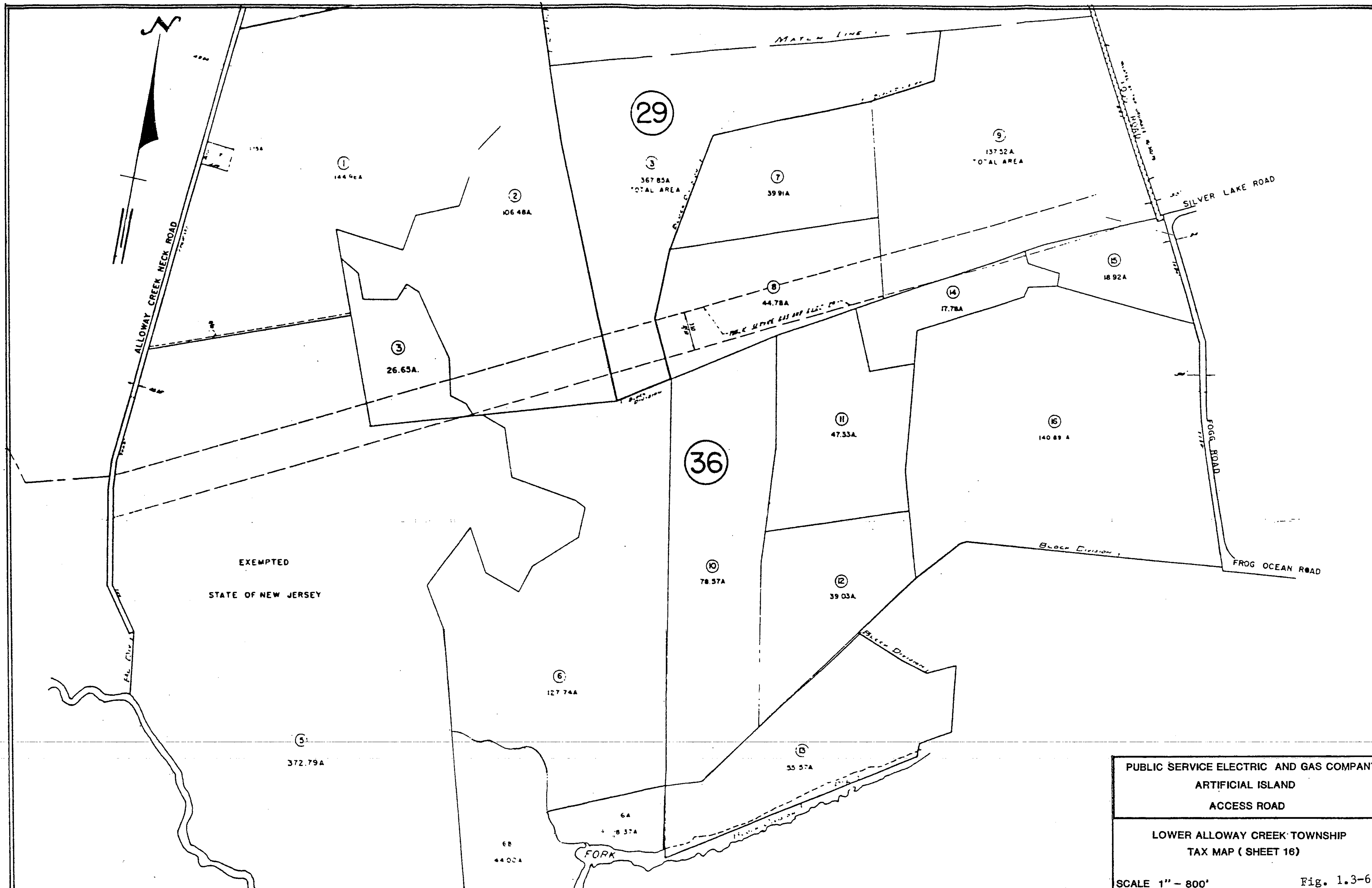


PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

LOWER ALLOWAY CREEK TOWNSHIP
TAX MAP (SHEET 15)

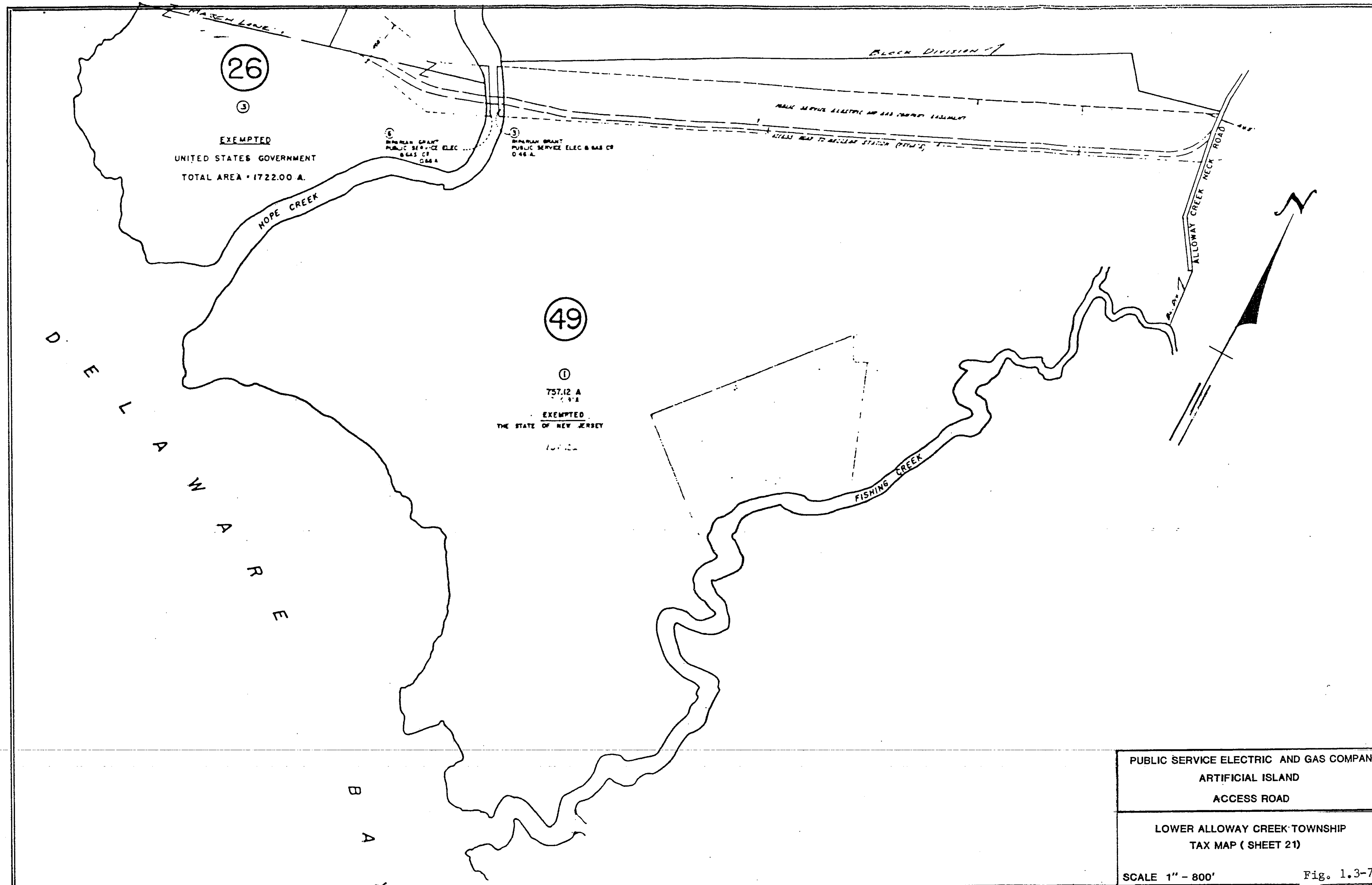
SCALE 1" - 800'

Fig. 1.3-5



MATCH LINE
29
36
ALLOWAY CREEK NECK ROAD
SILVER LAKE ROAD
FOGG ROAD
FROG OCEAN ROAD
EXEMPTED
STATE OF NEW JERSEY
1
2
106.48A
3
26.65A
3
367.85A
TOTAL AREA
7
39.91A
8
44.78A
9
137.52A
TOTAL AREA
14
17.78A
15
18.92A
11
47.33A
16
140.89A
10
78.57A
12
39.03A
6
127.74A
5
372.79A
13
6A
6B
44.00A
FORK
BLOCK DIVISION
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD
LOWER ALLOWAY CREEK TOWNSHIP
TAX MAP (SHEET 16)
SCALE 1" – 800'

Fig. 1.3-6



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

LOWER ALLOWAY CREEK TOWNSHIP
TAX MAP (SHEET 21)

SCALE 1" – 800'

Fig. 1.3-7

2.0 EXISTING SITE DESCRIPTIONS

2.1 General

(a) General topography, natural features, bearings, and distances

The existing roadway site (see Figure 2.1-1) lies on a low-lying coastal plain in New Jersey. The private portion lies in extensive tidal marsh. The public portion lies in an area which traverses agricultural and grazing lands and the outskirts of the Township of Hancocks Bridge. Tidal marshes to the north are extensive and range for several miles. Agricultural and rural residential areas are located to the northeast and east of the roadway.

(b) Existing structures and land uses, including open space, on and within 200 feet of the roadway

The zoning classifications (see Figure 2.1-2) of the site are primarily industrial, agricultural, and rural residential. The area at the end of the access road is used for the operation and maintenance of the Salem Generating Station. The area immediately surrounding the station and along the private roadway is zoned for industrial use and for parks and recreational development. Land use along the private sector of the roadway is agricultural and rural residential.

(c) Existing Easements.

For the private portion of the roadway, Public Service Electric and Gas Company possesses the right to construct, reconstruct, operate and maintain the roadway, bridges, and the transmission lines via the Grant of Easement from the State of New Jersey to Public Service Electric and Gas Company dated November 4, 1971, and a Deed of Easement from the United States of America to Public Service Electric and Gas Company dated April 3, 1968.

The public portion of the roadway is owned by Lower Alloways Creek Township. However, there are two easements which traverse the roadway. Atlantic City Electric Company possesses a 40' easement near the intersection of Locust Island Road and Alloway Creek Neck Road (see Figure 1.3-1). Public Service Electric and Gas Company possesses a 350' easement which traverses the roadway near Pancoast Road (see Figure 1.3-2).

(d) Regulated Wetlands, Publicly Owned Land, Delineated Flood Areas designated on Federal Flood Insurance Map

The entire roadway lies in the CAFRA boundary as delineated in N.J.S.A. 13:19-1 et seq. enacted June 20, 1973. The proposed roadway widening will fill about 7.7 acres of coastal wetlands as pictured in Figures 2.1-3 through 2.1-13. The publicly owned lands are mapped on the previously introduced tax maps. The flood areas, as delineated by FEMA and currently adopted by Lower Alloways Creek Township, are mapped on Figures 2.1-14 through 2.1-21.

(e) Land Use Within 200' of Site (Ref. 2.1-1)

The existing roadway is surrounded by wetlands for 70% of its length. The northernmost segment is bounded by agricultural uses and the project terminates at Hancock's Bridge Road where residential uses predominate. Approximately nine residences occur along Alloway Creek Neck Road. Most of these are farms, with residential structures on the eastern side of the road.

2.2 Existing Regional Conditions

The proposed roadway widening is needed to alleviate existing traffic hazards, traffic congestion, and potential air quality impacts. Alloway Creek Neck Road and the private road extension is the only road access to Artificial Island. The number of workers at the site has increased. Approximately two thousand persons work on site during outages. In addition, substantial truck deliveries are made as well as travel by the general public to the visitor center.

The areas to be affected by the proposed project are the land and residences adjacent to the roadway and intersection.

2.3 Geology and Soils

2.3.1 Geology

The Artificial Island access road and Alloway Creek Neck Road (public road) are located within the Chesapeake - Delaware Embayment on the Inner Atlantic Coastal Plain physiographic province, about 20 miles southeast of the Fall Zone.

This zone defines the contact between the unconsolidated sediments of the Coastal Plain and the Metamorphic-igneous rock complex of the Appalachian Highlands. The Coastal Plain is underlain by a stratigraphic sequence of interbedded sands, silts, and clays, which generally dip toward the southeast. The surface of the crystalline bedrock is between 1500 and 2000 feet below the road site. A generalized geological cross section of the site, based on soil borings taken at Artificial Island is shown in Figure 2.3-1.

The topography in the immediate vicinity of the site is generally flat, with elevations less than 50 feet above sea level. The Delaware River estuary lies immediately west and south of the road site.

The Coastal Plain sediments, which overlie the basement rocks, consist of a non-marine sequence of Lower Cretaceous strata and Upper Cretaceous-Tertiary marine deposits.

The non-marine deposits (Potomac Group) lie unconformably over the basement rocks and include discontinuous beds of sand, clay, and silt deposited as fluvial and detrital sediments. The Upper Cretaceous marine sediments consist of micaceous clays and calcareous, galuconitic and quartizitic sands. The formations are listed below in a chronological sequence:

1. Magothy -white to buff, fine to coarse quartz sand.

2. Merchantville -dark green clay and dark brown silt.

3. Englishtown - Woodbury - gray-black clayey silt, few fine shell fragments.

4. Wenonah - Marshalltown - dark green to black clayey sand.

5. Mount Laurel - brownish gray to dark green quartz and feldspar sand.

6. Navesink - dark green to greenish black glauconite sand.

Three formations of Tertiary age are present in the area. The lower Tertiary Hornerstown Formation lies unconformably on the Navesink and consists of olive green to green quartz and glauconite sand. This formation grades into the overlying Vincentown sands which consists of gray-green fine shell and quartz sand. The miocene Kirkwood clay overlies the calcareous Vincentown Sands.

Along the length of the road the quarternary deposits are quite variable. At Artificial Island there exists hydraulic fill overlying Pliestocene sand and gravel (river bottom sands), which overlie the pre-quarternary Kirkwood clays.

Proceeding away from the Island, tidal marsh deposits overlie the river-bottom-sands. Along the site's public portion, Alloway Creek Neck Road, the quarternary deposits consist of alluvial and marine deposits of sands, silts, and clays, which are underlain by the pre-quarternary Kirkwood Formation.

Details of the near surface and surface quarternary soils are described in the following Section 2.3.2.

2.3.2 Surface Soils

(a) Agricultural Characteristics

Surface soils on Artificial Island are hydraulic fill (composed of clay, silt, sand and gravel with some organic material) disposed of by the U.S. Army Corps of Engineers during the first half of this century. This dredged material, which is 25 to 30 feet thick, covers a 5 to 10 foot base of coarse sand and gravel (river bottom). No new dredge material has been deposited at this site for at least 15 years.

The soil type found along the length of the Artificial Island Access Road, as defined by the General Soil Map of Salem County (U.S. Department of Agriculture-Soil Conservation Service with the New Jersey Agricultural Experiment Station), is "Tidal Marsh - Made Land Association" (Ref. 2.3-1). By definition these soils are primarily organic silts and are subject to daily flooding.

Proceeding east, away from the island, the soil type changes from hydraulic fill to tidal marsh. The access road then turns north and encounters a variety of soil types, consisting primarily of mattapeake silt loam, mattapex silt loam, othello silt loam and woodstown sandy loam. To a lesser extent, the road traverses regions of Fallsington sandy loam, the Fallsington-Pocomoke-Beeryland complex, some "muck" and Woodstown-Dragston sandy loam. The pertinent characteristics of each soil type are presented in Table 2.3-1.

Trafficability (dust hazard) classifications are not provided in the Salem County USDA-SCS Soil Survey. However, the texture of the surficial soils do give some indication of potential dust problems that may arise during the construction phase of the project. USDA texture classifications are given in Table 2.3-1.

The soil erosion and sediment control plan that will be employed to minimize construction impact on soil loss and dust hazard is described in Section 3.6.

(b) Engineering Classification and Design Characteristics

Borings were recently taken along both the private and public portions of the access road. Figure 2.3-2 reflects the approximate locations of borings obtained from the private sector. The appropriate borings are also included (Appendix 2.3-1).

Those samples taken from marsh areas indicate that organic silt deposits range from 10 to 15 feet in depth. As shown in the actual borings, the proposed road will also encounter lenses of pure silt and sand.

Borings taken along the public road reveal that, in general, there are 4 to 15 feet of recent alluvial deposits. These consist of alternating layers of yellow or molted yellow-gray silty clay or fine sand, with the silty clay soils being predominant. Boring locations are provided in Figure 2.3-3.

On the basis of the soil samples described above, the following engineering classification and design limitation analysis is provided:

There are 3 general types of surface soils encountered along the length of the road: hydraulic fill, tidal marsh and alluvial deposits.

The hydraulic fill is so variable that a generalized engineering classification is not appropriate. Using the unfilled classification system (UCS) this material could be OL, SP, ML, or MLT material, in discontinuous lenses of variable thickness.

For road construction the hydraulic fill provides a fair to poor foundation. It has poor pavement support characteristics and provides fair embankment support. Significant surface treatment is normally required for direct pavement. Embankments in the range of 5 to 10 feet in height would have no stability problems, but significant settlement could occur.

The tidal marsh soils could be classified under UCS as OL or PT soils, depending on the silt content. Material consisting mostly of organic matter would be a PT (pert) soil. A significant amount of silt would make the material an OL (oganic silt, low plasticity) soil. This soil type is considered one of the most difficult from an engineering standpoint. It has extremely poor engineering properties, often requiring costly measures to be taken for road construction. Berm construction is typically used to control "mud-wave" stability problems. Settlement usually continues in the form of "creep" long after construction on this type of soil.

Material found along the public road, as described earlier, would consist of alluvial deposits with interbedded lenses of clay, silt, and sand. Thus, a general UCS classification is not appropriate. The lenses could be CL, MH, SP, or SM soils.

Surface preparation would be required for direct pavement on the alluvial soils. This would be in the form of excavation of approximately 2 feet of material and backfilling with select borrow material. Embankments from 20 to 30 feet in height would not be expected to present stability problems, but allowance for settlement would have to be incorporated into road design.

2.4 Hydrology

(a) Surface Water

The Artificial Island Access Road is located on the east shore of the Estuarian Zone of the Delaware River. The Delaware River Basin Commission (Ref. 2.4-1) has defined three major components of the Estuary System. These are (1) Delaware Bay; (2) Delaware Estuary; and (3) Delaware River. Delaware Bay is legally defined as including the waters between the mouth of Delaware Bay (Cape May - Cape Henlopen Transect) at river mile 0 and Liston Point, Delaware at river mile 48.2. The Delaware Estuary extends from Liston Point up to the head of tide above Trenton at river mile 133.4. The Delaware River extends upstream from the head of tide (river mile 133.4).

The Delaware River Estuary Zone drains a basin of 12,765 square miles which includes parts of Delaware, New Jersey, Pennsylvania, and eight square miles in Maryland. The mean annual precipitation (1921-50) in the basin is 44 inches, with a runoff of 21 inches or 4.7×10^{12} gallons per year.

Tidal flows dominate over fresh water discharges in the estuary portion of the system in which the Artificial Island Access Road is located. In measurements made by the U.S. Geological Survey (Ref. 2.4-2), a peak downstream flow of about 400,000 cfs and a peak upstream flow of about 600,000 cfs at Delaware Memorial Bridge occured while a 1650 cfs mean daily discharge occured at Trenton on the same day.

The maximum recorded discharge of 329,000 cfs occured at Trenton on August 20, 1955, (Ref. 2.4-3). This flow rate is lower than the typical rates of tidal flow at the Delaware Memorial Bridge.

The tide in the Delaware Estuary is semi-diurnal in character. There are two high waters and two low waters in a tidal day with comparatively little diurnal inequality. The mean range of the tide at the estuary mouth is about 4.3 feet and generally increases through the estuary to about 6.7 feet at Trenton (Ref. 2.4-4). The Reedy Point Station is the nearest tide gage station to the Artificial Island Access Road. The tides at the gage have the following characteristics (Ref. 2.4-4 and 2.4-5):

Mean Tide Range = 5.5 ft.

Spring Tide Range = 6.0 feet.

Local Mean Sea Level = 2.8 ft. above Mean Low Water (MLW)

10% Exceedance High Tide = 6.6 ft.

Winds significantly influence the tidal fluctuations in the Delaware Estuary, producing the maximum recorded tidal fluctuations. The highest tide ever recorded occurred as a result of strong easterly winds and reached an elevation of +8.5 feet MSL on November 25, 1950. The lowest tide occurred as a result of north-northwesterly winds blowing downstream and reached a level of -8.6 feet MSL on December 31, 1962. (Ref. 2.4-4).

The Artificial Island Access Road crosses Hope Creek, Devils Gut and other unnamed tidal creeks. Also, there are some drainage ditches installed for mosquito control by a local mosquito control district (Figs. 2.1-3,4). Movement and circulation flow patterns in these waterways are primarily influenced by the oscillatory tidal flow. In the winter, ice forms on these tidal creeks and is broken-up by tidal action. As a result of the ice flows, the applicant has found ice breaker maintenance on the Hope Creek Bridge a necessity.

The upper reaches of Hope Creek, together with tributary Solters Creek, provide adjacent farm land with fresh water drainage. A network of farmer installed ditches drain into these tidal creeks. The lower reach of Hope Creek is a tidal waterway connection (thoroughfare) between Alloways

Creek and Delaware Bay. The lower reach of Hope Creek serves as an access way for human navigation, physical water circulation and tidal flushing-recharging of the estuary system. A cross section profile at the Hope Creek Bridge is shown on Fig. 2.4-1.

Devils Gut, together with other un-named tributaries of Fishing Creek cross under the Artificial Island Access Road through corrugated metal pipes. Fishing Creek enters the Delaware Bay at Stoney Inlet. These creeks provide fresh-water drainage and significant tidal influence to the marshland.

The Artificial Island Access Road area has been mapped "Flood Prone" by the U.S. Department of the Interior (Figures 2.1-14 through 2.1-21). The static elevation of the 100 year tidal-flood event is about 9.0 feet above MSL. In the occurance, the area will be flowed by low velocity flood waters.

(b) Ground Water

The site lies within the Atlantic Coastal Plain, about 20 miles southeast of the fall zone. The coastal plain is underlain with interbedded aquifers and aquicludes of the Cretaceous, Tertiary, and Quaternary Ages. The strata composing these formations generally thicken and dip gently to the southeast. A generalized geological cross section of the site, as shown in Figure 2.3-1, consists (in descending order from the land surface) of approximately 20 feet of organic marsh mat overlying 5 to 10 feet of riverbed sand and gravel. The latter deposit is referred to as the shallow aquifer. Approximately 5 to 25 feet of grayish-brown clay underlies the riverbed sand and gravel. This clay is subdivided into an inorganic Quaternary Age unit and a lower layer of organic clay belonging to the Kirkwood Formation. The Kirkwood clay is underlain by a second aquifer, referred to as the Vincentown Formation, and the upper sands of the Hornerstown Formation. The Vincentown aquifer is also referred to as the deep aquifer even though there are other aquifers at the site which are deeper than the Vincentown aquifer.

The basal sand of the Kirkwood Formation generally consists of 5 to 10 feet of reddish-brown micaceous, fine- to medium-grained sand with varying amounts of silt. The Vincentown Formation consists of greenish-gray, silty fine- to medium-grained glauconitic sand with some highly cemented zones. The bottom of the Vincentown Formation varies from a depth of about 140 to 150 feet below the existing ground surface.

The basal sand of the Kirkwood Formation is in direct hydraulic contact with the underlying sand of the Vincentown Formation. As a result these sand units act as a single aquifer unit. In addition, the upper sands of the Hornerstown Formation are in direct hydraulic connection with the overlying sand of the Vincentown Formation. Therefore, for analytical purposes, the combination of these three sand units is referred to as the Vincentown Aquifer.

The Mount Laurel and Wenonah sands referred to herein as the Mount Laurel-Wenonah aquifer are separated from the overlying Vincetown Formation by a 40 foot thick aquitard consisting of the Hornerstown and Navesink Formations. The Hornerstown and Navesink Formations are dark green, fine- to medium-grain clayed sand. The Mount Laurel Formation, where it was penetrated by the test borings, wells, and water supply wells, consists of greenish-brown, fine to medium-grained sand with varying amounts of silt. The Wenonah sand is mainly composed of fine to course grained quartzose sands of white, yellow-red, rusty brown, and black hues.

Underlying the Mount Laurel-Wenonah aquifer are the Marshalltown formation, Englishtown sand, Woodbury clay, Merchantville clay, and the Raritan and Magothy formations. From this group, only the Raritan and Magothy formations constitute a significant aquifer. The Englishtown is a significant aquifer farther north in the state. The remaining formations are aquitards and aquicludes.

Natural recharge to the shallow aquifer occurs from direct infiltration of precipitation on the outcrop area. Temporary induced recharge also occurs from the Delaware River. Discharge under normal conditions is to the west and southwest toward the Delaware River. Some discharge occurs by leakage to the underlying Vincentown aquifer.

Recharge to the Vincentown aquifer occurs primarily by leakage from the overlying shallow aquifer. Under normal conditions discharge from the Vincentown aquifer is toward the southwest to the Delaware River.

Recharge to the Mount Laurel-Wenonah aquifer normally occurs by leakage from overlying aquifers. Discharge is towards the Delaware River.

Recharge to the Raritan and Magothy aquifers occurs from precipitation in the outcrop area, by induced infiltration from bodies of surface water that lie in their intake areas (mainly the Delaware River), and by leakage through the overlying or underlying aquicludes from the aquifers above or below.

The natural zones of discharge for the Raritan-Magothy are the small streams which cross the high parts of the intake area and the rivers in the low parts such as the Delaware, Raritan, and South Rivers and Raritan Bay.

Nearly all water used for consumption purposes within 25 miles of the site is ground water with the exception of the highly industrialized Wilmington, Delaware area, and major use of water is for domestic and agricultural purposes (Ref. 2.4-8). All domestic water supplies in this region are obtained from wells two inches in diameter and greater than 75 feet in depth. The aquifer commonly utilized in the vicinity of the site is the Mount Laurel - Wenonah Formation. Information pertaining to these domestic wells is presented in Table 2.4-1.

2.5 Vegetation

Vegetation studies were conducted from 1972 through 1974 to determine distribution and relative abundance of vascular plants in the region of Artificial Island. An update and verification of the roadside vegetation was performed in July, 1982. An extensive survey of the wetlands was conducted in September, 1982 (Appendix 2.5-1). Three major habitat types occur along the existing roadway, tidal marsh, upland woodlands, and fields.

(a) Tidal Marsh

Three different tidal marsh associates occur along the existing roadways; brackish low marsh, brackish high marsh, and reed grass. In many areas, the distinction is not clear resulting in a combination of species belonging to the different associations. A detailed account of the marsh north of the existing road is given in Appendix 2.5-1. A general description of the marsh follows.

Immediately along the existing roadway is a species combination more typical of uplands being dominated by reed grass, *Phragmites communis*. The species observed within 80 feet of the roadway are listed in Table 2.5-1. As shown, many of the species are introduced while others are not marshland types. The drier roadway bank provides soils and conditions more typical of upland areas.

Brackish Low Marsh

This species association is generally located between Hope Creek and the eastern edge of the marsh along both sides of the road (Figure 2.5-1). Saltmarsh cordgrass, Spartina alterniflora, dominates, usually comprising over 50 percent of the area. Saltmarsh cordgrass in the brackish low marsh usually grow from 0.9 - 1.5 meters in height.

Associated species that commonly occur in the low marsh of the study area include saltmeadow cordgrass, Spartina patens; salt grass, Distichlis spicata; big cordgrass, Spartina cynosuroides; bulrushes, Scirpus spp., including S. acutus, validus, robustus, and americanus; reed grass; and tidemarsh waterhemp, Amaranthus cannabinus. Actual percent composition varies with salinity and elevation. Marsh elder, Iva frutescens, and groundsel-bush, Baccharis halimifolia, are found locally on hummocks. Low marsh in fresher water will contain cattail and arrow-arum.

Brackish High Marsh

High marsh, or salt meadow, occurs from about mean high tide to the limit of spring tides. Thus, it is flooded only during spring tides or by storm tides. Vegetation is generally much shorter than in low marsh and has a matted swirled appearance. High marsh is characterized by two codominant species, saltmeadow cordgrass and salt grass. Salt grass occurs predominantly at the lower elevations, and reaches a height of about 36 cm in the study area. Saltmeadow cordgrass reaches a height of around 25 cm. Productivity is lower than in low marsh. The dominant species are less robust since they do not receive the twice daily tidal flushing with its fresh supply of nutrients.

More species are associated with high marsh than with low marsh. Common associates, i.e., characteristic subdominants, in the study area include dwarf spikerush, Eleocharis parvula; Olney's threesquare, Scirpus olneyi; and orach, Atriplex patula.

Reed Grass

Reed grass (Phragmites australis, formerly P. communis) is a relatively recent but successful invader in the Delaware Estuary. Near the access road, reed grass is common on fill or disturbed areas. In the study area, it occurs as large continuous stands, scattered small stands in other marsh types, narrow stands lining creek banks, and large stands mixed with saltmarsh cordgrass (Figure 2.5-1). Many stands of more desirable species, such as saltmarsh cordgrass, have been replaced in the study area by reed grass. Growth is rapid and the plant spreads quickly by vegetative reproduction.

(b) Upland Areas

Two major vegetation types are present along Alloway Creek Neck Road; agricultural fields and woodlands. Between these vegetation types, there are hedgerows and roadside vegetation associations. Descriptions of these areas follow below.

Upland Woods

There are four areas of woodland along Alloway Creek Neck Road. Three of these are small and more or less disturbed by roadside fill or intrusion of species from adjacent fields. One is more natural coastal plain forest. This is dominated by oaks (Quercus marilandica, Q. falcata, Q. palustris), sweet gum (Liquidambar styraciflua), sour gum (Nyssa sylvatica), and pignut hickory (Carya glabra). Shrubs and vines are common along the edges of the woodland, but are not abundant in the interior of woods. Herbs are similarly distributed, with grasses (Anthoxanthum odoratum, Muhlenbergia sp., Panicum spp.) and rough goldenrod (Solidago rugosa) in patches in the interior. Some areas appear to be flooded in early spring. The more disturbed forests are dominated by sweet gum, sour gum, and red maple (Acer rubrum). Oaks are uncommon. Shrubs (Viburnum dentatum, Rhus copallina) and vines (Rhus radicans, Lonicera japonica) are most important in these disturbed forests. Ground cover consists of tree seedlings, vines, and scattered herbs, with the majority of herbs at the woodland edges. Additional species encountered in woodlands are listed in Table 2.5-2.

Hedgerows

Hedgegrows bordering fields are much like the more disturbed forests, with trees of wild black cherry (Prunus serotina), sweet gum, black willow (Salix nigra), and persimmon (Diospyros virginiana). Vines are the most conspicuous element of hedgerow vegetation, especially Japanese honeysuckle (Lonicera japonica), poison ivy (Rhus radicans), and trumpet-creeper (Campsis radicans).

Roadsides

Roadside vegetation in upland areas is dominated by annual and perennial grasses and forbs (Table 2.5-2). Many of these are introduced species, and most are widespread in such habitats. In wetter areas, such as along ditches or creeks, roadside vegetation is dominated by reed grass. Other ditch plants included dock (Rumex sp.), arrow arum (Peltandra virginica), sedge (Carex spp.), rush (Juncus sp.), and grasses.

Agricultural Fields

The largest upland area is occupied by agricultural fields. These contain no natural vegetation and were not extensively surveyed. Agricultural fields are bordered by roadside vegetation (some of which may extend into the field if it is fallow) and hedgegrows.

(c) Endangered and Threatened Species

No Federally endangered or threatened species were observed along the roadway during the site visit. New Jersey has not included plants on its Endangered Species list. Species listed by Snyder and Vivian (1981) were not observed. Some plants were only identified down to genus so potentially may be on the Snyder and Vivian list.

2.6 Fish, Shellfish, and Wildlife

2.6.1 Fish and Shellfish

(a) Invertebrate Taxa Possible in Tidal Creeks

Plankton samples were not collected specifically in the tidal creeks which pass under the existing roadway, but extensive studies were performed nearby. This data is used to estimate the probable species present in the tidal creeks. Information on 20 taxa which were abundant in the Delaware River is presented below in phylogenetic order. (Ref. 2.6-1)

Rotifers were dominant members of the zooplankton community. They serve as an important food source for larval and juvenile fishes. Rotifers were present throughout the year with peak abundance from January to June. When abundant they comprised between 28 to 47 percent of the microzooplankton samples.

Polychaeta or bristleworms were present in the planktonic and benthic communities. The eggs and larvae serve as food for fishes. Adults are present in the benthos functioning as deposit feeders. The taxa was present in the benthos samples throughout the year. Two species, Scolecolepides viridis and Polydora sp. were predominant. S. viridis was common in the entire bay with clay substrate having the highest density. Polydora is found along the entire Atlantic coast. Polydora sp. prefers a mud-clay substrate. The species was sporadically abundant during various months.

Oligochaeta, aquatic earthworms, are benthic organisms which feed as detritivores. They occurred throughout the year and comprised up to 54 percent of the benthos samples. Paranais litoralis was the most abundant oligochaete, occuring in highest densities in the mud substrate.

Gastropods, or snails, were rare as adults near the site. Veliger larvae were seasonally abundant, peaking in July and August. The mudflats, tidal creeks, and marshes are probably supporting many adults.

Copepods are primary consumers and detritivores. They are an important food source to many fishes and invertebrates. Copepods occurred near the site throughout the year with peak abundance between March and November. Two species, Eurytemora affinis and Acartia tonsa, are common. E. affinis was collected generally during spring and fall at salinities between 0 and 14 ppt. A. tonsa was abundant from June to September at salinities from 0 to 14 ppt. A. tonsa is utilized as a food source to several fish species.

Cirripedia, or barnacles, are sessile filter feeders. Barnacles occurred throughout the year with peak densities in June and July. Barnacle larvae were most abundant between May and September. Balanus improvisus was the only species collected.

Mysids, shrimp-like crustaceans, are omnivores in the plankton. They were most abundant between June and November in the plankton samples. Neomysis americana was the most common species, especially in deeper estuarine waters. N. americana occurred in all months with highest densities in the summer and is an important food source for many fishes and invertebrates.

Isopods are omnivorous scavengers which occurred throughout the year. Peak densities were between May and October. Edotea trileba and Cyathura polita were dominant species. E. triloba was found in great abundance near Sunken Ship Cove, probably related to the wooden barges sunk there. Peak densities of this species occurred during August and September. C. polita is found from the Gulf of Mexico to

Maine. Like E. triloba the greatest density of C. polita was during August and September.

Amphipods aid in the breakdown of detritus and serve as food for many fishes. Gammarus spp. and Corophium lacustre are the two dominant amphipods taxa. The Gammarus spp., or scud, group is composed of G. daiberi, G. tigrinus, and G. fasciatus. Gammarus spp. are more common in low salinities and were present in greater density from April through September. C. lacustre is a tube dwelling amphipod common in hard substrate.

Carideans, or shrimp, are predators, scavengers, and prey for fishes. Palaemonetes pugio and Crangon septemspinosa were the only two carideans collected. P. pugio, grass shrimp, was collected from May through December. It was most abundant in drainage ditches and near structures. C. septemspinosa, sand shrimp, is a bottom dweller. This species was more common in higher salinity parts of the bay and was collected from February through December.

Brachyurans, true crabs, are important scavengers, predators, and food for fishes, birds, and mammals. Three species, Rhithropanopeus harrisii, Uca minax, and Callinectes sapidus were the dominant brackyurans. R. harrisii, brackish water mud crab, is common along east coast estuaries.

R. harrisii adults and larvae were found in the low saline region, 3 to 10 ppt. Larvae were present from June through August. Adults prefer substrate such as jetties, gravel, and rocky intertidal beaches which provide shelter. U. minax, the red-jointed fiddler crab, is common to low salinity salt marshes. Adults burrow in colonies in association with cord grass. Larvae peaked in density during June and July. C. sapidus, blue crab, was common throughout the entire estuary. C. sapidus begins to appear near the site in mid-March and peak during June and September. C. sapidus are omnivorous and frequently feed on Spartina spp. The low saline portions are utilized for mating and juvenile development. Deeper more saline sections serve as overwintering areas. A commercial industry for blue crab is present near Artificial Island.

(b) Tidal Creek Fishes

As part of the Artificial Island ecological studies various tidal creeks were sampled for fish by using both trawl and seine. Tidal creek sampling was performed in varying degrees of intensity between 1969 and 1977. Hope Creek was sampled by trawl during most of the years. Trawling is not effective for obtaining a truly representative estimate of tidal creek species so seining results from nearby Alloways Creek were added. A seining station in Alloways Creek which was similar to Hope Creek was selected. Since Hope Creek and Alloway's Creek are connected, species composition should be very similiar. (Figure 2.6-1)

Forty-one species of fish were taken in the trawl and seine programs (Table 2.6-1). Three species, American eel, Atlantic menhaden, and bay anchovy were taken in all years sampled. Blueback herring, white catfish, brown catfish, mummichog, Atlantic silverside, and white perch were taken in the most years.

No species caught is on the state or federal endangered or threatened species lists. Most ot the species are abundant in the adjacent Delaware Bay and the tidal creeks entering it. Studies in tidal creeks across the Delaware River have almost identical species composition.

The proposed additional road lane will cross several small unnamed tidal creeks in addition to Hope Creek. All of the creeks are brackish and interconnected with Hope Creek. It is expected that the large amount of interconnecting tidal creeks results in a similarity between their fish species.

(c) Food of Selected Fish

During 1974 a study was performed to determine food habits of three Delaware estuarine fish species; white perch, weakfish, and bay anchovy. All three fish species are present in Hope Creek with bay anchovy being a dominant species. A combined prey listing for all three species is given in Table 2.6-2. All of the examined fish came from the Delaware River but the prey species are probably present in the tidal creeks.

Dominant prey species were similiar for each fish. Bay anchovy, 303 examined, utilized 5 prey items mainly; *Eurytemora affinis*, *Neomysis americana*, *Bosminia* spp., *Gammarus* spp., and *Corophium* spp. White perch, 222 examined, specialized in *Crangon septemspinosa*, *E. affinis*, *Gammarus* spp. and *N. americana*. Weakfish, 116 examined, consumed bay anchovy in addition to the invertebrates *C. Septemspinosa*, *N. Americana*, and *Gammarus* spp.

2.6.2 Birds

Semi-qualitative bird observations were performed at Artificial Island between 1972 and 1978. The studies varied in depth and purpose but do supply information otherwise not available for the site. Most of the birds in the area are not dependent on the small area proposed to be disturbed but may be observed nearby. A species listing is given in Table 2.6-3 indicating the relative abundance of waterfowl species and osprey. A more comprehensive listing is given in Table 2.6-4 which includes upland species.

The Delaware River is used as a migratory route for many species of birds. The marshland and surrounding agricultural fields provide food, shelter, and nesting areas. Breeding species near the roadway are less in number than the total number that might be observed.

(a) General Composition

One hundred eighty-seven species were recorded from March 1972 through December 1978. Tidal marshes accounted for 29 percent of the observations while open water of the river, upland fields, and woods and brushland accounted for 19, 19, and 33 percent, respectively.

Game birds number 33 species, with 25 being waterfowl. The commonly hunted species were Canada goose, mallard, black duck, and green-winged teal. Duck blinds are common in the adjoining marsh, but are located several hundred yards away from the proposed roadway. Mad Horse Creek Wildlife Refuge is located along the southern section of the existing roadway in the marshland.

Community composition and relative abundance vary greatly by season and are largely a function of migration. Those species which occur throughout the region and utilize more than one habitat type are most abundant. Most of the common year-round species such as the red-winged blackbird, common grackle, starling, and brown-headed cowbird, are more abundant during periods of migration. Species abundant only during migration include mallard, black duck, green-winged teal, pintail, and rusty blackbird. In summer, abundant species are the laughing gull, black-backed gull, cattle egret, barn swallow, robin, and tree swallow. The Canada goose is most abundant from fall through spring.

(b) Waders

Waders (family Aredeidae) include herons, egrets, ibis, and bitterns. These birds occur locally as summer residents, generally wintering south of the Carolinas. This part of the estuary is particularly rich, both in diversity and abundance, due to two large heron rookeries within 16 km of southern Artificial Island, a rookery for nine species of heron, egret, and ibis on northern Pea Patch Island and a great blue heron rookery adjacent to Augustine Creek, Delaware.

Twelve species occurred in the Artificial Island region, with most sightings in June and fewer in July, May, and August. Waders arrived as early as March and stayed as late as October. Some great blue herons remained through the winter or as long as there was open water where they could fish.

The most abundant wader in the region is the cattle egret an Old World species that first occurred in the southern United States in the early forties and has rapidly spread north. It is chiefly a field feeding insectivore; most other herons are piscivorous, feeding in marshes and other water areas. The snowy egret, Leucophoyx thula; black-crowned night heron, Nycticorax nycticorax; great egret, Casmerodius albus; and great blue heron are common in the marshes and along the river. Great blue herons and great egrets are also common at freshwater ponds in the region. Glossy ibis, Plegadis falcinellus, and little blue herons, Florida caerulea, although common nesters on Pea Patch Island (Weise, 1978), were not commonly observed. Although occasionally observed in the salt marsh, the little blue heron appears to prefer freshwater areas where it feeds on invertebrates and amphibians. Small flocks of glossy ibis were frequently observed in flight over the marsh but seldom on the ground. They feed chiefly on marsh invertebrates. The Louisiana heron, Hydranassa tricolor, and the yellow-crowned night heron, Nyctanassa violacra, are uncommon nesters and were infrequently observed. The green heron, Butorides virescens, differs from the others in that it is a solitary nester, with scattered nests occurring in bushes and small trees near water. All waders, especially those less abundant, are more common in late summer after the young leave the nest. They congregate in mixed flocks at clumps of trees in the marsh for several weeks before migrating south.

The American bittern, Botarus lentiginosus, and least bittern, Ixobrychus exilis, have secretive natures, nocturnal habits, and a preference for freshwater marshes, so were seldom observed.

(c) Waterfowl

The most abundant waterfowl was the Canada goose, followed by the black duck, mallard, green-winged teal, and pintail (Table 2.6-3). Less common were the wood duck, scaup, canvasback, blue-winged teal, greater snow goose, and whistling swan. All others occurred infrequently.

Waterfowl (family Anatidae, i.e., ducks, geese, and swans) were the characteristic birds of the Artificial Island region from late fall through early spring. Twenty-seven species were recorded, mostly as transients or winter visitants.

Canada goose occurs in the area from September through June with highest abundance in March and April. Locally, Canada geese prefer rest areas of open water such as the river and mud flats. Marsh creeks are seldom used except by crippled or diseased birds.

Black duck is most abundant north of Long Island. It is one of the latest fall migrants typically arriving slightly later than the mallard. Abundance locally is greatest in December and March during migration.

Mallard is the most abundant North American duck. This species is common at the site during migration and in winter i.e., October through April. The local abundance peaks in March when wintering birds to the south move through the region on their way to breeding grounds in Ontario.

Green-winged teal is a transient species in the area although a few winter locally. Its migration period is between late August and December. Most move through the area from mid-September to mid-November. A large portion of green-winged teal breed north of the agricultural lands of Canada, and thus are not subject to habitat modification locally as other ducks may be.

Pintail is also a transient with only an occasional bird summering or wintering. It is the earliest spring migrant in the area, with peak abundance in February. Typically small flocks of relatively few birds occur in the fall.

(d) Raptors

Seventeen species in the raptor orders were observed within the vicinity of Artificial Island. Few individuals of each species were observed with migration periods and winter being the greatest. Two species, marsh hawk and kestrel, were observed hunting over the upland fields next to the marshes.

