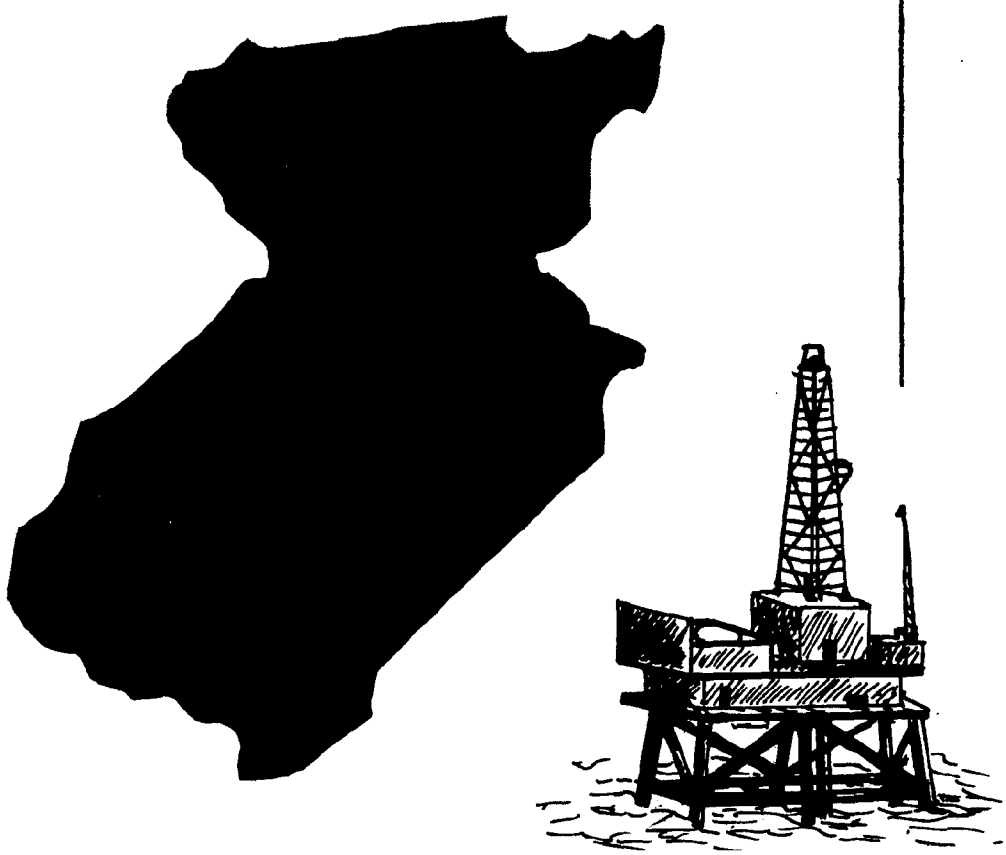
13649

COASTAL ZONE
INFORMATION CENTER

Environmental Systems Section

OFFSHORE OIL AND COASTAL ENERGY FACILITIES STUDY: INTERIM REPORT



Middlesex County Planning Board
New Brunswick, New Jersey

TD
195
.P4
M54
1977

COASTAL ZONE
INFORMATION CENTER

OFFSHORE OIL AND COASTAL ENERGY FACILITIES STUDY:

INTERIM REPORT

AUGUST, 1977

Property of CSC Library

Prepared By The

Middlesex County Planning Board

Environmental Systems Section

New Brunswick, New Jersey

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

TD195.P4 M54 1977
DEC 22 1997

The preparation of this report was supported by funds granted to the Middlesex County Board of Chosen Freeholders by the New Jersey State Department of Environmental Protection, Office of Coastal Zone Management and the U.S. Department of Commerce National Oceanic and Atmospheric Administration as authorized by Section 305 of the Federal Coastal Zone Management Act of 1972, as amended.

TABLE OF CONTENTS

	PAGE
INTRODUCTION	
The Study of Offshore Oil anc Coastal Energy Facilities	i
The Audience	ii
Statement of Purpose	ii
Objectives	iii
I. Existing Energy Facilities: Components in a Regional Pattern of Energy Supply	1
A. The Current Pattern of Supply	1
1. The United States	1
2. The North Atlantic Region	2
B. Inventory of Existing Facilities in Middlesex County	4
1. Petroleum Refineries	4
2. Marine Terminals	10
3. Pipelines and Pipeline Terminals	13
4. Petrochemical Industry	16
II. Outer Continental Shelf Activities	18
A. Phases of OCS Oil and Gas Activity	21
B. Description, Impacts and Requirements Facilities	23
1. Temporary Service Bases	23
2. Permanent Service Bases	24
3. Steel Platform Installation Support Bases	25
4. Repair and Maintenance Yards	26
5. Transportation	27
6. Pipeline Installation Support Bases	29
7. Partial Processing Plants	30
8. Gas Processing Treatment Plants	31
9. Refineries	32
10. Platform Fabrication Yards	34
11. Pipe Coating Yards	37
12. Tank Farms	38
C. The Potential for OCS Related Facilities Locating in Middlesex County	39
1. High Development Projection	42
2. Medium Development Projection	48
3. Low Development Projection	50
4. Summary	51
III. The Demand for Petroleum and Petroleum - Related Facilities	52
A. Projections of Future Energy Demands	52
B. The Potential for New Growth in Petroleum - Related Facilities	56
IV. Development Opportunities for OCS and Energy Facilities	71
A. Areas Meeting Industrial Siting Criteria of Petroleum - Related Facilities	73
V. Appendices	
A. Tentative Table of Contents for Final Report	A-1
B. Map: Industrial Zoned Lands	B-1
Bibliography	

INTRODUCTION

The Study of Offshore Oil and Coastal Energy Facilities

Middlesex County's Offshore Oil and Coastal Energy Facilities Planning Study is part of a joint State/Federal government effort to develop comprehensive policies and programs for the management of coastal areas. The coastal zone is an area in which industry, trade, recreation, waste disposal, and conservation interests all press most sharply on the limited resources of the environment. The rapidly increasing pressures in the coastal zone are created by the problems of conflicting use, as evidenced by the continuing destruction of valuable coastal wetlands and beaches. These competing pressures are best dealt with by a management system which permits conscious and informed decision-making to be made from among development alternatives. The United States Congress enacted the Coastal Zone Management Act (CZMA) of 1972 (Public Law No. 92-583; 90 Stat. 1013) to help institute such a management system for coastal areas.

Section 305 of the CZMA authorizes funds for the development of state coastal zone management programs to each coastal state. New Jersey's Department of Environmental Protection Office of Coastal Zone Management (NJDEP/OCZM) is in the midst of its third year CZMA authorized grant. As part of its third year program NJDEP/OCZM contracted with eleven coastal county planning boards and one county environmental agency to begin preliminary planning for the onshore impacts of offshore oil and other coastal energy facilities.