Common summer raptors were the turkey vulture and osprey. Both species were rarely observed on the river but were generally common in the marsh and upland. Osprey nest in the area and a detailed account is given below.

Osprey is classified as an endangered species by the New Jersey Department of Environmental Protection. Parallel to the existing roadway is a transmission line for Salem Generating Station, whose transmission towers have been used by osprey as nesting platforms. Since 1974 these towers have been monitored by boat and helicopter. Currently there is one active nest along the roadway which has produced young this year. Three other nests nearby have also produced young and six nests appeared to be active at some point during the breeding season.

Since the construction of the transmission towers, the osprey nests in the vicinity of the site have increased. Total number of nests have progressed from 6 in 1974 to 18 in 1981. Some of the nests are made by juvenile osprey and do not represent active nests. An estimate of active nests has shown an increase from 3 in 1974 to 12 in 1981. It is often difficult to determine if a nest is active from the helicopter since an adult will remain on the nests making it impossible to determine if eggs are present.

(e) Gulls and Terns

Gulls and terns (family Laridae) were the characteristic birds of the River from late spring through early fall. Twelve species were recorded in the Artificial Island region. Gulls occurred throughout the year but were most abundant during migration and as immature summer residents. Laughing gulls, great black-backed gulls, and herring gulls were most abundant, in that order. Most sightings were in August, the month of peak laughing gull and great black-backed gull migration.

Gulls and terns were most commonly observed where perches were abundant, e.g., Hope Creek Jetty, the barges forming Sunken Ship Cove, and the bulkheads along Artificial Island. They are also common at beaches and sand bars exposed at low tide. Gulls range widely through the region, feeding at landfills and freshly plowed fields.

(f) Shorebirds

Shorebirds (several families of the order Charadriiformes) occurred in the Artificial Island region from spring through fall but were most abundant during migration. Sixteen species were identified in the region. Most observations were late in the year beginning with the southerly movement of sandpipers in August. Flocks of 5-30 individuals were commonly observed flying over the river and marsh during this period but the speed of flight and similarity of winter plumage among species generally made attempts at identification impractical.

The killdeer, spotted sandpiper, least sandpiper, and semi-palmated sandpiper, were the most commonly recorded shorebirds on the river. Most were seen on beaches and exposed sand bars, although some were recorded on the barges of Sunken Ship Cove and at Hope Creek Jetty. The greater yellowlegs and willet, were frequently observed in the marsh. The willet is the only shorebird known to breed in the marshes of the study area. The killdeer is a frequent nester in upland fields.

(g) Passerines and Other Birds

An additional 103 bird species were recorded that do not belong to any group discussed above. Most occurred seasonally as rare or occasional summer residents, winter visitants, or transients. Seventy-six species were passerines (order Passeriformes, i.e., perching birds). Most of these were restricted to some major habitat type such as woodland or marsh. The most abundant were the red-winged blackbird, starling, and tree swallow. Swallows occur as migrants and summer residents. Large mixed flocks (to several thousand individuals) of red-winged blackbirds, starlings, brown-headed cowbirds, and common grackles, winter in the region. The double-crested cormorant, a relative of the pelican (Pelicaniiformes), occurred on the river all year, although it was most abundant during spring migration.

(h) Waterfowl Food Habits

From 1974 through 1978 the gullets and stomachs of selected waterfowl hunted or trapped within 20 kilometers of Artificial Island were examined. The contents of 239 stomachs and 77 gullets of 247 waterfowl were analyzed. The sampled individuals included 85 mallards, 84 black ducks, 48 green-winged teal, 19 Canada geese, 3 blue-winged teal, 1 pintail, 2 gadwall, 1 shoveler, and 4 wood ducks. The results are listed in Tables 2.6-5 and 2.6-6.

Plant items were most abundant while animal items contributed only 2 percent of the stomach and 7 percent of the gullet by volume. Seeds of dotted smartweed, saltmarsh cordgrass, and tidemarsh waterhemp occurred in 50 percent of the gullets and 40 percent of the stomachs examined. Other common food items included corn, unidentified bulrushes, twig-rush, wild millet, bayberry, and saltmarsh bulrush.

Canada goose fed entirely on plant material with corn and fall panic grass comprising 88 percent of the volume in gullets. Seventy-nine percent of the mallard gullets contained corn, waterhemp, and dotted smartweed. Seventy-one percent of the green-winged teal gullets were comprised of tidemarsh waterhemp. Dotted smartweed and saltmarsh cordgrass comprised 80 percent of the black ducks gullets.

2.6.3 Mammals

Few mammals inhabit the area to be disturbed by the proposed lane addition. The adjoining marshes and upland fields do support a large variety of mammalian species. As a result of the numerous mammals nearby, many species may be present for short periods while passing through the site. A listing of probable mammalian species is given in Table 2.6-7.

Muskrat is an obvious mammal inhabiting the marsh next to the existing roadway as evidenced by muskrat houses. A commercial trapping effort is present in the marshes for muskrat pelts. Ecologically the muskrat houses provide shelter for other mammals as well as perching sites for birds such as egrets.

No marine mammals have been observed in Hope Creek or Alloways Creek but two hooded seals were sighted several times in Mad Horse Creek and a harbor seal near Artificial Island.

Small mammals were surveyed by trapping in the tidal marsh, upland on Artificial Island, and in the woodlands during

March through November 1972 and April through November 1973. Both mouse and rat traps were used on a monthly or bimonthly schedule. Four marsh sites were sampled with 4,029 trap-nights of effort. The house mouse, Mus musculus, was most frequently captured, followed by the meadow vole, Microtus pennsylvanicus; masked shrew, Sorex cinereus; Norway rat, Rattus norveigicus; and marsh rice rat, Oryzomys palustris.

Four upland stations on Artificial Island, ranging in type from pasture through rush and reed grass, were sampled 2,986 trap-nights. The house mouse was again most frequently captured, followed by the Norway rat, masked shrew, and meadow vole.

Eight stations were sampled 5,642 trap-nights in the woodland east of the junction of Alloway Creek Neck Road and the access road to Artificial Island. The white-footed mouse, Peromyscus leucopus, was most abundant, with the short-tailed shrew, Blarina brevicauda; meadow-jumping mouse, Zapus hudsonius; masked shrew; meadow vole; and house mouse also captured.

2.7 Water Quality

Water quality parameters were collected during the tidal creek trawling and seining programs. Data are presented in Table 2.7-1 covering 1973 and 1974 for Alloway Creek and Hope Creek stations. The measurements are oriented toward the warmer months when trawling and seining were possible.

The important parameters for aquatic life, salinity, water temperature, dissolved oxygen, and Secchi disk reading, were recorded. Salinity ranged from 0.0 to 10 ppt with late July and early August having the highest values. Salinity was higher during 1974 than 1973 but remained relatively fresh during many months.

Temperature measurements ranged from 7.8°C to 28.2°C. Winter temperatures were not recorded but are expected to be near 0.0°C. These temperatures were recorded near the surface so spring water temperatures are high.

Dissolved oxygen was high during all times measured. Percent saturation ranged from about 50% to 100%. Most of the time precent saturation was between 70% and 90%. The high dissolved oxygen is probably a result of the constant mixing due to tidal action.

Secchi disk readings are done during the normal field sampling but their usefulness is questionable in tidal creeks. The Delaware River is turbid in the Artificial Island vicinity but the marshes also add a dark coloration of the water. As shown by the Secchi disk readings, the tidal creeks have a very high light extinction coefficient most of the time. No discernable trend in readings was apparent.

Hope Creek and the smaller guts are classified as TW-1 by the Division of Water Resources. A copy of the water classifications is given in Table 2.7-2. Water in the creeks is not used as a public potable water supply or swimming. The tidal creeks are used for boating, waterfowl hunting, trapping, and crabbing.

2.8 Air Quality

The region of the roadway is part of the Atlantic Coastal Plain consisting of flat low land with relatively uncomplicated topography. The wind patterns are mainly continental in nature.

Climatological data are available for Wilmington, Delaware, which is located about 20 miles north of the site. Table 2.8-1 lists monthly temperatures, precipitation and relative humidity. Summers are warm and winters are mild, (Ref. 2.8-1). Summer maximum average temperatures are near 80 degrees Fahrenheit and the coldest month is January having an average daily temperature of approximately 32 degrees Fahrenheit. The precipitation is about 45 inches in the form of rain, snow, ice storms, thunder storms, and hail. The humidity averages 70% (Ref. 2.8-2).

Air quality data are available for the surrounding region. Table 2.8-2 lists sulfur dioxide, particulates, carbon monoxide, ozone, nitrogen dioxide, and smoke shade from selected New Jersey sampling stations. In general, the air quality is good. However, the carbon monoxide and ozone levels exceed the ambient air quality standards.

2.9 Energy

Electric power for the overhead signal system will be supplied from the existing service of the Atlantic City Electric Company.

2.10 Transportation

The existing transportation system consists of a two lane road, one lane in each direction. This road is used by personnel required to operate, maintain, supervise, and construct at the generating stations.

Table 2.10-1 shows a typical day's traffic pattern on the roadway. During rush hour traffic, undue delays occur and the incidence of roadway hazards increases.

The site is currently staggering work hours to help alleviate the problem. However, the current manpower requirements are approximately 5770 men for the Hope Creek site and 2230 for the Salem site during outage periods. Table 2.10-2 is a breakdown of the current shift times and manpower.

2.11 Historical and Cultural Resources

Salem County's original inhabitants were the Lenni-Lenape Indians. They were a semi-nomadic agrarian people, who were peace loving in nature. As there was no established settlement in the area, traces of their existence are limited to artifacts, burial mounds and trails. It is unlikely that any of these would be found in wetlands, as they would have conducted their agricultural activities on drier ground.

The city of Salem was founded in 1675 by John Fenwick. It was once a bustling port area, whose economy was centered around the Delaware River and farming the fertile land. Caspar Wistak of Philadelphia introduced the first glass works to the area in 1738. This industry continues to be prominent today. Population has not increased at the rate that it has in other New Jersey counties, due in part to the large areas of nondevelopable land. Salem County remains rural in character, with agriculture still the major land use.

The proposed road widening project will terminate at the intersection of Hancocks Bridge Road in Hancocks Bridge. This area was of significance during the Revolutionary War. General "Mad Anthony" Wayne was dispatched to Salem (Fenwick's Colony) to obtain food for the starving Continental Army at Valley Forge. Local residents were extremely generous in supplying the troops with the needed provisions. The British retaliated by sending troops into the Salem County area to quell local resistance. The Tory troops captured a contingent of local patriots and massacred all but two of them in the William Hancock House. (Ref. 2.11-1)

Of historical interest are the twenty-nine remaining Eighteenth Century Flemish Bond brick dwellings and meeting houses with patterned or decorated gable ends. (Ref. 2.11-2) Houses of note in the Hancocks Bridge vicinity are as follows:

Judge William Hancock House
William Tyler House
John Maddox Dunn House
John Oakford House
Sketch-Padgett House
Chambless House

The nearest of these to the project area is the Chambless House, located on the east side of Alloway Creek Neck Road. According to Dave Culver, president of the Salem County Historical Society, this house, built in 1730, is one of the oldest examples of this architectural style. The Hancock House in Hancocks Bridge, which is listed on the National Register of Historic Places is said to have been patterned after the Chambless House.

Pursuant to the National Historic Preservation Act of 1966, the National Park Service annually lists properties on the National Register of Historic Places. Such properties have met the criteria for inclusion and have been adopted to the list by the Advisory Council on Historic Preservation. Additional properties are listed as being eligible for inclusion on the list.

The following properties within 10 miles of the proposed project site in Salem County are listed on the National Register of Historic Places:

1. <u>Alloway Vicinity</u>

   Dickinson House - Northeast of Alloway on Brickyard Road.

2. <u>Lower Alloways Creek Township</u>

   William Hancock House - Route 49 (Hancock's Bridge Road) and Front Street

3. <u>Salem and Vicinity</u>

   Salem. MARKET STREET HISTORIC DISTRICT, irregular pattern on both sides of Market Street from Broadway to Fenwick Creek.

   Salem vicinity. FINN'S POINT REAR RANGE LIGHT, northwest of Salem at Fort Mott and Lighthouse Rds.

   Salem vicinity. FORT MOTT AND FINNS POINT NATIONAL CEMETERY DISTRICT, northwest of Salem on Fort Mott Road.

Salem vicinity. HOLMES, BENJAMIN, HOUSE (HOLMELAND), west of Salem on Fort Elfsborg-Hancock's Bridge Road.

Salem vicinity. NICHOLSON, SARAH, AND SAMUEL, HOUSE, 2 miles south of Salem on Amwellbury Road.

Salem vicinity. BRICK, RICHARD, HOUSE, northeast of Salem off NJ 45 on Compromise Rd.

None of the above properties will be impacted by the proposed project.

The National Park Service also maintains the National Natural Landmarks Program whose purpose is to identify and preserve areas that illustrate the ecological and geological character of the United States. There are no natural areas listed for Salem County on the National Registry of Natural Landmarks.

2.12 Aesthetics

The roadway passes through coastal wetlands and agricultural properties. As one leaves the Salem Generating Station site and travels east, one views tidal marsh to the north which is characterized by tall reeds, mosquito control channels and meandering creeks. To the south one finds additional marsh land and sandy shoreline adjacent to the Delaware Bay. After approximately two miles the roadway turns northeast. After an additional one mile, the roadway turns north and joins the public road. One now enters an area of flat agricultural lands which are characterized by well groomed fields with a back drop of tall, hardwood trees which act as wind breaks. Finally, the last half mile is characterized by rural dwellings marking the outskirts of Hancocks Bridge.

For the entire length of the private road, as well as from portions of the public road, the power plant development is visable as are two 500 kV electric transmission lines connecting Salem with load centers to the north.

2.13 Demographic, Social, and Economic Conditions

As shown in Table 2.13-1, most of the land within the three counties surrounding the site is undeveloped (51.8%) or used for agricultural land (36.2%). Developed urban areas constitute about 10% of the available land.

The population in the surrounding communities is relatively small as shown in Table 2.13-2. The number of employed in Salem County is approximately 16,223 per week with an annual payroll of approximately $16,621 per person. (Ref. 2.13-1)

According to the New Jersey Department of Labor and Industry, there were approximately 600 people employed in the

Township of Lower Alloways Creek in 1976, excluding government workers. This represented an increase of 329 employees, or 121.4 percent over the estimated number of employees in 1975. This 1975-6 increase was largely due to the completion of the first of two new nuclear generating facilities. (Ref. 2.13-2)

The Salem Generating Station is a major employer in the area. The existing generating station employs about 400 permanent employees plus an additional 1800 temporary construction workers during outages. Perhaps ten percent of these workers reside within Salem County (Ref. 2.13-2). The remainder are drawn from the larger region. With the new Nuclear Department facility to be constructed, an additional 500 to 1,000 personnel will be employed on site.

2.14 References

2.1-1 Master Plan, Lower Alloways Creek Township, New Jersey December, 1978.

2.3-1 Soil Survey for Salem County, New Jersey, USDA-SCS, May 1969

2.3-2 Coastal Resource and Development Policies; April 1982

2.4-1 Delaware River Basin Commission, The Delaware River Basin, The Final Report an Environmental Impact Statement of the Level B Study, May 1981

2.4-2 E. G. Miller. Observations of Tidal Flow in the Delaware River - Hydrology of Tidal Streams, Geological Survey Water-Supply Paper 1586-C, Washington, D.C., 1962.

2.4-3 D. M. Thomas, Floods in New Jersey, Magnitude and Frequency, Water Resources Circular 13, U.S. Geological Survey, 1964.

2.4-4 National Ocean Survey, Tide Tables for the East Coast of North and South America (including Greenland), U.S. Department of Commerce 1980.

2.4-5 American Nuclear Society. An American National Standard Standards for Determining Design Basis Flooding at Power Reactor Sites, ANSI/ANS-28-1981, La Grange, Illinois, 1981.

2.4-8 Dames & Moore, "Report Site Environmental Studies, Proposed Salem Nuclear Generating Station, New Jersey," Public Service Electric and Gas Company, 1971.

2.6-1 Public Service Electric and Gas Company, An Ecological Study of the Delaware River Near Artificial Island; 1968-1976: A Summary, March 1980.

2.8-1 Chritchfield, Howard J.: General Climatology, Englewood Cliffs, N.J. (Prentice Hall Inc.) pp. 148-151, 1960.

2.8-2 U.S. Dept. of Commerce: Weather Atlas of the United States, pp. 170-175, June 1968.

2.11-1 New Jersey State Office of Cultural and Environmental Services, Historic Preservation Section

2.11-2 John, George W., 27 in 76 Patterned Brick Houses of Salem County, 1977.

2.13-1 U.S. Department of Commerce, Bureau of the Census, County Business Patterns 1979 - New Jersey, June 1981, pp. 111.

2.13-2 Brent B. Friedlander, Thomas A. Clark Planning Consultant, Master Plan - Lower Alloways Creek Township, October 1978, pp. 31.

TABLE 2.3-1

SOIL PROPERTIES

Soil Type	Drainage Class	Permeability Class (inches per hour)	Seasonal High Water Table Ft.	Soil PH	Foundation Limitation	Agricultural Land Capacity Class	Erodibility ("K" Factor)	USDA Texture	Engineering Soil Classification (Modified)
Hydraulic (HF) Fill	NA	NA	NA	NA	Slight; moderate Shear strength	IIW-20	NA	NA	NA
Tidal Marsh(1) (TM)	NA	Variable	0	Variable	Severe; flooded daily by tides	VIIIW-20	NA	Silt loam	ML, PT (0-60")
Matapeake (MCB) silt loam	Well-Drained	0.2-0.63	10+	4.0-4.5	Slight	IIE-4	0.32	Silt loam	ML, CR (0-8")
Mattapex (MOA) Silt Loam	Moderately Well-Drained	0.2-0.63	2	4.0-4.5	Moderate; High Water Table Seasonally	IIW-13	0.33	Silt loam	ML, CL (0-9")
Othello (OTA) Silt Loam	Poorly-Drained	0.2-0.63	1	4.0-4.5	Severe; High Water Table	IIW-13	0.28	Silt loam to silty clay leam	ML, CL (0-8")
Woodstown (WNB) Sand Loam	Poorly-Drained	2.0-6.3	2	4.5-5.0	Moderate; high Water Table Seasonally	IIIW-20	0.28	Sandy loam	NA
Fallsington-(FDA) Sandy Loam	Poorly-Drained	0.63-2.0	0-1	4.0-4.5	Severe; high Water Table	IIW-21	NA	Sandy loam	NA
Fallsington-(FP) Pocomoke Berryland Complex	Poorly-Drained	0.63-2.0	0-1	4.0-4.5	Severe; High Water Table	IIIW-21	NA	Muck	NA
Muck (MUA)(1)	NA	NA	0	3.5-4.0	Severe; subject	VIIW-30	NA	NA	NA
Woodstown (WSB) Dragston Sandy Loam	Moderately Well-Drained	0.63-2.0	2	4.0-4.5	Severe; slowly Permeable Substratum	IIW-14	0.30	Sandy loam	SM, SM-SC (0-8")

(1) Soil subject to overflow

M P 82 112/01 33.*-34

TABLE 2.4-1

PRIVATE WATER WELLS IN VICINITY OF THE SITE

Well No.	Owner's Name	Total Depth (feet)	Diameter (inches)	Casing Length (feet)	Static Water Level (feet)	Yield (gpm)	Remarks
1	Aloes Marina	252	2	220	3 1/2		
2	Dr. Devlin	252	2	210	5		
3	Dr. Devlin	252	2	330	2 1/2		
4	Dr. Devlin	252	2	212	4		
5	Mr. Henenman	252	2	218	6		Dug Well
6	G. Harbenson	15	42				Dug Well
7	G. Harbenson	15	42				Four wells,
8	F. Harris	12	36		8+		deepest is 32'
9	F. Shimp	90		60+	12-13		
10	T. Hilliard	90	6	60+	12-13		
11	Mr. Snideker	10	36		7-8		
12	Mr. Snideker	90	4				
13	W. Ashlock	252	2	231	8		
14	F. Schrier	90	4	60	12-13		
15	B. Hendman	89	2	84	15		
16	B. Hendman						Well filled in
17	State of N.J.	89	2	84	12		
18			2				
19	T. Dixon	156	2	147	3		
20							Well abandoned
21	T. Dixon	90	2		12		Well abandoned
22	D. Harris	32	2	32		Flowing	Well abandoned
23	Mr. McCray	17	2	17		Flowing	Water is salty
24	Mr. McCray	165	2	147	5		
25	J. Pancast	115	2		5-6		
26	J. Pancast	39	2	82	4		
27	R. Davis	14	36		6		Dug well iron,
28	W. Hancock	90	4	50	10-12		bad water
29	Mr. Ingersol	90	4	50	10-12		
30	L. Fonderbank	100	2	86	3		
31	O. Ayrs	199	2	189	7		
32	Stony Point	315+					Well abandoned
33		400+					
34		900+					
35							
36		163	2	90			
37	Eagle Island Gun Club	110	2	103	6		
38	J. Dilkes		2	131	8		
39	Public Service (Salem G.S. Production	298	16	243	20	200	Not in use
	Well #3)					200	Not in use
40	Public Service (Salem G.S. Production	284	16	210		200	Intermittent
	Well #4)						Use for
41	Public Service (Salem G.S. Production	300	10	250			Construction
	Well #1)						Not in use
42	Public Service (Salem G.S. Production Well #2)	286	16	200	18 1/2		

Notes:

1 - Inventory included wells within a 5 mile radius of the site in New Jersey.

2 - Total depth of well equals length of casing plus length of screen.

3 - Screen at bottom of well below casing.

4 - Static water level is the distance to the water level in the well measured from the top of the well casing.

5 - Well inventory was completed in 1971.

TABLE 2.5-1

Plant Taxa Observed in Salt Marsh Along Alloway Creek Neck Road, July and September 1982.

SCIENTIFIC NAME	COMMON NAME
TREES AND SAPLINGS	
Acer rubrum	red maple
+Albizia julibrissin	silk-tree
Juglans nigra	black walnut
Juniperus virginiana	red cedar
+Morus alba	white mulberry
Platanus occidentalis	sycamore
Populus grandidentata	big-tooth aspen
+Prunus persica	peach
P. serotina	wild black cherry
P. virginiana	choke cherry
+Pyrus sp.	crab-apple
Salix sp.	willow
Sassafras albidum	sassafras
SHRUBS	
Elaeagnus anguistfolia	groundsel-tree
Magnolia virginiana	Russian olive
Myrica pensylvanica	sweetbay
Baccharis halimifolia	bayberry
Rhus copallina	winged sumac
Rubus allegheniensis	blackberry
VINES	
+Lonicera japonica	Japanese honeysuckle
Rhus radicans	poison ivy
Sambucus canadensis	elderberry
HERBS	
Amaranthus cannabinus	tidemarsh waterhemp
Apocynum cannabinum	Indian hemp
Asclepias incarnata	swamp milkweed
A. syriaca	common milkweed
Bidens arostpsa	tickseed sunflower
Cenchrus tribuloides	sand-bur
Cicuta maculata	water hemlock
+Cirsium arvense	Canada thistle
Convolvulus sepium	black bindweed
+Daucus carota	wild carrot
Echinochloa muricata	barnyard grass
Hibiscus palustris	rose-mallow
Heterotheca subaxillaris	camphorweed
Iva frustesceus	marsh elder
+Lactuca serriola	prickly lettuce
+Melilotus alba	white sweet clover
+M. officinalis	yellow sweet clover
Oenothera biennis	evening primrose

TABLE 2.5-1
(CONT'D)

SCIENTIFIC NAME	COMMON NAME
HERBS (Cont'd.)	
*Phragmites australis	reed
Phytolacca americana	pokeweed
Polygonum densiflorum	smartweed
+P. orientale	prince's feather
P. pensylvanicum	smartweed
+Saponaria officinalis	bouncing bet
Scirpus robustus	Salt marsh bulrush
S. olneyi	Olney's threesquare
Setaria sp.	foxtail grass
Solidago canadensis	Canada goldenrod
S. graminifolia	flat-topped goldenrod
S. juncea	early goldenrod
S. rugosa	rough goldenrod
*Spartina alterniflora	salt-marsh cordgrass
S. cynosuroides	big cordgrass
S. patens	salt hay
Stellaria media	chickweed

+ Introducted taxa
* Dominant in one or more communities

TABLE 2.5-2

Plant Taxa Observed in Upland Woods and Roadsides on Alloway Creek Neck Road, July 1982

SCIENTIFIC NAME	COMMON NAME
TREES	
Albizria julibrissin	silk-tree
*Acer rubrum	red maple
A. saccharinum	silver maple
*Carya glabra	pignut hickory
Cornus florida	flowering dogwood
Diospyros virginiana	persimmon
Ilex opaca	American holly
Juniperus virginiana	red cedar
*Liquidambar styraciflua	sweetgum
Morus alba	white mulberry
*Nyssa sylvatica	sour-gum
Populus grandidentata	big-tooth aspen
Prunus serotina	wild black cherry
+Pyrus sp.	crab-apple
Quercus alba	white oak
*Q. flacata	Spanish oak
*Q. marilandica	black-jack oak
*Q. palustris	pin oak
Q. phellos	willow oak
Salix nigra	black willow
Sassafras albidum	sassafras
SHRUBS	
Aronia sp.	chokeberry
Baccharis halimifolia	groundsel-tree
Clethra alnifolia	sweet pepper-bush
+Elaeagnus angustifolia	Russian olive
*Rhus copallina	winged sumac
R. typhina	staghorn sumac
+Rosa multiflora	multiflora rose
Rubus allegheniensis	blackberry
Sambucus canadensis	common elderberry
Vaccinium corymbosum	high-bush blueberry
*Viburnum dentatum	arrowwood
VINES	
Campsis radicans	trumpet-creeper
+*Lonicera japonica	Japanese honeysuckle
Parthenocissus quinquefolia	Virginia creeper
*Rhus radicans	poison ivy
Smilax rotundifolia	greenbrier
Vitis aestivalis	summer grape
V. riparia	forest grape

TABLE 2.5-2
(CONT'D)

SCIENTIFIC NAME	COMMON NAME
HERBS	
+*Achillea millefolium*	yarrow
Ambrosia artemisiifolia	ragweed
**Anthoxanthum oderatum*	sweet vernal grass
Apocynum cannabinum	Indian hemp
Asclepias syriaca	common milkweed
Ascyrum stans	St. John's wort
+*Bromus inermis*	smooth bromegrass
Carex spp.	sedge
+*Chrysanthemum leucantemum*	ox-eye daisy
+*Cichorium intybus*	chicory
Cicuta maculata	water-hemlock
Cirsium spp.	thistle
Convolvulus sepium	black bindweed
Danthonia spicata	poverty oatgrass
+*Daucus carota*	wild carrot
Erigeron annuus	daisy fleabane
Eupatorium dubium	Joe-Pye weed
E. rotundifolium	thoroughwort
Holcus lanatus	Velvet grass
Impatiens sp.	jewelweed
Juncus effusus	rush
Ludwigia sp.	seedbox
Lysimachia quadrifolia	whorled loosestrife
Mitchella repens	partridge-berry
**Muhlenbergia* sp.	muhly-grass
Onoclea sensibilis	sensitive fern
Osmunda cinnaomea	cinnamon fern
O. regalis	royal fern
**Panicum* sp.	panic-grass
**Phragmites communis*	reed
Phytolacca americana	pokeweed
+*Plantago lanceolata*	English plantain
Phalaris arundinacea	reed canary grass
Polygonatum biflorum	Soloman's seal
Prenanthes sp.	white lettuce
Pycnanthemum sp.	mountain mint
Rhexia mariana	meadow-beauty
Scutellaria integrifolia	skull-cap
Solanum nigrum	horsenettle
Solidago canadensis	Canada goldenrod
Solidago graminifolia	flat-topped goldenrod
S. rugosa	rough goldenrod
+*Trifolium* spp.	clover
+*Vicia* sp.	vetch

+ Introduced taxa.
* Dominant in one or more communities.

Table 2.6-1

Species of Fish Taken by Seine and/or 9 ft. Semi-Balloon Bottom Trawl in Hope Creek and Similar Sections of Alloways Creek from 1969 through 1977.

Anguilla rostrata - American eel
Alosa aestivalis - blueback herring
A. pseudoharengus - alewife
A. sapidissima - American shad
Brevoortia tyrannus - Atlantic menhaden
Dorosoma cepedianum - gizzard shad
Anchoa mitchilli - bay anchovy
Cyprinus carpio - carp
Hybognathus nuchalis - silvery minnow
Notemigonus crysoleucas - golden shiner
Ictalurus catus - white catfish
I. nebulosus - brown bullhead
I. punctatus - channel catfish
Rissola marginata - striped cusk-eel
Strongylura marina - Atlantic needlefish
Cyprinodon variegatus - sheepshead minnow
Fundulus diaphanus - banded killifish
F. heteroclitus - mummichog
F. majalis - striped killifish
Membras martinica - rough silverside
Menidia berryllina - tidewater silverside
Gasterosteus aculeatus - three-spine stickleback
Syngnathus fuscus - northern pipefish
Morone americana - white perch
M. saxatilis - striped bass
Lepomis gibbosus - pumpkin seed
Pomoxis nigromaculatus - black crappie
Perca flavescens - yellow perch
Pomatomus saltatrix - bluefish
Bairdiella chrysura - silver perch
Cynoscion regalis - weakfish
Leiostomus xanthurus - spot
Micropogon undulatus - Atlantic croaker
Pogonias cromis - black drum
Gobiosoma bosci - naked goby
Scomberomorus maculatus - spanish mackerel
Peprilus triacanthus - butterfish
Paralichthys dentatus - summer flounder
Pseudopleuronectes americanus - winter flounder
Trinectes maculatus - hogchoker

Table 2.6-2

Prey Species Found in Stomachs of *Morone americana*, *Cynoscion regalis*, and *Anchoa mitchilli* in the Vicinity of Artificial Island During 1974.

Aschelminthes
- Nematoda - roundworms
- Rotifera - wheel animalcules
  - *Notholca* sp.

Annelida
- Polychaeta - bristle worms

Mollusca
- Gastropoda - snails and slugs

Arthropoda
- Crustacea
- Cladocera - water fleas
  - *Bosminia* sp.
  - *Daphina* sp.
- Ostracoda - seed shrimps
- Copepoda
  - Calanoida
    - *Acartia tonsa*
    - *Diaptomus sp.*
    - *Pseudodiaptomus coronatus*
    - *Eurytemora affinis*
    - *Centropages hammatus*
  - Cyclopoida
  - Harpacticoida
- Cirripedia
- Mysidacea - opossum shrimp
  - *Neomysis americana*
- Isopoda
  - *Cyathura polita*
  - *Lironeca ovalis*
  - *Chiridotea almyra*
- Amphipoda
  - *Corophium* spp.
  - *Gammarus* spp. - scud
  - *Monoculodes edwardsi*
  - *Leptocheirus plumulosus*

Table 2.6-2
(Cont'd)

Decopoda
- *Palaemonetes pugio* - grass shrimp
- *Crangon septemspinosa* - sand shrimp
- *Rhithropanopeus harrissii* - mud crab
- *Uca minax* - red-jointed fiddler crab
- *Callinectes sapidus* - blue crab

Pisces

Anquilliformes
- *Anquilla rostrata* - American eel

Clupeiformes
- *Brevoortia tyrannus* - Atlantic menhaden
- *Anchoa mitchilli* - bay anchovy

Gadiformes
- *Rissola marginata* - striped cusk-eel

Table 2.6-3

Monthly Mean Number of Individual Waterfowl and Osprey Sightings in New Jersey within 8 Kilometers of Southern Artificial Island, 1975 - 1978

Species	Mean Number of Sightings Per Month
Horned Grebe	< 0.1
Pied-billed Grebe	0.2
Canada Goose	151.0
Brant	0.2
Snow Goose	0.3
Common Merganser	< 0.1
Red-breasted Merganser	< 0.1
Mallard	25.1
Black Duck	35.2
Black or Mallard	6.8
Gadwall	0.1
Pintail	13.6
Green-winged Teal	21.9
Blue-winged Teal	0.6
Unidentified Teal	< 0.1
Shoveler	< 0.1
American Widgeon	< 0.1
Ruddy Duck	< 0.1
White-winged Scoter	0.2
Wood Duck	0.7
Ring-necked Duck	< 0.1
Canvasback	0.9
Greater Scaup	1.7
Lessen Scaup	0.9
Common Goldeneye	0.3
Bufflhead	0.2
Oldsquaw	< 0.1
Unidentified Duck	0.4
Osprey	2.2
Common Gallinule	0.3
American Coot	2.7

TABLE 2.6-4

Birds in New Jersey and Delaware
Within a 16 Kilometer Radius of Southern Artificial Island,
1972-1978

COMMON NAME	SCIENTIFIC NAME
LOONS	
Common loon	Givia immer
Red-throated loon	Gavia stellata
GREBES	
Horned grebe	Podiceps auritus
Pied-billed grebe	Podilymbus podiceps
TUBENOSES	
Wilson's petrel	Oceanties oceanicus
PELICANS AND ALLIES	
Double-crested cormorant	Phalacrocorax auritus
HERONS AND ALLIES	
Great blue heron	Ardea herodias
Green heron	Butorides virescens
Little blue heron	Florida caerulea
Cattle egret	Bubulcus ibis
Great egret	Casmerodius albus
Snowy egret	Leucophoyx thula
Louisiana heron	Hydranassa tricolor
Black-crowned night heron	Nycticorax nycticorax
Yellow-crowned night heron	Nyctanassa violacea
Least bittern	Ixobrychus exilis
American bittern	Botaurus lentiginosus
Glossy ibis	Plegadis falcinellus
WATERFOWL	
Whistling swan	Olor comunbianus
Canada goose	Branta canadensia
Snow goose	Chen hyperborea
Blue goose	Chen caerulescens
Fulvous tree duck	Dendrocyana bicolor
Mallard	Anas platyrhynchos
Black duck	Anas rubripes

TABLE 2.6-4
(CONT'D)

COMMON NAME	SCIENTIFIC NAME
Gadwall	Anas strepera
Pintail	Anas acuta
Shoveler	Spatula clypeata
Green-winged teal	Anas carolinensis
Blue-winged teal	Anas discors
American widgeon	Mareca americana
Wood duck	Aix sponsa
Redhead	Aythya americana
Canvasback	Aythya valisineria
Ring-necked duck	Aythya collaris
Greater scaup	Aythya marila
Lesser scaup	Aythya affinis
Common goldeneye	Bucephala clangula
Bufflehead	Bucephala albeola
Oldsquaw	Clangula hyemalis
White-winged scoter	Melanitta deglandi
Common scoter	Oidemia nigra
Ruddy duck	Oxyura jamaicensis
Common merganser	Mergus merganser
Red-breasted merganser	Mergus serrator
VULTURES, HAWKS, AND FALCONS	
Turkey vulture	Cathartes aura
Black vulture	Coragyps atratus
Sharp-shinned hawk	Accipiter striatus
Cooper's hawk	Accipiter cooperii
Rough-legged hawk	Buteo lagopus
Red-tailed hawk	Buteo jamaicensis
Broad-winged hawk	Buteo playtypterus
Red-shouldered hawk	Buteo lineatus
Bald eagle	Haliaeetus leucocephalus
Marsh hawk	Circus cyaneus
Osprey	Pandion haliaetus
Eastern merlin	Falco columbarius
American kestrel	Falco sparverius
GALLINACEOUS BIRDS	
Bobwhite	Colinus virginicus
Ring-necked pheasant	Phasianus colchicus

TABLE 2.6-4
(CONT'D)

COMMON NAME	SCIENTIFIC NAME
CRANES AND ALLIES	
Clapper rail	*Rallus longirostris*
Virginia rail	*Rallus limicola*
Sora	*Porzana carolina*
Common gallinule	*Gallinula chloropus*
American coot	*Fulica americana*
SHOREBIRDS	
Semipalmated plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
American golden plover	*Pluvialis dominica*
Black-bellied plover	*Squatarola squatarola*
American woodcock	*Philohela minor*
Common snipe	*Capolla gallinago*
Solitary snadpiper	*Tringa solitaria*
Spotted sandipiper	*Actitis macularia*
Willet	*Catoptrophorus semipalmatus*
Greater yellowlegs	*Toranus melanoleucas*
Pectoral sandpiper	*Erolia melanotos*
Least sandpiper	*Erolia minutilla*
Ruddy turnstone	*Arenaria interpres*
Dunlin	*Erolia alpina*
Long-billed dowitcher	*Limnodromus scolopaceus*
Semipalmated sandpiper	*Ereunetes pusillus*
GULLS AND TERNS	
Great black-backed gull	*Larus marinus*
Herring gull	*Larus argentatus*
Ring-billed gull	*Larus delawarensis*
Laughing gull	*Larus atricilla*
Bonaparte's gull	*Larus philadelphia*
Common tern	*Sterna hirundo*
Least tern	*Sterna albifrons*
Gull-billed tern	*Gelochelidon nilotica*
Royal tern	*Thalasseus maximus*
Caspian tern	*Hydroprogne caspia*
Black tern	*Childonias niger*
Black skimmer	*Rynchops nigra*
PIGEONS AND DOVES	
Rock dove	*Columbia livia*
Mourning dove	*Zenaidura macroura*

TABLE 2.6-4
(CONT'D)

COMMON NAME	SCIENTIFIC NAME
CUCKOOS	
Yellow-billed cuckoo	Coccyzus americanus
OWLS	
Barn owl	Tyto alba
Screech owl	Otus asio
Great horned owl	Bubo virginianus
Short-eared owl	Asio flammeus
GOATSUCKERS	
Whip-poor-will	Caprimulgus vociferus
Common nighthawk	Chordilei minor
SWIFTS AND HUMMINGBIRDS	
Chimney swift	Chaetura pelagica
Ruby-throated hummingbird	Archilochus colubris
KINGFISHERS	
Belted kingfisher	Megaceryle alcyon
WOODPECKERS	
Yellow-shafted flicker	Colaptes auratus
Red-bellied woodpecker	Centurus carolinus
Red-headed woodpecker	Melanerpes erythrocephalus
Yellow-bellied sapsucker	Sphyrapicus varius
Hairy woodpecker	Dendrocopos villosus
Downy woodpecker	Dendrocopus pubescens
PERCHING BIRDS	
Eastern kingbird	Tyrannus tyrannus
Great crested flycatcher	Myiarchus crinitus
Eastern phoebe	Sayornis phoebe
Horned lark	Eremophila alpestris
Tree swallow	Iridoprocne bicolor
Rough-winged swallow	Stelqidopteryx ruficollis
Barn swallow	Hirundo rustica
Purple martin	Progne subis
Blue jay	Cyanocitta cristata
Common crow	Corvus brachyrhynchos
Fish crow	Corvus ossifragus
Black-capped chickadee	Parus atricapillus
Carolina chickadee	Parus carolinensis
Tufted titmouse	Parus bicolor

TABLE 2.6-4
(CONT'D)

COMMON NAME	SCIENTIFIC NAME
Brown creeper	*Certhia familiaris*
House wren	*Troglodytes aedon*
Winter wren	*Troglodytes troglodytes*
Carolina wren	*Thryothorus ludovicianus*
Long-billed marsh wren	*Telmatodytes palustris*
Mockingbird	*Mimus polyglottos*
Catbird	*Dumetella carolinensis*
Brown thrasher	*Toxostoma rufum*
Robin	*Turdus migratorius*
Wood thrush	*Hylocichla mustelina*
Hermit thrush	*Hylocichla guttata*
Swainson's thrush	*Hylocichla ustulata*
Veery	*Hylocichla fuscescens*
Easton bluebird	*Sialia sialis*
Golden-crowned kinglet	*Regulus satrapa*
Water pipit	*Anthus spinoletta*
Cedar waxwing	*Bombycilla cedrorum*
Starling	*Sturnus vulgaris*
White-eyed vireo	*Vireo griseus*
Red-eyed vireo	*Vireo olivaceus*
Black-and white warbler	*Mniotilta varia*
Prothonotary warbler	*Protonotaria citrea*
Yellow warbler	*Dendroica petechia*
Magnolia warbler	*Dendroica magnolia*
Myrtle warbler	*Dendroica coronata*
Blackpoll warbler	*Dendroica striata*
Fine warbler	*Dendroica pinus*
Yellowthroat	*Geothlypis trichas*
Hooded warbler	*Wilsonia critrina*
American redstart	*Setophaga ruticilla*
House sparrow	*Passer domesticus*
Bobolink	*Dolichonyx oryzivorus*
Eastern meadowlark	*Sturnella magna*
Red-winged blackbird	*Agelaius phoeniceus*
Baltimore oriole	*Icterus galbula*
Rusty blackbird	*Euphagus carolinus*
Boat-tailed grackle	*Cassidix mexicanus*
Common grackle	*Quiscalus quiscula*
Brown-headed cowbird	*Molothrus ater*
Scarlet tanager	*Piranga olivacea*
Summer tanager	*Piranga rubra*
Cardinal	*Richmondena cardinalis*
Blue grosbeak	*Guiraca caerulea*
Indigo bunting	*Passerina cyanea*

TABLE 2.6-4
(CONT'D)

COMMON NAME	SCIENTIFIC NAME
Evening grosbeak	Hesperiphona vespertina
American goldfinch	Spinus tristis
Rufous-sided towhee	Pipilo erythrophtalmus
Savannah sparrow	Passerculus sandwichensis
Grasshopper sparrow	Ammodramus savannarum
Sharp-tailed sparrow	Ammospiza caudacuta
Seaside sparrow	Ammospiza maritima
Vesper sparrow	Pooecetes gramineus
Slate-colored junco	Junco hyemalis
Tree sparrow	Spizella arborea
Chipping sparrow	Spizella passerina
Field sparrow	Spizella pusilla
White-crowned sparrow	Zonotrichia leucophrys
White-throated sparrow	Zonotrichia albicollis
Fox sparrow	Passrella iliaca
Swamp sparrow	Melospiza georgiana
Song sparrow	Melospiza melodia
Snow bunting	Plectrophenax nivalis

TABLE 2.6-5

FALL AND WINTER FOOD ITEMS IN WATERFOWL STOMACHS, 1974 - 1975, 1975 - 1976, AND 1976

PLANT
- Algae, Basicladia sp.
- Burreed, Sparganium americanum
- Saltgrass, Distichlis spicata
- Wild millet, Echinochloa walteri
- Fall panic grass, Panicum dichotimiflorum
- Switchgrass, Panicum virgatum
- Reed grass, Phragmites communis
- Saltmarsh cordgrass, Spartina alterniflora
- Corn, Zea mays
- Unidentified grasses, Gramineae
- Sedge, Cyperus sp.
- Blunt spike-rush, Eleocharis obtusa
- Dwarf spike-rush, Eleocharis parvula
- Bulrush, Scirpus sp.
- Saltmarsh bulrush, Scirpus robustus
- Twig-rush, Cladium mariscoides
- Arrow-arum, Peltandra virginica
- Bayberry, Myrica pensylvanica
- White oak, Quercus alba
- Smartweed, Polygonum sp.
- Tearthumb, Polygonum arifolium
- Pennsylvania smartweed, Ploygonum pennsylvanicum
- Dotted smartweed, Polygonum punctatum
- Tidemarsh waterhemp, Amaranthus cannabinus
- Pigweed, Amaranthus hybridus
- Common chickweed, Stellaria media
- Black cherry, Prunus serotina
- Soybean, Glycine max
- Water willow, Decodon verticillstus
- Black gum, Nyssa sylvatica
- Jimson weed, Datura stramonium
- Buttonbush, Cephalanthus occidentalis
- Unidentified seeds
- Unidentified plant material

ANIMAL
- Isopod, Cyathura polita
- Amphipod, Orchestia grillus
- Crabs, Brachyura
- Mud crab, Rhithropanopeus harrisii
- Insects, Insecta
- Killifish, Fundulus sp.