The Middlesex County Planning Board's Offshore Oil and Coastal Energy Facilities Planning Study is funded with a grant from a DEP/OCZM contract.

Under the contract, the Planning Board is expected to: 1) analyze the capability of local governments to respond to the opportunities and cope with the problems of offshore oil and energy facility development; and 2) identify from the local and county government perspective, the geographic areas suitable of unsuitable for specific energy facilities. This document is an interim report which has been prepared to provide information and to stimulate communication between the municipalities, the County, and the public. This interim report is intended to serve as a basis for further discussion; it is the foundation for communication, coordination, and cooperation.

The Audience

This report is primarily addressed to municipal and county officials who may soon be faced with decisions regarding the development of offshore oil and coastal energy facilities. The report provides these officials, the public and all interested groups with information on: 1) existing petroleum related facilities and; 2) the types, requirements, and impacts of new facilities that may seek to locate in Middlesex County. This facility information is presented for use by all parties interested in evaluating current energy facility siting policies and then in developing new plans and policies that suit the desires and needs of communities in Middlesex County.

Statement of Purpose

It has been estimated that the amount of energy demanded by the North

Atlantic Region will increase by more than 100 percent between 1975 and 2000. This increasing demand will result in changes in the number and types of energy facilities needed in the region. The interim report identifies the ranges (in number and type) of the petroleum-related facilities that may seek to locate in the North Atlantic Region and, specifically, in Middlesex County.

The report does not attempt to answer the questions of whether or where the facilities should locate in Middlesex County. Rather, the main purpose of this report is to provide the municipalities, the County, and the public with information that they can use to collaboratively arrive at decisions concerning the development of offshore oil, and other coastal energy facilities in the County. The report has been presented in an interim form to allow decision makers and interested parties to begin to convey their preferences and concerns as to the types and location of various facilities.

Objectives

The Interim Report has the following objectives:

1. To identify the type, number, and location of energy facilities already existing in Middlesex County;
2. To introduce interested parties and decision makers to the types and impacts of facilities associated with offshore oil and gas activities and other petroleum related activities (i.e., importing, storage and distribution of crude and refined petroleum products);
3. To discuss the potential for development of petroleum related facilities in Middlesex County;

4. To identify areas in Middlesex County that satisfy the industrial siting criteria for petroleum related facilities;
5. To provide municipal and county officials and all interested parties with information useful in determining the suitability of a range of sites for the development of various facilities.

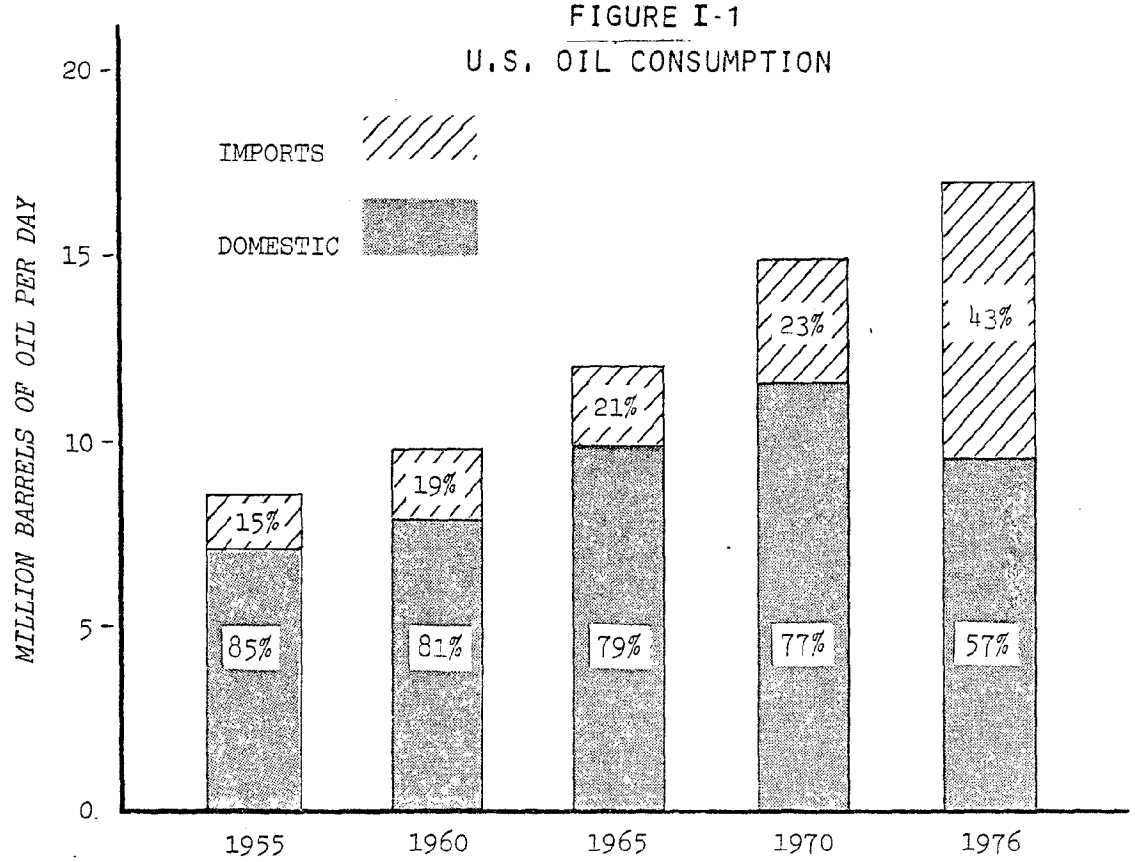
I. EXISTING PETROLEUM-RELATED FACILITIES: COMPONENTS IN A REGIONAL PATTERN OF ENERGY SUPPLY

A. The Current Pattern of Petroleum Supply

1. The United States

The United States uses more energy per person than any other nation in the world. Petroleum is the nations primary energy source, accounting for 45% of the nation's consumption. In the past twenty years, oil consumption in the U.S. has nearly doubled. As our nation's hunger for petroleum has been steadily rising, domestic production, having reached a peak of 11.2 million barrels per day (MB/D) in 1970, has been steadily declining. To fill the increasing gap between demand and domestic supply, foreign oil is being imported in ever increasing quantities. Figure I-1 shows these trends in U.S. oil consumption.

FIGURE I-1
U.S. OIL CONSUMPTION



SOURCE: U.S. Bureau of Mines

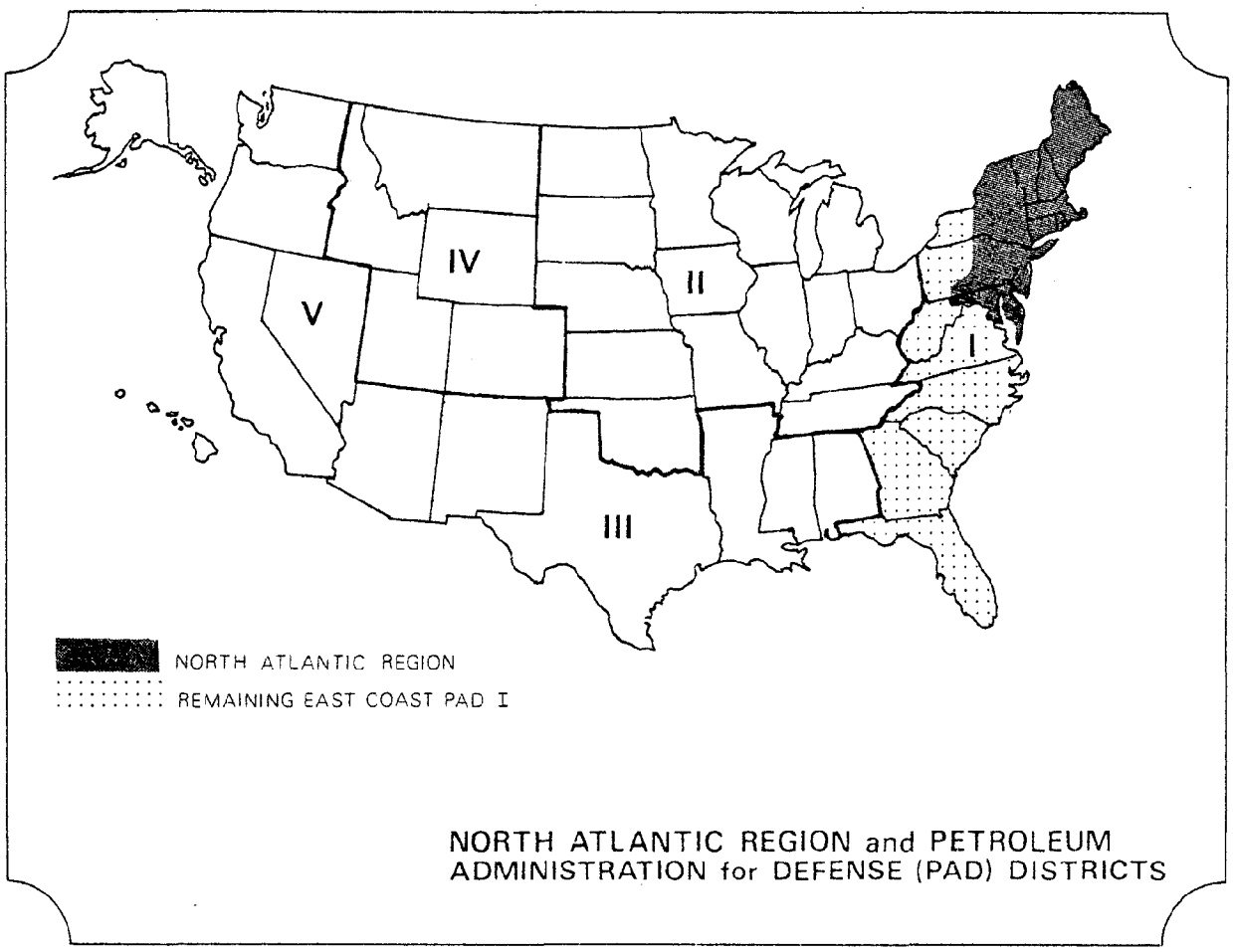
Foreign oil imports have increased significantly since 1970, when domestic production first began declining. Between 1955 and 1970, the amount of foreign oil imported to this Country increased by 2.1 MB/D. Since 1970 foreign imports have increased by 3.9 MB/D.

2. The North Atlantic Region

The East Coast of the United States, which comprises the Petroleum Administration for Defense (PAD) District I, and the North Atlantic Region, which comprises the northern extent of PAD I, are shown in figure I-2. The North Atlantic Region includes the greater portion of a Northeastern megalopolis which ranges from Boston, Massachusetts to Richmond, Virginia. The vast concentration of population, industry, and related economic activity located within this region represents one of the largest markets for petroleum products in the world. The North Atlantic Region, however, is currently an area almost entirely lacking in any petroleum resources of its own and is therefore most dependent on imports of oil from both foreign sources and other regions of the country, particularly the Gulf Coast. The majority of oil delivered to the North Atlantic Region comes in the form of refined petroleum products (65%). Originating from both domestic and foreign sources and processed at refineries outside of the PAD I district, these refined products are transported via tanker and pipeline to terminals in the North Atlantic Region where they are temporarily stored and then distributed to final market.

The remaining oil imported to the North Atlantic comes in the form of crude oil and is transported primarily from foreign sources via

FIGURE I-2



tankers to refineries located in the region where it is processed to obtain fuels (i.e., gasoline, jet fuel, heating oil, and residual oil used for electricity generation), feedstocks for petrochemical products such as plastics and fertilizers, waxes, lubricants, coke, and asphalt.

The following section discusses the various energy facilities that are the physical components in the regional pattern of energy supply which to date has had profound impacts on the landscape, environmental quality, and social and economic character of Middlesex County. Facilities located in Middlesex County are specifically identified and described and their relationships to the overall regional network of energy facilities and the current pattern of energy supply are examined.

B. Inventory of Existing Petroleum Facilities in Middlesex County

1. Refineries

The modern refinery consists of a series of units designed to produce a number of petroleum products by physically and chemically altering all or part of the crude oil stream. The complexity of the system depends on the type of crude being refined and the number and characteristics of the products being refined. In addition to the processing units, other components of the refinery include storage tanks, influent and effluent water treatment facilities, ancilliary buildings and services (administration building, machine shop, storage and warehouse, electrical substation, firehouse, pumping stations, truck loading terminals, etc.) transportation systems (road, marine terminal, pipeline, railroad spurs, parking lots, etc.) and a buffer zone.

According to the Bureau of Mines, as of 1976, there were 15 refineries with a combined total capacity of 1,614,200 barrels of oil per day in the North Atlantic Region (Table I-1). Refineries in the Middlesex and Union County/Arthur Kill area (32%) and the Delaware River area (62%) constitute the largest concentrations of this existing capacity, producing a wide range of products including asphalt, coke, lubricants, and wax, but primarily refinery gasoline, jet fuels, and heating oils for the regional market (Figure I-3). The only other major refinery over 50,000 barrels/day in the North Atlantic region is along the York River in Virginia (3%). Three small asphalt refineries, one located in East Providence, R.I. and two in Baltimore, Md. account for only 2% of the regions' total capacity.