TABLE 2.6-6

FALL AND WINTER FOOD ITEMS IN WATERFOWL GULLETS, 1974 - 1975, 1975 - 1976, AND 1976

PLANT

- Algae, *Cladophora* sp.
- Burreed, *Sparganium americanum*
- Saltgrass, *Distichlis spicata*
- Wild millet, *Echinochloa walteri*
- Fall panic grass, *Panicum dichotimiflorum*
- Foxtail grass, *Setaria glauca*
- Saltmarsh cordgrass, *Spartina alterniflora*
- Corn, *Zea mays*
- Unidentified grasses, Gramineae
- Dwarf spike-rush, *Eleocharis parvula*
- Saltmarsh bulrush, *Scirpus robustus*
- Arrow-arum, *Peltandra virginica*
- Bayberry, *Myrica pensylvanica*
- Spanish oak, *Quercus falcata*
- White oak, *Quercus alba*
- Smartweeds, *Polygonum* sp.
- Dotted smartweed, *Polygonum punctatum*
- Tidemarsh waterhemp, *Amaranthus cannabinus*
- Pigweed, *Amaranthus hybridus*
- Soybean, *Glycine max*
- Black gum, *Nyssa sylvatica*
- Unidentified seeds
- Unidentified plant material

ANIMAL

- Coffee snail, *Melampus bidentatus*
- Spider, Araneae
- Isopod, Isopoda
- Isopod, *Cyathura polita*
- Amphipod, *Corophium* sp.
- Amphipod, *Gammarus* sp.
- Amphipod, *Orchestia grillus*
- Mud crab, *Rhithropanopeus harrisii*
- Red-jointed fiddler crab, *Uca minax*
- Dragonfly, *Tramea* sp.
- Water boatmen, *Notonecta* sp.
- Snout beetles, Curculionidae
- Water bug, *Belastoma* sp.
- Crane-fly, *Tipula* sp.
- Tabanid flies, Tabanidae
- Killifish, *Fundulus* sp.
- Banded killifish, *Fundulus diaphanus*
- Mummichog, *Fundulus heteroclitus*
- Unidentified animal material

Table 2.6-7

Mammals Probable Along the Roadway

COMMON NAME	SCIENTIFIC NAME
POUCHED MAMMALS	
Opossum	*Didelphis marsupialis virginia*
INSECTIVORES	
Masked shrew	*Sorex cinereus fontinalis*
Short-tailed shrew	*Blarina brevicauda talpoides*
BATS	
Little brown myotis	*Myotis l. lucifugus*
Keen's myotis	*Myotis keenii septentrionalis*
Small-footed myotis	*Myotis subulatus leibii*
Eastern pipistrelle	*Pipistrellus s. subflavus*
Big brown bat	*Espesicus f. fuscus*
Red bat	*Lasiurus b. borealis*
RABBITS	
Eastern cottontail	*Sylvilagus floridanus mallurus*
New England cottontail	*Sylvilagus transitionalis*
GNAWING MAMMALS	
Eastern chipmunk	*Tamias striatus fisheri*
Woodchuck	*Marmota m. monax*
Eastern gray squirrel	*Sciurus carolinensis pennsylvanicus*
Marsh rice rat	*Oryzomya p. palustris*
White-footed mouse	*Peromyscus leucopus noveboracensis*
Meadow vole	*Microtus p. pennsylvanicus*
Muskrat	*Ondatra zibethica macrodon*
Southern bog lemming	*Synaptomys cooperi stonei*
Norway Rat	*Rattus n. norveigicus*
House mouse	*Mus musculus subsp.*
Meadow jumping mouse	*Zapus hudsonius americanus*
FLESH-EATERS	
Red fox	*Vulpes f. fulva*
Gray fox	*Urocyon c. cinereoargentous*
Raccoon	*Procyon l. lotor*
Long-tailed weasel	*Mustels frenata noveboracensis*
EVEN-TOED HOOFED MAMMALS	
Whitetail deer	*Odocoileus virginianus* subsp.

TABLE 2.7-1

Observed Water Quality Parameters During Seining and Trawling of Tidal Creeks During 1973 and 1974.

Alloways Creek - Trawl Station 5, 1973

	5/9	6/5	7/3	7/23	8/3	8/13	8/31	9/10	9/27	12/3
Salinity (ppt)	0.0	0.0	0.0	2.0	2.5	2.5	4.5	2.2	5.5	0.0
Temp (c)	15.0	23.5	26.0	25.8	27.0	26.9	28.2	24.0	21.5	7.8
O_2 (mg/l)	7.4	9.3	-	5.2	5.1	-	4.6	5.8	5.2	10.3
Secchi (in.)	8	5	6	9	10	6	-	-	12	-

Alloways Creek - Seine Station 3, 1973

	4/12	5/9	5/23	6/7	6/20	7/4	7/20	8/17°	9/28
Salinity (ppt)	2.0	1.0	0.0	0.0	0.4	0.0	1.8	3.5	3.0
O_2 (mg/l)	7.5	16.0	17.4	24.0	23.0	25.0	26.0	25.8	21.0
Secchi (in.)	9.0	8.9	9.2	-	7.6	-	4.2	-	-
	6	10	-	-	12	-	-	-	-

Alloways Creek - Trawl Station 5, 1974

	4/23	6/17	7/16	7/29	8/16	8/26	9/13	10/8	10/23
Salinity (ppt)	0.0	1.0	5.0	7.0	5.0	4.0	3.0	1.0	1.0
Temp (c)	18.2	21.5	26.0	24.3	25.0	27.0	25.8	14.9	12.0
O_2 (mg/l)	7.8	7.0	5.7	6.2	5.6	3.8	6.1	9.5	9.0
Secchi (in.)	12	9	7	10	8	6	10	11	18

Alloways Creek - Seine Station 3, 1974

	4/23	5/22	6/4	6/21	7/1	7/16	7/29	8/12	8/29	9/10	9/24	10/11	10/23
Salinity (ppt)	0.0	0.0	0.0	4.0	4.0	4.5	-	4.0	3.5	2.0	1.0	4.0	1.0
Temp (c)	14.5	25.0	20.5	24.2	26.5	27.5	27.0	24.0	27.1	23.0	16.4	17.1	12.0
O_2 (mg/l)	7.6	7.0	8.5	6.2	7.0	5.7	5.6	6.2	5.2	5.4	6.8	-	9.0
Secchi (in.)	-	-	-	-	-	-	11	-	-	-	-	-	18

Hope Creek - Trawl Station 1, 1974

	4/30	5/31	6/4	6/17	7/16	7/29	8/16	8/29	9/10	10/11	10/23
Salinity (ppt)	2.0	1.5	4.5	5.0	8.0	10.0	9.8	9.0	5.0	5.0	2.5
Temp (c)	20.5	18.3	20.0	21.0	26.0	25.0	24.9	26.5	25.0	14.0	10.3
O_2 (mg/l)	7.5	7.0	7.8	6.8	5.0	6.6	6.0	5.2	6.7	8.6	8.4
Secchi (in.)	17	12	10	8	6	18	8	-	12	10	14

Hope Creek - Trawl Station 2, 1974

	4/30	5/31	6/4	6/17	7/16	7/29	8/16	8/26	9/13	10/8	10/23
Salinity (ppt)	2.0	2.0	4.5	9.0	9.5	10.0	10.0	9.0	3.0	6.0	5.0
Temp (c)	21.0	17.8	19.9	22.0	25.8	24.7	24.1	26.5	24.5	15.0	10.0
O_2 (mg/l)	7.8	7.6	7.5	5.8	5.9	6.9	6.1	5.2	6.4	8.5	8.1
Secchi (in.)	15	12	10	8	13	18	7	-	18	15	15

TABLE 2.7-2

WATER QUALITY CLASSIFICATION OF TIDAL CREEKS

(d) Class definition and quality criteria for TW-1 waters are:

1. Class TW-1 definition:

i. Tidal waters approved as sources of public water supply. These waters shall be suitable for public potable water supply after such treatment as shall be required by law or regulation;

ii. These waters shall be suitable for shellfish harvesting where permitted;

iii. These waters shall also be suitable for the maintenance, migration and propagation of the natural and established biota; and for primary contact recreation; industrial and agricultural water supply and any other reasonable uses.

2. Class TW-1 criteria:

i. Floating, suspended, colloidal and settleable solids; color; petroleum hydrocarbons and other oils and greases:

(1) None noticeable in the water or deposited along the shore or on the aquatic substrata in quantities detrimental to the natural biota. None which would render the waters unsuitable for the designated uses;

(2) For "petroleum hydrocarbons" the goal is none detectable utilizing the Federal EPA - Environmental monitoring and support laboratory method (Freon extraction - silica gel adsorption - infrared measurement); the present criteria, however, are those of item (1) above.

(3) Maximum 30-day average of 25 Jackson Turbidity Units (JTU), a maximum of 130 JTU at any time, unless exceeded due to natural conditions.

ii. Toxic or deleterious substances, including but not limited to mineral acids, caustic alkali, cyanides, heavy metals, carbon dioxide, ammonia or ammonium compounds, chlorine, phenols, pesticides, and so forth: None, either alone or in combination with other substances, in such concentrations as to affect humans or be detrimental to the natural aquatic biota, produce undesirable aquatic life, or which would render the waters unsuitable for the designated uses. Where tidal waters are approved as sources of public water supply, none which would cause standards for drinking water to be exceeded after appropriate treatment;

iii. Taste and odor producing substances: None offensive to humans or which would produce offensive tastes and/or odors in water supplies and biota used for human consumption. None which would render the waters unsuitable for the designated uses;

iv. pH: Between 6.5 and 8.5. Natural conditions outside this range shall prevail;

v. Dissolved oxygen:

(1) Trout maintenance waters: 24-hour average not less than 6.0 mg/l. Not less than 5.0 mg/l at any time;

(2) Nontrout waters: 24-hour average not less than 5.0 mg/l. Not less than 4.0 mg/l at any time from other than natural conditions.

vi. Temperature:

(1) Trout maintenance streams: No heat may be added which would cause temperatures to exceed two degrees Fahrenheit (1.1 degrees Centigrade) over ambient temperatures at any time or which would cause temperatures in excess of 68 degrees Fahrenheit (20 degrees Centigrade). Reductions in temperatures may be permitted where it can be shown that trout will benefit without detriment to other designated water uses. The rate of temperature change in designated heat dissipation areas shall not cause mortality of fish or shellfish;

(2) Nontrout waters:

(A) General: Shall not be raised above ambient by more than four degrees Fahrenheit (2.2 degrees Centigrade) during September through May, nor more than 1.5 degrees Fahrenheit (0.8 degrees Centigrade) during June through

August, nor shall temperatures exceed 82 degrees Fahrenheit (27.8 degrees Centigrade) in yellow perch waters or 85 degrees Fahrenheit (29.4 degrees Centigrade) in other nontrout waters. Temperatures shall be measured outside of designated heat dissipation areas;

(B) Heat dissipation areas: The limitations specified above may be exceeded in designated heat dissipation areas by special permission on a case-by-case basis;

(C) Heat dissipation area determinations: The determination of designated heat dissipation areas in estuarine waters, including bays, shall take into special consideration the extent and nature of such waters so as to meet the intent and purpose of the criteria and standards, including provision for the passage of free-swimming and drifting organisms so that negligible or no effects are produced on their populations. As a guideline, heat dissipation areas shall be limited to no more than 1/4 of the cross-sectional area and/or volume of flow of the body of water, leaving at least 3/4 free as a zone of passage, including a minimum of 1/3 the surface measured from shore to shore at any stage of tide;

(D) Adjacent heat dissipation areas: Where waste discharges would result in heat dissipation areas in such close proximity to each other as to impair protected uses, additional limitations may be prescribed to avoid such impairment;

(E) Rate of temperature change: The rate of temperature change in designated heat dissipation areas shall not cause mortality of fish or shellfish.

vii. *Radioactivity: Current United States Public Health Service* Drinking Water Standards shall apply;

viii. Bacterial quality:

(1) Approved shellfish harvesting waters: Where harvesting of shellfish is permitted, requirements established by the National Shellfish Sanitation Program as set forth in its current manual of operations shall apply;

(2) All other waters: Fecal coliform levels shall not exceed a geometric average of 200/100 ml. Samples shall be obtained at sufficient frequencies and at locations and during periods which will permit valid interpretation of laboratory analyses. Appropriate sanitary surveys shall be carried out as a supplement to such sampling and laboratory analyses.

ix. Total dissolved solids: Not to exceed 500 mg/l for waters approved as sources of public water supply. Not to exceed 133 per cent of background. Notwithstanding this criterion, the department, after notice and opportunity for hearing, may authorize increases exceeding these limits provided the discharger responsible for such increases can demonstrate to the satisfaction of the department that such increases will not significantly affect the growth and propagation of indigenous aquatic biota or other designated uses, including public potable water supplies. Any authorization by the department of such increases shall be conditioned upon utilization of the maximum practicable control technology.

Source: NJAC
7:9-4.6

TABLE 2.8-1

CLIMATOLOGICAL DATA FOR WILMINGTON, DELAWARE*

Month	Temp. °F (Mean Monthly)			Precipitation (in.)		Relative Humidity (%)	
	Normal	Max	Min	Normal	Max	1:00 a.m.	1:00 p.m.
January	33.4	41.3	25.5	3.40	5.55	75	61
February	33.8	42.4	25.2	2.95	6.29	73	59
March	41.3	50.5	32.0	4.02	5.72	73	53
April	52.1	62.5	41.6	3.33	5.97	74	51
May	62.7	73.4	52.0	3.53	7.35	79	53
June	71.4	81.8	61.0	4.07	6.34	83	53
July	76.0	86.2	65.8	4.25	7.51	84	54
August	74.0	84.2	64.3	5.59	12.09	86	56
September	67.6	77.9	57.3	3.95	9.53	85	53
October	56.6	67.3	45.9	2.91	6.41	83	54
November	45.4	55.1	35.7	3.53	7.32	79	56
December	35.1	43.5	26.7	3.03	7.90	76	60
			Total	44.56			

*Based on 24 years of data and taken from Local Climatoogical Data, Wilmington, Delaware, 1971, U.S.D.C., No. A.A.

M P82 112/01 55

TABLE 2.8-2

AIR QUALITY DATA FOR GENERAL THE REGION*

ılfur Dioxide	Monitoring Site (a)	Max. (ppm)	Std. (ppm)
3-Hour Average	Penns Grove	.143	. 5 (Secondary) (b)
24-Hour Average	Penns Grove	.051	.14 (Primary) (b) .10 (Secondary) (c)
12-Month Average	Penns Grove	.011	.03 (Primary) (b) .02 (Secondary) (c)
Particulates			
Annual Geometric Mean	Salem	50.4	75 (Primary) (b) 60 (Secondary) (b)
24-Hour Average	Salem	82	260 (Primary) (b) 150 (Secondary) (b)
Carbon Monoxide			
1-Hour Average	Penns Grove	14.1	9 (Primary) (b) 9 (Secondary) (b)
8-Hour Average	Penns Grove	7.2	9 (Primary) (b) 9 (Secondary) (b)
ɔne			
Max. Daily 1-Hr.	Vineland	.144	.12 (Primary) (b) .12 (Secondary) (b)
1-Hour Average	Vineland	.144	.08 (Primary) (c) .08 (Secondary) (c)
Nitrogen Dioxide			
12-Month Average	Vineland	.019	.05 (Primary) (b) .05 (Secondary) (b)
Nitric Oxide			
12-Month Average	Vineland	.013	NA
Smoke Shade			
Daily Average	Penns Grove	1.31(d)	NA

NOTES:
a) Monitoring site chosen by closest available data.
b) National and New Jersey Ambient Air Quality Standards.
c) New Jersey Ambient Air Quality Standard.
d) Smoke Shade Data given in COHS.

..J. Department of Environmental Protection, Air Quality in New Jersey, Compared with Air Quality Standards, 1980

Table 2.10-1

A TYPICAL DAY'S TRAFFIC PATTERN*
ARTIFICIAL ISLAND ACCESS ROAD

(No. of Persons/No. of Cars)

TIME PERIOD	INGRESS	EGRESS
6:00 - 7:00 am	3540/2360	
7:00 - 7:30 am	1669/1112	
7:30 - 8:00 am	750/500	
2:30 - 3:30 pm	1180/786	
3:30 - 4:00 pm		3540/2360
4:00 - 4:30 pm	575/383	269/179
4:30 - 5:00 pm		750/500
6:00 - 6:30 pm		1400/933
11:30 - 12:00 pm	79/52	1755/1170

*The typical day was July 30, 1982.

Table 2.10-2

SALEM GENERATING STATION AND
HOPE CREEK CONSTRUCTION

SHIFT AND MANPOWER REQUIREMENTS

Shift	Time	No. of Personnel
Salem Generating Station (Outage Period*)		
Outage Day Shift	0730 - 1800	1,400
Regular Day Shift	0730 - 1600	269
Swing Shift	1630 - 2400	500
Midnight Shift	2400 - 0800	57
Total		2,226
Hope Creek Construction		
Day Shift		
Manual	0700 - 1530	3,540
Manual Subcontractor	0800 - 1630	750
Total		4,290
Swing Shift		
Manual Swing Shift	1530 - 2330	1,180
Manual Subcontractor	1630 - 2400	75
Total		1,255
Midnight Shift		
Manual	2400-0800	25
Total		5570

*Outage periods occur approximately annually for each unit and last for about three months.

Table 2.13-1

Land Use in Surrounding Counties*

	Salem, NJ		Cumberland, NJ		New Castle, DE		Total	
	Acres	%	Acres	%	Acres	%	Acres	%
Developed, Urban	16,200	7.4	30,000	9.3	52,300	18.8	98,500	12.0
Agricultural	122,000	55.5	80,000	24.9	94,650	34.0	296,650	36.2
Undeveloped	81,400	37.1	211,500	65.8	131,385	47.2	424,285	51.8
Total	219,600	100.0	321,500	100.0	278,335	100.0	819,435	100.0

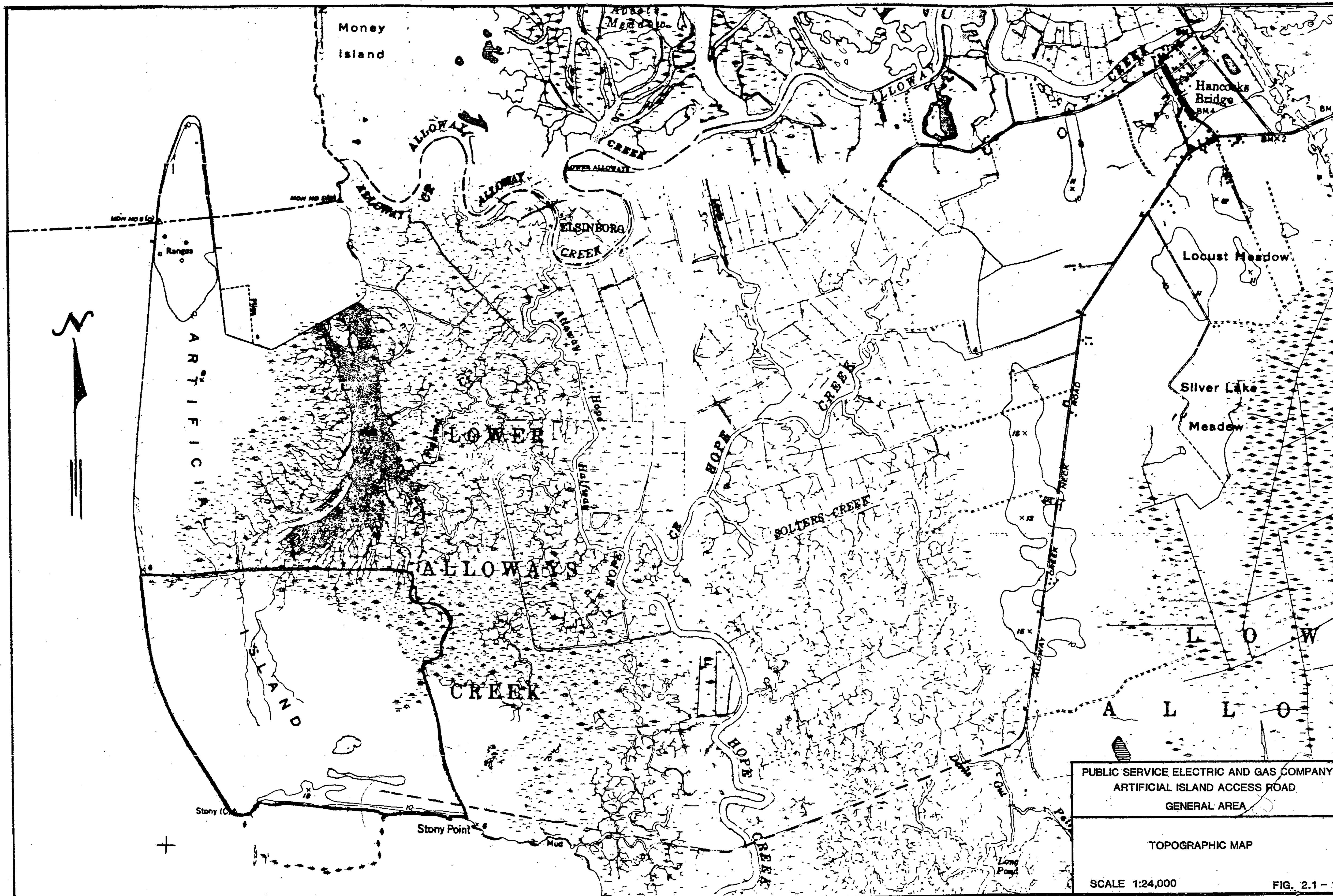
*Public Service Electric and Gas Company, Salem Nuclear Generating Stations Unit 1 and 2, Environmental Report, Figure 20, June 30, 1971

Table 2.13-2

Population Statistics for Surrounding Area*

City, State	1980 Population	1970 Population
Lower Alloways Creek Township	1,547	1,400
Elsinboro Township	1,290	1,204
Salem City	6,959	7,648
Bridgeton, NJ	18,795	20,435
Newark, DE	25,241	20,757
Wilmington, DE	70,195	80,386
County, State		
Salem County, NJ	64,676	60,346
Cumberland County, NJ	132,866	121,374
New Castle County, DE	367,562	349,674

*U.S. Department of Commerce, 1980 Census of Population Number of Inhabitants New Jersey, Part 32, February 1982.

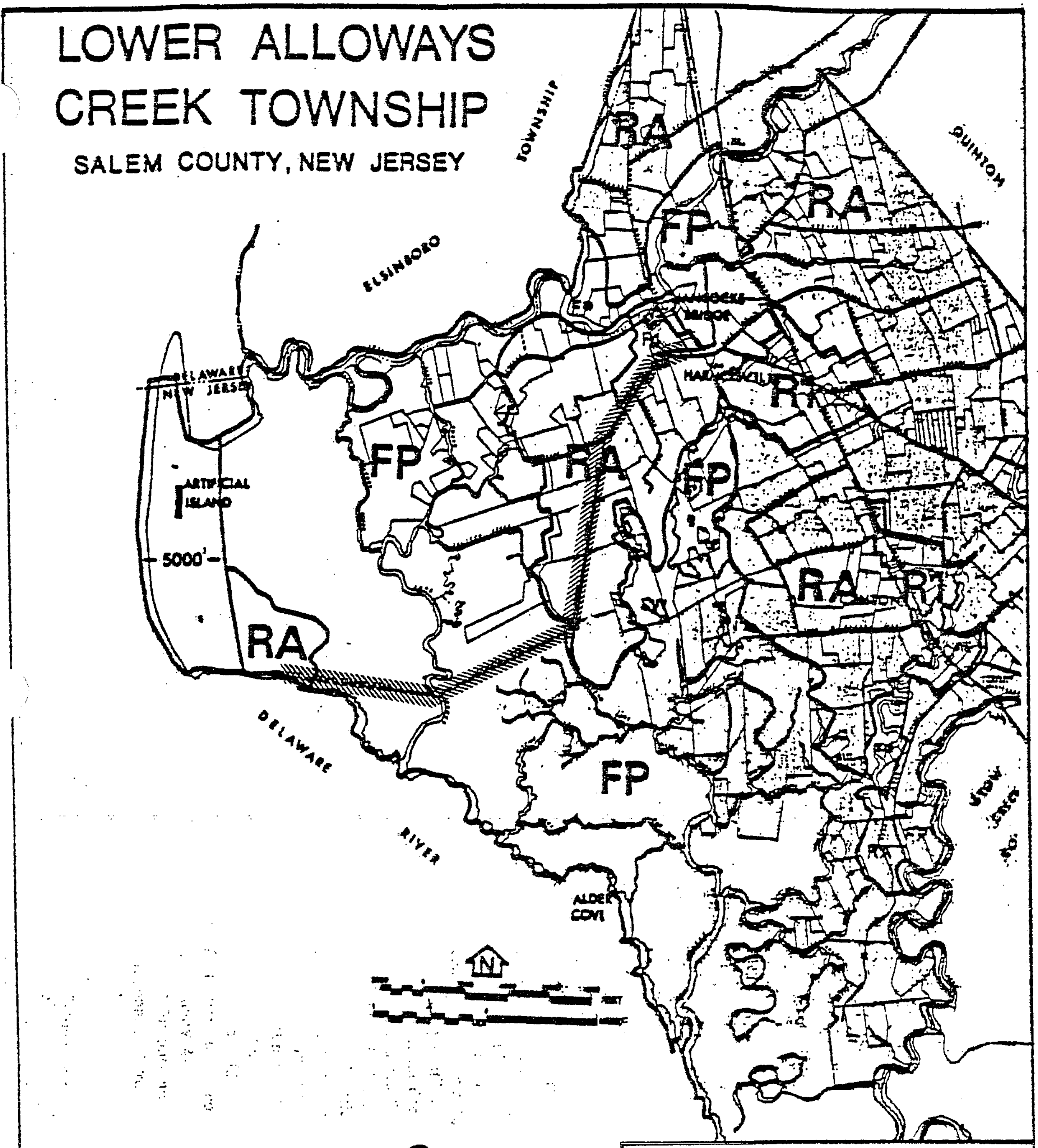


PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND ACCESS ROAD
GENERAL AREA

TOPOGRAPHIC MAP

SCALE 1:24,000

FIG. 2.1 - 1



RA Residence Agriculture
R1 Residence
R2 Residence Mobile Home
C Commercial
I Industry
FP Flood Plain

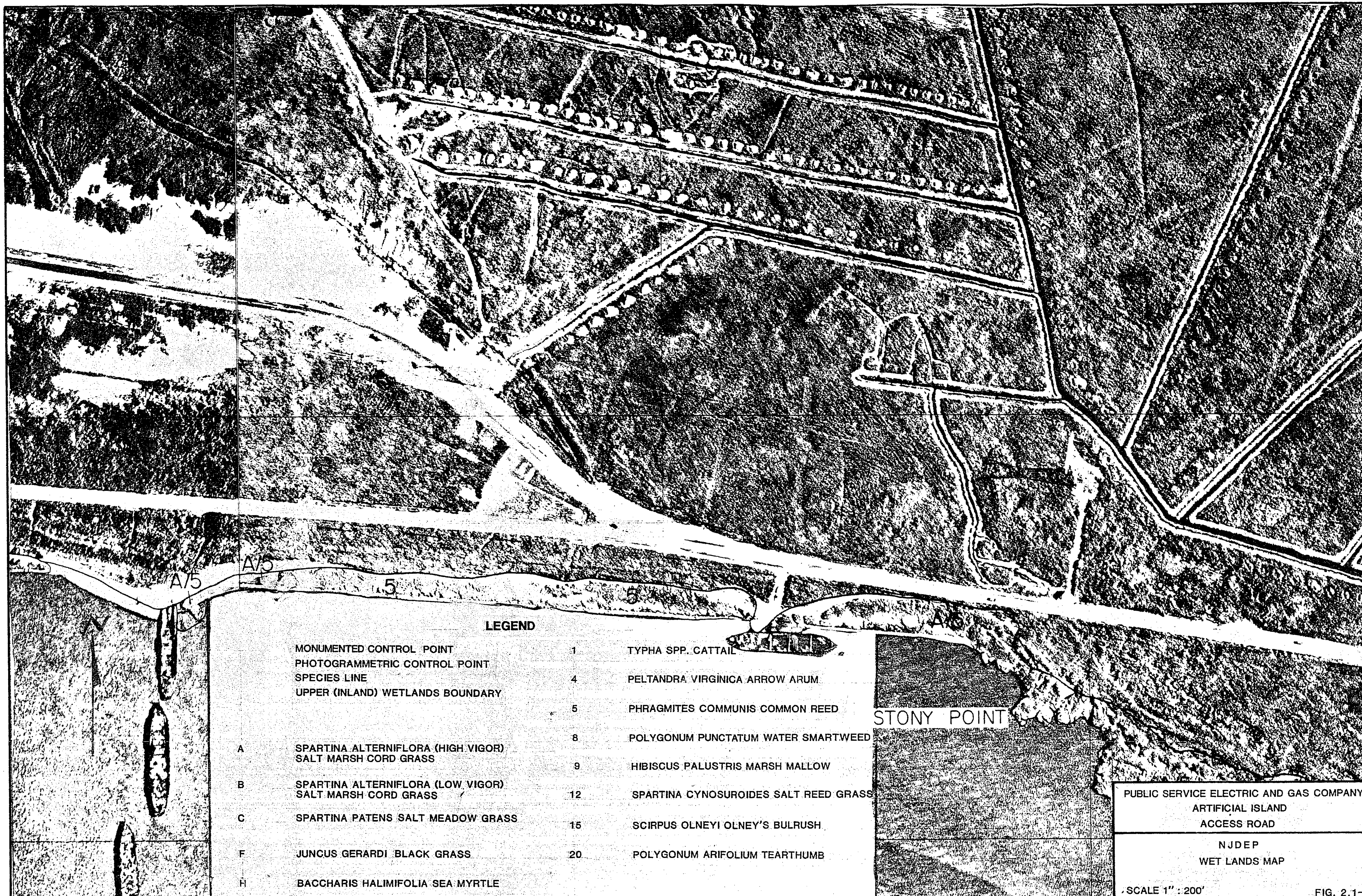
PUBLIC SERVICE ELECTRIC AND GAS COMPANY

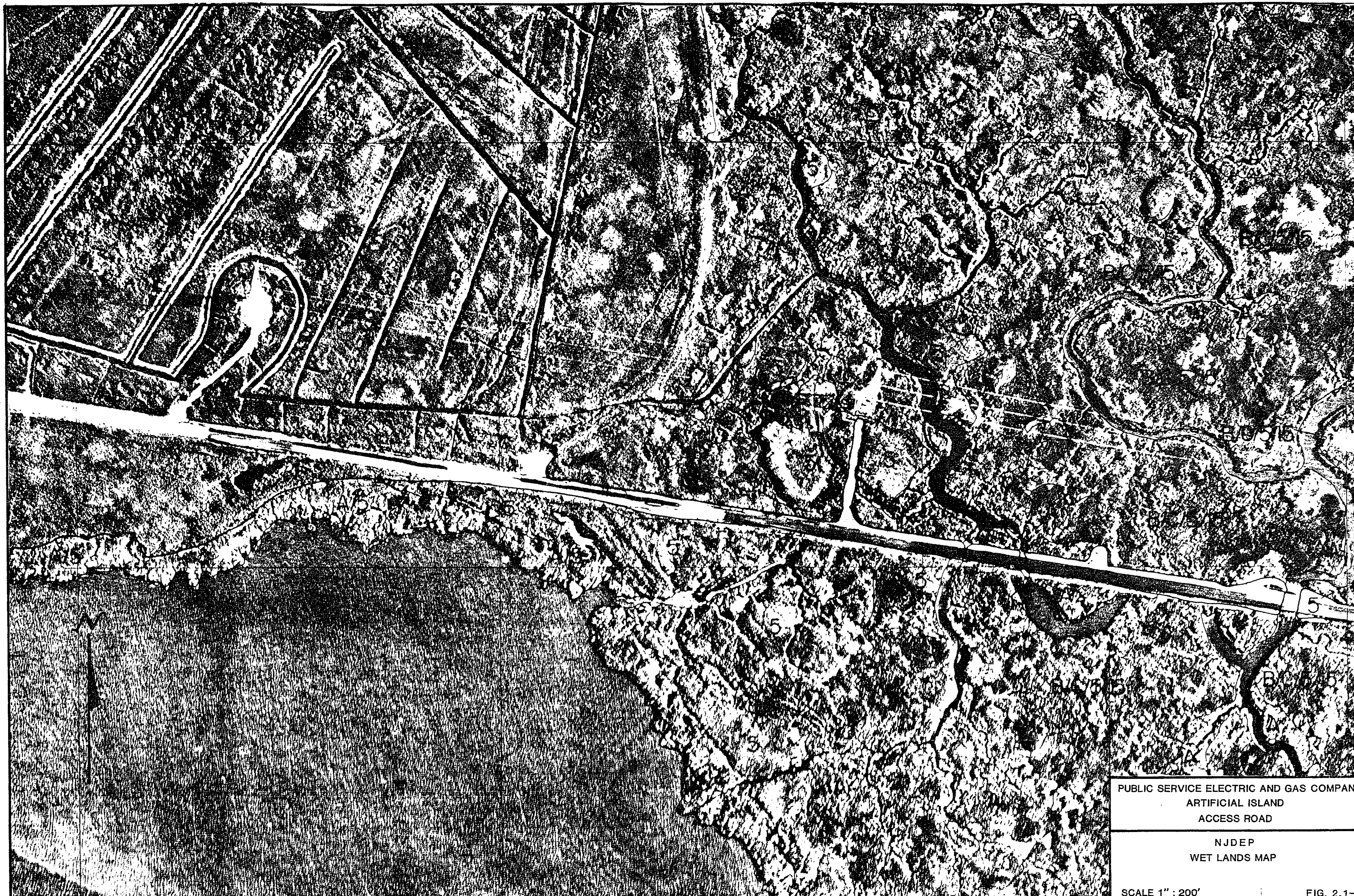
ARTIFICIAL ISLAND ACCESS ROAD

ZONING ORDINANCE

ORDINANCE #77-8 ADOPTED 1/12/77

Fig. 2.1-2


A/5
A/5
5
5
A/6
STONY POINT
LEGEND
MONUMENTED CONTROL POINT
PHOTOGRAMMETRIC CONTROL POINT
SPECIES LINE
UPPER (INLAND) WETLANDS BOUNDARY
A SPARTINA ALTERNIFLORA (HIGH VIGOR) SALT MARSH CORD GRASS
B SPARTINA ALTERNIFLORA (LOW VIGOR) SALT MARSH CORD GRASS
C SPARTINA PATENS SALT MEADOW GRASS
F JUNCUS GERARDI BLACK GRASS
H BACCHARIS HALIMIFOLIA SEA MYRTLE
1 TYPHA SPP. CATTAIL
4 PELTANDRA VIRGINICA ARROW ARUM
5 PHRAGMITES COMMUNIS COMMON REED
8 POLYGONUM PUNCTATUM WATER SMARTWEED
9 HIBISCUS PALUSTRIS MARSH MALLOW
12 SPARTINA CYNOSUROIDES SALT REED GRASS
15 SCIRPUS OLNEYI OLNEY'S BULRUSH
20 POLYGONUM ARIFOLIUM TEARTHUMB
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD
NJDEP
WET LANDS MAP
SCALE 1" : 200'
FIG. 2.1-3

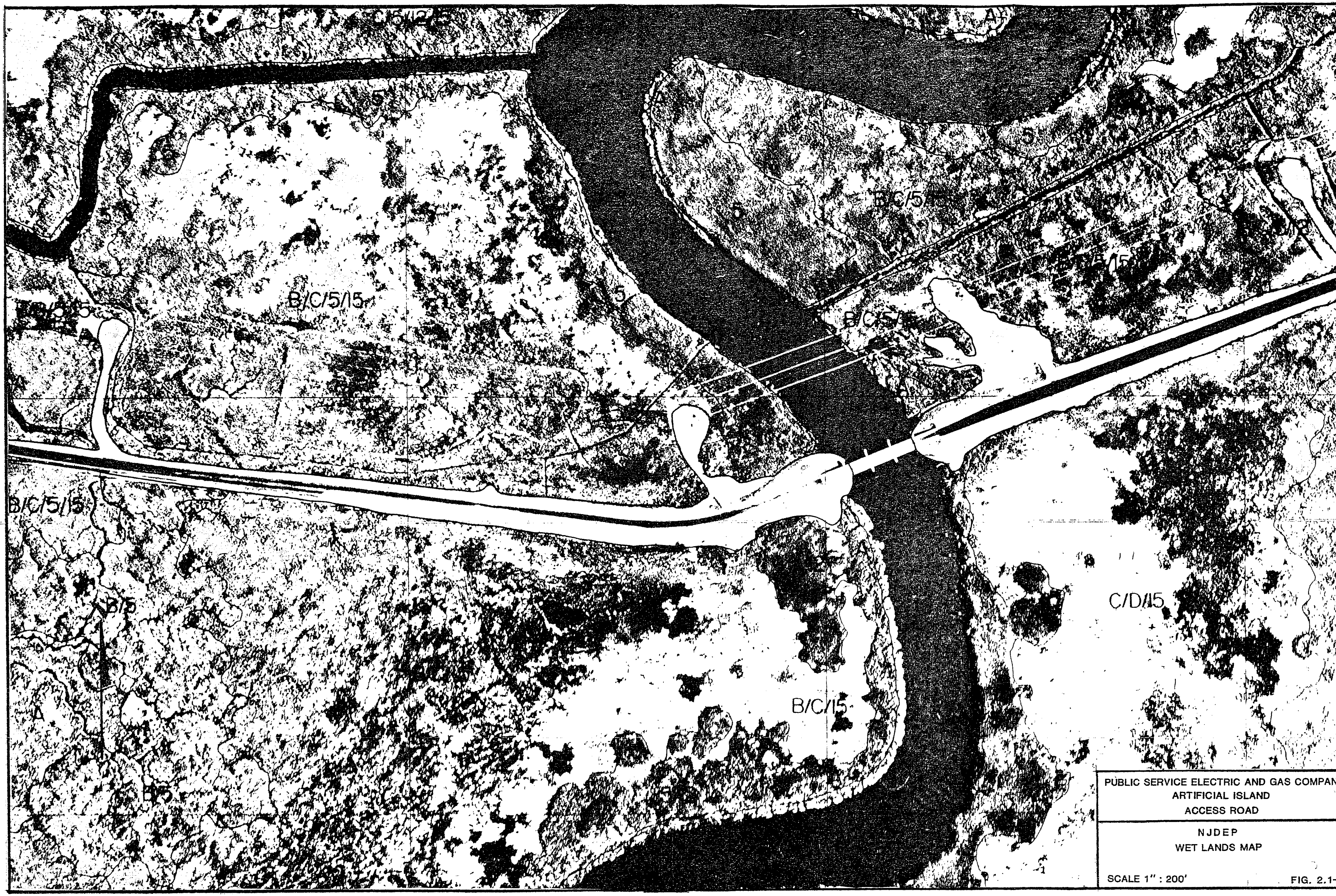


PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

NJDEP
WET LANDS MAP

SCALE 1" : 200'

FIG. 2.1-4

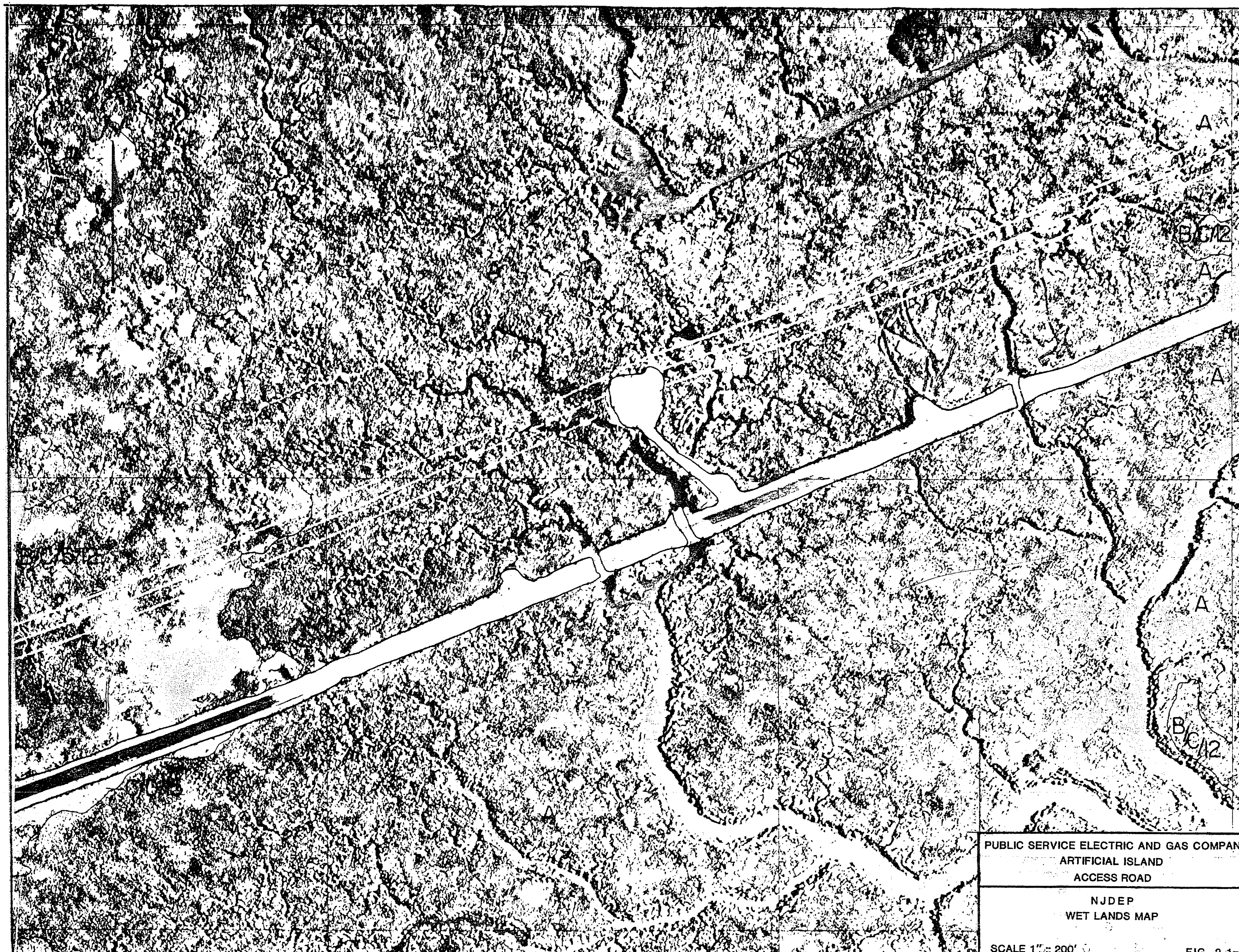


PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

NJDEP
WET LANDS MAP

SCALE 1" : 200'

FIG. 2.1-5



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

NJDEP
WET LANDS MAP

SCALE 1" = 200'

FIG. 2.1-6

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

NJDEP
WET LANDS MAP

SCALE 1" :: 200'