TABLE I - 1

REFINERY CAPACITY IN THE EAST COAST (PAD I)

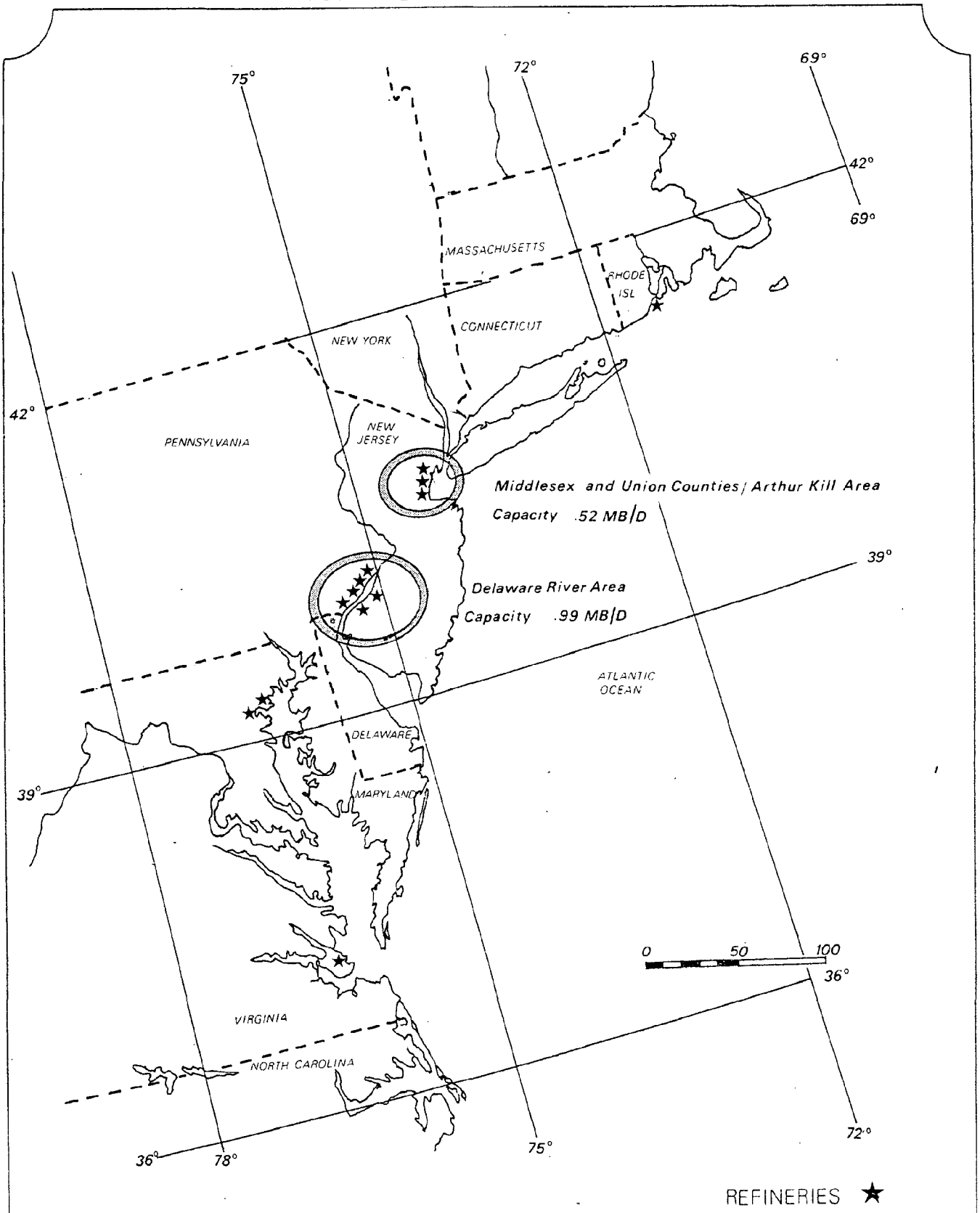
January 1, 1976

REGION/STATE	COMPANY	LOCATION	CAPACITY[1] (1,000 barrels/day)	PRODUCTS[5]
North Atlantic Region				
(Middlesex & Union Co./Arthur Kill) New Jersey	Amerada Hess Corp.	Woodbridge	67.9[2]	G
	Chevron Oil Co.	Perth Amboy	160.0[3]	G-A
	Exxon Co.	Linden	295.0[3]	G-A
		Subtotal	522.9	
(Delaware River)				
New Jersey	Mobil Oil Corp.	Paulsboro	98.0	G-K-L-W
	Texaco, Inc.	Westville	88.0	G
Eastern Pennsylvania	Atlantic Richfield Co.	Philadelphia	185.0[4]	G-A
	BP Oil Corp.	Marcus Hook	143.0	G
	Gulf Oil Corp.	Philadelphia	174.3	G
	Sun Oil Corp.	Marcus Hook	165.0	G-A-L-W
Delaware	Getty Oil Co.	Delaware City	140.0	G-K
		Subtotal	993.3	
(Remaining Region)				
Virginia	Amoco Oil Co.	Yorktown	53.0	G-K
Maryland	Amoco Oil Co.	Baltimore	15.0	A
	Chevron Asphalt Co.	Baltimore	13.5	A
Rhode Island	Mobil Oil Corp.	E. Providence	7.5	A
New Hampshire	A. Johnson & Co.	Newington	9.0	(NA)
		Subtotal	98.0	
		NORTH ATLANTIC REGION TOTAL	1,614.2	
Remaining East Coast				
New York	Ashland Oil Inc.	N. Tonowanda	64.0	G-A
	Mobil Oil Corp.	Buffalo	43.0	G-A
Western Pennsylvania	Pennzoil Co.	Oil City	10.0	G-L-W
	Pennzoil-Wolf's Head	Reno	2.1	L-W
	Quaker State Corp.	Emlenton	3.3	G-L-W
	Quaker State Corp.	Southport	6.5	G-L-W
	United Refining	Warren	52.0	G-A
	Valvoline Oil Co.	Freedom	6.8	L-W
	Witco Chem. Corp.	Bradford	9.0	G-L
West Virginia	Pennzoil Co.	Falling Rock	4.9	G-L-W
	Quaker State Corp.	Newell	9.7	G-L-W
	Quaker State Corp.	St. Marys	5.0	G-L-W
Georgia	Amoco Oil Co.	Savannah	13.0	A
	Young Refinery Corp.	Douglasville	5.0	A
Florida	Seminole Asphalt Refinery, Inc.	St. Marks	6.0	A
		REMAINING EAST COAST TOTAL	240.3	
	TOTAL REFINERY CAPACITY EAST COAST (PAD I)		1,854.5	

Source: U.S. Bureau of Mines. Mineral Industry Survey "Petroleum Refineries in the United States and Puerto Rico January 1, 1976"

(1) Crude oil distillation capacity
(2) Shutdown in 1974, but operable
(3) Up-to-date capacity information was obtained directly from these two companys
(4) 60,000 barrels/day. Shutdown, but operable
(5) Products: G-Gas and Oil; A-Asphalt; K-Coke; L-Lubricants; W-Wax

FIGURE I-3



LOCATION of EXISTING REFINERIES on the NORTH ATLANTIC COAST

Middlesex County is the site of two of the five existing refineries in New Jersey (See map on pg. 9.). The Amerada Hess Corporation refinery in Woodbridge Township was constructed in 1958. One of the last two refineries built in the Northeast, it was shut down in 1974 with an operating capacity of 67,900 barrels per day. Cited in the decision to close the plant were expansion plans that were necessary in order to produce a sufficient profit but that were made "economically impractical" by delays caused by environmental lawsuits. Nevertheless, this refinery is still maintained and Hess operates a marine terminal and storage facilities there to handle the delivery of refined petroleum products. The capacity set aside in the closing of this refinery was more than taken up in Hess's huge new refinery in the Virgin Islands (595,000 barrels/day).

The Chevron Oil Company refinery has been in continuous operation on a 325 acre site in Perth Amboy since 1950. It is on the site of the old Barber Oil refinery built in the early 1900's. The Chevron facility presently refines crude oil originating exclusively from foreign sources. On the average one tanker is received at the dock facilities every three days. The average tanker capacity is 500, 000 barrels. Larger size tankers that, when fully loaded, are unable to navigate to the dock facilities because of inadequate channel depth must weigh anchor in the New York Harbor area off the eastern shore of Staten Island where barges unload just enough crude oil to allow the tanker to reach the Perth Amboy waterfront.

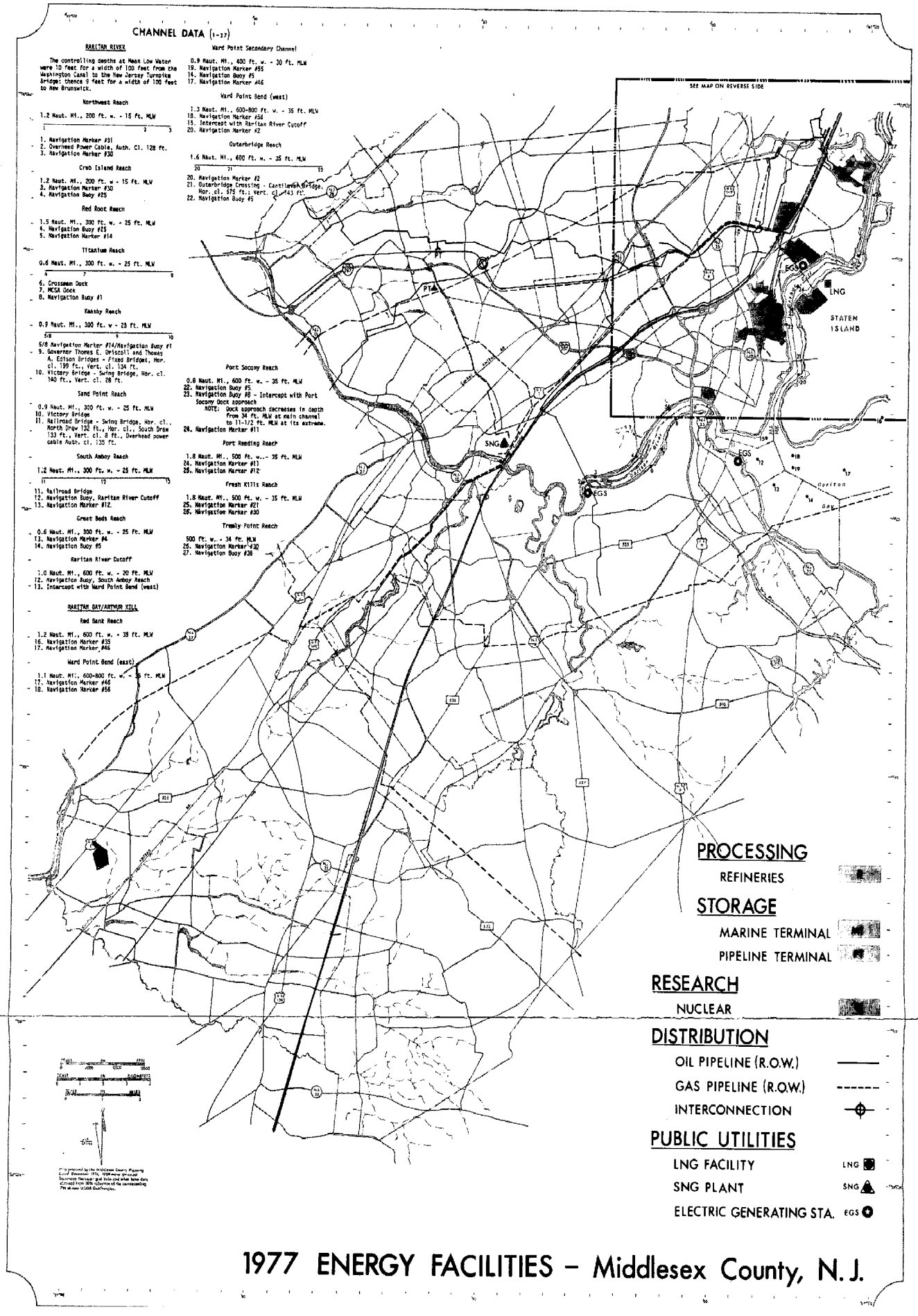
The refinery operations are geared toward removing the high amounts of sulfur found in the foreign crude oil. Pollution control

facilities treat the hydrogen and ammonia sulfides that occur as a by-product of the refinery operation. In addition waste water treatment facilities and oil spill containment equipment offer additional environmental safeguards.