FIG. 2.1-7

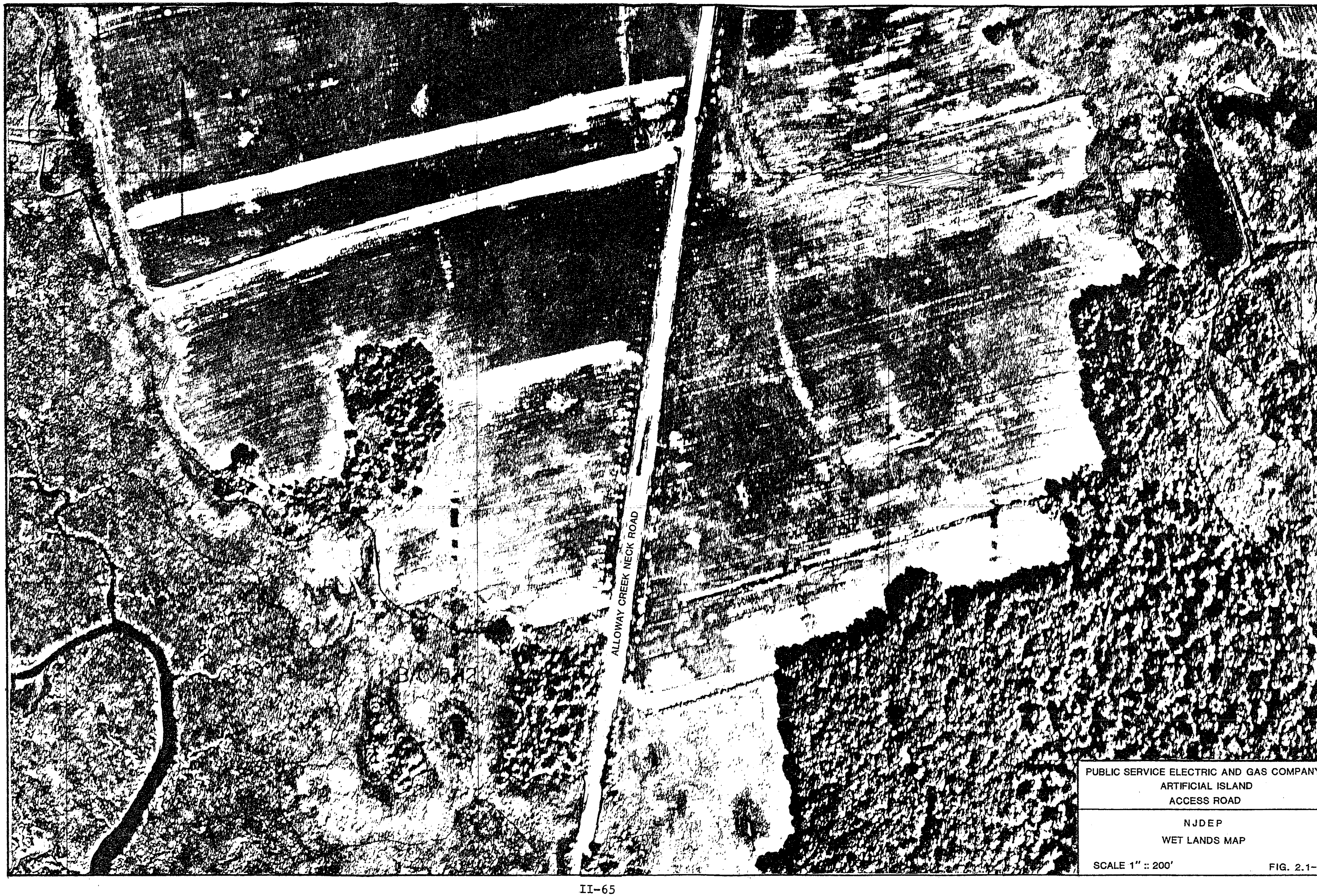

ALLOWAY CREEK NECK ROAD
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD
NJDEP
WET LANDS MAP
SCALE 1" :: 200'

FIG. 2.1-8

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

NJDEP
WET LANDS MAP

SCALE 1" :: 200'

FIG. 2.1-9


ALLOWAY CREEK NECK ROAD
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD
NJDEP
WET LANDS MAP
SCALE 1" :: 200'
FIG. 2.1-10

N
ALLOWAY CREEK NECK ROAD
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD
NJDEP
WET LANDS MAP
SCALE 1" :: 200'
FIG. 2.1-11

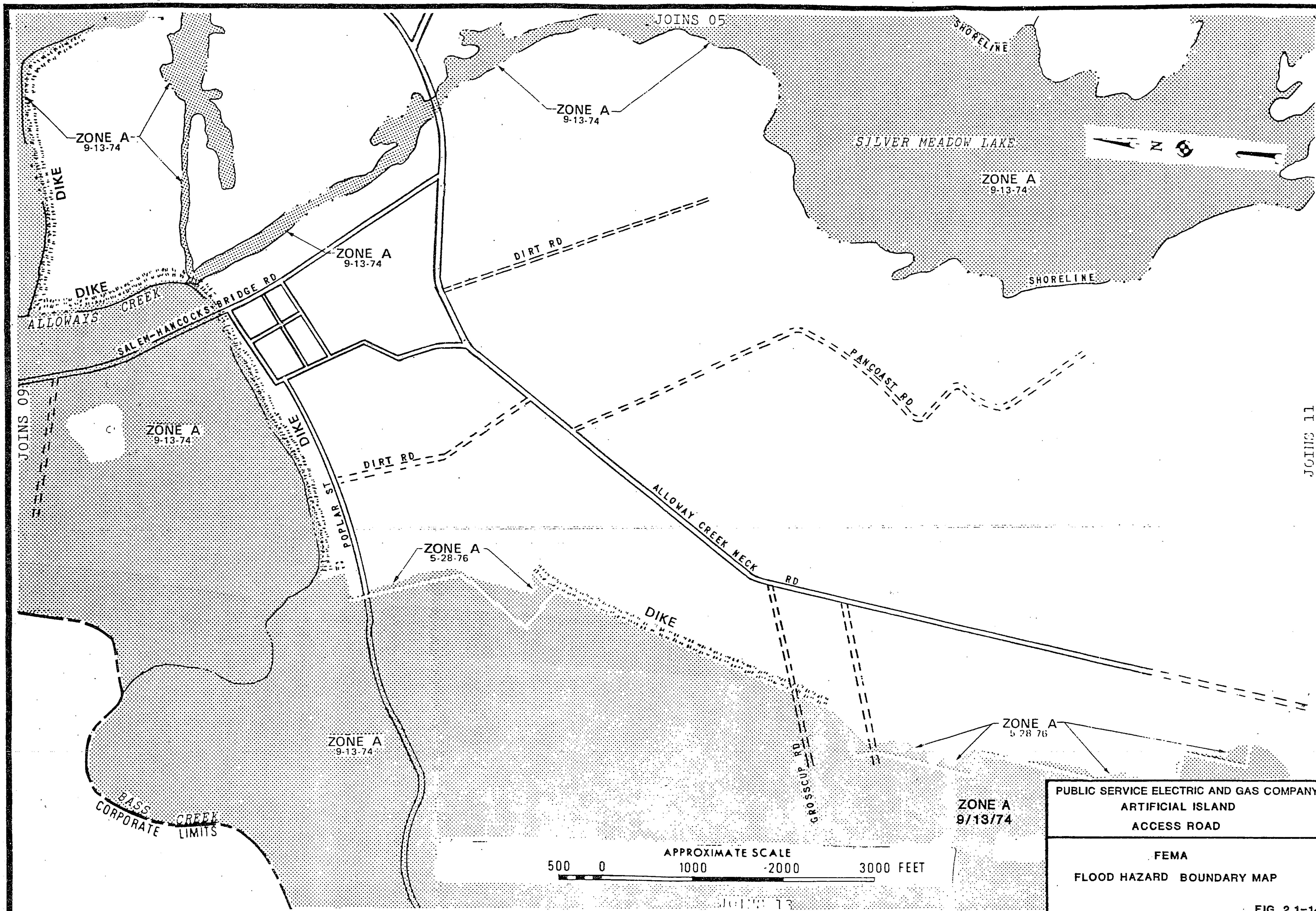

ALLOWAY CREEK NECK ROAD
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD
NJDEP
WET LANDS MAP
SCALE 1" :: 200'
FIG. 2.1-12

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

NJDEP
WET LANDS MAP

SCALE 1" :: 200'

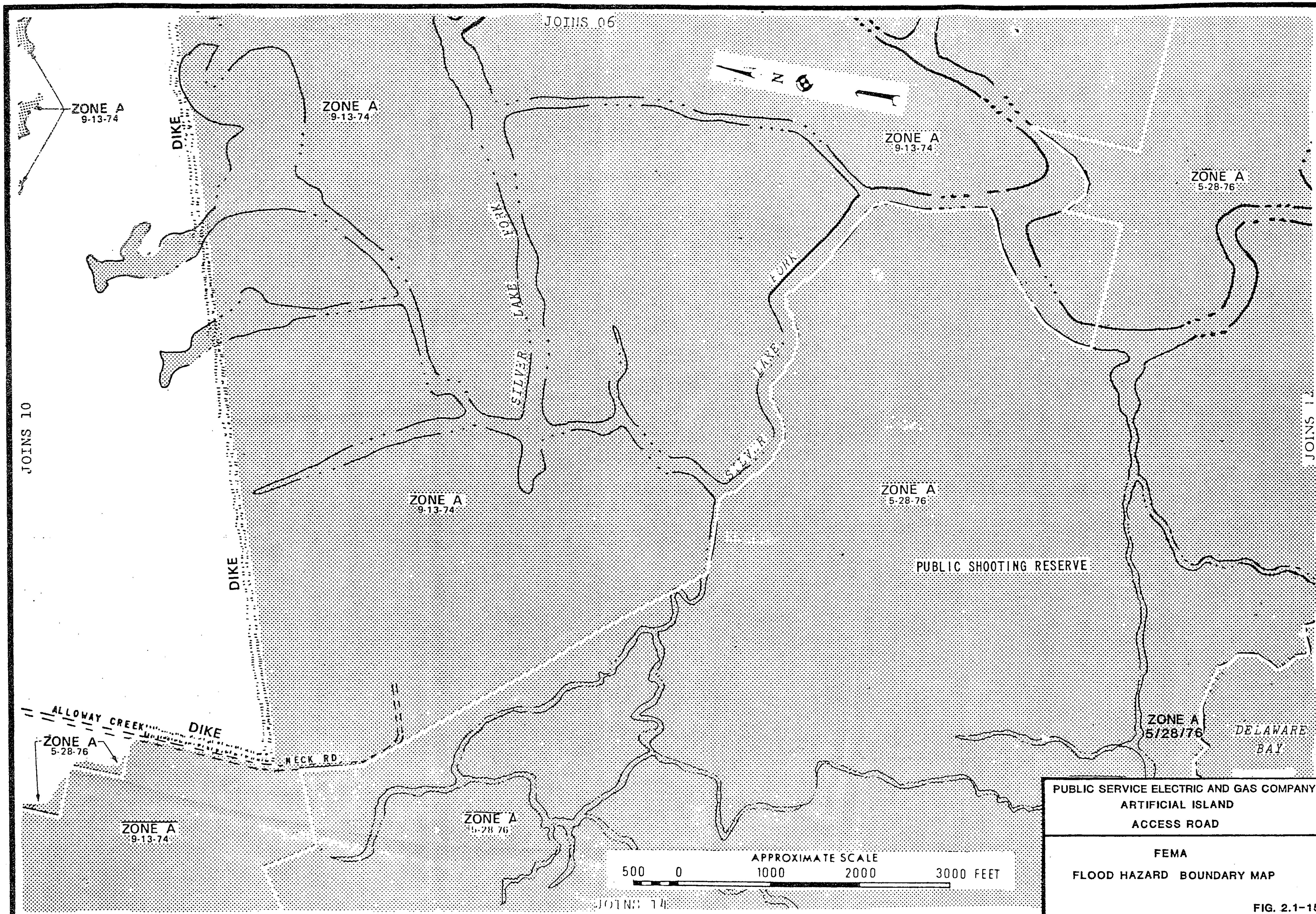
FIG. 2.1-13



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

FEMA
FLOOD HAZARD BOUNDARY MAP

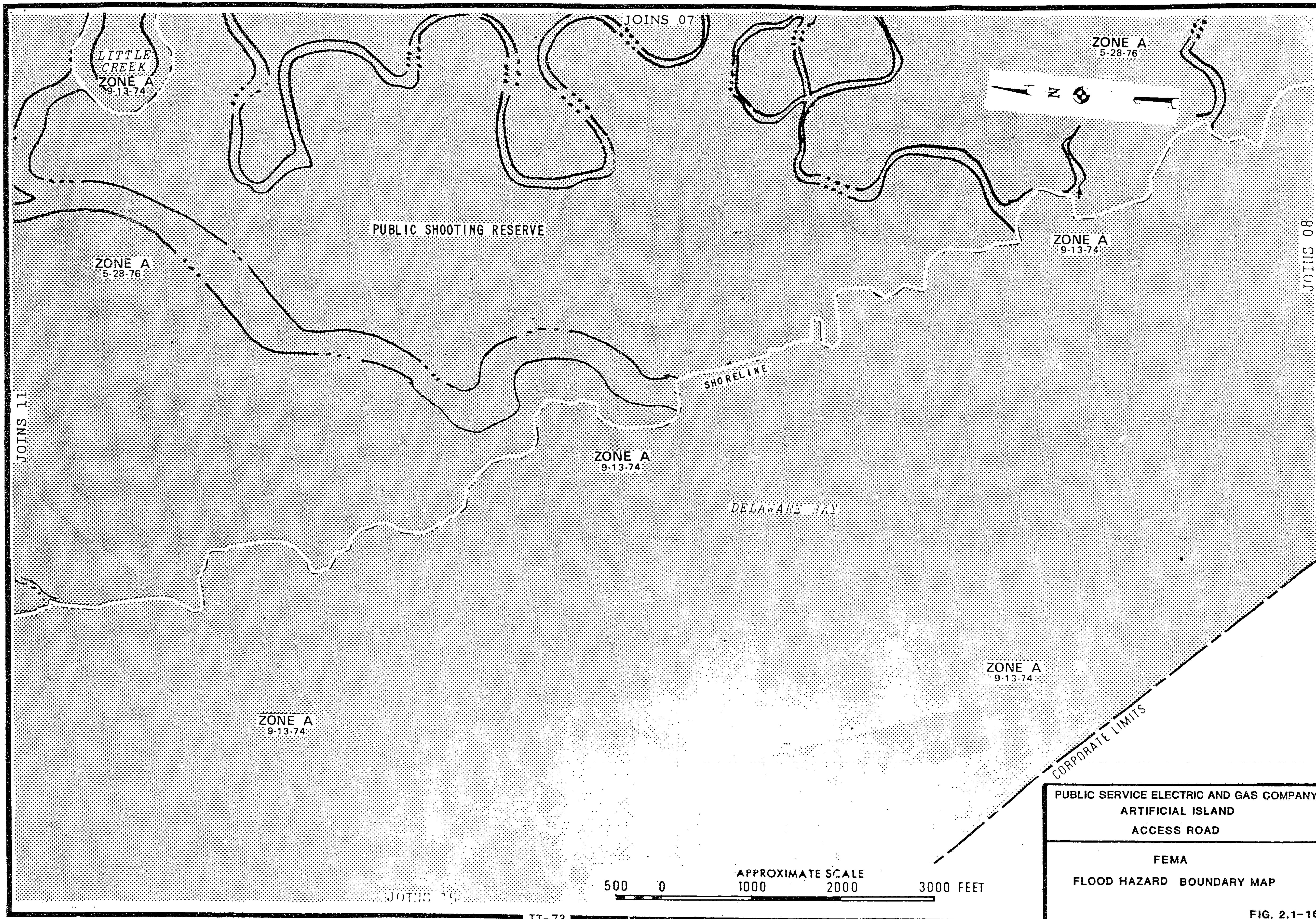
FIG. 2.1-14



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

FEMA
FLOOD HAZARD BOUNDARY MAP

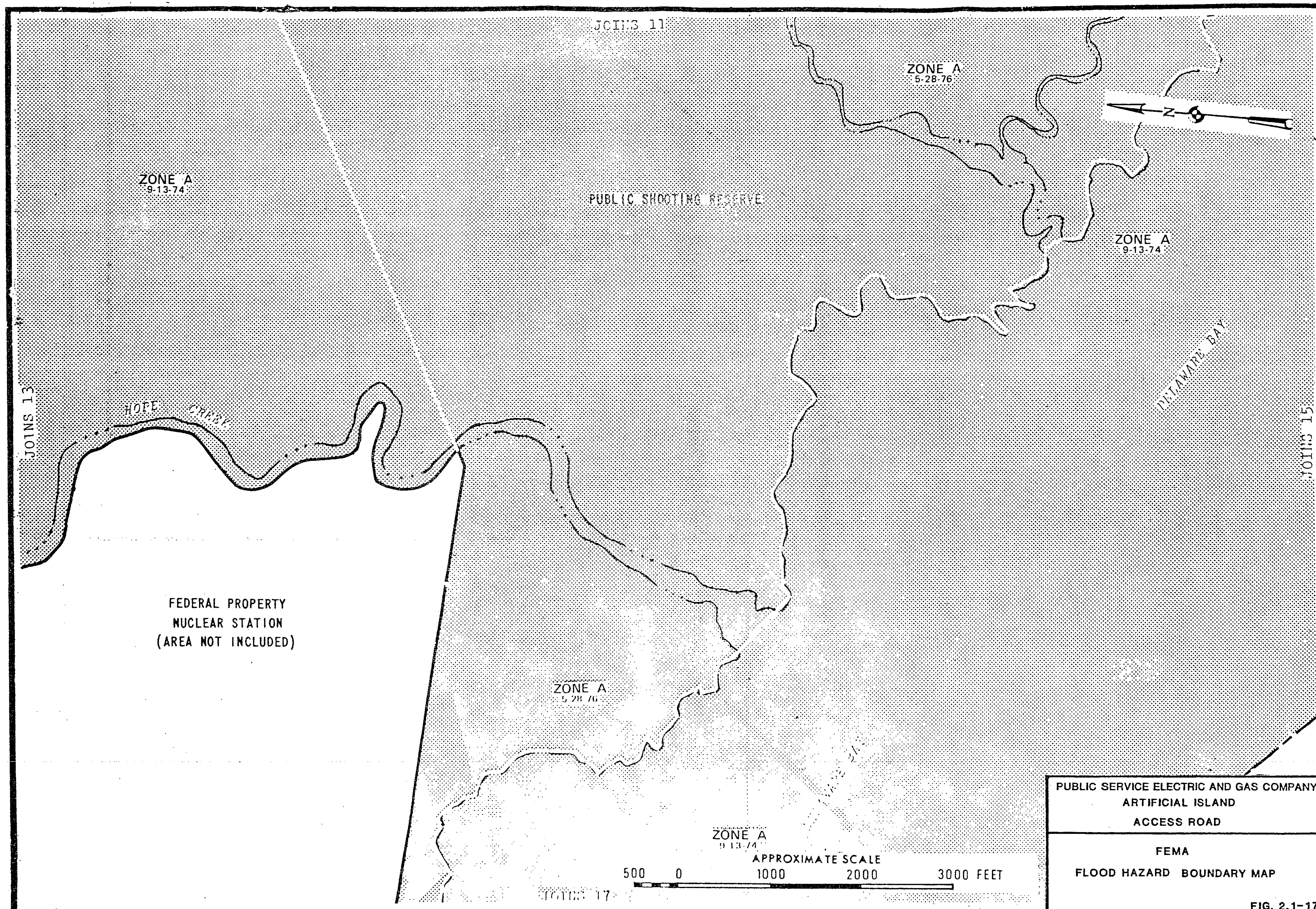
FIG. 2.1-15



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

FEMA
FLOOD HAZARD BOUNDARY MAP

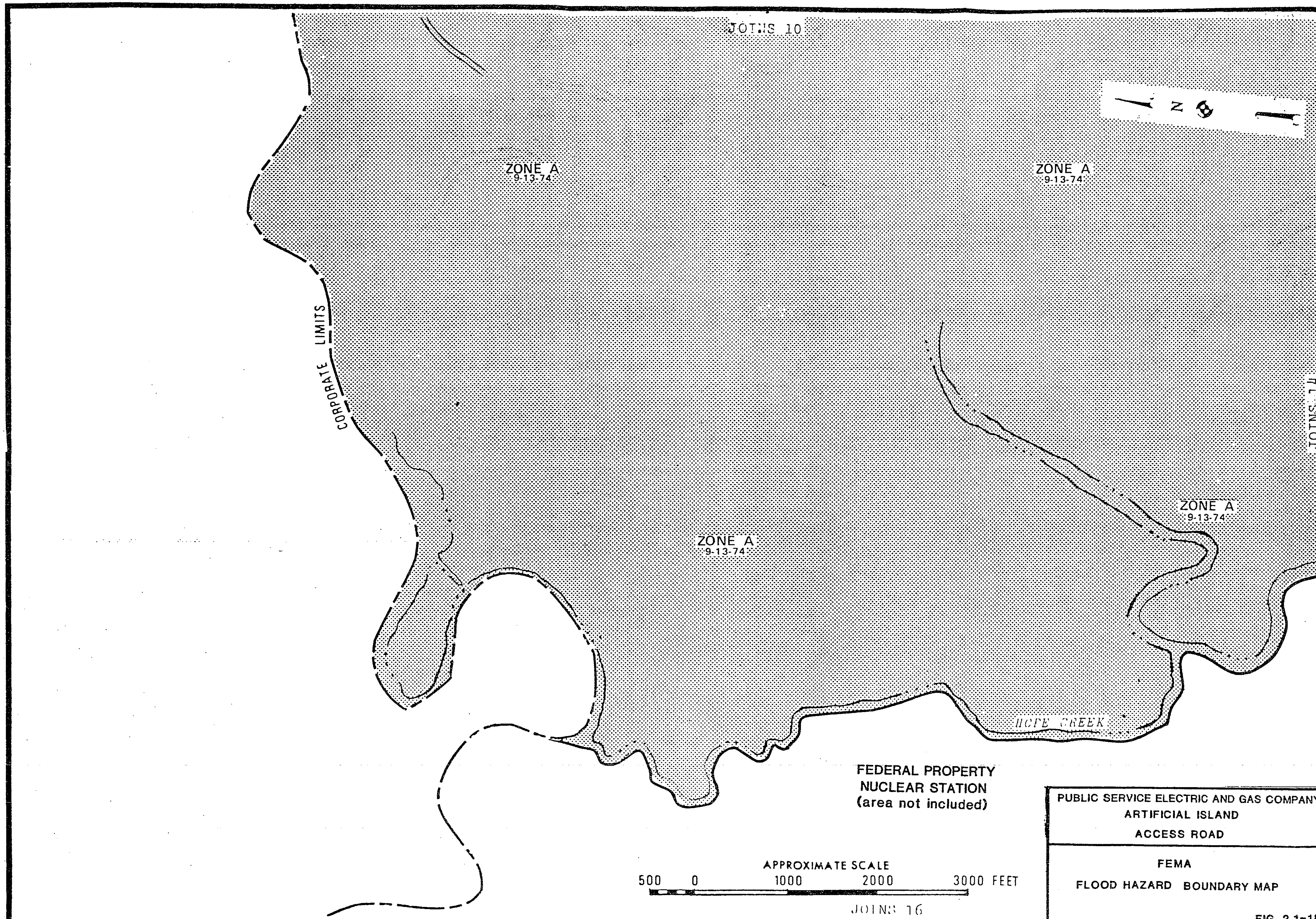
FIG. 2.1-16



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

FEMA
FLOOD HAZARD BOUNDARY MAP

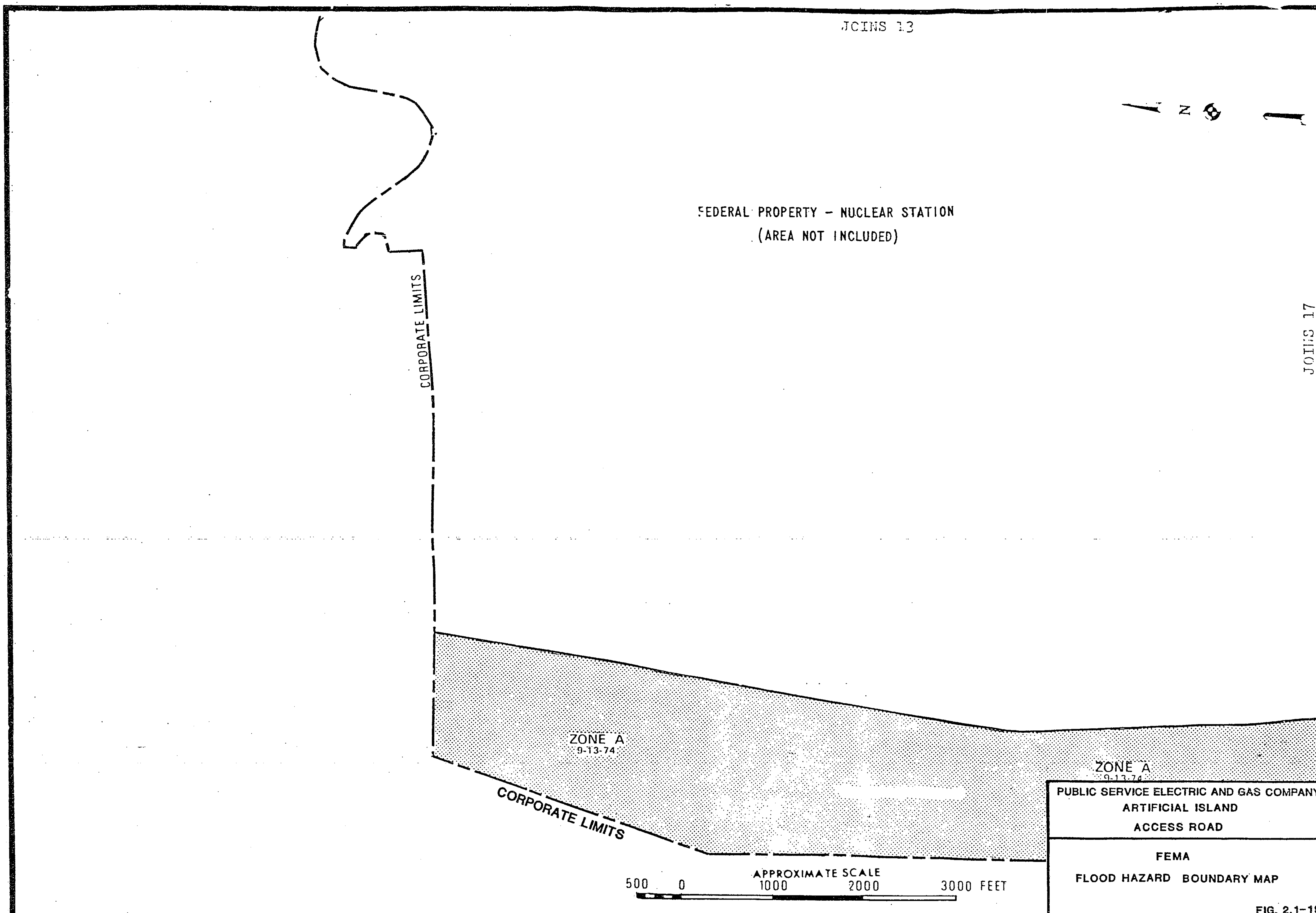
FIG. 2.1-17



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

FEMA
FLOOD HAZARD BOUNDARY MAP

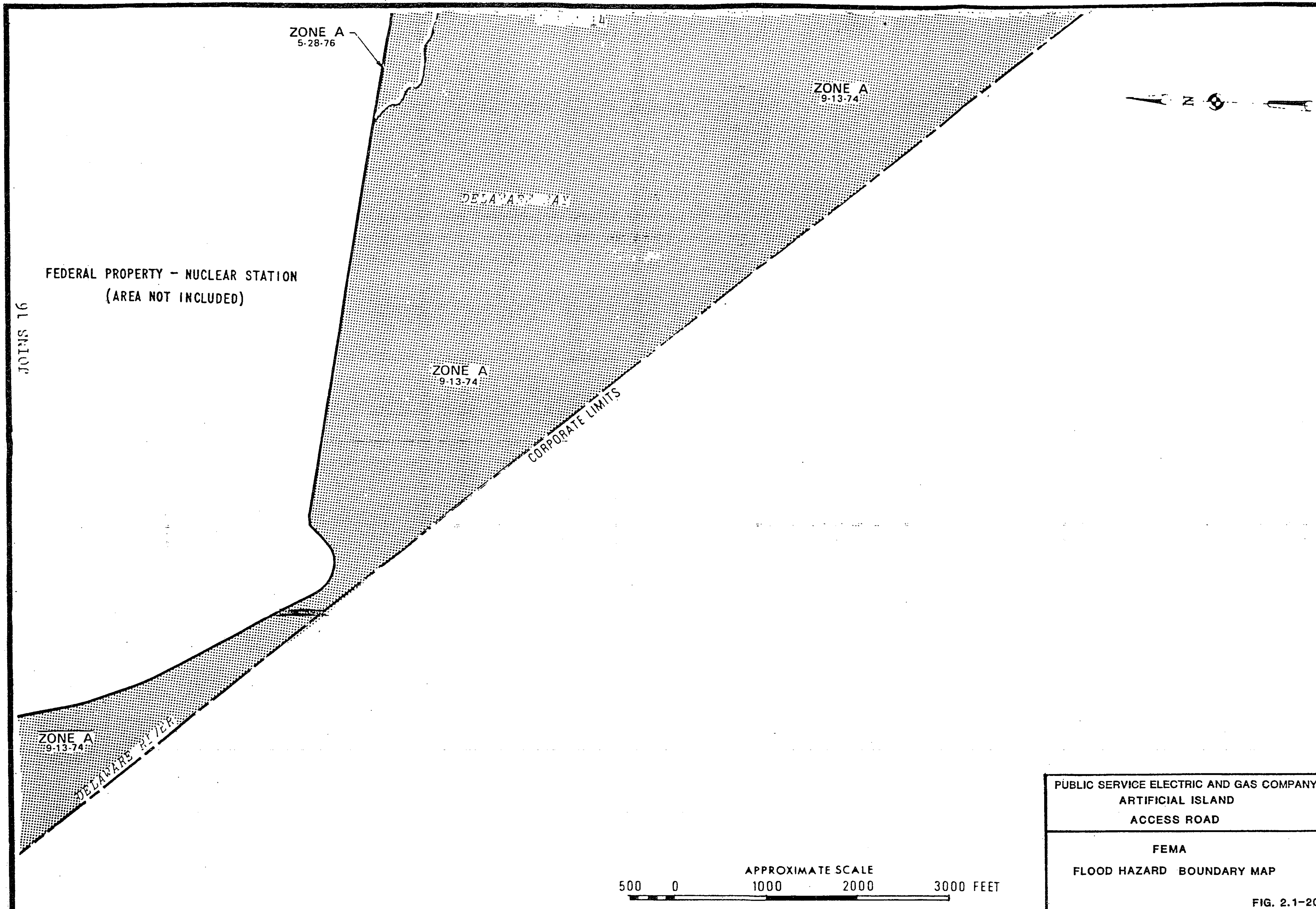
FIG. 2.1-18



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

FEMA
FLOOD HAZARD BOUNDARY MAP

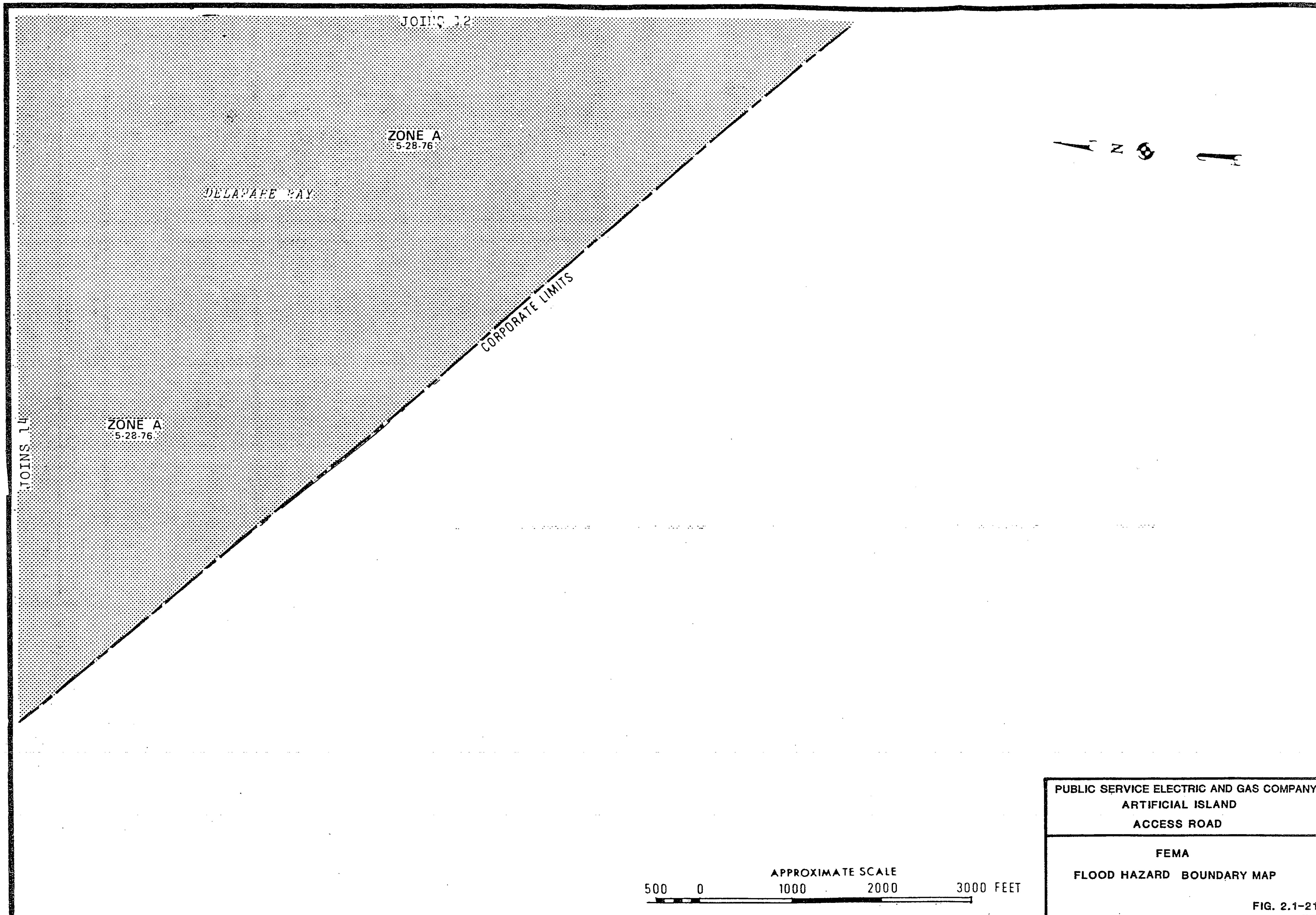
FIG. 2.1-19



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

FEMA
FLOOD HAZARD BOUNDARY MAP

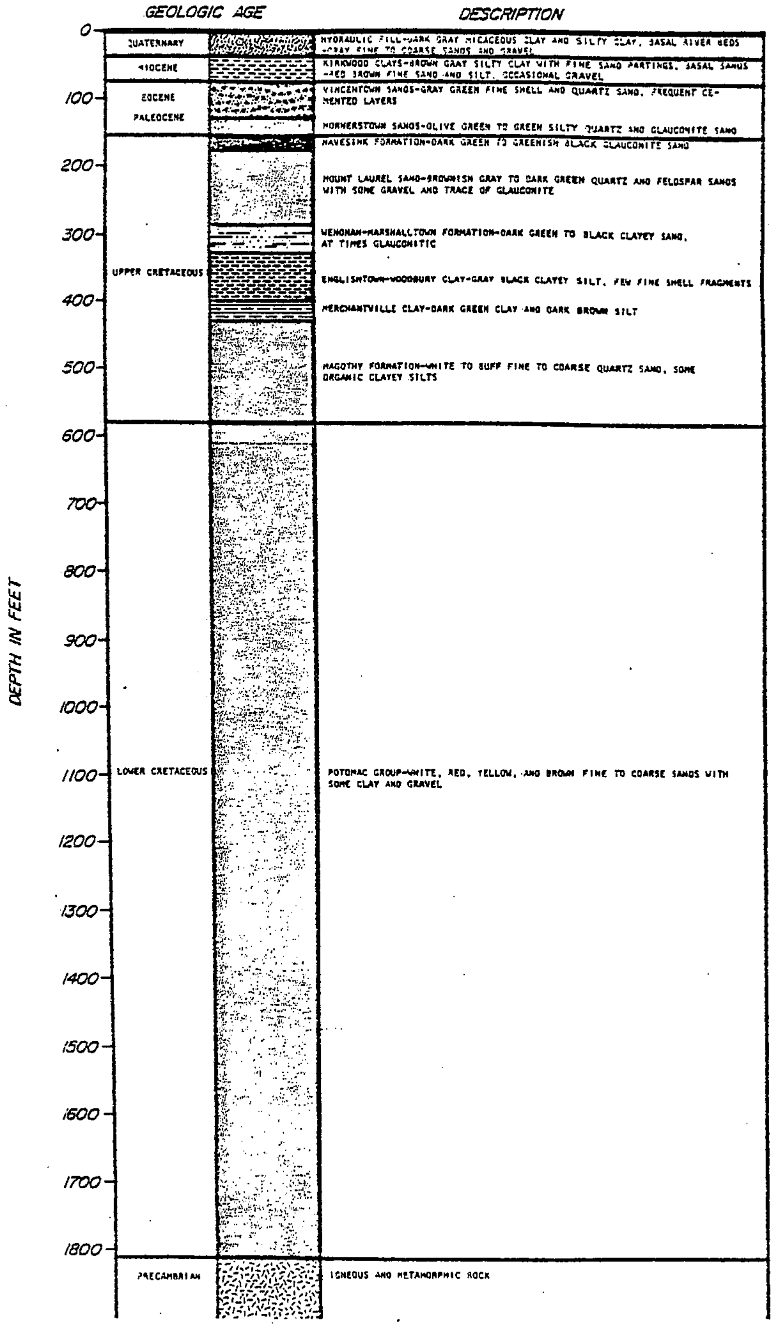
FIG. 2.1-20



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

FEMA
FLOOD HAZARD BOUNDARY MAP

FIG. 2.1-21



GENERALIZED GEOLOGIC COLUMN-SITE AREA

REFERENCES. 1) DAMES & MOORE BORING LOGS.

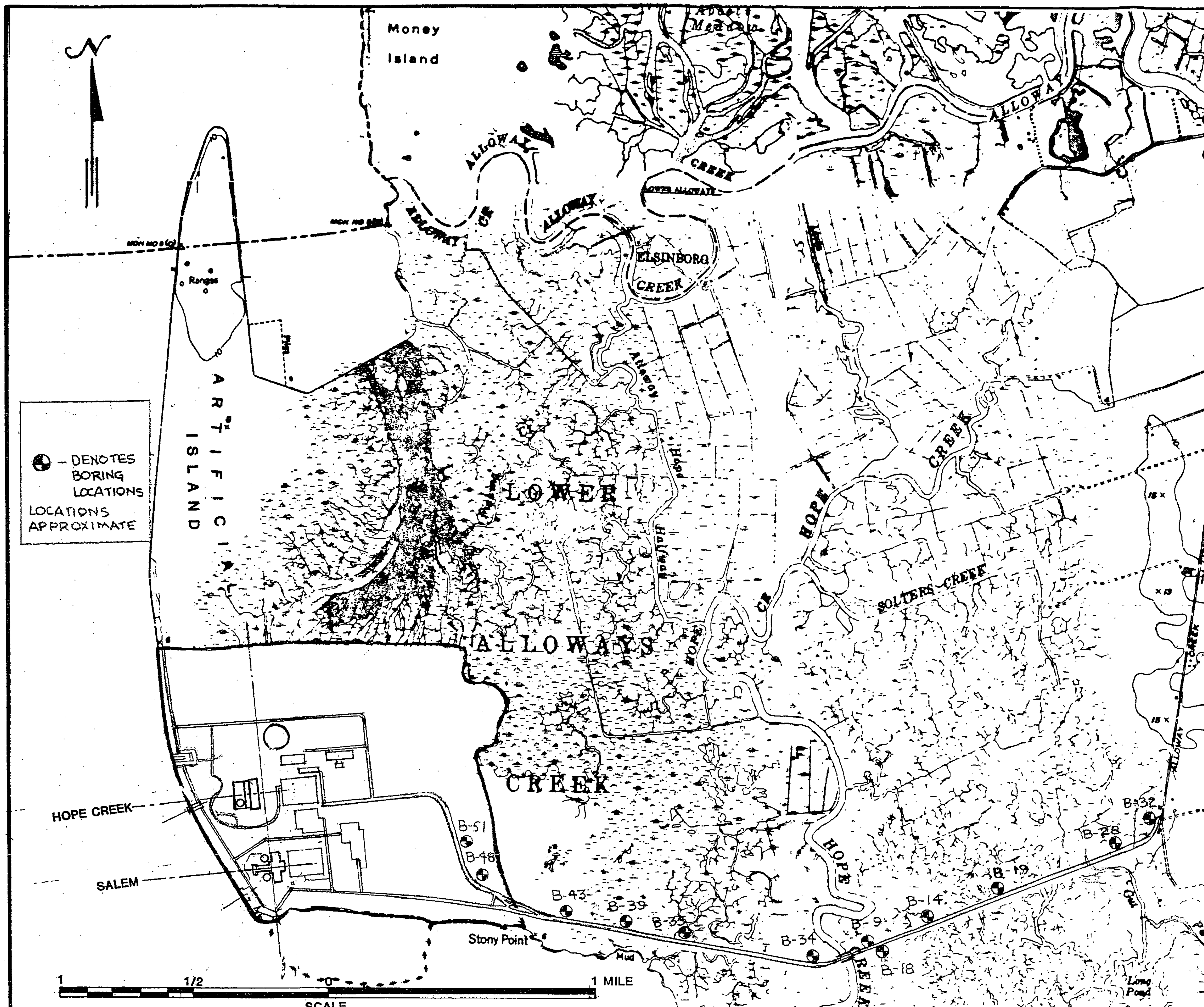
2) MINARD, J.P., 1965, GEOLOGIC MAP OF THE WOODSTOWN QUADRANGLE, GLOUCESTER AND SALEM COUNTIES, N.J., U.S. GEOL. SURVEY

3) U.S.G.S., 1967, ENGINEERING GEOLOGY OF THE NORTHEAST CORRIDOR, WASHINGTON, D.C., TO BOSTON, MASS. MISC. GEOL. INVESTIGATIONS, MAP I-514-B.

4) OWENS, J.P., AND MINARD, J.P., 1970 U.S. GEOL. PROF. PAPER 674.

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND ACCESS ROAD WIDENING PROJECT
GENERALIZED GEOLOGIC CROSS SECTION

Fig. 2.3-1



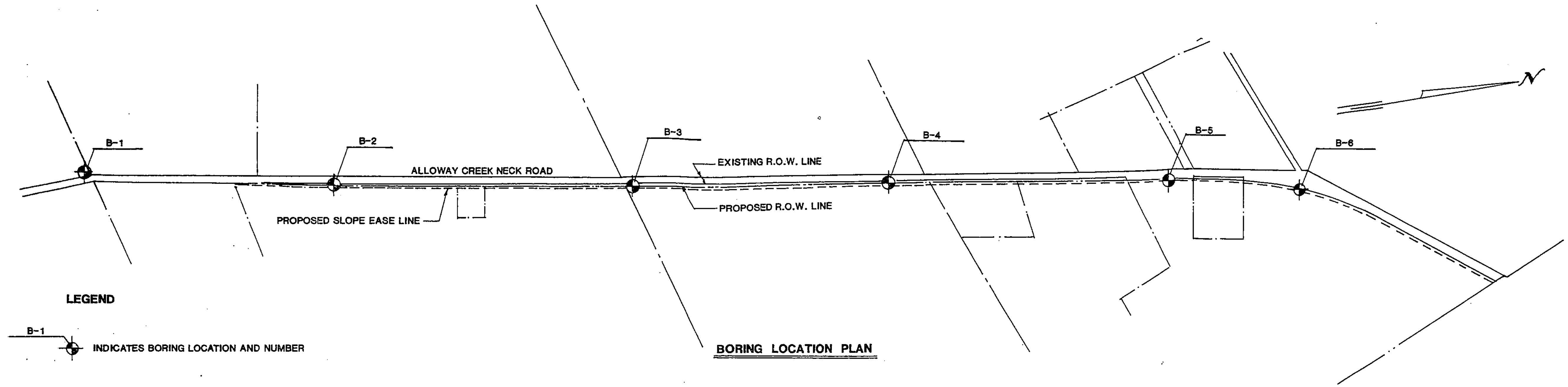
PUBLIC SERVICE ELECTRIC AND GAS COMPANY

ARTIFICIAL ISLAND ACCESS ROAD

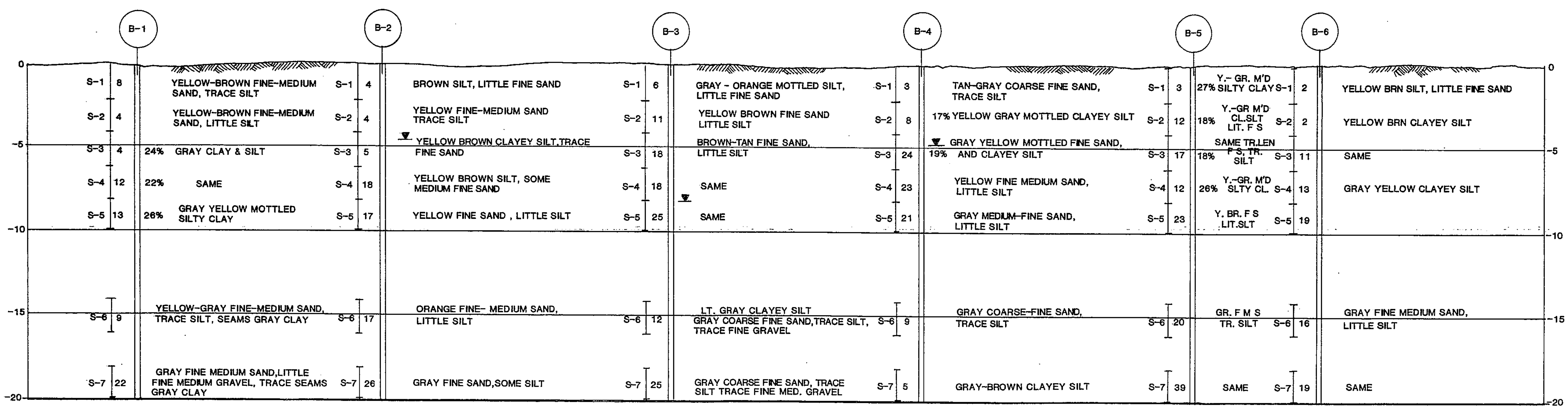
SOIL BORING LOCATION PLAN

PRIVATE SECTOR

FIG. 2.3 - 2

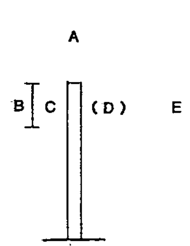


BORING LOCATION PLAN



GEOLOGIC SECTION

LEGEND - GEOLOGIC SECTION



A – LOCATION AND NUMBER OF SOIL BORING

B – SAMPLE TYPE AND NUMBER S – SPLIT SPOON SAMPLE

C – STANDARD PENETRATION RESISTANCE
NO. OF BLOWS FROM A 140 LB. HAMMER
FREE FALLING 30" TO DRIVE 1 FOOT

D – MOISTURE CONTENT AS PERCENT OF DRY WEIGHT

E – SAMPLE CLASSIFICATION

NOTES:

1 BORINGS WERE LOCATED IN THE FIELD BY SKINNER, COMPTON, & FRALINGER.

2 BORINGS WERE PERFORMED BY TECHNISOIL THE DRILLING DIVISION OF LIPPINCOTT ENGINEERING ASSOC.

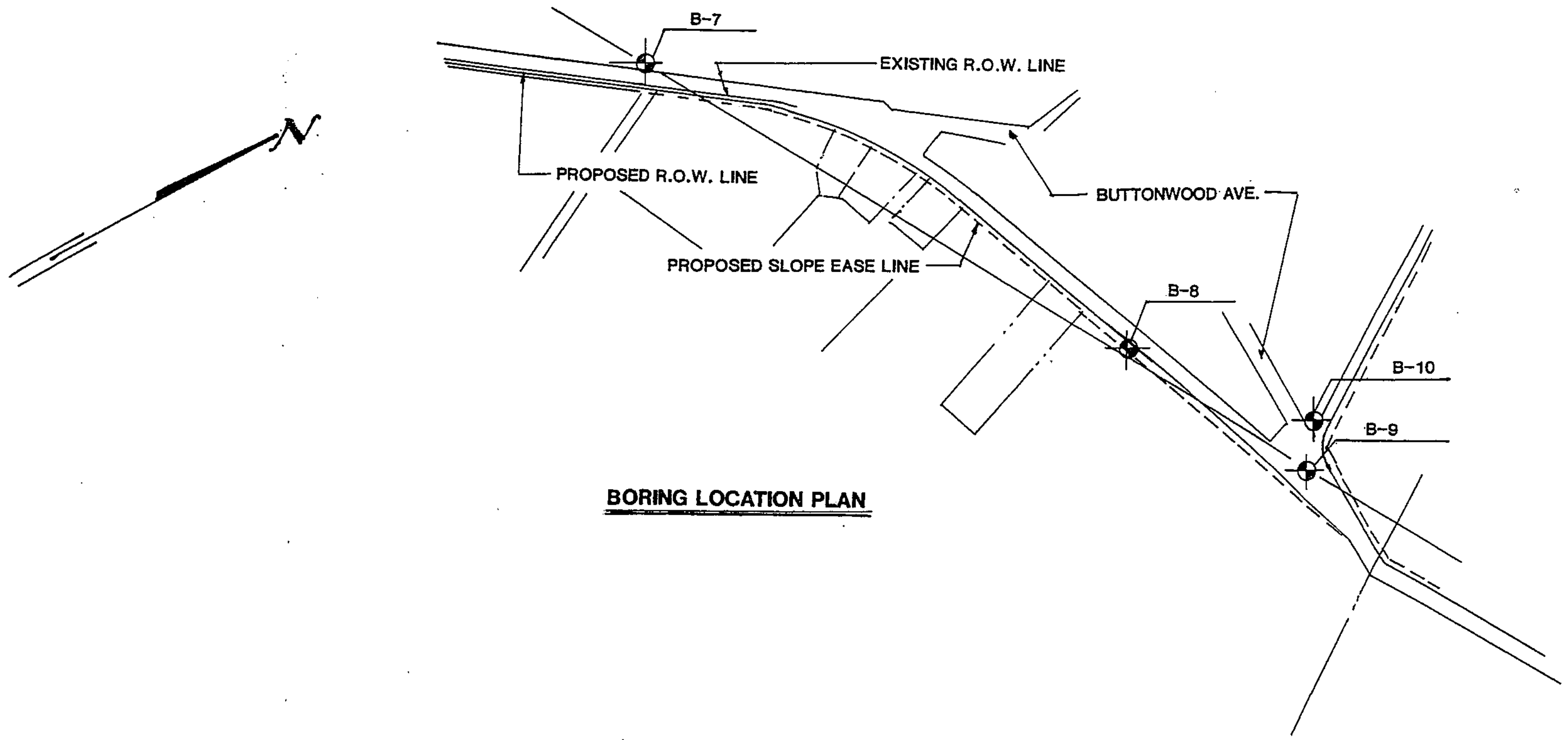
3 SITE INFORMATION WAS TAKEN FROM PRELIMINARY DWG. ROAD RENOVATION PROJ. DATED 4/6/82, PREPARED BY SKINNER, COMPTON, & FRALINGER.

4 THE STRATIGRAPHY PLOTTED IS A NECESSARY INTERPRETATION OF CONDITIONS BETWEEN BORINGS MADE USING OUR ENGINEERING JUDGEMENT, AND MAY NOT REFLECT ACTUAL FIELD CONDITIONS.

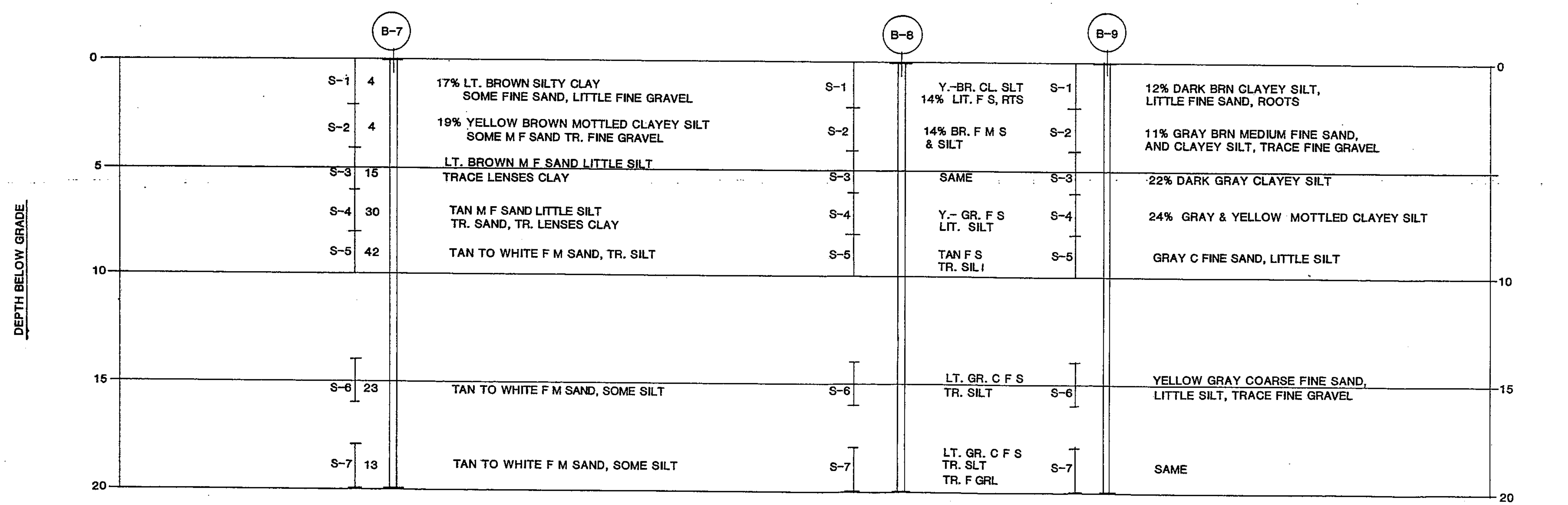
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

SOIL BORING LOCATION PLAN

PUBLIC SECTOR FIGURE 2.3 – 3



BORING LOCATION PLAN



GEOLOGIC SECTION

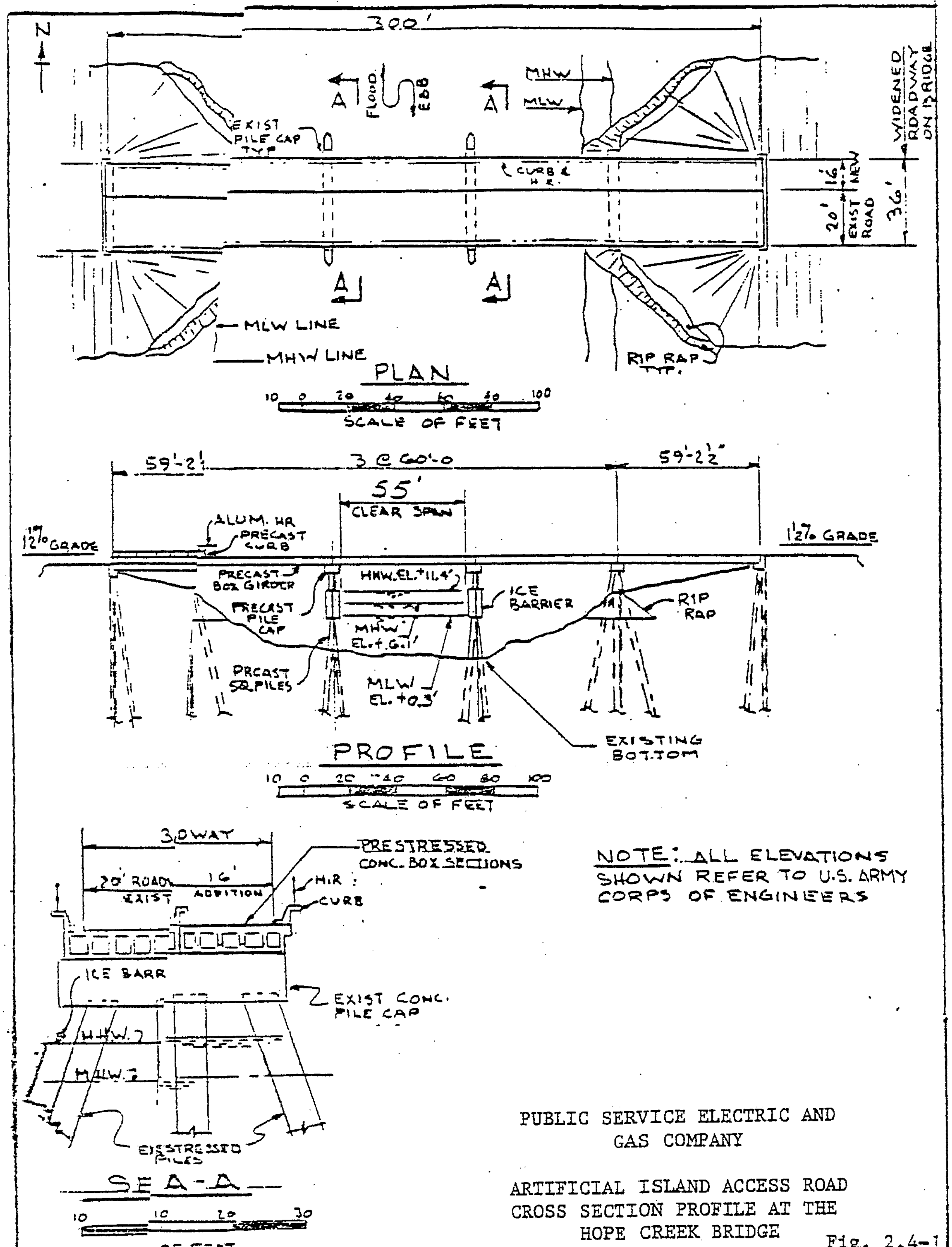
SEE SHEET NO. 1 FOR NOTES

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

SOIL BORING LOCATION PLAN

PUBLIC SECTOR

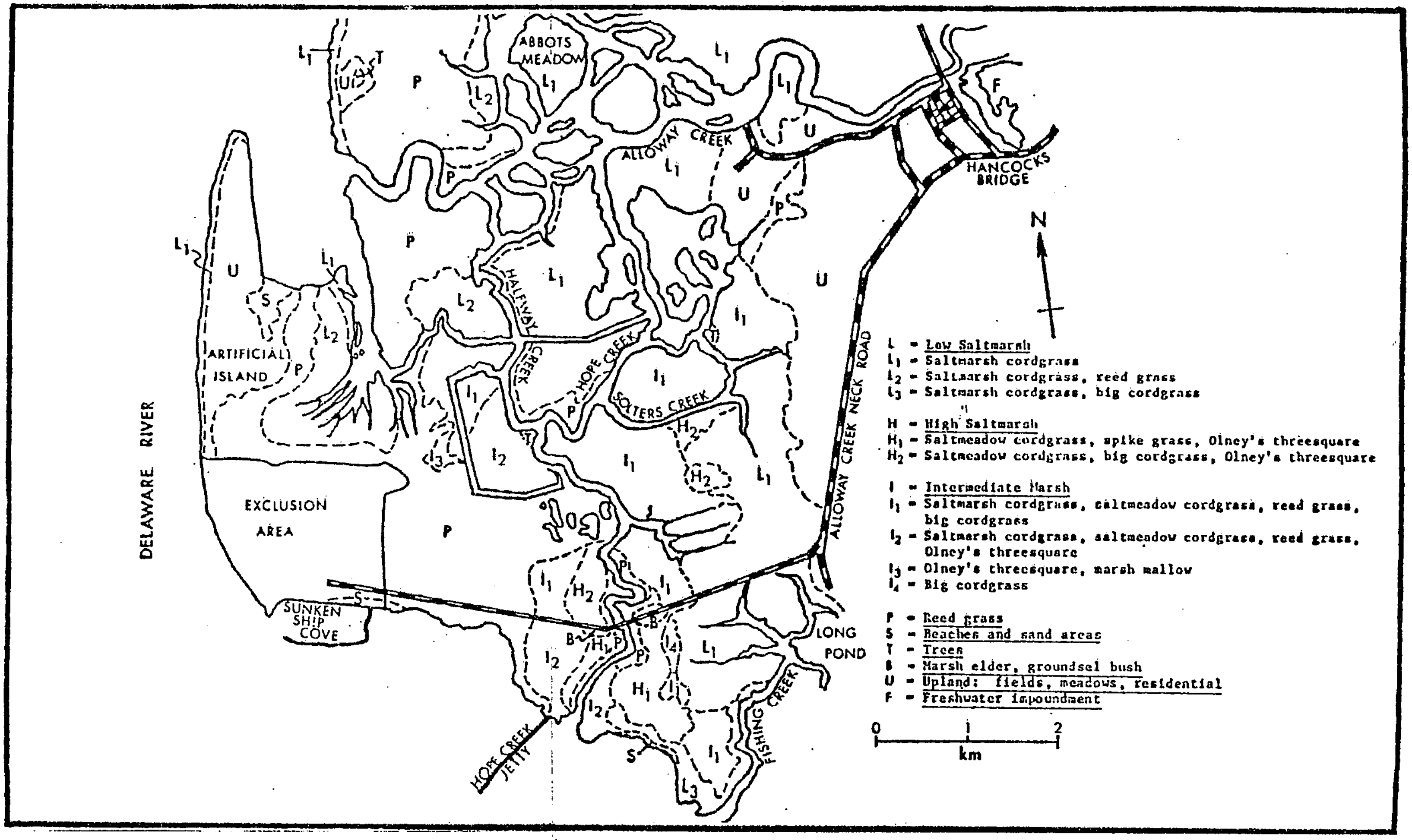
FIGURE 2.3 - 3
(CONT'D)



PUBLIC SERVICE ELECTRIC AND GAS COMPANY

ARTIFICIAL ISLAND ACCESS ROAD CROSS SECTION PROFILE AT THE HOPE CREEK BRIDGE

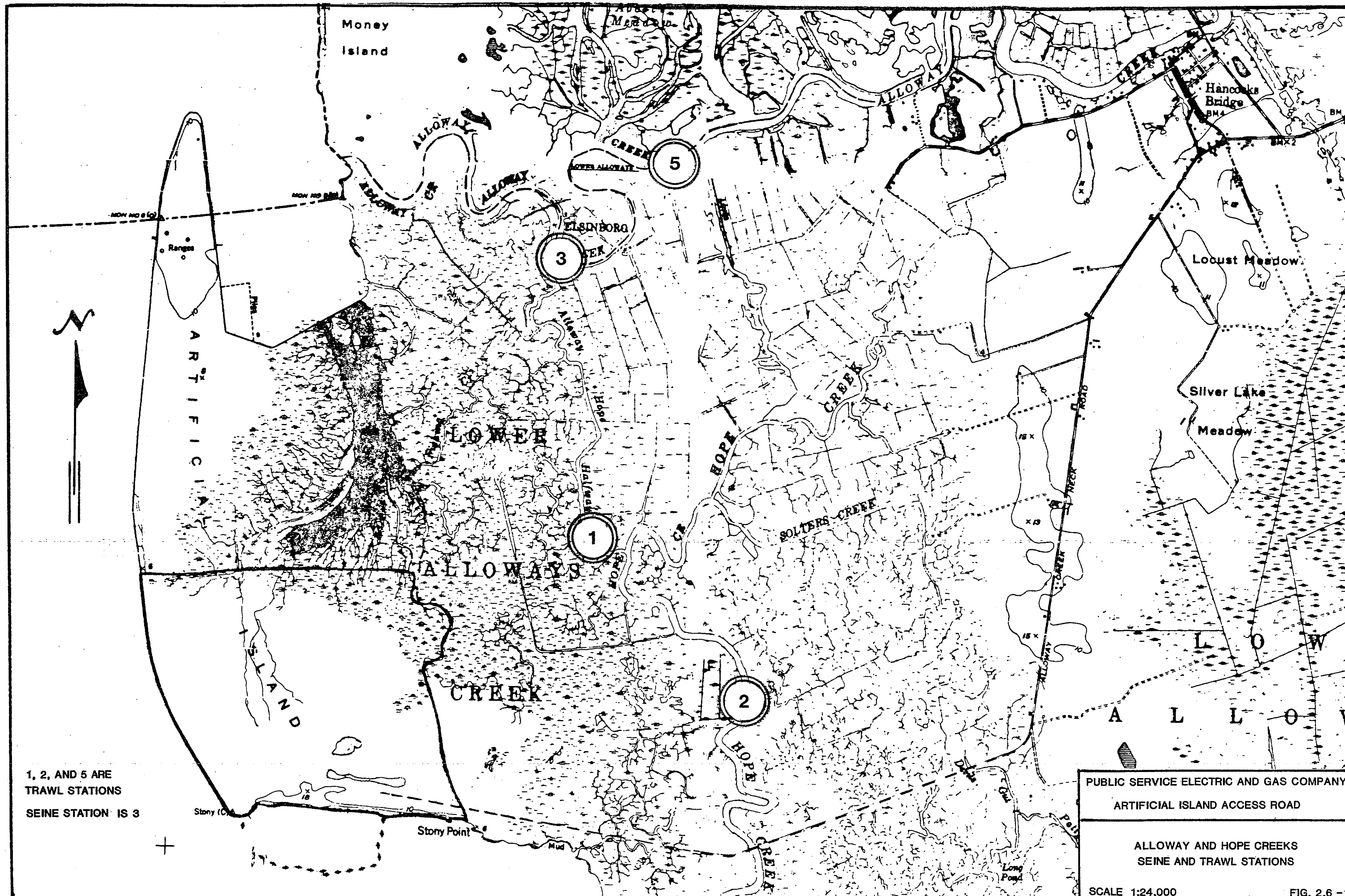
Fig. 2.4-1



PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND
ACCESS ROAD

MAJOR VEGETATION
ASSOCIATIONS

FIG. 2.5 -1


Money Island
Hancocks Bridge
ALLOWAY CREEK
LOWER ALLOWAY
ELSINBORG
Rangas
ARTIFICIAL ISLAND
LOWER ALLOWAYS CREEK
HOPE CREEK
SOLTERS CREEK
Locust Meadow
Silver Lake Meadow
ALLOWAY CREEK NECK ROAD
LOW
ALLOW
Stony Point
Mud
Long Pond
1, 2, AND 5 ARE
TRAWL STATIONS
SEINE STATION IS 3
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ARTIFICIAL ISLAND ACCESS ROAD
ALLOWAY AND HOPE CREEKS
SEINE AND TRAWL STATIONS
SCALE 1:24,000
FIG. 2.6 -1

APPENDIX 2.3-1

PUBLIC SERVICE ELECTRIC & GAS CO.

ARTIFICIAL ISLAND ACCESS ROAD

SOIL BORINGS FROM PRIVATE SECTOR OF
PROJECT SITE (SEE FIGURE 2.3-2)

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE
LIVINGSTON, N.J. 07039

CLIENT: PSE&G
PROJECT: Proposed Access Road Widening
LOCATION: Salem, New Jersey
NUMBER: 03682

HOLE NO. B9
SHEET 1 OF 2
TYPE portable
DATE 7/2/82

GROUND WATER OBSERVATION
At 2 ft after 0 Hours
At ___ ft. after ___ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. grade
DATUM ------
BORING CONTR. HP Drilling
BORING FOREMAN M. Pratt
INSPECTOR Walsh

LOCATION: See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	3 3 2 2		Loose sand with vegetation
		2'-4'	S2	2 2 3 2	4'	
5		4'-6'	S3	2 1 1 1		Very soft silt trace sand
		6'-8'	S4	1 1 1 1		same as above
10		8'-10'	S5	WOH		becoming silt
15		15'-17	S6	WOH		same as above
20		20'-22	S7	WOH		same as above
25		25'-27'	S8	3 3 1 1		becoming soft trace sand
30		30'-32'	S9	2 1 1 4		becoming very soft
35		35'-37'	S10	3 8 8 12		becoming stiff
40		40'-42	S11	3 2 4 6		becoming firm trace sand, clay
45						

HOLE NO. B9

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE.
LIVINGSTON, N.J. 07039

CLIENT: PSE&G
PROJECT: Proposed Access Road Widening
LOCATION: Salem, New Jersey
NUMBER: 03682

HOLE NO. B9
SHEET 2 OF 2
TYPE portable
DATE 7/2/82

GROUND WATER OBSERVATION
At ____ ft. after ____ Hours
At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM ----
BORING CONTR. HP Drilling
BORING FOREMAN M. Pratt
INSPECTOR H. Walsh

LOCATION: See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/ to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
45		45'-47'	S12	3 2 4 6		Loose mf-sand trace silt, clay
50		50'-52'	S13	14 19 17 17		becoming very dense f-sand
55		53'-55'	S14	7 11 12 14	55'	becoming dense
						Bottom of Boring @ 55'

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE
LIVINGSTON, N.J. 07039

CLIENT: PSE&G
PROJECT: Proposed Access Road Widening
LOCATION: Salem, New Jersey
NUMBER: 03682

HOLE NO. B14
SHEET 1 OF 1
TYPE rotary
DATE 7/15/82

GROUND WATER OBSERVATION: not obtained
At ____ ft. after ____ Hours
At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM ------
BORING CONTR. HP Drilling
BORING FOREMAN C. Thomas
INSPECTOR H. Walsh

LOCATION. See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/ to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0					3"	Asphalt
		0'-2'	S1	87 66 41 17	2'	Fill: gravel base
5		5'-7'	S2	2 6 7 8		medium dense yl sand
10		10'-12'	S3	1 0 2 1		becoming very loose cm-sand
15		15'-17'	S4	WOH		same as above
20		20'-22'	S5	3 4 8 17		becoming medium dense silty sand trace clay
25		25'-27'	S6	13 20 22 29		becoming very dense gr f-sand with mica flakes
30		30'-32'	S7	4 8 11 11	32'	becoming dense silty gr sand
35						Bottom of Boring @ 32'
40						

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE.
LIVINGSTON, N.J. 07039

CLIENT: PSE&G
PROJECT: Proposed Access Road Widening
LOCATION: Salem, New Jersey
NUMBER: 03682

HOLE NO. B18
SHEET 1 OF 1
TYPE portable
DATE 7/6 & 7/7/82

GROUND WATER OBSERVATION
At 1'6" ft after 0 Hours
At ___ ft after ___ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM ------
BORING CONTR. HP Drilling
BORING FOREMAN R. Barber
INSPECTOR H. Walsh

LOCATION: See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	1 1 1 2		Very loose or m-sand
		2'-4'	S2	1 1 1 1		becoming mf-sand
5		4'-6'	S3	1 1 1 2		same as above
		6'-8'	S4	1 2 1 2		same as above
10		8'-10'	S5	2 2 2 4		becoming loose
15		15'-17'		2 3 3 5		no recovery
		17'-19'	S6	2 4 6 9		becoming medium dense
20		20'-22'	S7	15 30	22'	becoming very dense
25						Bottom of Boring @ 22'
30						
35						
40						

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE
LIVINGSTON, N.J. 07039

CLIENT: PSE&G
PROJECT: Proposed Access Road Widening
LOCATION: Salem, New Jersey
NUMBER: 03682

HOLE NO. B 19
SHEET 1 OF 1
TYPE rotary
DATE 7/16/82

GROUND WATER OBSERVATION: not obtained
At ____ ft after ____ Hours
At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM -----
BORING CONTR. HP Drilling
BORING FOREMAN G. Thomas
INSPECTOR H. Walsh

LOCATION: See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	5 6 4 2		Medium dense yl m-sand
5		5'-7'	S2	4 5 6 5		becoming mf-sand
					9'	
10		10'-12'	S3	1 1 1 2		Very soft dk gr organic silt with vegetation
					15'	
15		15'-17'	S4	9 8 9 11		Dense gr f-sand
20		20'-22'	S5	1 1 5 8		becoming loose
25		25'-27'	S6	3 6 9 15	27'	same as above
30						Bottom of Boring @ 27'
						shoulder hole
35						
40						

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE
LIVINGSTON, N.J. 07039

CLIENT	PSE&G	HOLE NO.	B28
PROJECT	Proposed Access Road Widening	SHEET	1 OF 1
LOCATION	Salem, New Jersey	TYPE	rotary
NUMBER	03682	DATE	7/15/82

GROUND WATER OBSERVATION
not obtained
At ____ ft. after ____ Hours
At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM ------
BORING CONTR. HP Drilling
BORING FOREMAN G. Thomas
INSPECTOR H. Walsh

LOCATION: See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	4 6 7 8		Medium dense yl cmf-sand
5		5'-7'	S2	13 9 9 7		same as above
10		10'-12'	S3	2 2 2 5		becoming loose
15		15'-17'	S4	8 11 12 14		becoming dense gr f-sand
20		20'-22'	S5	2 3 5 9		becoming medium dense gr silty f-sand
25		25'-27'	S6	8 10 12 15		becoming dense tr clay, mica flakes
30		30'-32'	S7	7 11 15 15	32'	becoming very dense f-sand
35						Bottom of Boring @ 32'
40						

THOR ENGINEERS P.A.
513 W MT PLEASANT AVE
LIVINGSTON, N.J. 07039

CLIENT PSE&G
PROJECT Proposed Access Road Widening
LOCATION Salem, New Jersey
NUMBER 03682

HOLE NO. B32
SHEET 1 OF 1
TYPE portable
DATE 9/19/82

GROUND WATER OBSERVATION
At 8" ft after 0 Hours
At ____ ft after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM -----
BORING CONTR. HP Drilling
BORING FOREMAN G. Thomas
INSPECTOR H. Walsh

LOCATION. See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/ to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	4 6 5 7		Medium dense yl f-sand
		2'-4'	S2	6 5 3 2		same as above
5		4'-6'	S3	3 3 1 2	6'	becoming loose gr silty f-sand
		6'-8'	S4	2 3 15 13	8'	very stiff sandy silty clay
10		8'-10'	S5	4 7 7 9		Medium dense gr f-sand
15		15'-17'	S6	47 32 12 17		becoming very dense
					19'	
20		20'-22'	S7	4 6 7 9	23'	Stiff gr silt
25		25'-27'	S8	7 7 11 14		Dense gr mf-sand
30		28'-30'	S9	7 7 8 13	30'	same as above
						Bottom of Boring @ 30'
35						
40						

HOLE NO. 32

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE
LIVINGSTON, N.J. 07039

CLIENT	PSE&G	HOLE NO.	B34
PROJECT	Proposed Access Road Widening	SHEET	1 OF 1
LOCATION	Salem, New Jersey	TYPE	portable
NUMBER	03682	DATE	7/19/82

GROUND WATER OBSERVATION

At 4" ft after ____ Hours

At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM -----
BORING CONTR. HP Drilling
BORING FOREMAN H. Walsh
INSPECTOR H. Walsh

LOCATION. See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/ to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	WOH		Very soft dk gr organic silt with decomposed vegetation
		2'-4'	S2	WOH		same as above
5		4'-6'	S3	WOH		becoming organic silt & peat fibers
		6'-8'	S4	WOH		same as above
10		8'-10'	S5	WOH		same as above
15					16'	becoming stiff organic sandy silt
		15'-17'	S6	0 1 2 3		Loose gr silty f-sand trace clay
20		20'-22'	S7	16 26 27 23		becoming very dense f-sand
25		26'-28'	S8	7 11 10 11	28'	becoming dense
30						Bottom of Boring @ 28'
35						
40						

HOLE NO. 34

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE
LIVINGSTON, N.J. 07039

CLIENT: PSE&G
PROJECT: Proposed Access Road Widening
LOCATION: Salem, New Jersey
NUMBER: 03682

HOLE NO. B35
SHEET 1 OF 1
TYPE rotary
DATE 7/19/82

GROUND WATER OBSERVATION
not obtained
At ____ ft after ____ Hours
At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM ------
BORING CONTR. HP Drilling
BORING FOREMAN H. Walsh
INSPECTOR H. Walsh

LOCATION. See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/to	NO & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	WOH		Very soft gr organic silt with decomposed vegetation
		2'-4'	S2	WOH		becoming gr silt
5		4'-6'	S3	WOH		same as above
		6'-8'	S4	WOH		becoming gr organic silt with decomposed vegetation
10		8'-10'	S5	WOH		becoming very soft peat
15		15'-17'	S6	WOH		becoming dk gr organic silt
					18'	becoming silt
20		20'-22'	S7	19 32 57 47		Very dense gr cmf-snad trace gravel
25		24'-26'	S8	6 8 9 11		becoming dense f-sand
		26'-28'	S9	5 9 8 13	28'	same as above
30						Bottom of Boring @ 28'
35						
40						

HOLE NO. 35

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE
LIVINGSTON, N. J. 07039

CLIENT: PSE&G
PROJECT: Proposed Access Road Widening
LOCATION: Salem, New Jersey
NUMBER: 03682

HOLE NO. B39
SHEET 1 OF 1
TYPE portable
DATE 7/21/82

GROUND WATER OBSERVATION
At 8" ft after 0 Hours
At ___ ft. after ___ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM -----
BORING CONTR. HP Drilling
BORING FOREMAN H. Walsh
INSPECTOR H. Walsh

LOCATION. See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0					1'	Very soft dk gr organic silt with vegetation
		0'-2'	S1	WOH		
		2'-4'	S2	8 7 9 8		Very loose bn mf-sand
5		4'-6'	S3	9 9 8 7		becoming mf-sand
		6'-8'	S4	6 4 3 3	8'	becoming loose silty f-sand
10		8'-10'	S5	3 1 0 2		Very soft organic silt trace sand
15		15'-17'	S6	WOH		becoming organic silt
					18'	
20		20'-22'	S7	3 7 19 21		Dense gr silty sand
25		25'-27'	S8	9 8 8 8		becoming f-sand
30		28'-30'	S9	9 8 7 4	30'	same as above
						Bottom of Boring @ 30'
35						
40						

THOR ENGINEERS P.A.
313 W. MT. PLEASANT AVE
LIVINGSTON, N. J. 07039

CLIENT	PSE&G	HOLE NO.	B43
PROJECT	Proposed Access Road Widening	SHEET	1 OF 1
LOCATION	Salem, New Jersey	TYPE	rotary
NUMBER	03682	DATE	7/22/82

GROUND WATER OBSERVATION
At 0 ft after 0 Hours
At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM ----
BORING CONTR. HP Drilling
BORING FOREMAN H. Walsh
INSPECTOR H. Walsh

LOCATION: See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/ to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	1 1 1 1		Very soft organic silt with decomposed vegetation
		2'-4'	S2	5 4 2 5	4'	becoming firm
5		4'-6'	S3	4 3 3 2		Loose gr silty sand
		6'-8'	S4	2 1 0 1		becoming very loose
10		8'-10'	S5	1 1 1 0		same as above
					12'	peat
15		15'-17'	S6	1 2 3 3		Frim dk gr organic silt
20		20'-22'	S7	0 0 1 3		becoming very soft clay
					23'	becoming soft organic peat
25		25'-27'	S8	3 2 3 5		Loose gr f-sand trace clay
30		30'-32'	S9	92 49 37 34	32'	becoming very dense gr f-sand
35						Bottom of Boring @ 32'
40						

HOLE NO. 43

THOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE
LIVINGSTON, N.J. 07039

CLIENT: PSE&G
PROJECT: Proposed Access Road Widening
LOCATION: Salem,
NUMBER: 03682

HOLE NO. B48
SHEET 1 OF 1
TYPE portable
DATE 7/22 - 7/23/82

GROUND WATER OBSERVATION
At 3'10"ft after 0 Hours
At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM -----
BORING CONTR. HP Drilling
BORING FOREMAN H. Walsh
INSPECTOR H. Walsh

LOCATION: See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/to	NO. & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	3 3 56		Stiff dk gr organic silt with decomposed vegetation
			S2A		3'	becoming sandy silt
		2'-4'	S2B	3 5 7 8		Medium dense yl silty sand
5		4'-6'	S3	7 4 5 4		same as above
			S4A			becoming mf-sand
		6'-8'	S4B	7 4 5 4		becoming gr f-sand
10		8'-10'	S5	1 1 7 6		becoming silty
					14'	
15					16'	Very soft peat
		15'-17'	S6	1 0 10		Very loose silty sand
					19'	
20		20'-22'	S7	2 2 3 3		Stiff dk gr silt
25					26'	becoming sandy
		25'-27'	S8	2 3 3 5		Medium dense gr mf-sand
30		30'-32'	S9	21 28 39 46	32'	becoming very dense f-sand
35						Bottom of Boring @ 32'
40						

TMOR ENGINEERS P.A.
513 W. MT. PLEASANT AVE
LIVINGSTON, N.J. 07039

CLIENT: PSE&G
PROJECT: Proposed Access Road Widening
LOCATION: Salem, New Jersey
NUMBER: 03682

HOLE NO. B51
SHEET 1 OF 1
TYPE portable
DATE 9/26/82

GROUND WATER OBSERVATION
At 5'1" ft after ____ Hours
At ____ ft after ____ Hours

	CASING	SAMPLER	CORE BAR
TYPE		SS	
SIZE I.D.		1 3/8"	
Hammer Wt.		140#	BIT
Hammer Fall		30"	

SURFACE ELEV. Grade
DATUM ------
BORING CONTR. HP Drilling
BORING FOREMAN G.Thomas.
INSPECTOR H. Walsh

LOCATION: See Boring Location Plan

DEPTH BELOW SURFACE	CASING BLOWS PER FOOT	SAMPLE DEPTHS from/to	NO & TYPE of Sample	BLOWS PER 6" ON SAMPLER	STRATA CHANGE DEPTH	FIELD DESCRIPTION
0		0'-2'	S1	3 6 9 10		Medium dense silty sand
		2'-4'	S2	3 3 4 5	4'	same as above
5		4'-6'	S3	2 3 4 3		Frim organic silt with decomposed vegetation
		6'-8'	S4	15 2 3 3		becoming organic silt trace clay
		8'-10'	S5	2 1 2 1		becoming soft silt
10						
					14'	
15		15'-17'	S6	1 1 2 2		Loose gr silty f-sand
					18'	
20		20'-22'	S7	2 1 2 2		Soft silt trace sand
25		25'-27'	S8	1 1 1 2		becoming very soft
30		30'-32'	S9	3 4 5 7		becoming stiff trace peat fibers
					33'	
35		35'-37'	S10	55 38 51 50	37'	Very dense gr cmf-sand & gravel
40						Bottom of Boring @ 37'

HOLE NO. 51

APPENDIX 2.3-2

PUBLIC SERVICE ELECTRIC & GAS CO.

ARTIFICIAL ISLAND ACCESS ROAD

SOIL BORINGS FROM PUBLIC SECTOR OF PROJECT SITE (SEE FIGURE 2.3-3)

LIPPINCOTT ENGINEERING ASSOCIATES
501 BURLINGTON AVENUE DELANCO, N.J. 08075

PROJECT NO. 3037.1
DATE April 15, 1982

SHEET 1 OF 10
SURFACE ELEV Grade

PROJECT Alloway Creek Neck Road
CLIENT Albert A. Fralinger, Jr.

LOCATION Lower Alloway Creek Twp.
LOG OF BORING NO. B-1

M. Gouda-mk

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT %
0	S-1	A	0/2	3-4-4-5	Yellow-brown fine-medium SAND, trace silt.	
	S-2	A	2/4	5-3-1-1	Yellow-brown fine-medium SAND, little silt.	
5	S-3	A	4/6	2-2-2-2	Gray CLAY & SILT.	24
	S-4	A	6/8	4-5-7-7	Same.	22
	S-5	A	8/10	5-5-8-7	Gray-yellow mottled SILTY CLAY.	26
10						
15	S-6	A	14/16	3-3-6-8	Yellow-gray fine-medium SAND, trace silt, seams gray clay.	
	S-7	A	18/20	9-10-2-8	Gray fine-medium SAND, little fine-medium gravel, trace seams gray clay.	
20						
					EOB 20'	

R-106 Rev 2/7

GROUND WATER DATA

DEPTH	HOUR	DATE
4'0"		4/15/82
2'0"	EOB	"

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER T. [illegible]
HELPER S. [illegible]

LIPPINCOTT ENGINEERING ASSOCIATES

501 BURLINGTON AVENUE DELANCO, N.J. 08075

SHEET 2 OF 10
SURFACE ELEV Grade

ROJECT NO. 3037.1
ATE April 14, 1982

R(CT Alloway Creek Neck Road
CLIENT Albert A. Fralinger, Jr.

OCATION Lower Alloway Creek Twp.
LOG OF BORING NO. B-2

M. Gouda-mk

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT %
0	S-1	A	0/2	1-2-2-4	Brown SILT, little fine sand.	
	S-2	A	2/4	3-2-2-2	Yellow fine-medium SAND, trace silt.	
5	S-3	A	4/6	1-2-3-5	Yellow-brown CLAYEY SILT, trace fine sand. Same.	21 (S-3)
	S-4	A	6/8	5-8-10-14	Yellow-brown SILT, some fine sand.	
	S-5	A	8/10	8-8-9-9	Yellow fine SAND, little silt.	
10						
15	S-6	A	14/16	6-8-9-10	Orange fine-medium SAND, little silt.	
	-7	A	18/20	7-9-17-17	Gray fine SAND, some silt.	
20						
					EOB 20'	

R-106 Rev. 2/77

OUND WATER DATA

DEPTH	HOUR	DATE
[illegible]		4/14/82
[illegible]	EOB	4/14/82

* A. STANDARD PENETRATION TEST (ASTM - D 1586)
  B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
  C. CORE DRILLING

DRILLER T. MAGEE HELPER S. WILLIS

LIPPINCOTT ENGINEERING ASSOCIATES
501 BURLINGTON AVENUE DELANCO, N.J. 08075

PROJECT NO. 3037.1
DATE April 14, 1982

SHEET 3 OF 10
SURFACE ELEV Grade

P[illegible]ECT Alloway Creek Neck Road

CLIENT Albert A. Fralinger, Jr.

LOCATION Lower Alloway Creek Twp.

LOG OF BORING NO. B-3

M. Gouda-mk

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT
0	S-1	A	0/2	3-3-3-4	Gray-orange mottled SILT, little fine sand.	
	S-2	A	2/4	5-5-6-6	Yellow-brown fine SAND, little silt.	
5	S-3	A	4/6	6-9-9-8	Brown-tan fine SAND, little silt.	
	S-4	A	6/8	8-9-9-11	Same.	
	S-4	A	8/10	8-12-13-13	Same.	
10						
15	S-6	A	14/16	5-6-6-9	Light gray SILT. Gray coarse-fine SAND, trace silt, trace fine gravel.	
20	S-7	A	18/20	9-11-14-16	Gray coarse-fine SAND, trace silt, trace fine-medium gravel.	
					EOB 20'	

R-106 Re[illegible] 2/[illegible]

GROUND WATER DATA

DEPTH	HOUR	DATE
8'6"		4/14/82
0'	EOB	"

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER T. [illegible] HELPER S. [illegible]

LIPPINCOTT ENGINEERING ASSOCIATES
501 BURLINGTON AVENUE DELANCO, N.J. 08075

SHEET 4 OF 10
SURFACE ELEV Grade

JECT NO. 3037.1
E April 14, 1982

J - Alloway Creek Neck Road
CLIENT Albert A. Fralinger, Jr.