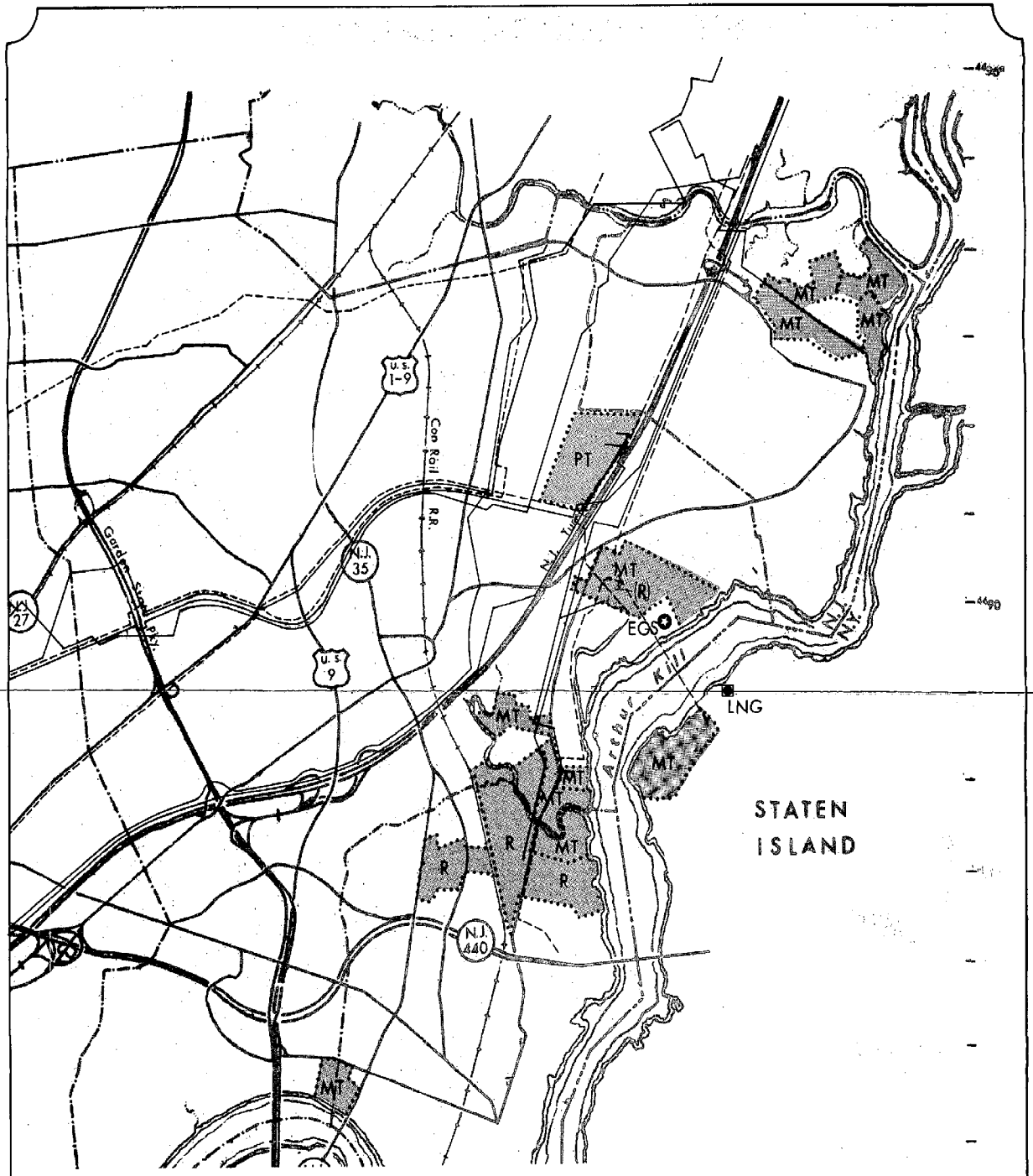
Motor gasoline and No. 2 fuel oil are principal products refined at this 160,000 barrel/day facility. Following environmental impact assessment and various permit processes, Chevron has just completed an approximately 80,000 barrel/day expansion. Expansion plans were predicated on projections of future demands for the Chevron products in its market region. The market region which this refinery serves encompasses 13 states, stretching from Maine to Virginia.

Total storage capacity for the entire refinery complex is approximately 8.0 million barrels. Of this total capacity, 1.5 million barrels is for crude oil storage. Daily water needs of the operation include 50 million gallons per day of brackish cooling water obtained from the Arthur Kill. Two million gallons per day of fresh water for making steam and for potable purposes are obtained from the Middlesex Water Company. The refinery employs 480. Because of its just completed expansion, Chevron is paying $4 million in taxes per year to the City of Perth Amboy.

The following map of 1977 Energy Facilities (page 9.) was derived through interpretations of 1974 aerial photographs and direct contacts with some of the companies that own facilities in the County.



1977 ENERGY FACILITIES – Middlesex County, N. J.



N

Scale In Feet
0 4000 8000

Map prepared by the Middlesex County Planning Board, June 1977.

PROCESSING

REFINERIES — R

STORAGE

MARINE TERMINAL — MT

PIPELINE TERMINAL — PT

RESEARCH

NUCLEAR — N

DISTRIBUTION

OIL PIPELINE

GAS PIPELINE

INTERCONNECTION

PUBLIC UTILITIES

LNG FACILITY — LNG

SNG PLANT — SNG

ELECTRIC GENERATING STA. — EGS

1977 ENERGY FACILITIES – Middlesex County, N. J.

2. Marine Terminals

Tankers, barges, and marine terminals comprise the mechanism by which refined petroleum products and crude oil travel via water-borne transport. Marine terminals consist of berthing capacity for vessels, unloading and/or loading equipment, storage tanks, terminal control and safety equipment, and harbor and navigation facilities. Terminals vary in their size, function, loading facilities and processing equipment. In the North Atlantic Region, existing marine terminals function to:

1) receive refined petroleum products from tankers and store them for delivery overland to final markets; and/or

2) receive crude oil from tankers for delivery to nearby refineries.

Tankers transport about 74% of the petroleum supplied to the North Atlantic Region. Petroleum storage capacity in the North Atlantic Region's ports is shown in Table I-2. The New York, N.Y./N.J. harbor area surpasses all other areas in the number and capacity of oil storage tanks. A large portion of this capacity is composed of tanks associated with the marine terminals to which crude oil and refined petroleum products are delivered. A scan of the N.Y./N.J. harbor area reveals that, by far, the majority of storage facilities are located along the Arthur Kill and the Kill Van Kull, the waterways bordering between New Jersey and Staten Island.

TABLE I-2
NORTH ATLANTIC PORTS
PETROLEUM STORAGE CAPACITY (1)

Port	Number of Tanks	Capacity (bbls)
Searsport, Maine	8	642,000
Portland, Maine	14	137,000
Portsmouth, New Hampshire	NA	NA
Salem, Mass.	NA	NA
Boston, Mass.	365	15,131,000
Fall River, Mass.	100	3,362,000
Providence, R.I.	442	8,616,000
New London, Conn.	38	1,050,000
New Haven, Conn.	182	6,362,000
Bridgeport, Conn.	58	1,871,000
New York, N.Y. & N.J.	3,428+	93,775,000
Albany, N.Y.	249	11,031,000
Port Jefferson, L.I., N.Y.	53	850,000
Delaware Bay	1,809	61,508,000
Baltimore, Md.	493	14,910,000
Potomac River, Md.	NA	NA
York River, Va.	NA	680,000
Hampton Roads, Va. (Norfolk and Newport News)	363	9,610,000
TOTAL	7,602+	229,535,000+

(1) Does not include numerous private facilities outside indicated port limits.