CATION Lower Alloway Creek Twp.
LOG OF BORING NO. B-4

M. Gouda-mk

SAMPLE NUMBER	TYPE *	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT %
S-1	A	0/2	2-2-1-1	Tan-gray coarse-fine SAND, trace silt.	
				Yellow-gray mottled CLAYEY SILT.	17
S-2	A	2/4	2-3-5-7		
				Gray yellow mottled fine SAND & CLAYEY SILT.	19
S-3	A	4/6	8-12-12-18		
S-4	A	6/8	8-11-12-16	Yellow fine-medium SAND, little silt.	
S-5	A	8/10	7-9-12-15	Gray medium-fine SAND, little silt.	
S-6	A	14/16	5-7-2-1	Gray coarse-fine SAND, trace silt.	
	A	18/20	2-2-3-4	Gray-brown CLAYEY SILT.	
				EOB 20'	

R-106 Rev.2/77

OUND WATER DATA

DEPTH	HOUR	DATE
5'10"		4/14/82
3'5"	EOB	"

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER T. MAGEE HELPER S. WILLIS

LIPPINCOTT ENGINEERING ASSOCIATES

501 BURLINGTON AVENUE DELANCO, N.J. 08075

PROJECT NO. 3037.1
DATE April 14, 1982

SHEET 5 OF 10
SURFACE ELEV Grade

PROJECT Alloway Creek Neck Road
CLIENT Albert A. Fralinger, Jr.

LOCATION Lower Alloway Creek Twp.
LOG OF BORING NO. B-5

M. Gouda-mk

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT %
0	S-1	A	0/2	1-1-2-2	Yellow-gray mottled SILTY CLAY.	27
	S-2	A	2/4	5-5-7-8	Yellow-gray mottled CLAY & SILT, little fine sand.	18
5	S-3	A	4/6	6-8-9-8	Same, trace lenses fine SAND, trace silt.	18
	S-4	A	6/8	5-5-7-10	Yellow-gray moTtled SILTY CLAY.	26
	S-5	A	8/10	10-10-13-15	Yellow-brown fine SAND, little silt.	
10						
15	S-6	A	14/16	7-8-12-5	Gray fine-medium SAND, trace silt.	
	S-7	A	18/20	12-19-20-23	Same.	
20					EOB 20'	

R-106 Rev.2/

GROUND WATER DATA

DEPTH	HOUR	DATE
7'		4/14/82
11'2"	EOB	"

*A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER T. MAGEE HELPER S. WILLIS

LIPPINCOTT ENGINEERING ASSOCIATES
501 BURLINGTON AVENUE DELANCO, N.J. 08075

PROJECT NO. 3037.1
DATE April 15, 1982

SHEET 6 OF 10
SURFACE ELEV Grade

PROJECT Alloway Creek Neck Road
CLIENT Albert A. Fralinger, Jr.

LOCATION Lower Alloway Creek Twp.
LOG OF BORING NO. B-6

M. Gouda-mk

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT %
0	S-1	A	0/2	1-1-1-1	Yellow-brown SILT, little fine SAND.	
	S-2	A	2/4	1-1-1-1	Yellow-brown CLAYEY SILT.	23
	S-3	A	4/6	3-5-6-6	Same.	23
5					Gray-yellow CLAYEY SILT.	25
	S-4	A	6/8	6-6-7-6	Same, trace lenses medium-fine sand, trace silt.	
	S-5	A	8/10	7-8-11-13	Yellow-gray fine-medium SAND, little silt.	
10						
15	S-6	A	14/16	12-8-8-7	Gray fine-medium SAND, little silt.	
	S-7	A	18/20	9-9-10-8	Same.	
20						
					EOB 20'	

R-106 Rev.2/7

GROUND WATER DATA

DEPTH	HOUR	DATE
5'		4/15/82

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER T. [illegible] HELPER S. [illegible]

LIPPINCOTT ENGINEERING ASSOCIATES

501 BURLINGTON AVENUE DELANCO, N.J. 08075

ROJECT NO. 3037.1
ATE April 15, 1982

SHEET 7 OF 10
SURFACE ELEV Grade

R CT Alloway Creek Neck Road

CLIENT Albert A. Fralinger, Jr.

OCATION Lower Alloway Creek Twp.

LOG OF BORING NO. B-7

M. Gouda-mk

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT %
0	S-1	A	0/2	5-2-2-2	Light brown SILTY CLAY, some fine sand, little fine gravel.	17
	S-2	A	2/4	3-2-2-3	Yellow-brown mottled CLAYEY SILT, some medium-fine sand, trace fine gravel.	19
5	S-3	A	4/6	5-7-8-11	Light brown medium-fine SAND, little silt, trace lenses clay.	
	S-4	A	6/8	9-13-17-22	Tan medium-fine SAND, little silt, trace coarse sand, trace lenses clay.	
	S-5	A	8/10	25-27-15-19	Tan-white fine-medium SAND, trace silt.	
10						
15	S-6	A	14/16	7-10-13-10	Tan-white fine-medium SAND, some silt.	
	S-7	A	18/20	8-8-5-4	Tan-white fine SAND, some silt.	
20					EOB 20'	

R-106 Rev.2/77

GROUND WATER DATA

DEPTH	HOUR	DATE
3'		4/15/82
2'	EOB	"

*A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER T. MAGEE HELPER S. WILLIS

LIPPINCOTT ENGINEERING ASSOCIATES
501 BURLINGTON AVENUE DELANCO, N.J. 08075

SHEET 8 OF 10
SURFACE ELEV Grade

PROJECT NO. 3037.1
DATE April 15, 1982

PROJECT Alloway Creek Neck Road
LOCATION Lower Alloway Creek Twp.

CLIENT Albert A. Fralinger, Jr.
LOG OF BORING NO. B-8
M. Gouda-mk

DEPTH	SAMPLE NUMBER	TYPE*	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT %
0	S-1	A	0/2	2-2-2-2	Yellow-brown CLAYEY SILT, little fine sand, roots.	14
	S-2	A	2/4	3-3-2-1	Brown fine-medium SAND & SILT.	14
	S-3	A	4/6	7-9-13-11	Same.	
5	S-4	A	6/8	5-4-4-6	Yellow-gray fine SAND, little silt.	
	S-5	A	8/10	5-4-5-7	Tan fine SAND, trace silt.	
10						
15	S-6	A	14/16	8-8-16-24	Light gray coarse-fine SAND, trace silt.	
	-7	A	18/20	11-15-15-22	Light gray coarse-fine SAND, trace silt, trace fine gravel.	
20					EOB 20'	

R-106 Rev.2/

GROUND WATER DATA

DEPTH	HOUR	DATE
4'		4/15/82

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER T. MAGEE HELPER S. WILLIS

LIPPINCOTT ENGINEERING ASSOCIATES

501 BURLINGTON AVENUE DELANCO, N.J. 08075

PROJECT NO. 3037.1
DATE April 15, 1982

SHEET 9 OF 10
SURFACE ELEV Grade

PROJECT Alloway Creek Neck Road

CLIENT Albert A. Fralinger, Jr.

LOCATION Lower Alloway Creek Twp.

LOG OF BORING NO. B-9

M. Gouda-mk

DEPTH	SAMPLE NUMBER	TYPE *	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT %
0	S-1	A	0/2	6-3-4-4	Dark brown CLAYEY SILT, little fine sand, roots	12
	S-2	A	2/4	5-7-7-6	Gray-brown medium-fine SAND & CLAYEY SILT, trace fine gravel.	11
5	S-3	A	4/6	5-5-5-6	Dark gray CLAYEY SILT.	22
	S-4	A	6/8	4-5-5-6	Gray-yellow mottled CLAYEY SILT.	24
	S-5	A	8/10	10-12-14-18	Gray coarse-fine SAND, little silt.	
10						
15	S-6	A	14/16	15-18-19-22	Yellow coarse-fine SAND, little silt, trace fine gravel.	
	S-7	A	18/20	11-13-15-22	Same.	
20						

EOB 20'

R-106 Rev.2/7

GROUND WATER DATA

DEPTH	HOUR	DATE

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER T. MAGEE HELPER S. WILLIS

LIPPINCOTT ENGINEERING ASSOCIATES

501 BURLINGTON AVENUE DELANCO, N.J. 08075

PROJECT NO. 3037.1
DATE April 15, 1982

SHEET 10 OF 10
SURFACE ELEV Grade

PROJECT Alloway Creek Neck Road
CLIENT Albert A. Fralinger, Jr.

LOCATION Lower Alloway Creek Twp.
LOG OF BORING NO. B-10

M. Gouda-mk

DEPTH	SAMPLE NUMBER	TYPE *	SAMPLE DEPTH	NUMBER OF BLOWS PER 6"	CLASSIFICATION OF MATERIALS BASED ON SAMPLES RECOVERED PLUS OBSERVATION OF MATERIAL RETURNED BETWEEN SAMPLES	MOISTURE CONTENT %
0	S-1	A	0/2	3-4-8-7	Brown coarse-fine SAND, some silt, trace fine gravel.	
	S-2	A	2/4	6-5-5-6	Yellow-brown CLAYEY SILT.	18
5	S-3	A	4/6	4-3-3-3	Yellow-brown CLAYEY SILT, lenses fine-medium sand, little silt.	22
	S-4	A	6/8	7-6-6-9	Yellow-gray mottled fine-medium SAND, little silt.	
	S-5	A	8/10	9-11-11-12	Yellow coarse-fine SAND, little silt.	
10						
15	S-6	A	14/16	7-8-8-11	Dark gray SILTY CLAY.	
	S-7	A	18/20	8-11-14-20	Gray fine-medium SAND, little silt, trace lenses gray clayey silt.	
20						
					EOB 20'	

R-106 Rev.2/7

GROUND WATER DATA

DEPTH	HOUR	DATE

* A. STANDARD PENETRATION TEST (ASTM-D 1586)
B. STANDARD THIN-WALLED 3" TUBE (ASTM-D 1587)
C. CORE DRILLING

DRILLER T. MACHE HELPER S. WILLIS

APPENDIX 2.5-1

PUBLIC SERVICE ELECTRIC & GAS CO.

ARTIFICIAL ISLAND ACCESS ROAD

THE VEGETATION AND STANDING CROP OF THE MARSH STRIP BORDERING THE ARTIFICIAL ISLAND ACCESS ROAD

THE VEGETATION AND STANDING CROP ON THE MARSH STRIP BORDERING THE ARTIFICIAL ISLAND ACCESS ROAD

Prepared for

Public Service Electric and Gas Co.
80 Park Plaza
Newark, New Jersey 07101

By

Robert E. Meadows, Harold M. Brundage III, and Jason E. Krout

Cartography by

Robert G. Howells

Ichthyological Associates, Inc.
100 South Cass St.
Middletown, Delaware 19709

Victor J. Schuler
Senior Vice President

October 1, 1982

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INTRODUCTION

The abundance, distribution and interrelationships of the wetland vegetation of Artificial Island have been described in the floristic surveys of Hardin (1980) and Montgomery (1982). The present study estimated the standing crop of principal wetland plant communities bordering the north side of the Artificial Island Access Road. Component tasks included 1) identifying dominant and secondary plant taxa, 2) mapping and determining the acreage of principal community types and 3) sampling to determine mean dry biomass of each community.

STUDY AREA

The study area was the band of marshland which lies along and is contiguous with the north side of the Artificial Island Access Road, from approximately Tower 4/1 west to Tower 2/1 on the Salem New Freedom-South transmission line, a distance of ca. 3.4 km (2.1 mi) (Fig. 1). It extended 24 m (80 ft) out from the north edge of the Access Road pavement except at the road's eastern bend where the area extended to 32 m (105 ft) and at the bridge over Hope Creek where it extended to 46 m (150 ft).

MATERIALS AND METHODS

Transect Survey and Mapping

On September 5, 1982 the study area was surveyed to determine the nature and extent of principal vegetation communities. Twenty-three belt transects were established perpendicular to the road at intervals of approximately 152 m (500 ft). The linear extent of each community type along each transect line was measured with optical range finders (accuracy within 3 percent). Plants occurring within ca. 1 m of the transect line were included in the census.

Maps showing the locations and extent of the principal community types within the study area were prepared based on measurements made along the transects, supplemental field reconnaissance and aerial photographs. The acreage of each community type was determined from these maps with a polar planimeter. As per specification, only portions of the study area designated wetlands on the New Jersey wetland maps (NJDEP, 1972) were included in acreage calculations.

Standing Crop Estimation

Samples to determine the standing crop of three basic community types; Spartina alterniflora, Spartina patens/Distichlis spicata mix and Phragmites australis were collected on September 12. Since the standing crop of salt marsh vegetation in the mid-Atlantic region typically peaks in late August to early September (Morgan, 1961) these samples represented peak standing crop. Any single-harvest method will underestimate annual production since 1) portions of the plant may be eaten or die and fall off prior to sampling and 2) growth may occur after harvest (see Bradbury and Hofstra, 1976; Keefe and Boynton, 1973); however, the data do provide a relative index for comparing production between community types and locations.

Each sample consisted of all aerial vegetation clipped within 1 to 2 cm of the soil from a randomly selected $0.5m^2$ square quadrat. Five quadrats per community type were sampled (Table 1). The clipped vegetation was separated by species in the field. The *P. australis* samples were also separated into live and dead standing culms. All culms and live flowering heads in each *P. australis* and *S. alterniflora* quadrat were counted; for *S. patens*/*D. spicata* quadrats, counts were estimated from weighed subsamples. Ten culms were selected at random from each sample and measured for total length, i.e., from soil level to the tip of the tallest vegetative component (Hardisky and Reimold, 1977).

Each sample was placed in a labeled paper bag and dried at 66 C (150 F) in a convection oven until a stable weight was attained (8 days). Dry weight was recorded to the nearest gram and used in calculation of standing crop.

RESULTS AND DISCUSSION

Transect Survey and Mapping

Thirty-three plant taxa comprising 20 families were observed on the 23 transects established perpendicular to the Artificial Island Access Road (Table 1). Spartina alterniflora, S. patens/D. spicata and P. australis were dominant and formed relatively pure stands, thereby providing the basis for defining three principal community types. The other 29 taxa occurred only occasionally.

Species variety per transect ranged from 2 to 18 (Table 1). Variety was greatest on transects which included an expanded area of fill; plants found on fill were frequently upland species typically associated with disturbed areas.

Total acreage of the wetlands component of the study area was estimated as 6.97 ha (17.25 acres). The P. australis community comprised 65.9 percent; S. alterniflora, 30.8 percent; S. patens/D. spicata, 1.1 percent; and mixed marsh/upland vegetation, 2.2 percent of the total wetlands acreage (Table 2).

Zonation was clearly evident; there was a varying-width band of P. australis adjacent to the road, the transmission tower access points and, typically, the larger culverts (Figs. 2-7). As expected, S. alterniflora predominated at lower marsh elevations which are flushed by daily tides. Both tall and short forms of *S. alterniflora* were found, with the tall form occurring in low, deeply channelized, well-flushed areas and the short form in slightly higher less regularly flushed areas. *Spartina patens*/*D. spicata* occurred in two relatively small stands which were only slightly channelized and poorly flushed.

Standing Crop Estimation

The *S. alterniflora* community showed the highest mean peak live standing crop ($\overline{x}$ = 986 g(dry)m^{-2}; range = 574-1,374 g(dry)m^{-2}) of the three community types sampled (Table 2). Variation in biomass was also greatest in this community, probably reflecting inclusion of varying amounts of tall and short form *S. alterniflora* with correspondingly different mean weight per culm and the non-uniform distribution of culms within a quadrat (*S. alterniflora*, particularly tall form tends to grow in dense hummocks surrounded by muddy channels). The amount of standing dead material in the *S. alterniflora* samples was too small to quantify. Culm density averaged 288/m^2, mean culm length was 0.99 m and 33.7 percent of the culms had flowering heads (Table 3).

Mean peak live standing crop for the *S. patens*/*D. spicata* community was 806 g(dry)m^{-2} (range = 686-1,060 g(dry)m^{-2}) (Table 2). These values may, however, be biased relative to those for the other communities since up to 25 percent of the *S. patens* in Delaware may overwinter and continue growing the next year (Hardisky and Reimold, 1977). Variation in biomass was least in this community, probably reflecting the relatively uniform distribution of culms within a quadrat and the slight variation in culm total length (range = 0.36-0.50 m; $\overline{x}$ = 0.43 m) (Table 3). Little standing dead material was evident in these samples. Culm density averaged 6,501/m^2. While no flowering heads were taken in random subsamples (Table 3), a small number of both species with flowering heads were found in the balance of the sample.

Mean peak live standing crop for the *P. australis* community was 806 g(dry)m^{-2} (range = 540-1,212 g(dry)m^{-2}) (Table 2). Mean peak standing crop of dead material was 700 g(dry)m^{-2} (range = 368-1,086g(dry)m^{-2}). The live/dead ratio (by weight) ranged from 0.6 to 2.4 (Table 2) and did not appear related to the periodicity or extent of tidal flooding, contrary to reports by Tyrawski (1977) for a *P. australis* colony in Delaware. Live culm density averaged 70/m^2, mean culm length was 1.94 m and 52.5 percent had flowering heads (Table 3).

The standing crop of the mixed marsh/upland vegetation community was not determined.

Standing crop values in the present study are within the ranges reported for other east coast marshes (Table 4), except for *P. australis* which is somewhat below the previously reported minimum.

An estimate of the total live dry standing crop of each dominant community was calculated by multiplying the mean peak standing crop of each community by its corresponding area. These estimates were 21.2 mt (metric tons) for the *S. alterniflora* community, 0.6 mt for *S. patens*/*D. spicata*, 36.9 mt for live *P. australis* and 32.1 mt for dead *P. australis* (Table 2).

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Table 1.
Plants observed on transects perpendicular to the Artificial Island Access Road, September 1982. Occurrence is noted as Abundant (A) or Present (x). Quadrat number appears in parenthesis.

Taxon - Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Cupressaceae - Cypress Family																							
<u>Juniperus</u> <u>virginiana</u> - Eastern red cedar	x		x				x						x	x									
Gramineae (Poaceae) - Grass Family																							
<u>Spartina</u> <u>alterniflora</u> - Saltmarsh cordgrass	x		A (1)	A	A	A (2)	x	A	A (3)	A	A	x (4)	x				x	A	A	A (5)	x	A	
<u>Spartina</u> <u>patens</u>/<u>Distichlis</u> <u>spicata</u> community (Saltmeadow cordgrass/Spike grass community)	x		x	x	x (1)		x			x		A (2,3)	A (4,5)				x				x		A
<u>Spartina</u> <u>cynosuroides</u> - Big cordgrass[1]																				x			
<u>Phragmites</u> <u>australis</u> - Reed	A	A (1)	A	A	A (2)	A	A	A	A	A	A	A (3)	A	A	A	A	A	A	A	A (4)	A	A (5)	A
Cyperaceae - Sedge Family																							
<u>Scirpus</u> <u>robustus</u> - Salt marsh bulrush								x															
<u>Scirpus</u> <u>Olneyi</u> - Olney's threesquare																					x		x
Myricaceae - Myrtle Family																							
<u>Myrica</u> <u>pensylvanica</u> - Bayberry	x														x								
Amaranthaceae - Amaranth Family																							
<u>Amaranthus</u> <u>cannabinus</u> - Tidemarsh waterhemp											x												
Phytolaccaceae - Pokeweed Family																							
<u>Phytolacca</u> <u>americana</u> - Pokeweed																	x						
Caryophylacceae - Pink Family																							
<u>Stellaria</u> <u>media</u> - Chickweed	x																						
Magnoliaceae - Magnolia Family																							
<u>Magnolia</u> <u>virginiana</u> - Sweetbay			x																				
Lauraceae - Sassafras Family																							
<u>Sassafras</u> <u>albidum</u> - Sassafras													x	x									
Platanaceae - Sycamore Family																							
<u>Platanus</u> <u>occidentalis</u> - Sycamore	x									x					x								
Rosaceae - Rose Family																							
<u>Prunus</u> <u>virginiana</u> - Choke cherry	x						x								x								
F[illegible]ceae - Bean Family																							
<u>[illegible]izia</u> <u>julibrissin</u> - Silk-tree			x																				

Table 1.
Continued.

Taxon - Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
										Transect No.													
Anacardiaceae - Cashew Family																							
Rhus copallina - Winged sumac	x		x				x						x										
Rhus radicans - Poison ivy	x	x	x																				
Aceraceae - Maple Family																							
Acer rubrum - Red maple	x												x										
Malvaceae - Mallow Family																							
Hibiscus palustris - Marsh mallow																							x
Elaeagnaceae - Oleaster Family																							
Elaeagnus angustifolia - Russian olive	x	x																					
Umbelliferae (Apiaceae) - Carrot Family																							
Cicuta maculata - Water hemlock																			x				
Daucus carota - Wild carrot	x	x												x	x								
Asclepiadaceae - Milkweed Family																							
Asclepias syriaca - Common milkweed															x								
Caprifoliaceae - Honeysuckle Family																							
Lonicera japonica - Japanese honeysuckle	x	x	x										x										
Sambucus canadensis - Elderberry	x		x																				
Compositae (Asteraceae) - Aster Family																							
Iva frustescens - Marsh elder												x				x	x						
Cirsium spp. - Thistle															x								
Baccharis halimifolia - Groundsel-bush	x	x	x				x	x		x			x		x	x	x	x					
Bidens aristosa - Tickseed sunflower		x							x														
Solidago spp. - Goldenrods	x	x												x	x		x						
Heterotheca subaxillaris - Camphorweed	x			x						x		x									x		x
Total No. of Taxa	18	8	11	4	3	2	7	4	3	6	3	5	9	5	9	3	7	3	3	3	5	2	5

[1]*S. cynosuroides* found during quadrat sampling near transect 20.

Table 2.
Peak standing crop of marsh communities adjacent to the Artificial Island Access Road, September 1982.

Community Type	Peak Standing Crop (g(dry)m^{-2}) Quadrat No. 1	2	3	4	5	x	Peak Standing Crop (kg) per ha (acre)	Area of Community Type ha	(acres)	Total Peak Standing Crop kg (mt)
I. *Spartina alterniflora*										
Live	1,374	1,306	574	866	810	986	9,860 (3,990)	2.15	(5.32)	21,199 (21.2)
II. *S. patens/D. spicata*										
Live	1,060	686	720	706	860	806	8,060 (3,262)	0.08	(0.20)	645 (0.6)
III. *Phragmites australis*										
Live	866	640	540	774	1,212	806	8,060 (3,262)	4.59	(11.35)	36,995 (36.9)
Dead	368	1,086	608	474	966	700	7,000 (2,833)	4.59	(11.35)	32,130 (32.1)

Table 3.
Density, mean total length and percentage with flowering heads of live plant culms of dominant and secondary plants in marsh adjacent to the Artificial Island Access Road, September 1982.

Community Type	Culm Density (n/m^2) Quadrat						Mean Culm Total Length (m) Quadrat						Percentage with Flowering Heads Quadrat					
	1	2	3	4	5	$\bar{x}$	1	2	3	4	5	$\bar{x}$	1	2	3	4	5	$\bar{x}$
I. *Spartina alterniflora*	338	376	180	242	304	288	1.19	1.14	0.92	0.95	0.77	0.99	60.9	11.7	42.2	19.8	–	33.7
S. patens/D. spicata	24	0	0	0	376	80	0.74	–	–	–	0.57	0.66	–	–	–	–	–	–
II. *S. patens/D. spicata*	6,758	5,716	6,453	8,236	5,342	6,501	0.50	0.41	0.44	0.36	0.45	0.43	–	–	–	–	–	–
Heterotheca subaxillaris	0	0	6	0	0	1	–	–	0.31	–	–	0.31	–	–	–	–	–	–
Amaranthus cannabinus	0	0	0	0	2	0.4	–	–	–	–	1.83	1.83	–	–	–	–	–	–
Spartina alterniflora	0	0	0	0	10	2	–	–	–	–	0.73	0.73	–	–	–	–	–	–
Scirpus Olneyi	0	0	0	0	18	4	–	–	–	–	0.75	0.75	–	–	–	–	–	–
III. *Phragmites australis*	75	42	78	58	98	70	2.17	1.81	1.48	2.11	2.14	1.94	64.8	61.9	23.1	41.4	71.4	52.5
Spartina alterniflora	24	0	66	14	0	21	1.13	–	0.71	1.37	–	1.07	–	–	–	–	–	–
Heterotheca subaxillaris	0	0	14	0	0	3	–	–	0.20	–	–	0.20	–	–	–	–	–	–
Amaranthus cannabinus	0	0	0	1	0	0.2	–	–	–	1.83	–	1.83	–	–	–	–	–	–

Table 4.
Comparison of standing crop of aerial plant parts in a number of salt marsh vegetation studies.

Dominant Species	Net Production or Max. Standing Crop (g(dry)m^{-2})	Method[1]	Location	Source
Spartina alterniflora (tall form)	827	-	Long Island, NY	Udell et al., 1969
	1,700	-	Great Bay, NY	Good, 1972
	1,592	b	Great Bay, NJ	Squiers and Good, 1974
	850		Great Egg Harbor, NJ	Good, 1977
	735-825	b	Manahawkin, NJ	Sugihara et al, 1979
	1,419	b	Canary Creek, DE	Daiber et al., 1976
(short form)	508	-	Long Island, NY	Udell et al., 1969
	590	-	Great Bay, NJ	Good, 1972
	548	-	Great Egg Harbor, NJ	Good, 1977
	444-574	b	Manahawkin, NJ	Sugihara et al., 1979
	362-517	b	Canary Creek, DE	Daiber et al., 1976
(mixed or not specified)	300	b	Cape May, NJ	Good, 1965
	1,332	b	Virginia	Wass and Wright, 1969
	427-558	b	Chincoteague Bay, MD & VA	Keefe and Boynton, 1976
	445	a	Canary Creek, DE	Morgan, 1961
	704	b	Murderkill River, DE	Daiber et al., 1976
	3,000	-	Georgia	Odum, 1959
Spartina patens	805	b	Virginia	Wass and Wright, 1969
	550	-	Great Bay, NJ	Good, 1972
	463	-	Great Bay, NJ	Nadeau, 1972
	535-618	b	Manahawkin, NJ	Sugihara et al., 1979
	537	b	Murderkill River, DE	Daiber et al., 1976
	908	b	Sussex Co., DE	Daiber et al., 1976
Distichlis spicata	360	b	Virginia	Wass and Wright, 1969
	670	-	Great Bay, NJ	Good, 1972
	613-644	b	Manahawkin, NJ	Sugihara et al., 1979
	629	b	Murderkill River, DE	Daiber et al., 1976
	460	b	Sussex Co., DE	Daiber et al., 1976
S. patens/D. spicata	680	b	Chesapeake Bay	Flemer et al., 1978
	1,525	-	Ann Arundel Co., MD	Jack McCormick and Associates, Inc., 1974
S. patens/D. spicata and Scirpus robustus	1,334	a	North Carolina	Waits, 1967
Phragmites australis	1,367	b	Chesapeake Bay	Flemer et al., 1978
	1,379	b	Sussex Co., DE	Daiber et al., 1976
	861	b	Murderkill River, DE	Daiber et al., 1976
	1,812	b	Blackbird Creek, DE	Daiber et al., 1976
	1,900	b	Lewes, DE	Tyrawski, 1977
	1,450	b	Milford, DE	Tyrawski, 1977
	1,727	-	Oldmans Creek, NJ	McCormick and Ashbaugh, 1972

[1]Method a = production estimate took into account material that was produced during the growing season, but was removed before the time of peak standing crop.
b = Peak standing crop without correction for material removed by natural processes before sampling.

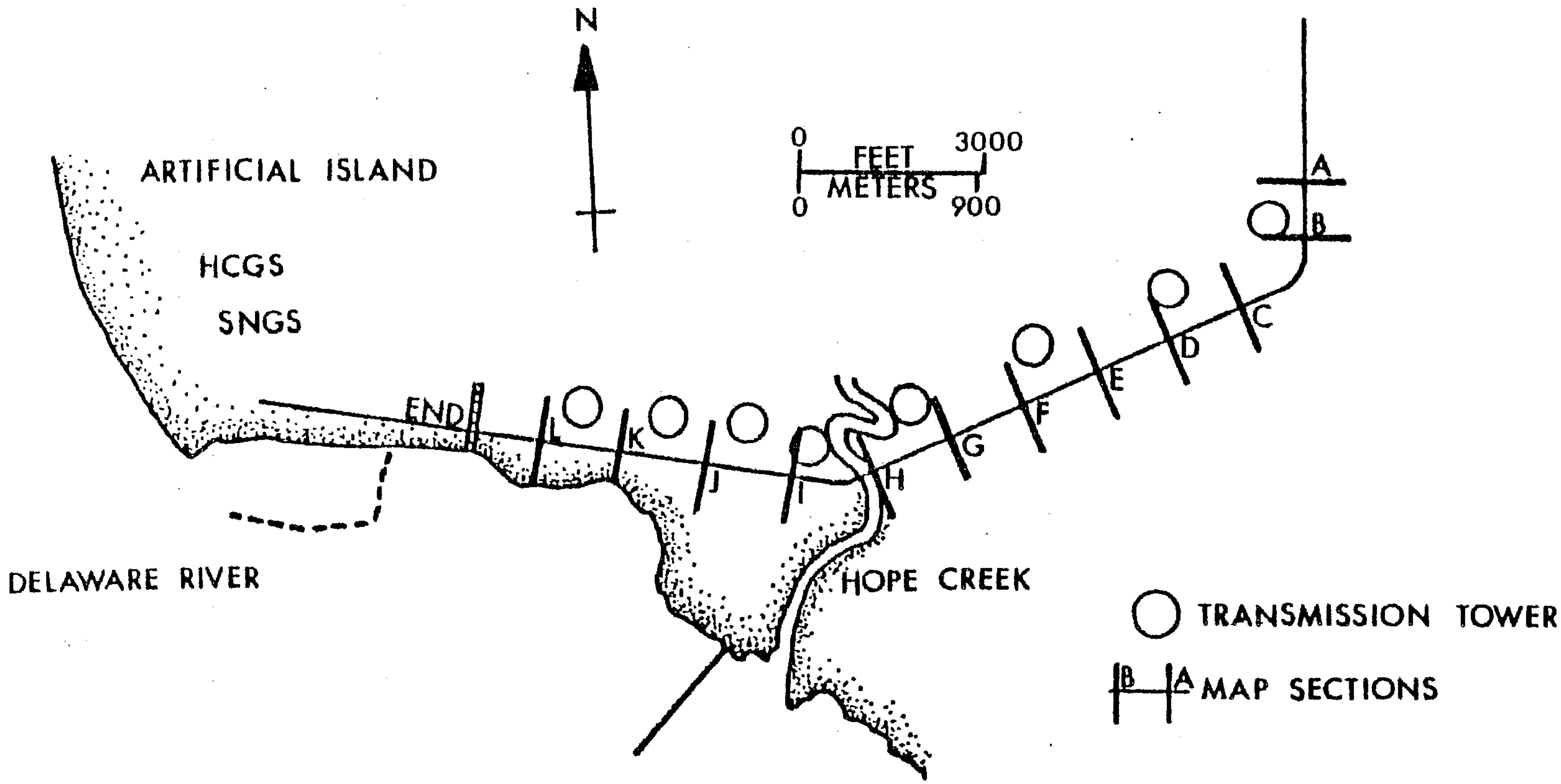


Figure 1. Artificial Island Access Road with expanded map sections shown in Figures 2-7 indicated.

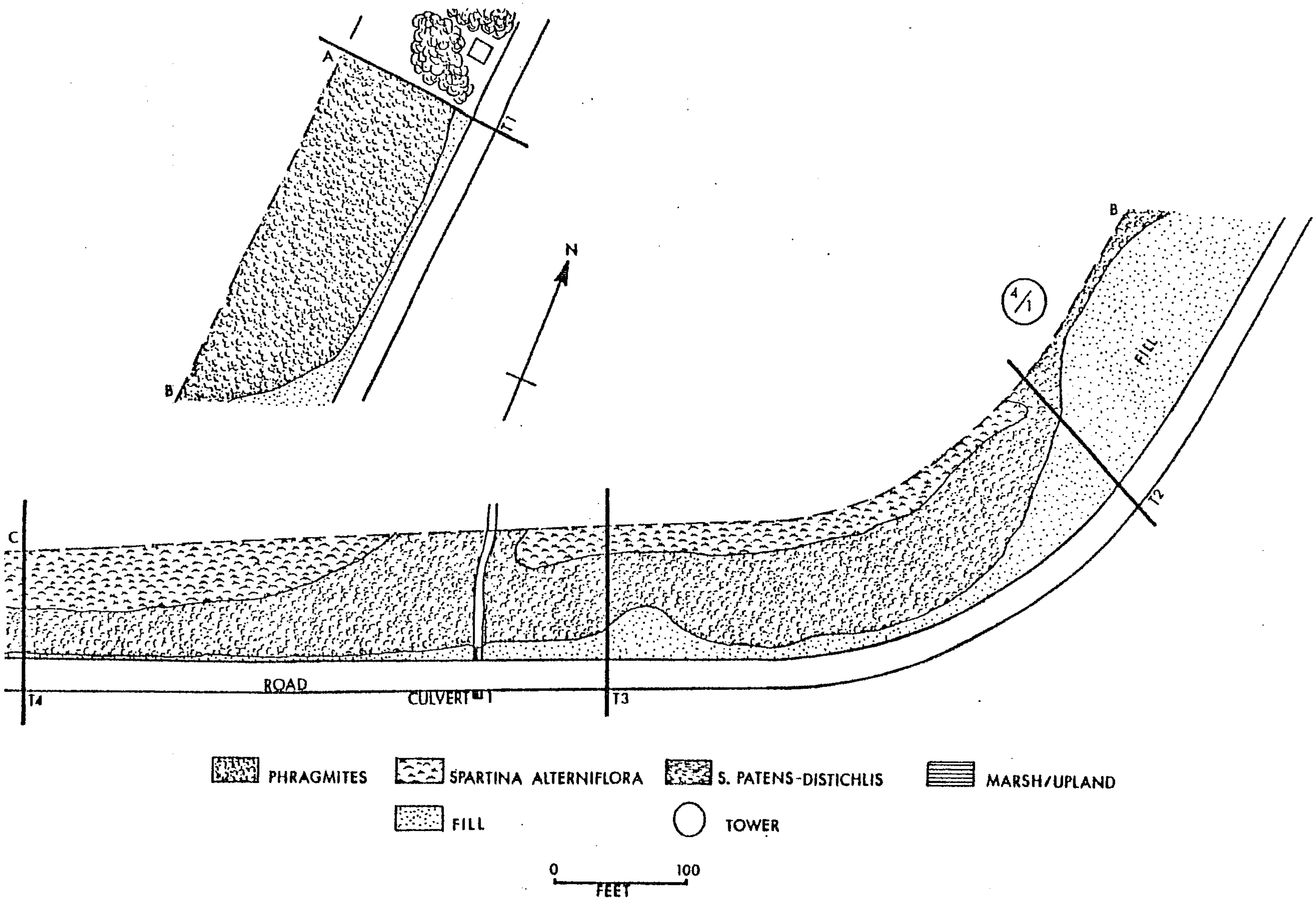


Figure 2. Marsh communities along Artificial Island Access Road, sections A-B and B-C (transects T1-T4).

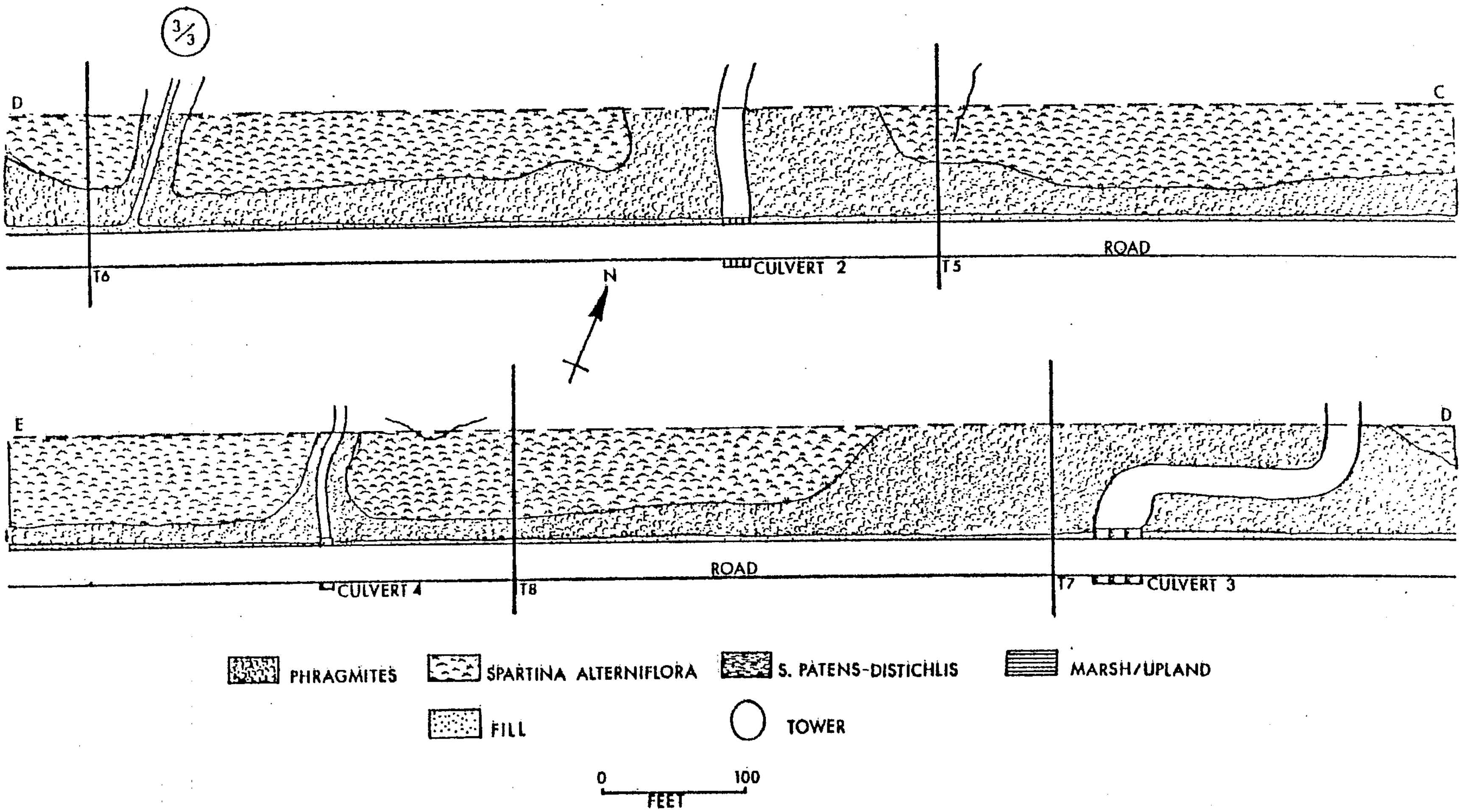


Figure 3. Marsh communities along Artificial Island Access Road, sections C-D and D-E (transects T5-T8).

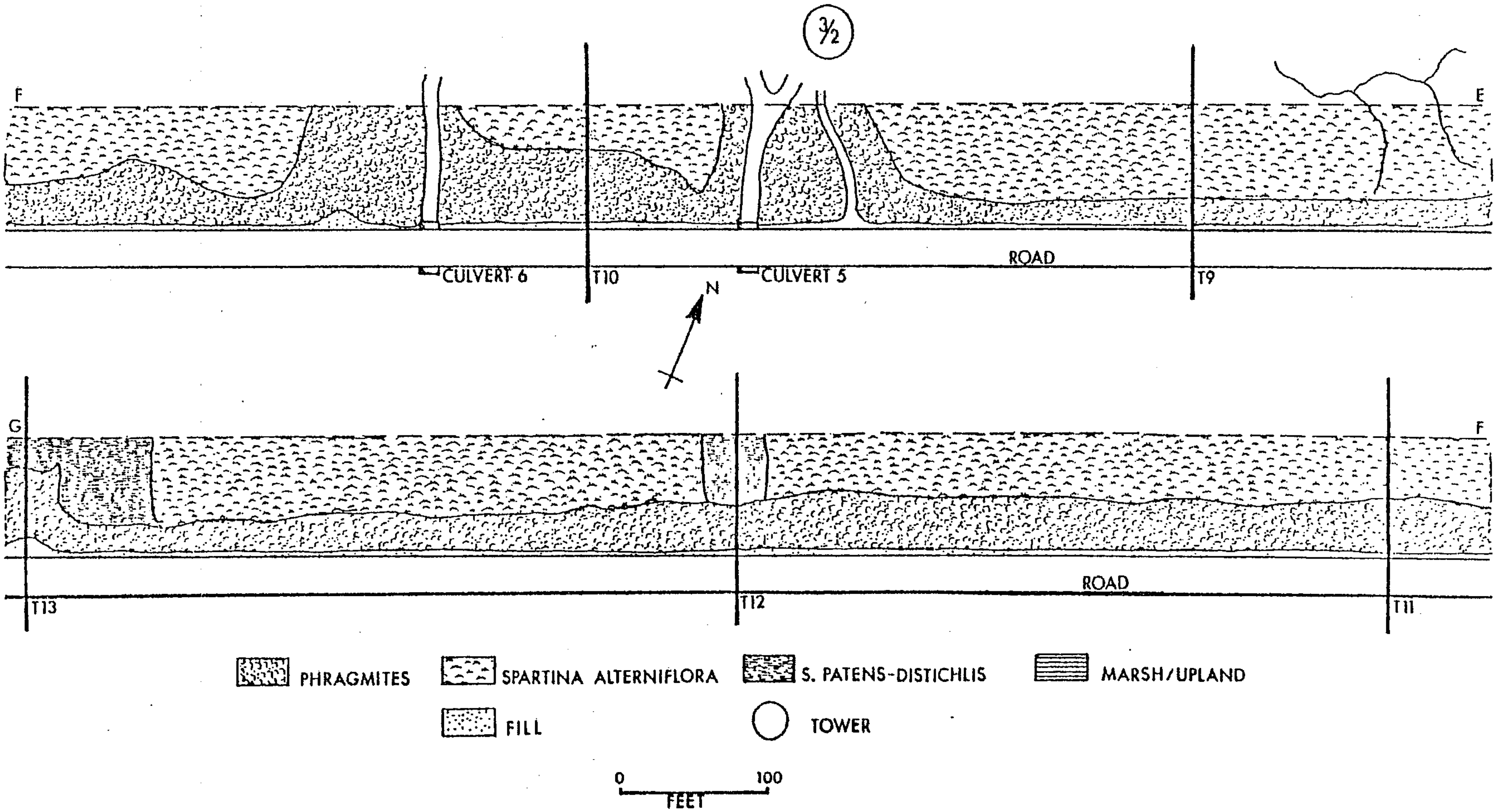


Figure 4. Marsh communities along Artificial Island Access Road, sections E-F and F-G (transects T9-T13).

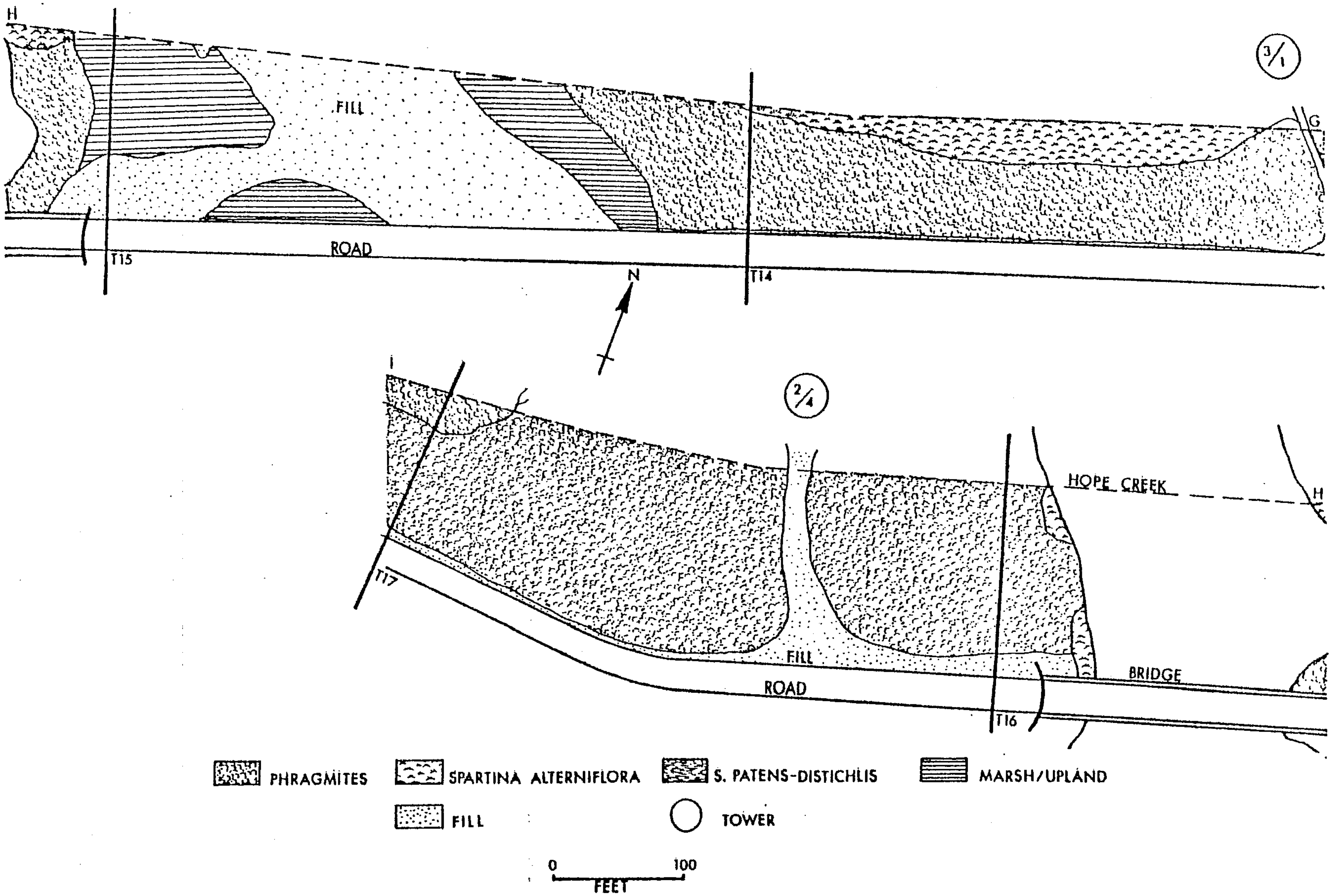


Figure 5. Marsh communities along Artificial Island Access Road, sections G-H and H-I (transects T14-T17).

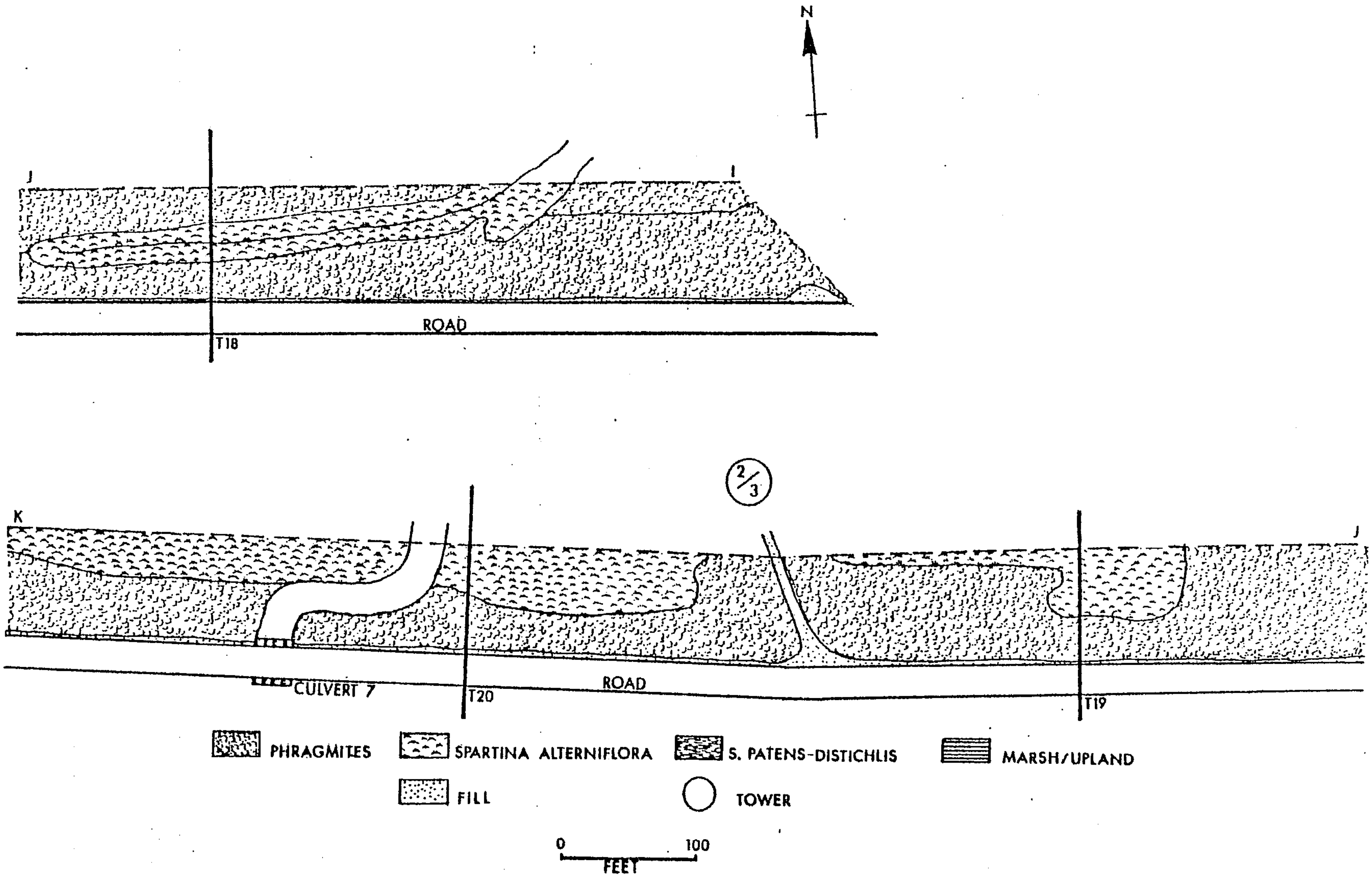


Figure 6. Marsh communities along Artificial Island Access Road, sections I-J and J-K (transects T18-T20).

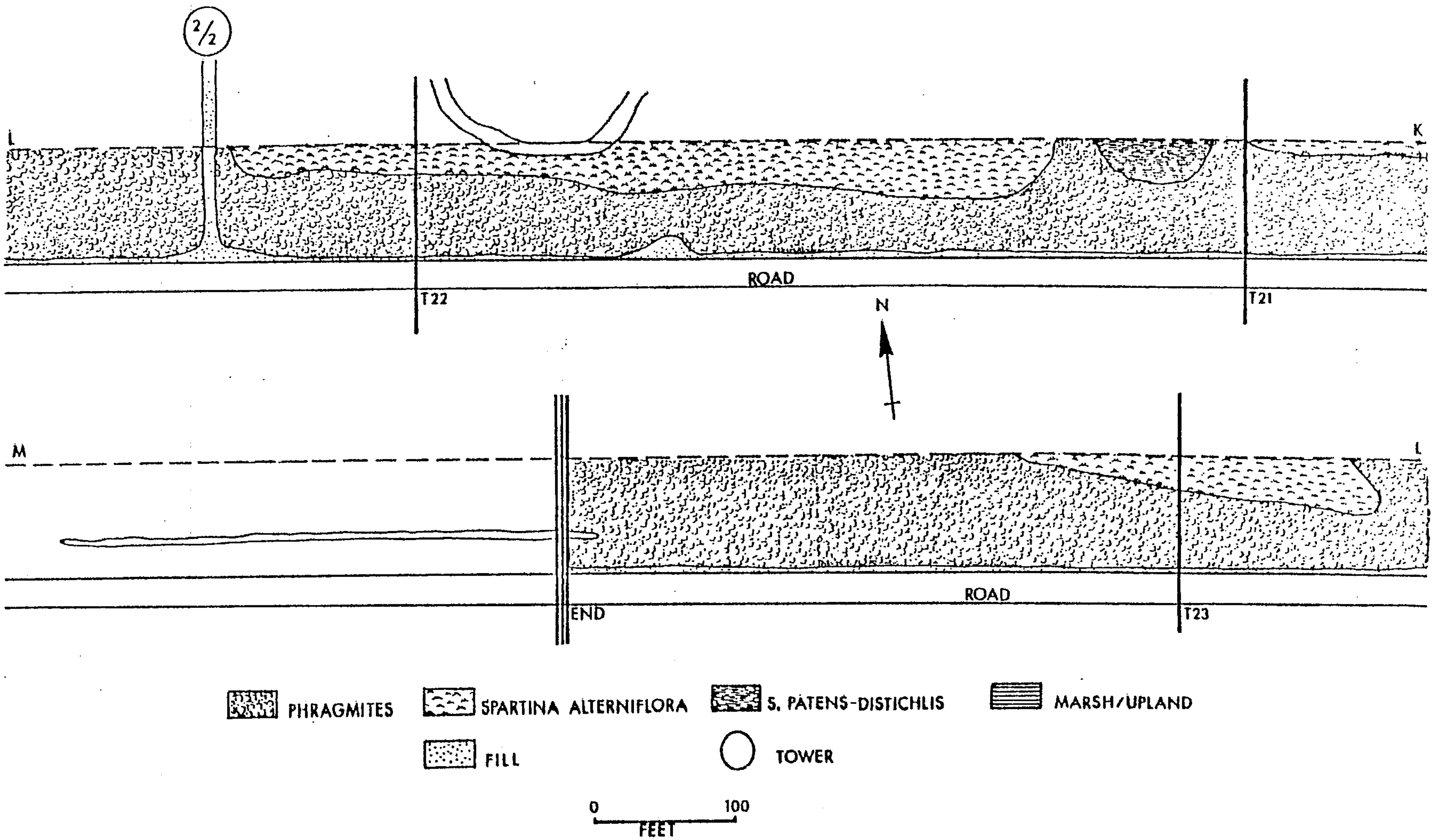


Figure 7. Marsh communities along Artificial Island Access Road, sections K-L and L-M (transects T21-T23).

3.0 PROJECT DESCRIPTION

3.1 General

Public Service Electric and Gas Company and the Township of Lower Alloways Creek propose to widen the private and public access road between the Salem Generating Station parking lot area and the intersection of Alloway Creek Neck Road and Salem - Hancocks Bridge Road (see Figures 3.1-1 and 3.1-2). The 5.3-mile stretch of roadway will provide for a reversible center lane of traffic, 3 foot wide crushed stone shoulders and necessary guardrails. The third lane will be controlled by the use of overhead lane control signals.

3.2 Development Plan

3.2.1 Site Plan and Description

The access road to Artificial Island is to be widened to accommodate a third lane of traffic. Considering that the roadway passes through various soil terrains, the following paragraphs will describe the embankment requirements for the additional roadway. The site plan is mapped on Figures 3.1-1 and 3.1-2.

The access road embankment below the private road covers highly organic silt deposits OL/MH which are compressible, vary in thickness up to approximately 20 feet, and have an undrained shear strength of approximately 200 psf. Based on these characteristics, a 6 ft. embankment height will not warrant any special requirements. Above this height, a controlled fill is required. The roadway elevation varies from an average height of eight feet above the surrounding terrain to an average height of thirteen feet at the bridge. The fill will only be required on the north side of the roadway because there will be no significant change to the existing roadway on the south side.

The public portion of the access road, Alloway Creek Neck Road, covers recent alluvial deposits which extend from 4 to 15 feet below the ground surface. Below this deposit there are alternating layers of yellow or mottled yellow-gray silty clay, fine sand, and marine deposits. Although the upper portion of the alluvial is quite soft, the consistency and density of the deposit increases rapidly with depth and consequently only requires an average embankment height of two and a half feet.

The project will require new embankments on agricultural and residential lands and wetlands. According to the NJDEP Wetlands Map dated 1972, the project will require, at the maximum, approximately 7.7 acres of wetland of which 7.4 acres is adjacent to the private roadway and 0.3 acres is adjacent to the public roadway. The project will also require approximately 7.6 acres of agricultural lands.

3.2.2 Land Use

See Table 3.2-1 for the Land Use Chart containing the applicable facility characteristics.

3.3 Structures

Calculations made for the subsurface strata of the private road show that settlement of the embankment material might reach a total of 2.5 feet for a 15 foot deep fill. A large percentage of the consolidation settlement occurs during the construction period. However, secondary compression or creep, as well as additional primary consolidation could occur continuously after construction. This would require repeated resurfacing of the road. The approach to all details of design was therefore to accommodate the anticipated settlement.

The embankment material will be an easily compactable, granular material enabling the use of a vibratory compactor. Therefore, a New Jersey Highway Type Ill material would be applicable, or any other material having less than 10% passing the 200 sieve test.

To allow consolidation drainage of the subsurface materials during and after construction, a drainage blanket will be provided at the base of the embankment. A filter fabric will be placed directly on the virgin ground (after clearing vegetation, if applicable), a 2 foot blanket of 3/4" stone will be placed on the fabric, and a filter fabric cover will be placed on top of the stone blanket. Embankment fill material will be placed directly on the fabric cover (Ref. 3.3-1).

Based on the available field and laboratory data, the public road will require preparation of the subgrade and additional supporting capability of the existing soil. Since the upper two to three feet of existing soils are unable to support the proposed roadway, this material will be excavated. A geotextile fabric will be laid and covered with six inches of granular sub-base soils. The sub-base layer should then be proof-rolled using a rubber tire roller. Then the pavement section will be placed (Ref. 3.3-2).

The finished three lane roadway will have an overhead signal system to control traffic flow during the morning and evening peak periods. Center lane reversible signals will provide two lanes of traffic inbound to the station in the morning and outbound in the evening. The overhead signals will be spaced at a maximum of 1500 feet. Electric power for the system will be supplied by the existing service of the Atlantic City Electric Company.

The roadway construction for both the public and private roadways will be in accordance with Public Service Electric and Gas and NJDOT standards for signs and striping, and the manual on Uniform Traffic Control Devices (U.S.D.O.T. - Federal Highway Administration).

3.4 Transportation Plan

(a) System of roads, bridges, intersection and interchange;

The Artificial Island access road is the only paved roadway linking the Artificial Island site and the mainland. The access road intersects with Salem-Hancocks Bridge road and Maskell's Mill Road (Salem County Route 658). The roadway passes over numerous culverts and the Hope Creek bridge. There is an intersection where the Island traffic is directed to either the Salem Generating Station or the Hope Creek construction site.

(b) Loading and unloading areas;

The only major loading and unloading zones along the access road are located at the Artificial Island parking lots. There are a few homes along the public portion of the roadway. The proposed project will enhance the mobility of these homeowners as well as Artificial Island commuters.

(c) Off-street parking areas;

The site owned by Public Service Electric and Gas Company on Artificial Island, has sufficient parking lots for the operating, maintenance, and construction workers presently employed at the site, as well as visitors.

(d) Access points, both entrance and exits, to the site from the surrounding transportation system;

Figure 1-1.1 shows the general roadway system in the surrounding region.

(e) Access to, availability of, and incentives for public and private mass transportation on or near the site, including bus, rail, car pooling, taxi, shuttle, air, and water modes of transportation;

Artificial Island is not served by public bus or rail transportation. Weather and ice conditions, coupled with the lack of suitable embarkation points on the mainland, make waterborne transportation infeasible. Public Service Electric and Gas Company has a van pooling program available to its employees working at Artificial Island.

3.5 Landscaping Plan

The landscaping plan is designed to maintain the existing vegetation. As described in Section 2.6 the existing vegetation is primarily Phragmites communis in the wetlands and vegetables in the agricultural areas. The new construction will create an embankment in the wetlands which will be hydromulched with grass. The natural, surrounding vegetation will be allowed to spread over the embankment. In the agricultural areas the embankment will be seeded.

The new embankment for the private roadway will be a composite of stone, backfill, and topsoil (see Figure 3.1-1). The base will be a fabric filter covered with about two feet of stone above the normal wetlands which will maintain the natural flooding action of the area. Backfill of a silty sand (SM) will be added to form the berm. Considering the compressibility of the soil and the maximum fill requirements, the embankment will require approximately 21,000 cubic yards of soil and 80,000 cubic yards of coarse stone.

The embankment along the public road will be primarily backfill from the surrounding area.

3.6 Soil Erosion and Sediment Control Plan

Public Service Electric and Gas Company plans to take all steps necessary to minimize soil loss due to the erosional effects of water and wind. Procedures will be based on standards specified in "Standards for Soil Erosion and Sediment Control in New Jersey" (adopted by State Soil Conservation Committee, 1972), and in accordance with the Soil Erosion and Sediment Control Permit.

3.7 Aesthetics Plan

Upon completion, the widening of the road will create a small aesthetic impact on its surroundings. The roadway will be widened an additional twelve feet. Embankments will be added in a small part of the adjacent wetlands and farmlands. Overhead traffic signal lights will be added above the roadway. The wooden telephone and transmission line poles will be moved to accommodate the new road portions.

The various visual perspectives of the site will have little or no change. The side view will have no change other than the supports for the control signals. From an aerial view one will perceive a wider roadway and added embankment.

3.8 Construction Plan

Construction will commence as soon as possible and be completed approximately nine months later. The total cost of construction has been estimated to be $8,380,000. The construction job can be split into two major components - the third lane addition and the signalization.

The third lane addition will be done by a grading and paving contractor. Following three phases of fill and consolidation, a stabilized road base, a bituminous roadway, and necessary signs and guardrail will be installed.

The signalization of the roadway will be installed by an electrical contractor.

3.9 Operation Plan

The roadway widening will facilitate ingress and egress from the Salem Generating Station. The maintenance of the private roadway will be handled by Public Service Electric and Gas Company. The maintenance of the public portion of the roadway will be handled by Lower Alloways Creek Township.

The Lower Alloways Creek Township police department will be responsible for operation of the entire traffic control system.

3.10 Future Site Development

Artificial Island will become the site of Public Service Electric and Gas Company's Nuclear Department and Hope Creek Generating Station. The Nuclear Department will be comprised of corporate staff to support the current Salem Generating Station and the future Hope Creek Generating Station. The Hope Creek Generating Station will be the site of a base-load 1067 MWe boiling water reactor system with associated steam and auxiliary equipment.

3.11 Riparian Lands, Regulated Wetlands, and Public Trust Lands

(a) Riparian Lands

The roadway abuts the Hope Creek Bridge on both sides.The existing bridge was constructed with a two (2) lane roadway and provisions for a future railroad track on the north side. Present plans are to utilize the space reserved for the future railroad track for another roadway making the bridge a three (3) lane structure. Public Service Electric and Gas Company is presently entitled to construct, reconstruct, operate and maintain the bridge and appurtenant structures via the State of New Jersey Riparian Grant No. 68-12. In July 1982 Pubic Service Electric and Gas Company submitted the following applications for consideration and approval:

1. Bridge Permit Amendment - U.S. Department of Transportation, U.S. Coast Guard, 3rd District;

2. Plan Release - N.J. Department of Community Affairs-Bureau of Construction Code;

3. Waterfront Development Permit - NJDEP, Bureau of Coastal Resources;

4. Notification of Construction - Army Corps of Engineers, Philadelphia District;

5. Stream Encroachment Waiver NJDEP, Bureau of Flood Plain Management; and

6. 401 Water Quality Certification - NJDEP, Bureau of Coastal Resources as part of Waterfront Development Permit.

(b) Regulated Wetlands

The existing roadway passes through adjacent regulated wetlands from approximately the intersection of the Hope Creek Construction access road and the Salem Generating Station access road to about 3 miles east where the road turns to meet Alloway Creek Neck Road. (See Figure 1.2-1). Public Service Electric and Gas Company is entitled to construct, reconstruct, operate, inspect and maintain roadways and culverts upon, under, across and along the easements mentioned in Section 2.1(c).

(c) Public Trust Lands

The roadway passes through two wetlands tracts owned by the U.S. Government and the State of New Jersey and is adjacent to the Mad Horse Creek Fish and Wildlife Management Area. The proposed project will not alter nor affect the public access to these lands.

3.12 References

3.3-1 Public Service Electric and Gas Company, Preliminary Geotechnical Recommendation for the Proposed Widening of Creek Neck Road, pp. 1-10, 1982

3.3-2 Lippincott Engineering Associates, Geotechnical Investigation Report Proposed Alloway Creek Neck Road Expansion, pp. 1-7, May 1982

Table 3.2-1 FACILITY [illegible]RACTERISTICS

Instructions: Complete each cell of the chart, where applicable for the facility. If a cell is not applicable, inse[illegible] "NA". As necessary indicate an approximate value, e.g. 40,000-55,000 square feet.

LAND USE TYPES		Land Area (Acres)	Ground Coverage of Floor Area (Sq. ft.)	Gross Floor Area (Sq. ft.)	Floor area Ratio (Gross Floor Area to Land Area)	No. of Stories and Height (ft.) of Structures
1.	RESIDENTIAL	N/A				
	a. single family detached					
	b. single family attached					
	c. townhouses					
	d. garden apartments					
	e. medium rise apartments					
	f. high rise apartments					
	g. mobile homes					
	h. other					
2.	OPEN SPACE-RECREATION	N/A				
3.	TRANSPORTATION	64.4A	(Total roadway) = 44.5A existing + 19.9A additional for widening			
4.	INSTITUTIONAL	N/A				
5.	COMMUNITY FACILITIES	N/A				
6.	COMMERCIAL	N/A				
7.	INDUSTRIAL	N/A				
8.	OTHER (SPECIFY)					
TOTAL		64.4A				

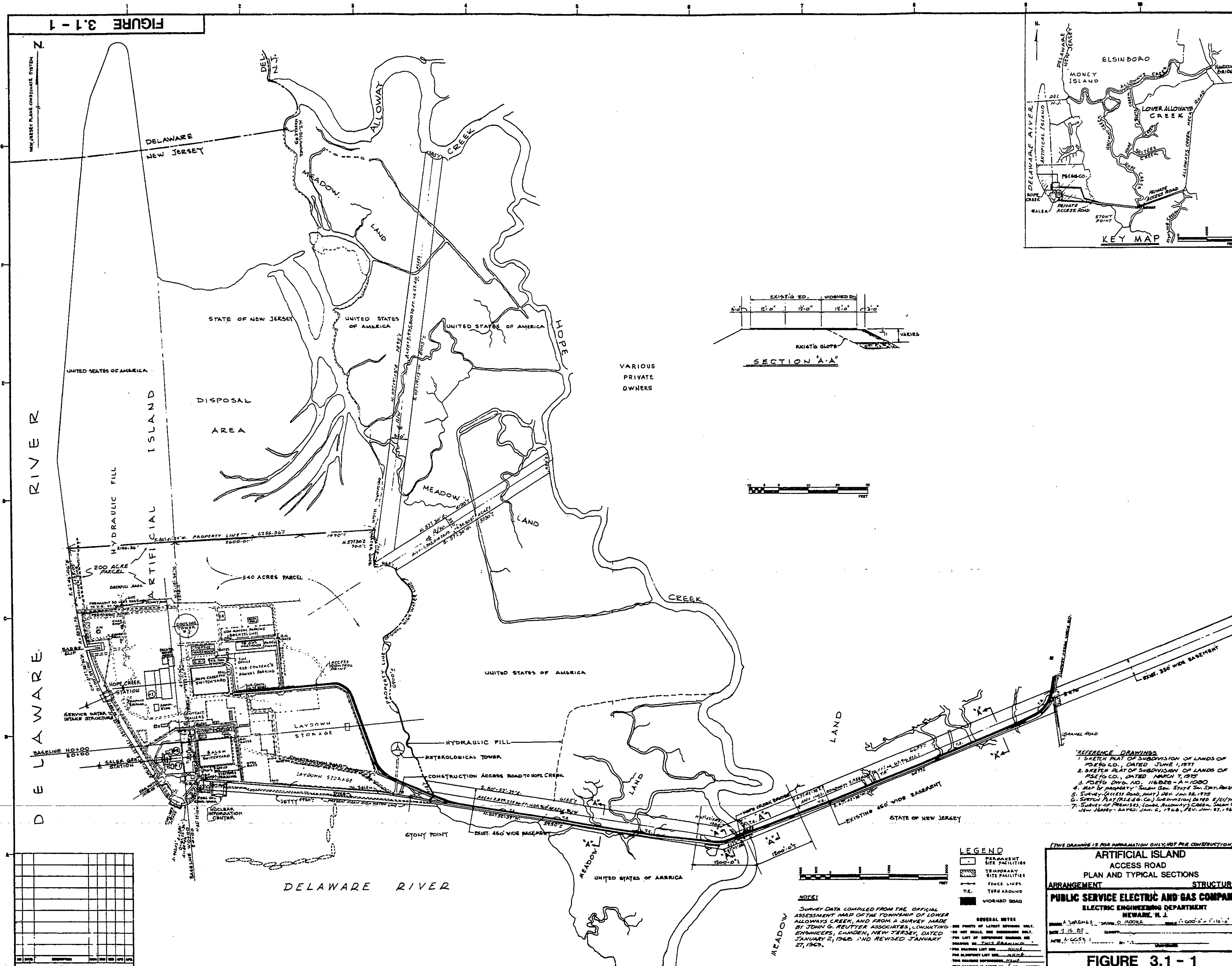


FIGURE 3.1 - 1
DELAWARE
NEW JERSEY
ALLOWAY CREEK
MEADOW LAND
HOPE CREEK
VARIOUS PRIVATE OWNERS
STATE OF NEW JERSEY
UNITED STATES OF AMERICA
DISPOSAL AREA
HYDRAULIC FILL
ARTIFICIAL ISLAND
DELAWARE RIVER
200 ACRE PARCEL
540 ACRES PARCEL
COOLING TOWER
HOPE CREEK STATION
SERVICE WATER INTAKE STRUCTURE
SALEM GEN. STATION
SALEM SWITCHYARD
HOPE CREEK SWITCHYARD
LAYDOWN STORAGE
HYDRAULIC FILL
METEROLOGICAL TOWER
CONSTRUCTION ACCESS ROAD TO HOPE CREEK
NUCLEAR INFORMATION CENTER
STONY POINT
EXIST. 460' WIDE EASEMENT
EXISTING 460' WIDE EASEMENT
EXIST. 350' WIDE EASEMENT
GRAVEL ROAD
LAND
SECTION "A-A"
EXIST'G RD.
WIDENED RD.
VARIES
EXIST'G SLOPE
KEY MAP
ELSINBORO
MONEY ISLAND
LOWER ALLOWAYS CREEK
HANCOCKS BRIDGE
PRIVATE ACCESS ROAD
STONY POINT
REFERENCE DRAWINGS
1. SKETCH PLAT OF SUBDIVISION OF LANDS OF PSE&G CO., DATED JUNE 1, 1977
2. SKETCH PLAT OF SUBDIVISION OF LANDS OF PSE&G CO., DATED MARCH 7, 1975
3. PSE&G DWG. NO. 116828-A-1080
LEGEND
PERMANENT SITE FACILITIES
TEMPORARY SITE FACILITIES
FENCE LINES
T.R. TURN AROUND
WIDENED ROAD
NOTE:
SURVEY DATA COMPILED FROM THE OFFICIAL ASSESSMENT MAP OF THE TOWNSHIP OF LOWER ALLOWAYS CREEK, AND FROM A SURVEY MADE BY JOHN G. REUTTER ASSOCIATES, CONSULTING ENGINEERS, CAMDEN, NEW JERSEY, DATED JANUARY 2, 1968 AND REVISED JANUARY 27, 1969.
(THIS DRAWING IS FOR INFORMATION ONLY, NOT FOR CONSTRUCTION)
ARTIFICIAL ISLAND
ACCESS ROAD
PLAN AND TYPICAL SECTIONS
ARRANGEMENT
STRUCTURAL
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
ELECTRIC ENGINEERING DEPARTMENT
NEWARK, N. J.
REVISION
FIGURE 3.1 - 1

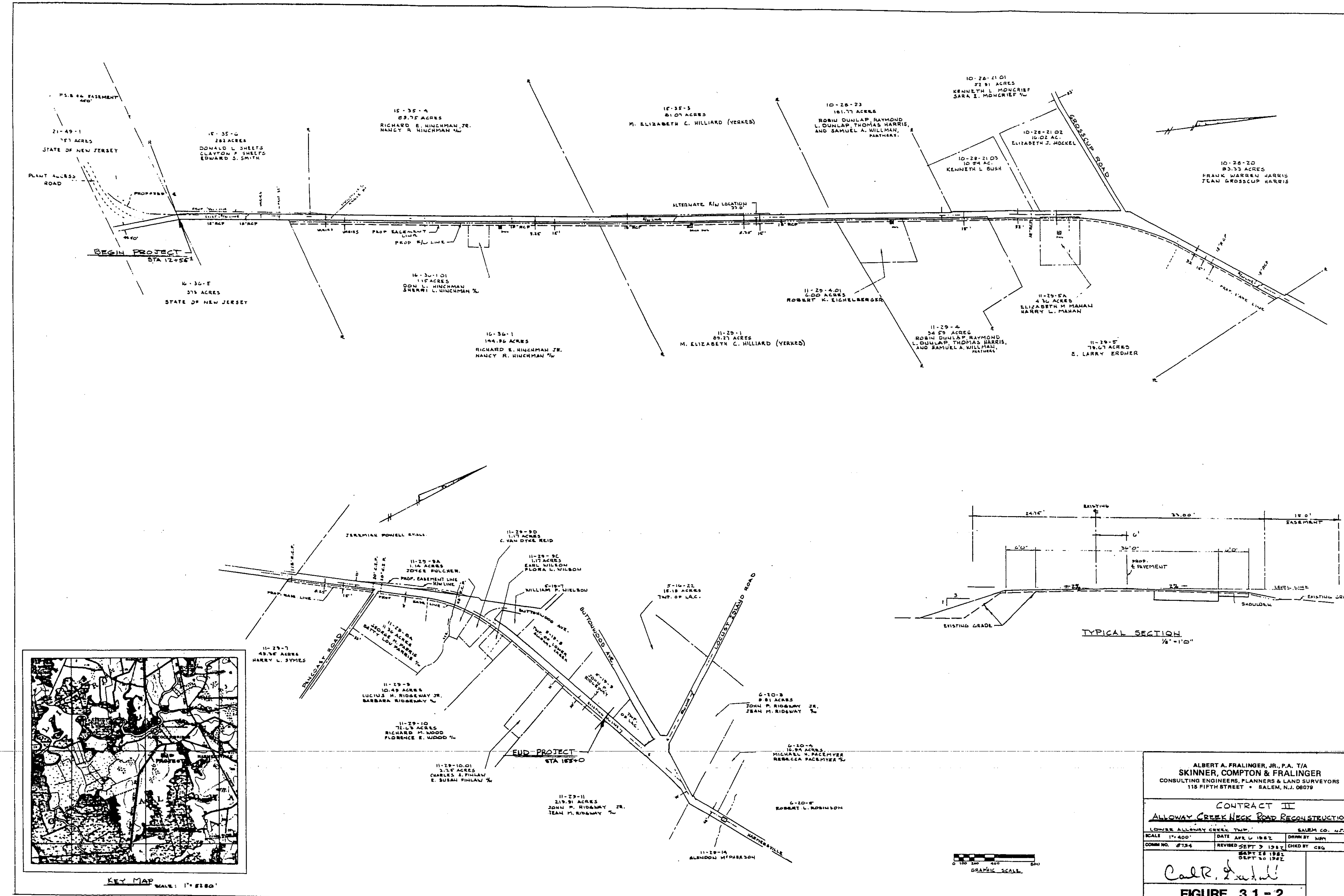

BEGIN PROJECT
STA 12+56±
END PROJECT
STA 155+0
GROSSCUP ROAD
PANCOAST ROAD
BUTTONWOOD AVE.
LOCUST ISLAND ROAD
TYPICAL SECTION
KEY MAP SCALE: 1" = 5280'
GRAPHIC SCALE
ALBERT A. FRALINGER, JR., P.A. T/A
SKINNER, COMPTON & FRALINGER
CONSULTING ENGINEERS, PLANNERS & LAND SURVEYORS
115 FIFTH STREET • SALEM, N.J. 08079
CONTRACT II
ALLOWAY CREEK NECK ROAD RECONSTRUCTION
LOWER ALLOWAY CREEK TWP.
SALEM CO. N.J.
SCALE 1" = 400'
DATE APR 6 1982
DRWN BY WM
COMM NO. 8734
REVISED SEPT 3 1982
SEPT 28 1982
SEPT 30 1982
CHKD BY CEG
SEAL

FIGURE 3.1 - 2

4.0 COMPLIANCE WITH COASTAL RESOURCE AND DEVELOPMENT POLICIES

4.1 Location Policies

4.1.1 Special Areas

(a) Navigation Channels (7:7E-3.7)

Navigation channels, as specified by state location policies, include water areas in tidal rivers and bays presently maintained by the Department of Environmental Protection or the Army Corps of Engineers and marked by the United States Coast Guard with buoys or stakes. Development which would result in loss of navigability is prohibited. The roadway modification will have no effect on navigation in the area.

The only major navigable waterway which could be affected by the roadway construction is Hope Creek. There are no plans to place any additional fill or obstructions in the creek during the construction. The embankments adjacent to the proposed roadway will extend farther north than the existing embankments, but will have no effect on navigation.

The existing and proposed roadway also traverses various streams and guts which are connected by culverts. The proposed construction will not change the existing water level in the associated streams and guts.

(b) Intertidal Flats (7:7E-3.16)

There is very little intertidal flat development along the proposed roadway widening. The eight tidal creeks and guts which are crossed have vegetative growth along the banks down to the high water line or slightly below. The small intertidal zone is a habitat for *Uca minax*, fiddler crab, which burrows into the soft substrate. Brackish water mud crab, *Rhithropanopeus harrisii*, is also present along the banks. The culverts are extended sufficiently to minimize the disturbance to the intertidal areas.

(c) Filled Water's Edge (7:7E-3.17)

The State's location policies specify that Filled Water's Edge include filled areas lying between wetlands and the first public road landward of the adjacent water area. State policy states that non-water dependent development is conditionally acceptable provided it would not preempt use of the waterfront portion of the Filled Water's Edge for potential water dependent uses, and it would not prevent public access along the water's edge. The proposed modifications will enhance public access to the waterfront and water's edge by increasing traffic flow and driver safety.

(d) Alluvial Flood Margins (7:7E-3.20)

As defined in the State regulations, alluvial flood margins are mainland areas adjacent to, and upland from, flood plains. They extend inland to the limit of alluvial soils with a seasonal high water table equal to, or less than, one foot. They exhibit essentially no modification of the deposited materials. Some of the land, which will be used for the roadway and forms a buffer between the wetlands and agricultural lands, is in this category.

The policy discourages development in these areas unless no feasible alternative site exists. In our case, no feasible alternative exists which would use less alluvial land.

(e) Wetlands (7:7E-3.26)

As discussed in previous sections, a large percentage of the road widening will take place in wetlands. Previous filling for the existing roadway has changed the vegetation along the road from <u>Spartina</u> spp. to <u>Phragmites</u> <u>australis</u>. <u>P. australis</u> will be covered during the filling and nearby <u>Spartina</u> spp. plants will also be affected. Approximately 7.7 acres of mapped wetlands will be disturbed adjacent to the existing roadway.

The area of proposed disturbance is one of the least productive portions of the local marshland. The existing roadway limits the extent of this habitat utilization by wildlife due to the heavy traffic present during the daytime. Additionally, a large area at the western extent of the roadway is designated as a dredge spoil area and has previously been trenched by the mosquito commission. <u>P. australis</u> has taken over this portion of the marsh.

During construction of the original roadway, culverts were installed to aid in maintaining tidal flushing of the marshes. As described in Section 2.4 Hydrology, these culverts are still supplying substantial flow under the roadway to allow the salt tolerant plant species to continue. The proposed lane addition will use the existing culverts to keep tidal flushing at its current level.

To mitigate the filling of approximately 7.7 acres of wetland, the applicant proposes to set aside and preserve a similar size area of productive wetlands adjacent to Stow

Creek in Greenwich Township, Cumberland County, New Jersey. PSE&G and Atlantic City Electric Company are presently co-owners of a 4500-acre tract known as the Bayside site, situated between the Cohansey River and Stow Creek. PSE&G will consult with NJDEP to select the precise parcel to be preserved.

The preservation of this area will offset the loss of 7.7 acres of mapped wetlands for the following reasons: First, P. australis that will be covered will be allowed to regrow on the new berm. Only on the additional 12 feet of pavement width will P. australis not reestablish itself. Secondly, the preserved marsh will contain Spartina spp. which is the natural species to the area preferred by many waterfowl species. Thirdly, the preserved marsh will not be adjoining a heavily travelled roadway which will allow wildlife to utilize the habitat more fully.

(f) Wetlands Buffer (7:7E-3.27)

A small portion of the land adjacent to the existing roadway is in a wetland buffer area. Located on the west side of the roadway where it joins with Alloway Creek Neck Road, this portion consists of a woodland less than one acre in area, and a turnoff. The turnoff will be used during construction and some trees will be removed from the area. However, native vegetation will be retained as much as possible and areas cleared during construction will be replanted with native vegetation.

(g) Intermittent Stream Corridors (7:7E-3.31)

Intermittent Stream Corridors are areas including and surrounding the surface water drainage channels. The inland extent of the corridors is either the inland limit of soils with a seasonal high water table equal to, or less than one foot, or a distance of 25 feet on either side of the channel, whichever is greater. Cutting, filling, damming structures or any other activities that would directly degrade their function, except for linear infrastructure for which there is no feasible alternate route, is prohibited. The roadway's embankment will not require the damming and filling of these intermittent streams. The other build alternatives would require filling more intermittent streams.

(h) Farmland Conservation Areas (7:7E-3.32)

Farmland Conservation Areas, as defined (Ref. 2.3-2), consist of continuous areas of 20 acres or more of soils that have an agricultural capability Class of I, II, or III.

As shown in Table 2.3-1, the proposed access road will cross a number of soils whose capability class falls within the above description. From this classification, the soil types encountered over the greatest distances are hydraulic fill (Class III W-20), Mattapeake silt loam (Class II e-4), Mattapex silt loam (Class II W-13) and Othello silt loam (II W-20). In all, it is expected that 7.6 acres of agricultural lands will be covered through expansion of the roadway, 1.3 acres of which is land owned by PSE&G and 6.3 acres is privately owned land.

(i) Historic and Archeological Resources (7:7E0-03.35)

Historic, archeological and cultural resources in and around the project area were discussed in Section 2.11. As previously stated, there will be no significant impacts to historic and archeological resources as a result of implementation of the proposed project.

(j) Endangered or Threatened Wildlife or Vegetation Species Habitat (7:7E - 3.37)

No federally endangered species are resident along the roadway. Several endangered species may be present in the Delaware River but the salt marshes are not a habitat utilized by them. Two bird species, bald eagle and peregrine falcon, have been observed within a few miles of the roadway. Neither species nests in the area nor are they dependent on the small resource proposed to be filled.

The State endangered and threatened list includes several species which are present in the salt marshes. Bald eagle and peregrine falcon are incidental visitors to the area and will not be affected by the project. Osprey nest in the transmission towers in the marsh by the roadway. The towers will not be disturbed for the project and will remain as viable nesting platforms. During construction effort will be made to keep construction activities from interfering with nesting.

State threatened species possibly in the area include great blue heron and marsh hawk. Great blue heron are observed frequently in the marshes feeding. No nesting has been observed along the roadway but there is a rookery several miles northwest on an island in the Delaware River. The additional lane will not affect the great blue heron habitat significantly. Marsh hawks feed in the salt marshes near the roadway. Like the osprey this species will cover a large area during its hunting. Loss of a few acres along the roadway will be insignificant to the survival of individual birds in the area.

(k) Critical Wildlife Habitats (7:7E-3.38)

The marshes surrounding the existing roadway fit the definition of critical wildlife habitat. The salt marsh is a muskrat habitat and is used by waterfowl as a migratory stopover. The area proposed to be filled is not extensively utilized because of the traffic on the existing roadway. No muskrat huts have been observed in the proposed fill area.

The deposited fill will be covered by reed grass in a short time thereby providing habitat suitable for some bird and mammal species.

Preservation of approximately 7.7 acres of valuable Delaware River wetlands near Stow Creek is planned as a mitigating effort. As described in Section (e), "Wetlands", this action will equal or exceed in value the wetlands to be filled.

(l) Public Open Space (7:7E-3.39)

The State's location policies specify that Public Open Space include areas owned and maintained by state, federal, county, and municipal agencies and dedicated to the conservation of natural resources, public recreation, or wildlife protection or management. State policy states that new or expanded public or private open space development is encouraged at locations compatible or supportive of adjacent and surrounding land use. The availability of adjacent public lands for use by fishermen, trappers, and hunters will be enhanced by the proposed project. The roadway expansion will not affect the visual and physical sense of continuity and will afford users more rapid, continued movement through the public open spaces.

(m) Excluded Federal Lands (7:7E-3.41)

Excluded Federal Lands are lands that are owned, leased, held in trust or whose use is otherwise by law subject solely to the discretion of the United States of America, its officers or agents, and are excluded from New Jersey's Coastal Zone as required by the Federal Coastal Zone Management Act. Actions on Excluded Federal Lands that significantly affect the coastal zone shall be consistent with the State's Policies, to the maximum extent practicable. The construction project will have the same impacts on federal and state lands. No unexpected spillover impacts appear to be associated with this project on lands under the jurisdiction of the state.

4.1.2 General Water Areas

(a) Tidal Guts (7:7E-4.6)

Tidal guts include waterway connections between two estuarine bodies of water and are characterized by tidal influencing both flow rate and natural water depths. According to the Water Area Policy Summary Table, Section 7:7E-4.2, tidal guts are discouraged for development when realignment is involved.

The proposed roadway modification will cross Devil's Gut and approximately seven other unnamed guts. Flooding and draining of the surrounding areas will not be altered by the project.

4.1.3 General Land Areas

(a) Coastal Growth Rating (7:7E-5.3)

According to the State's Policies, all of Cumberland County and Salem County within the Bay and Ocean Shore Region is designated a Limited Growth Region. This region contains environmentally sensitive areas, where only infill development is acceptable.