SOURCE: U.S. Army Corps of Engineers. Interim Report Atlantic Coast Deep Water Port Facilities Study. June 1973.

In Middlesex County, a total of nine marine terminals occupy various waterfront acreage along the Arthur Kill and the Raritan River in the northeastern portion of the County (See map on pg. 9.). Eight of these terminals receive refined petroleum products from tankers and barges and store them for overland delivery via tank trucks, rail cars, and/or pipelines to final market. Although it is presently handling refined petroleum products, the Hess Terminal in Woodbridge is located at the site of the idle Hess refinery and at one time received crude oil deliveries. The only marine terminal currently receiving crude oil is part of the Chevron Oil Company refinery complex in Perth Amboy.

Marine terminals in Middlesex County are as follows:

Name	Location Waterbody/Municipality	Type of Oil
American Oil Co.	Arthur Kill/Carteret	Crude
American Oil Co. and Phillips Petroleum Co.	Arthur Kill/Carteret	Refined Products
Chevron Oil Co.	Arthur Kill/Perth Amboy	Refined Products
General American Transportation Co. (GATX)	Arthur Kill/Carteret	Refined Products
Hess Oil Co. (3)	Arthur Kill/Woodbridge	Refined Products (at one time crude)
	Arthur Kill/Perth Amboy	Refined Products
	Raritan River/Perth Amboy and Woodbridge	Refined Products
Royal Petroleum Co.	Arthur Kill/Woodbridge	Refined Products
Shell Oil Co.	Arthur Kill/Woodbridge	Refined Products

3. Petroleum Pipelines and Pipeline Terminals

Pipelines are the primary mode of overland transport for petroleum products. The major pipelines serving the North Atlantic Region are the Colonial Pipeline Company (the largest in the U.S.) and the Plantation Pipeline Company, both of which originate at the Gulf Coast and transport only refined petroleum products (Figure I-4). Having a combined capacity of about 1.2 MB/D these two pipeline systems transport about 26% of the petroleum supplied to the North Atlantic Region. Products transported from the Gulf Coast consist principally of motor gasoline and jet fuel (65%) and distillate fuel oil (30%).

Storage tanks, office space, and a pumping station are the basic components in a pipeline terminal. Upon reaching the North Atlantic Region, oil piped from the Gulf Coast is temporarily stored at pipeline terminals, from which it is eventually distributed to market. Lesser pipelines transport oil from these pipeline terminals, as well as from refineries and marine terminals in the Region, to final market destinations. In particular, a number of pipeline systems transport refined products from the Delaware River Area refineries to the Middlesex and Union County/Arthur Kill Area. Additionally, product pipeline systems transport oil products from both Middlesex and Union County/Arthur Kill refineries and Delaware River refineries to market regions in Western Pennsylvania and mid-state New York.

Five major petroleum product pipelines currently transect Middlesex County. (See map on page 9.). Three of the pipelines transport oil products to the Middlesex and Union County/Arthur Kill Area. They are:

INFORMATION FROM THE

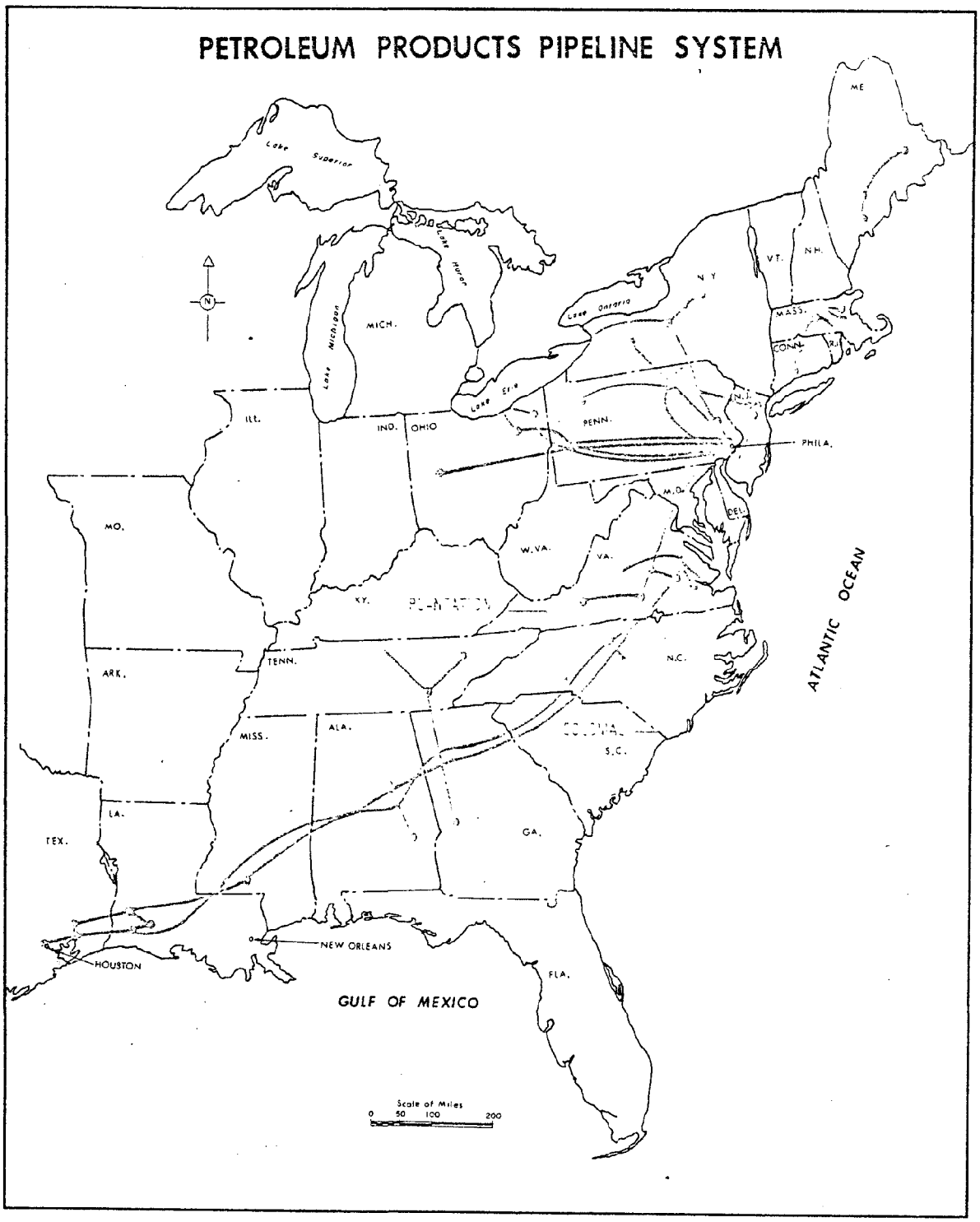
NEW JERSEY

OFFICE OF COASTAL ZONE MANAGEMENT

Let's protect our earth

DIVISION OF MARINE SERVICES
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BOX 1889, TRENTON, N.J. 08625 609-292-9762