(b) Environmental Sensitivity Rating (7:7E-5.4)

The Environmental Sensitivity rating of a given soil is defined (Ref. 2.3-2) as an "...indication of the general suitability of a land area for development based on three factors ...(1) vegetation, (2) fertile soils, and (3) high permeability wet soils...". These three factors are used to arrive at a general sensitivity rating of either high, moderate, or low sensitivity.

The environmental sensitivity rating of the soils along both public and private sectors of the road are generally "moderate". That is, they are neither of low sensitivity (characterized by on site paving, bare earth, or early successional meadow) nor high sensitivity (containing forest vegetation or high permeability wet soils).

(c) Development Potential (7:7E-5.5)

According to the state policies concerning Development Potential, Development Potential Ratings for energy facilities shall be jointly determined by New Jersey Department of Environmental Protection and the New Jersey Department of Energy on a case by case basis pending completion of energy facility siting studies. Considering the Salem and Hope Creek Generating Stations have already been approved for siting, this area should be interpreted to be an area of High Development Potential for energy related facilities.

(d) Acceptable Intensity of Development (7:7E-5.6, 5.7)

Since the site is in a limited growth region characterized by high development potential and medium environmental sensitivity, the acceptable development intensity can be determined from the Land Acceptability Table to be of low to moderate intensity. The low intensity development area, which includes the agricultural and wetland areas adjacent to the roadway, requires a maximum of 3% of the total land use being structures and impervious paving. The moderate intensity development area, which includes the area considered to be the Village of Hancocks Bridge, supports land use in the form of structures and impervious paving to a maximum of 30%.

The current land use would support the additional grading and paving of the roadway. The current traffic problem in agricultural areas prohibits normal agricultural activities, such as tractor movements, on the roadway during peak ingress and egression. The surrounding area of the roadway is sparsely developed and therefore it will support the 3% development requirement. In the area of the Village of Hancocks Bridge, the suburban development is again sparse, and consequently would support the additional roadway development. Also the policies state that the major concern in the Delaware Bayshore region is the conservation of agricultural land. The entire project will only require approximately 7.6 acres of agricultural lands.

4.2 General Location Policies

(a) Basic Location Policy (7:7E-6.2)

Under the State's Basic Location Policy, a linear development, such as our proposed roadway, that connects two points shall comply with the specific location policies to the maximum extent practicable. In the case of the proposed modification the acceptable intensity of development in the wetland area is low intensity requiring a minimum of development. However, the Basic Location Policy does provide for acceptance of the project provided the following conditions are met:

(1) There is no prudent or feasible alternative alignment which would have less impact on sensitive areas.

(2) There will be no permanent or long term loss of unique or irreplaceable areas.

(3) Appropriate measures will be used to mitigate adverse environmental impacts to the maximum extent feasible.

(4) The alignment is located on or in existing transportation corridors and alignment to the maximum extent practicable.

This project follows these guidelines. Section 7.0 of this report analyzes all feasible alternatives of alignment and concludes that the proposed project and mitigation have an acceptable impact on sensitive areas. The wetlands and agricultural properties are not unique to the area and the loss is small in comparison to the surroundings. The mitigation measures as described in Section 6.0 will be used to mitigate adverse environmental impacts to the maximum extent practicable. Finally the roadway expansion is adjacent to the existing roadway, and the existing easements and rights--of-way provide for the allowance of construction and maintenance of a roadway.

(b) Secondary Impacts (7:7E-6.3)

Secondary impacts are almost always long-term in nature. They are those indirect impacts which may occur as a result of construction and/or implementation of the proposed project. Consequently, they are difficult to quantify.

The secondary impacts most commonly associated with a new or improved roadway are:

1. Increased traffic

2. Increased development

The first impact usually occurs when the project provides an alternate route to a given destination. In this case, the driver chooses the new route because of improved conditions. Since the Artificial Island Access Road is the only route available, there is no reason for traffic to increase over present levels, except for the few who would visit the Station under improved conditions only.

The second impact most frequently occurs with the building of a new roadway. This is especially true in the case of a highway which opens up an area which was previously inaccessible (e.g., U.S. Interstate 80). For the same reason as above, the project is not expected to increase strip development.

Approximately 67% of the project lies in regulated wetlands, which would minimize the potential for strip development. Public Service Electric and Gas Company's plans for development on Artificial Island are the same with or without the road widening.

(c) Transportation Use Policy (7:7E-7.5)

The state's policy requires that new road construction must be consistent with the Policy on Location of Linear Development and shall be limited to situations where:

(1) a clear need exists, taking into account the alternatives of upgrading existing roads and of using public transportation to meet the need,

(2) provision is made to include construction of bicycle and foot paths, except where these would not be feasible,

(3) provision is made for coordinated construction of public transportation rights-of-way and facilities, such as bus lanes, rail lanes, and related transit stop or station facilities and parking, except where construction would not be feasible,

(4) visual and physical access to the coastal waters is maintained, to the maximum extent practicable, and

(5) individual development in conflict with coastal policies would not be expected to result.

The project appears to meet these criteria. The roadway expansion will be an extension of an existing roadway. The public transportation system in the area is not sufficient to support the additional load. Provisions for bicycle or foot paths is considered of little benefit as the minimum distance to an inhabited area is five miles. The visual and physical access to the coastal waters will be maintained and improved. However, this will probably not induce further development in the area and therefore will not conflict with coastal policies.

4.3 Resource Policies

(a) Marine Fish and Fisheries (7:7E-8.2)

The wetlands to be affected are located in a portion of the river which is used as a nursery area for several species of marine fish. The actual wetlands to be filled will not include the tidal guts which flush the marshes. Existing culverts will maintain the present tidal flushing action. The nutrient flow and fish passage will therefore be continued and will have no effect on the nursery area.

(b) Water Quality (7:7E-8.4)

The addition of the lane to the existing roadway will have little effect on water quality. Runoff from the roadway will be increased simply due to the larger surface area. The runoff will be allowed to permeate into the surrounding soils naturally. In the wetlands some runoff from the roadway will run into the tidal creeks being crossed but the amount should be extremely small.

During construction erosion and soil conservation techniques will be used to minimize any runoff. A soil erosion and sediment control plan is described in Section 4.3(f).

(c) Surface Water Use (7:7E-8.5)

As defined by the State regulations, surface water is water in rivers, bogs, wetlands, bays, and ocean that is visible on land. The state policy concerning surface water use states that coastal development shall demonstrate that construction of the facility will not cause unacceptable surface water disturbances, such as drawdown, bottom scour or alteration of flow patterns. Coastal development which uses design processes and fixtures which minimize consumptive water use will be encouraged. Coastal development will conform with all applicable DEP and, in the Delaware River area, Delaware River Basin Commission, requirements for surface water diversions.

The proposed project will not cause extensive surface water disturbances. The construction plan does not appear to require drawdown of the adjoining wetlands during backfill. However, the construction will require the loss of tidal wetland areas to the embankments. The additional roadway, by the nature of the structures, will not place any additional demand on the consumptive water supplies in the area. Details on the road widening project will be submitted to the Delaware River Basin Commission for their information.

(d) Runoff (7:7E-8.7)

Runoff is that portion of precipitation on the land which is not absorbed by the soil, but instead runs off to surface water bodies. Calculations were performed based on 7.5 inches of rainfall in twenty-four hours which is the anticipated maximum storm for 100 years, and revealed a runoff of approximately 6.75 cubic feet per linear foot per twenty-four hours. The runoff from the bituminous road surface with no curb will run onto the shoulder and across the 20 foot wide embankment area. This runoff will result in an additional 12,200 cubic feet of runoff along the three and a half miles of road. Considering the surrounding lands are predominantly wetlands, this runoff should have no environmental impact.

(e) Soil Erosion and Sedimentation (7:7E-8.8)

CAFRA policies (Ref. 2.3-2) describe erosion as "...the detachment and movement of soil or rock particles by water, wind, ice or gravity...". These same policies require that all construction activities minimize soil loss through erosion.

The erodability or "K" factor, which describes expected erosional losses of various soil types, is provided in Table 2.3-1. Due to the variable nature of the "made land - hydraulic fill" areas and the consistent flooding of the tidal marsh and "muck" soils, no "K" factor is given by the USDA. Most acreage along the access road have erodability factors of 0.32 or greater.

Section 3.6 of this report describes PSE&G's soil erosion and sediment control plan for the project.

(f) Vegetation (7:7E-8.9)

As described in Section 2.5 two distinct associations of vegetation will be affected. On the upland section the majority of the bordering vegetation is agricultural. The proposed widening will involve little removal of native plants in this section. In the wetland part the dominant species is *Phragmites australis* which is growing on the existing embankments.

After construction of the lane the new embankment in the wetlands will be hydromulched and seeded. *P. australis* will self seed to duplicate the existing habitat.

(g) Important Wildlife Habitat (7:7E-8.10)

Upland portions of the roadway are composed primarily of agricultural fields. These areas are not Important Wildlife Habitat. The wetland portions have been described in the Critical Wildlife Habitat portion.

(h) Air Quality (7:7E-8.11)

Coastal development shall conform to all applicable regulations and guidelines established to meet requirements to the Federal Clean Air Act as amended in 1977. Currently the air quality is good, but the carbon monoxide and ozone levels at the nearest New Jersey monitoring stations (Penns Grove and Vineland respectively) exceed certain ambient air quality standards. Improving traffic flow in the area may help lower carbon monoxide and ozone levels.

(i) Public Access to the Shorefront (7:7E-8.13)

Public access to the Delaware River will be improved by the lane addition. Currently there are parking locations used by local fishermen near Sunken Ship Cove. During the peak traffic flows access to the parking areas is difficult because of slow moving traffic and high volume. The additional lane will therefore benefit public access to the waterfront.

(j) Energy Conservation (7:7E-8.17)

Coastal development shall incorporate energy conservation techniques. The increased traffic flow will help to conserve valuable oil resources. Our proposal improves traffic flow. Therefore, the consumption of oil should decrease, and our proposal is consistent with the energy conservation philosophy.

(k) Neighborhoods and Special Communities (7:7E - 8.18)

The proposed project will have no adverse effects on any neighborhood or community. The Village of Hancocks Bridge will not experience any negative impacts from the roadway improvement.

(l) Traffic (7:7E-8.19)

Coastal development that induces land traffic is conditionally acceptable provided it does not cause unacceptable congestion and safety problems. This project is designed to alleviate a recurring traffic congestion and safety problem.

(m) High Permeability Moist Soils (7:7E-8.20)

As defined in CAFRA policy guidelines (Ref. 2.3-2), High Permeability Moist Soils are those contiguous with perennial stream channels, having a depth to seasonal high water less than 5 feet and with a loamy sand or coarser soil.

As distinguished in Table 2.3-1, most soils along the project route have seasonal high water levels of 2 feet or less. However, the USDA texture classification reveals that most are silty or sandy loams. Therefore, it is seen that the soils involved are not "High Permability Moist Soils."

(n) Wet Soils (7:7E-8.21)

Wet Soils, in comparison with High Permeability Soils, are those regions with a depth to seasonal high water of 3 feet or less (Ref. 2.3-2). As described above, all areas in the project scope fall within the description (except Mattapeake silt loam). CAFRA policy discourages development in these regions unless certain conditions are met. Applicable to this project is condition (iv), which requires that the "...stability of roads and paved areas (are) assured, using techniques such as removal of compressible sediments and replacement with a firm substrate and thicker than normal road base." Construction procedures used to widen the access roadway are described in Section 3.8.

(o) Fertile Soils (7:7E-8.22)

Fertile Soils are delineated (Ref. 2.3-2) according to their USDA Agricultural Capability Ratings and Erodability ("K" factor). If a given soil has a capability rating of I, II, or III and a K value less than 0.20, it is considered "fertile."

As shown in Table 2.3-1, none of the region along the proposed road widening meet the requirements as set forth. Thus, none are "fertile soils."

(p) Flood Hazard Areas (7:7E-8.23)

The area surrounding the existing private roadway is considered a flood hazard area as delineated by FEMA (see Figures 2.1-14) thru 2.1-21). According to N.J.A.C. 7:13-1.4(c), any lawful, pre-existing prohibited uses may be maintained in a delineated floodway provided, that if expanded or enlarged, they do not increase the flood damage potential of the area.

The current proposed design will provide for a permeable coarse rock layer as part of the embankment. This layer will provide for drainage of the embankment soils and for some margin of flood storage capacity.

5.0 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

The construction of the additional lane will require that approximately 7.7 acres of wetland be filled. As described in Section 2.5, Vegetation, the plant species to be disturbed include *Phragmites australis*, *Spartina alterniflora*, *Spartina patens*, and *Distichlis spicata*. All of these species are common in the area and occupy thousands of acres on either side of the private roadway portion. They will continue to grow after construction.

The additional lane is being constructed partially in a flood hazard area which will decrease slightly the flood storage capacity of the area. The use of permeable coarse rock will reduce the loss of flood storage capacity.

Approximately 7.6 acres of agricultural lands will be displaced as a result of the construction.

6.0 TECHNIQUES TO MINIMIZE ADVERSE ENVIRONMENTAL IMPACTS

Roadway design has been selected to minimize encroachment into productive wetlands. As planned, the project will involve approximately 7.7 acres of wetlands from approximately 4400 similarly vegetated acres between Alloway Creek and Fishing Creek on the east side of the Delaware River.

Despite the small encroachment into wetlands, it is proposed to preserve approximately 7.7 acres of wetlands near Stow Creek, Greenwich Township, Cumberland County in return for the right to fill a similar acreage of wetlands for the roadway widening project. PSE&G and Atlantic City Electric Company co-own and hold for future use a tract in this location with the potential for energy development.

Vegetation along the existing roadway embankment will be replaced by suitable wetlands species. It is anticipated the *Phragmites australis* will self seed and grow along the new embankment since this species is currently growing along the existing roadway.

Should any temporarily filled areas be required, they will be removed upon completion of the construction. All filling will be performed by trucks utilizing the existing roadway. As little as possible of the vegetation will be disturbed or covered during filling.

7.0 ALTERNATIVES

The present traffic problems can be alleviated by reducing the volume of traffic during the peak periods or by physical improvements to the highways. PSE&G considered two major alternatives - the no build alternative and the roadway improvement option. The following sections are descriptions of the various alternatives. All costs should be used for comparison purposes only and not interpreted as final estimates.

7.1 The No Build Alternatives

Three no-build alternatives - staggering of work hours, van pooling or busing, and one way traffic - were considered in order to improve the traffic situation.

7.1.1 Staggering of Work Hours

PSE&G has attempted to reduce the traffic delay by increased staggering of work hours. Data collected and analyzed indicate that during 1982 if the work hours were not staggered the peak hourly traffic volume would be approximately 3,300 critical movements per hour in the morning and 3,200 in the afternoon. A number greater than 1,200 critical movements per hour causes an unreasonable delay. The staggered work hours have reduced critical movements to approximately 1,800 in the morning and 1,700 in the afternoon. These levels are still high enough to cause traffic delays of up to 15 additional minutes along the access road to Hancock's Bridge, a distance of 6.4 miles normally travelled in nine to ten minutes. This assessment was based on sampling in the morning and evening hours between Second Street in the village of Hancocks Bridge and at the intersection on Artificial Island where traffic divides between the Salem and Hope Creek Generating Stations. It does not take into account further delays beyond those points for traffic waiting to enter, nor time allowances made by workers themselves wishing to avoid delays enroute. Vehicle breakdowns contribute to substantial additional delays as vehicles pass the affected location in the single available traffic lane.

The Hope Creek construction contractual agreements with the trade unions and the interaction of the various facets of the construction prevent any further staggering of work hours.

7.1.2 Van Pooling or Busing

The second option for reducing the volume of peak hour traffic is to increase vehicle occupancy rates by introducing a van pooling or busing operation. The following three plans were considered.

(1) Plan "A" called for the organization of van pools operating from local neighborhoods, i.e., picking up members of the group at or near their homes.

(2) Plan "B" provided for van pooling from designated staging areas to be provided by the leasing service.

(3) Plan "C" proposed the operation of 49-passenger PUC regulated buses operating from designated staging areas.

Each of the three plans would cost about $1,000 per person annually.

Reluctance by the employees to patronize the van pooling program is much the same as the normal resistance to mass transit. Most of the workers will have driven at least a half hour to the point of the van pool start. It is more convenient at that point to continue on to the plant than wait for a van pool to load-up and leave. Further, if the van pooling reduced the congestion on the access road the workers would then return to their cars because the delay had been reduced.

Staggered work hours would have to be continued for the van pooling to be an effective traffic reducer. This staggering would reduce the number of workers who could meet and form a pool at a convenient time to keep the delay to a minimum.

7.1.3 <u>One-way Traffic - Entire Route</u>

Projected Costs: $500,000
Anticipated Construction Time: 3 months

The one-way traffic option is a proposal to increase the highway capacity during peak periods. The proposal would include the prohibition of two-way traffic during the morning and evening rush hours. During these periods, the stretch of the roadway would become only an ingress or egress route. Overhead signalization and highway signs would be required to control the system.

This solution is not considered as desirable an alternative as constructing a third lane.

1. The proposal requires special measures to insure safety.

2. Local residents traveling to and from their homes along the public road will be inconvenienced.

3. Special efforts to schedule the arrival and departure of Artificial Island workers would be needed to avoid delays to personnel not working the day shift.

7.2 Roadway Improvement Alternatives (See Figure 7.2-1)

(a) One-Way Traffic - Private Road; Three Lanes - Public

Project Costs: $2,540,000

This combined widening and one-way traffic option would increase the private road capacity during peak periods. As in the above 7.1.3 option the private roadway would become only an ingress or egress route with resulting benefits. The public portion would become three lanes with the middle lane being used for ingress or egress during peak periods. This option benefits the residents along the public portion by always being able to enter or leave their property. Overhead signalization and highway signs would be required to control the system.

(b) Construction of a causeway linking Artificial Island and Elfsborg - Hancocks Bridge Road.

Projected Costs: $28,600,000

The causeway, linking Artificial Island and Elfsborg - Hancocks Bridge Road, is an alternative to the widening of the Alloway Creek Neck Road and the private road. It would pass through wetlands north of the station and bridge the Alloways Creek and Halfway Creek. The roadway would be similar to the existing Artificial Island access road with normal eight foot embankments and thirteen foot embankments bordering the two bridges. The causeway would be constructed with two 12-foot wide travel lanes and six-foot wide shoulders and would require approximately 30.2 acres of wetlands.

The causeway has certain significant advantages. A totally separate route for traffic would be offered in the event of an emergency. Construction could be conducted with no disruption of the existing road network. The traffic would bypass the Village of Hancocks Bridge.

The causeway would require additional easements and riparian grants from the State of New Jersey. Additional permits would be required for waterfront development, stream encroachment, and water quality from the State for the bridges and two bridge permits would be required from the U.S. Coast Guard. The causeway would require filling of wetlands. Finally, the causeway would increase the traffic in the City of Salem.

The causeway linking the Artificial Island site and the Elfsborg - Hancocks Bridge Road is considered the least desirable construction alternative. In addition to high costs, the construction would require the filling of 30.2 acres of wetlands. Implementation of this alternative will create an extensive delay in the improvement of the traffic situation.

(c) Construction of the Meadows Connector including widening of Silver Lake Road.

Project Cost: $7,500,000

The Meadows Connector is proposed as an alternative to the widening of Alloway Creek Neck Road and would be done in conjunction with the widening of the private access road. The roadway would require the construction of embankments over wetlands and tidal streams. The widening of existing Silver Lake Road (to provide two 12-foot wide travel lanes and six-foot wide shoulders) and the realignment and reconstruction of the Silver Lake Road/Canton Road/Church Road intersection would be required. The Meadows Connector would also require the construction of a new intersection at the junction with Alloway Creek Neck Road and the private access road (Mad Horse Bend). Note that the cost estimate does not assume construction to elevation 10, i.e., above the 100-year flood level.

The Meadows Connector offers the advantages of a totally separate public route for traffic in the event of an emergency and construction (except at the Alloway Creek Neck Road intersection) which can be conducted with little or no disruption of the existing road network.

Although the Meadows Connector could be constructed within the 350-foot wide easement from the New Jersey Bureau of Fish and Game, right-of-way acquisition and/or easements will be necessary along Silver Lake Road as well as for the Church Road realignment. The relocation of approximately 37 percent of the plant traffic will result in an increase in traffic through Canton. It is estimated that the traffic volume (from the plant) will increase from four percent of the total plant traffic to perhaps 12 percent of the total plant traffic if the Meadows Connector is constructed.

The Meadows Connector represented an option which had more significant environmental impacts than the option chosen. Additional wetlands (approximately 32.1 acres) would require filling. The roadway would pass through Mad Horse Creek Fish and Wildlife Management Area. The roadway would result in additional traffic in downtown Canton.

(d) Construction of an Elevated Causeway Linking Artificial Island and Elfsborg - Hancocks Bridge Road.

Project Costs: $115,000,000

The elevated causeway, linking Artificial Island and Elfsborg - Hancocks Bridge Road, is another alternative to the widening of Alloway Creek Neck Road and the private road. The alternative would be the construction of two 14' lanes consisting of reinforced concrete slabs over metal decking.

One hundred ton capacity piles approximately 100' long and ASHTO Type III girders at 60' spans would be used. There would also be standard barrier rails, lighting and signals.

The elevated causeway has many advantages. The causeway would afford a totally separate route for traffic in the event of an emergency. Construction could be conducted with no disruption of the existing road network. The traffic would bypass the Village of Hancocks Bridge. The causeway would require a minimum of wetlands.

The major disadvantages of the elevated causeway are the cost, complicated construction and time for construction. The projected costs are the highest of any alternative. The time for construction would be two to three years.

(e) Construction of an Elevated Meadows Connector and Widening of the Private Road.

Projected Costs: $66,000,000

The elevated causeway, linking Mad Horse Bend and Silver Lake Road/Canton Road/Church Road intersection, is the last major alternative considered. The construction would be similar to the previously described elevated causeway. The advantages and disadvantages would be similar to the other elevated causeway option.

7.3 Construction Method Alternatives

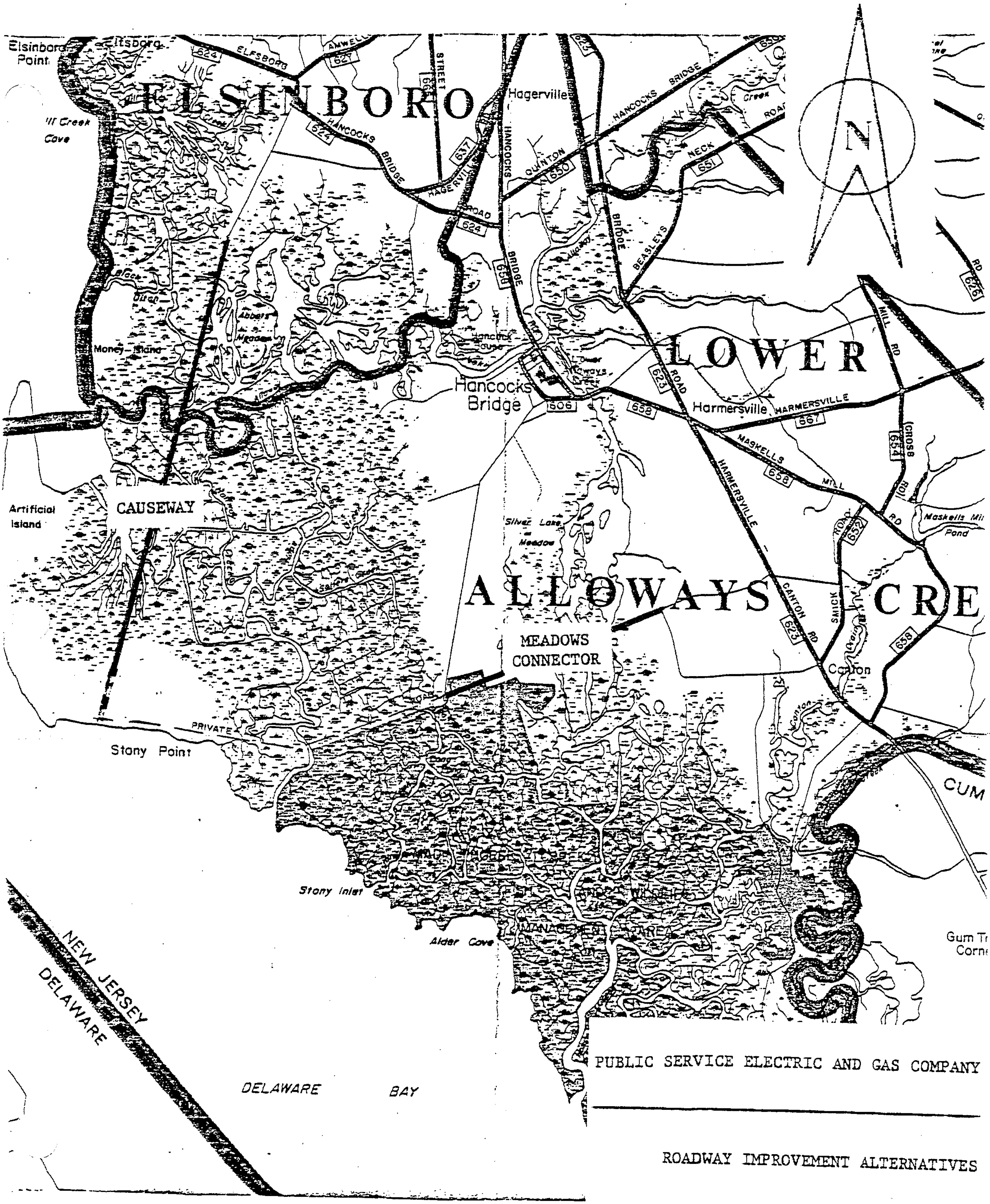
Alternative construction methods for the private section of the roadway were evaluated. The methods included the phased fill, the elevated causeway, the retaining wall, and the bermed fill. The various construction methods were evaluated considering environmental impact and cost.

The bermed fill method, although technically feasible and requiring less time to complete, would require the use of an additional 7.3 acres of wetlands. The bermed fill method also cost approximately $1.2 million more than the phased fill method.

The elevated causeway method (Figure 7.3-2) would require the installation of 100 ton capacity X 100' long piles and ASHTO type III girders (60') spans, reinforced concrete roadway slabs over metal decking, standard barrier rails, lighting and signals. The environmental impact would be minimal. The cost of this alternative would be $79,700,000.

The retaining wall construction method (Figure 7.3-3) would require the installation of sheet metal piles, batter piles, whalers and channels. This construction method would require a minimum amount of wetland use. The cost of this construction method would be approximately $33,000,000. The construction time would be approximately two years using four construction crews.

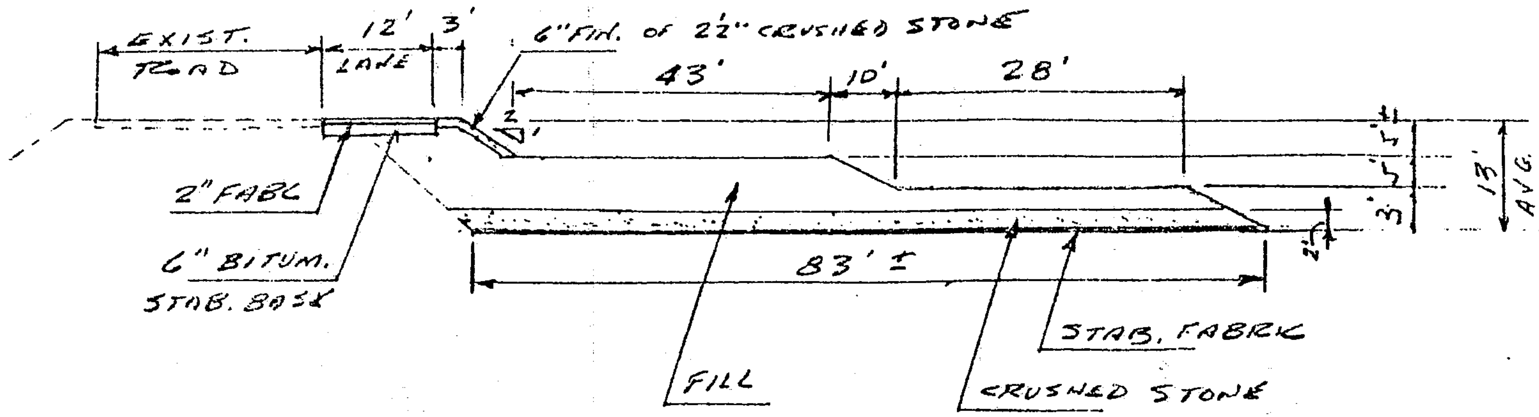
The phased fill method, the chosen alternative, is described in Section 3.0. The estimated cost of the access road widening using the phased fill method for the private portion, is $8,380,000.



PUBLIC SERVICE ELECTRIC AND GAS COMPANY

ROADWAY IMPROVEMENT ALTERNATIVES

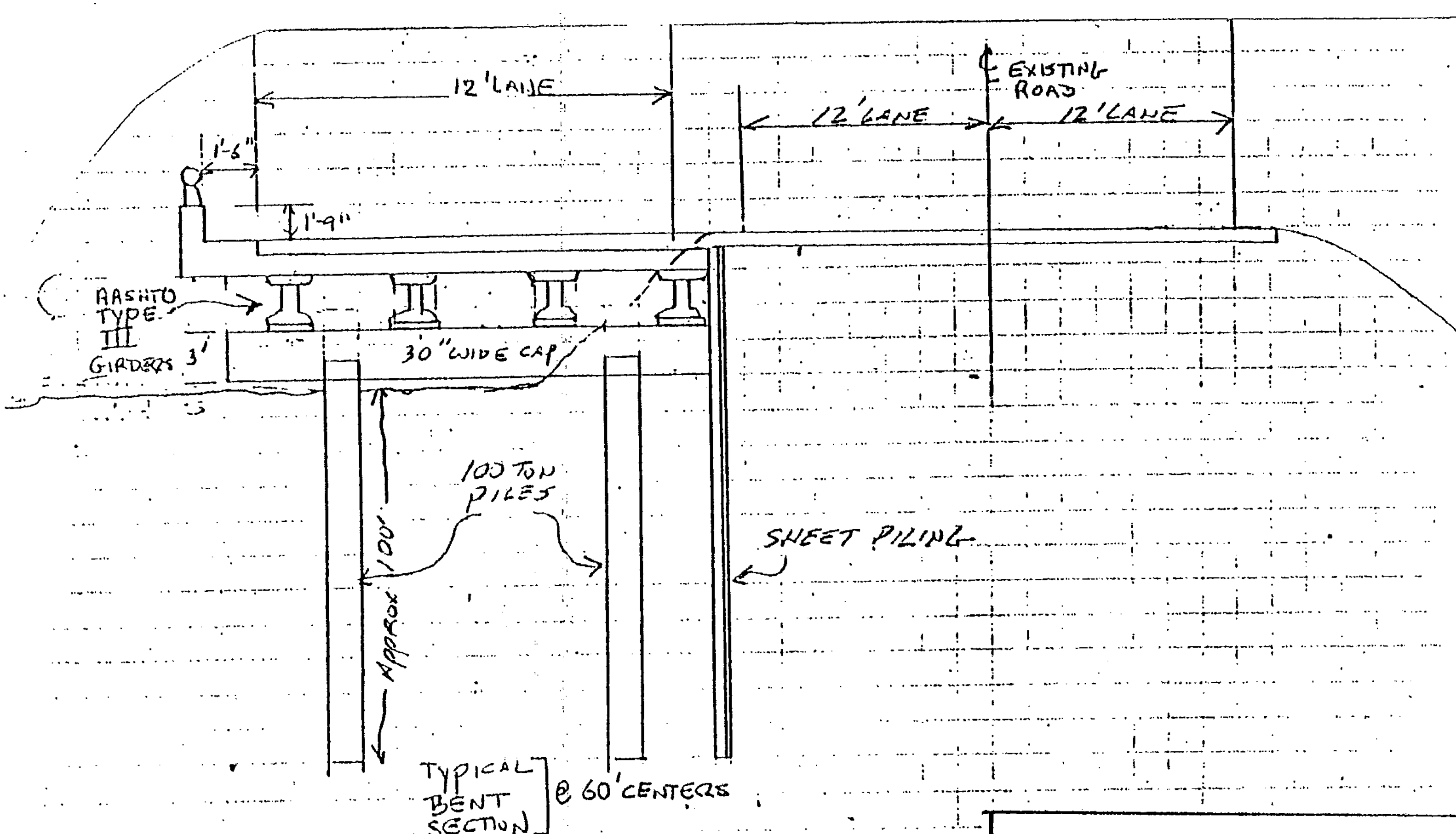
Fig. 7.2-1



Public Service Electric and Gas Company

Artificial Island Access Road Construction Alternative Bermed Fill Method

Fig. 7.[illegible]-1



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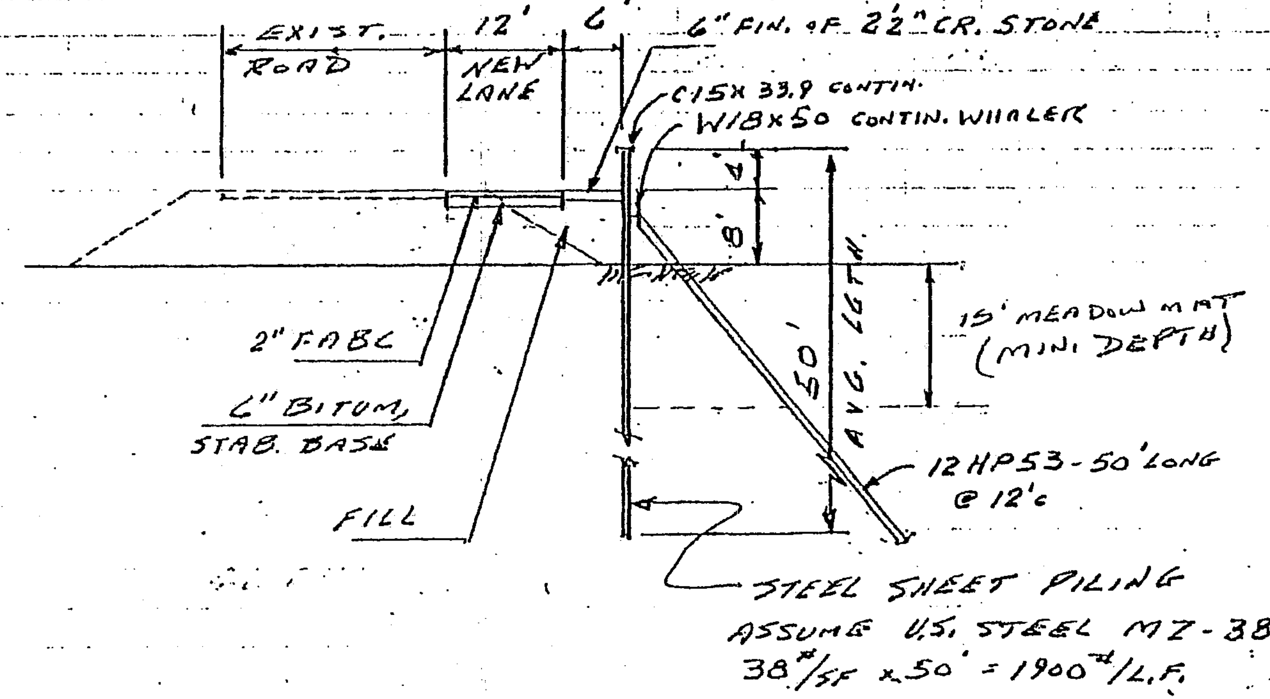
ARTIFICIAL ISLAND ACCESS ROAD
CONSTRUCTION ALTERNATIVE
ELEVATED CAUSEWAY

Fig. 7.3-2



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ARTIFICIAL ISLAND ACCESS ROAD

CONSTRUCTION ALTERNATIVE
RETAINING WALL METHOD

Fig. 7.3

8.0 Regulatory Requirements

Tables 8.0-1, 8.0-2, and 8.0-3 are the required permits and regulatory requirements for the private, public roads, and Hope Creek Bridge respectively.

Table 8.0-1

ARTIFICIAL ISLAND ACCESS ROAD - PSE&G PRIVATE ROAD
FEDERAL, REGIONAL, STATE, AND MUNICIPAL
LICENSING, PERMITS, OR CERTIFICATES

PERMIT	AGENCY	PURPOSE	STATUTORY OR LEGAL AUTHORITY	STATUS
FEDERAL				
404 Permit	United States of America, Army Corps of Engineers	Federal Approval of Wetlands Development	Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (P.L. 95-217 12/28/77 ER 71:5101)	
Coast Guard Permit	United States D.O.T, 3rd District Coast Guard	Federal Approval of Culvert Modifications	33 CFR 2 General Duties and Jurisdiction Navigable Waters.	
STATE				
Riparian Grant	NJDEP - Division of Coastal Resources, Bureau of Tidelands	Acquisition of State - Owned Lands Subject to tidal action.	N.J.S.A. 12:5-1 et seq.	
CAFRA	N.J.D.E.P. - Division of Coastal Resources, Bureau of Coastal Project Review	State Approval of Construction within Coastal Zone	N.J.S.A. 13:19-1 et seq.	
Wetlands - Type 'B'	N.J.D.E.P. - Division of Coastal Resources, Bureau of Coastal Project Review	State Approval of Filling of Mapped Wetlands	N.J.S.A. 13:9A-1 et seq.	
401 Water Quality Certification	NJDEP - Division of Water Resources	Satisfy Federal Permit Requirements	N.J.S.A. 58:10-1 to 13	

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Table 8.0-1 (Cont.)

ARTIFICIAL ISLAND ACCESS ROAD - PSE&G PRIVATE ROAD
FEDERAL, REGIONAL, STATE, AND MUNICIPAL
LICENSING, PERMITS, OR CERTIFICATES

PERMIT	AGENCY	PURPOSE	STATUTORY OR LEGAL AUTHORITY	STATUS
Stream Encroachment Waiver	N.J.D.E.P. - Division of Water Resources Bureau of Flood Plain Management	State Approval of Culvert Modifications	N.J.S.A. 58:16A-50 et seq.	
Soil Erosion and Sediment Control Plan	N.J.D.A - Salem County Soil Conservation District	Land Disturbance Approval	N.J.S.A. 4:24-1 et seq. (P.L. 1975 Chapter 251 Soil Erosion and Sediment Control Act	
N.J.D.O.T. Endorsement	N.J. Dept. of Transportation	Design Review of Public Road and Signal System		
Waterfront Development	NJDEP-Division of Coastal Resources, Bureau of Coastal Project Review	State Approval of Structure Modification Within Waterfront	N.J.S.A. 12:3-1 et seq.	
Additional Requirements				
Municipal				
Ordinance	Lower Alloways Creek Township	Incorporate as part of Public Sector the Signal and Control System		
Regional				
DRBC Endorsement	Delaware River Basin	Statisfy 401 Certification and CAFRA requirements	N.J.S.A. 58:10-1 to 13	

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Table 8.0-2

ARTIFICIAL ISLAND ACCESS ROAD - ALLOWAY CREEK NECK ROAD WIDENING (PUBLIC ROAD)
STATE, AND MUNICIPAL
LICENSING, PERMITS, OR CERTIFICATES

PERMIT	AGENCY	PURPOSE	STATUTORY OR LEGAL AUTHORITY	STATUS
FEDERAL				
404 Permit	United States of America, Army Corps of Engineers	Federal Approval of Wetlands Development	Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (P.L. 95-217 12/28/77 ER 71:5101)	
STATE				
Riparian Grant	NJDEP - Division of Coastal Resources, Bureau of Tidelands	Acquisition of State - Owned Lands Subject to tidal action.	N.J.S.A. 12:5-1 et seq.	
CAFRA	N.J.D.E.P. - Division of Coastal Resources, Bureau of Coastal Project Review	State Approval of Construction within Coastal Zone	N.J.S.A. 13:19-1 et seq.	
Wetlands - Type 'B'	N.J.D.E.P. - Division of Coastal Resources, Bureau of Coastal Project Review	State Approval of Filling of Mapped Wetlands	N.J.S.A. 13:9A-1 et seq.	
401 Water Quality Certification	NJDEP - Division of Water Resources	Satisfy Federal Permit Requirements	N.J.S.A. 58:10-1 to 13	

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Table 8.0-2 (Cont.)

ARTIFICIAL ISLAND ACCESS ROAD – ALLOWAY CREEK NECK ROAD WIDENING (PUBLIC ROAD)
STATE, AND MUNICIPAL
LICENSING, PERMITS, OR CERTIFICATES

PERMIT	AGENCY	PURPOSE	STATUTORY OR LEGAL AUTHORITY	STATUS
Stream Enroachment Waiver	N.J.D.E.P. – Division of Water Resources Bureau of Flood Plain Management	State Approval of Culvert Modifications	N.J.S.A. 58:16A-50 et seq.	
Soil Erosion and Sediment Control Plan	N.J.D.A – Salem County Soil Conservation District	Land Disturbance Approval	N.J.S.A. 4:24-1 et seq. (P.L. 1975 Chapter 251 Soil Erosion and Sediment Control Act	
N.J.D.O.T. Endorsement	N.J. Dept. of Transportation	Design Review of Public Road and Signal System		
Waterfront Development	NJDEP-Division of Coastal Resources, Bureau of Coastal Project Review	State Approval of Structure Modification Within Waterfront	N.J.S.A. 12:3-1 et seq.	
<u>Additional Requirements</u>				
<u>Municipal</u>				
Ordinance	Lower Alloways Creek Township	Incorporate as part of Public Sector the Signal and Control System		
<u>Regional</u>				
DRBC Endorsement	Delaware River Basin	Statisfy 401 Certification and CAFRA requirements	N.J.S.A. 58:10-1 to 13	

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TABLE 8.0-3

ARTIFICIAL ISLAND ACCESS ROAD - HOPE CREEK BRIDGE WIDENING
FEDERAL, STATE, AND MUNICIPAL
LICENSING, PERMITS, OR CERTIFICATES

PERMIT	AGENCY	PURPOSE	STATUTORY OR LEGAL AUTHORITY	STATUS
FEDERAL				
Bridge Permit Amendment	U.S. Department of Transportation, Coast Guard, 3rd District	Approval of Proposed Work and Design Review	River and Harbor Act of Mar. 3, 1899 (30 Stat. 1151; 33 U.S.C. 401). General Bridge Act of Mar. 23, 1906 (34 Stat. 84; 33 U.S.C. 491), and General Bridge Act of 1946 (60 Stat. 847; 33 U.S.C. 525 et seq).)	
Army Corps	United States of America, Army Corps of Engineers	Notification of Proposed Work	Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (P.L. 95-217 12/28/77 ER 71:5101)	Notification made and jurisdiction given to U.S. Coast Guard
STATE				
Riparian Grant	NJDEP - Division of Coastal Resources, Bureau of Tidelands	Acquisition of State - Owned Lands under water	N.J.S.A. 13:19-1 et. seq.	Approved
Waterfront Development	NJDEP - Division of Coastal Resources, Bureau of Coastal Project Review	State Approval of Structure Modification within Waterfront	N.J.S.A. 12:3-1 et. seq.	Approved
401 Water Quality Certification	NJDEP - Division of Water Resources	Satisfy Federal Permit Requirements	N.J.S.A. 58:10-1 to 13	Part of Waterfront Development Review
Stream Encroachment Waiver	NJDEP - Division of Water Resources Bureau of Flood Plain Management	State Approval Structure within Flood Plain	N.J.S.A. 58:16A-50 et. seq.	Approved
Plan Release	N.J. Department of Community Affairs Bureau of Construction Code	State Approval of Construction Plans	N.J.A.C. 23:5	Approved
MUNICIPAL				
Construction Permit	Lower Alloways Creek Building Department	Local Construction Approval	N.J.A.C. 23:5	Approved

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