FIGURE I-4


PETROLEUM PRODUCTS PIPELINE SYSTEM
Lake Superior
Lake Huron
Lake Michigan
Lake Ontario
Lake Erie
MICH.
ILL.
IND.
OHIO
PENN.
N.Y.
VT.
N.H.
ME
MASS.
CONN.
R.I.
N.J.
PHILA.
MD.
DEL.
W.VA.
VA.
KY.
MO.
ARK.
TENN.
N.C.
MISS.
ALA.
S.C.
GA.
LA.
TEX.
FLA.
HOUSTON
NEW ORLEANS
GULF OF MEXICO
ATLANTIC OCEAN
Scale of Miles
0 50 100 200

PIPELINE NAME	SIZE	MAXIMUM CAPACITY (bbl/day)	TOTAL MILEAGE	ORIGIN-DESTINATION
Colonial	30"	828,000	1,600	Pasadena, Texas-Woodbridge, NJ
Sun	14"	86,000	90	Marcus Hook, PA-Newark, NJ
Sohio (Harbor)	16"	144,000	81	Phila., PA-New York Harbor

The Colonial pipeline terminates in Middlesex County at a pipeline terminal consisting of twenty-five storage tanks and pumping facilities located in Northern Woodbridge Township. Smaller pipelines connect this terminal with Shell and Chevron facilities in Woodbridge and Perth Amboy, respectively. The Sun Pipeline Co. maintains a relatively small pipeline terminal in Piscataway, consisting of two small storage tanks and functioning as a dropoff and regional distribution point.

The two remaining refined petroleum pipelines in Middlesex County transport products from the Middlesex and Union County/Arthur Kill Area to Pennsylvania for distribution in that area: They are:

PIPELINE NAME	SIZE	MAXIMUM CAPACITY (bbl/day)	TOTAL MILEAGE	ORIGIN-DESTINATION
Buckeye (2)	16" 20"	151,000 230,000	33.4 33.4	Linden, NJ-Macungie, PA
Getty (Tidewater) (2)	6"	7,800	115	Bayonne, NJ-Williamsport, PA

The Getty pipeline has located along its right-of-way, in South Plainfield, a pipeline terminal consisting of two small storage tanks.

In addition to the five major pipelines located in Middlesex County, a number of shorter pipelines transport oil products between the various pipeline terminals, marine terminals, and refineries located in the Northeastern portion of Middlesex County and neighboring Union County.

4. Petrochemical Industry

The word "petrochemical" is used to describe those chemicals derived from petroleum and natural gas liquids. Petrochemical producers utilize these raw materials to manufacture a broad array of primary chemicals and intermediates; through further chemical processing, these intermediates are converted into an even wider range of chemical derivatives.

Most of the petrochemical industry's products, both primary and intermediate organic chemicals and their derivatives, are practically unknown to the consumer because the average person never sees or buys them. The customers of the petrochemical industry are, in general, other industries, which use petrochemicals as the raw materials for the manufacture of thousands of industrial and consumer products. Packaging material made from plastics is the largest end use followed by building materials, tires, clothing, transportation equipment, home furnishings, housewares, furniture, appliances, and toys. There are others such as fire retardants and solvents, perfumes, cosmetics and medicines, dyes, antifreeze, adhesives, and many, many more.

New Jersey leads the nation in manufacturing chemicals and synthetics, and Middlesex is one of the leading chemical manufacturing counties in the State, (See Table I-4). Petrochemical products constitute the largest portion of chemical industry operations. The predominance of petrochemical industries in Middlesex County can be explained easily by the primary siting factor for such operations: i.e. the availability of raw materials. In Middlesex County, the heavy concentration of such petroleum related facilities as refineries, marine terminals, and pipelines represent sources of raw materials. It follows that petrochemical industries seek sites in proximity to such facilities. New Jersey Department of Labor and Industry statistics indicate that approximately 100 chemical companies, employing 20,700, are located in Middlesex County.

TABLE I-4

1976 EMPLOYMENT IN CHEMICAL AND ALLIED INDUSTRIES IN NEW JERSEY[1]

Labor Market Areas	Chemical Industry Employment (SIC 28)	% of Total State Chemical Industry Employment
Atlantic County	400	0.3%
Bergen County	13,200	10.8%
Camden SMSA[2] (Comprised of Camden, Burlington, & Gloucester Counties)	4,900	4.0%
Cumberland County	300	.3%
Hudson County	6,800	5.6%
Mercer County	3,800	3.1%
Middlesex County	20,700	17.0%
Monmouth County	1,600	1.3%
Newark SMSA[2] (Comprised of Essex, Morris, Somerset & Union Counties)	48,700	40.0%
Passaic County	9,700	8.0%
Remainder of State	11,700	9.6%
STATE OF NEW JERSEY TOTAL	121,800	100.0%

(1) All figures are for employees covered under the State unemployment insurance system.

(2) SMSA is abbreviation for Standard Metropolitan Statistical Area; a U.S. Census reporting classification for high population urban areas.

SOURCE: New Jersey Department of Labor and Industry, telephone interview July 27, 1977.

II. OUTER CONTINENTAL SHELF OIL AND GAS ACTIVITIES

Offshore operations of the *petroleum* industry began as extensions of onshore exploration, development and production. The earliest offshore production in the United States was developed off Summerland, California, in 1896. The offshore portion of the field was an extension of an onshore discovery made prior to 1894. Similarly, most of the early activities in areas covered with water were carried out to recover oil from reservoirs that had already been discovered and defined through onshore exploration.

Gradually, as technology has advanced, exploration and development activities have been moving further offshore to areas with greater water depths and more hostile environments. For example, production has begun in the cold and stormy waters of the North Sea, and seven exploratory wells have been drilled in the Santa Barbara Channel, off California, in water more than 1,200 feet deep.

Most exploratory and development drilling activities have been conducted in the geographical areas known as the continental shelf. The legal and physiographic definitions of the continental shelf differ slightly, but the general phrase *continental shelf* refers to the shallow submarine plain of varying width that forms a border to a continent and typically ends in a steep slope to either a more gently sloping continental rise or the oceanic abyss. Off the coasts of the United States, the shelf is very broad in the Gulf of Mexico and around western and northern Alaska, moderately wide along much of the Atlantic Coast and relatively narrow along the Pacific Coast.

Most of the subsea continental shelf lands adjacent to the United States are under the jurisdiction, ownership and control of the United States

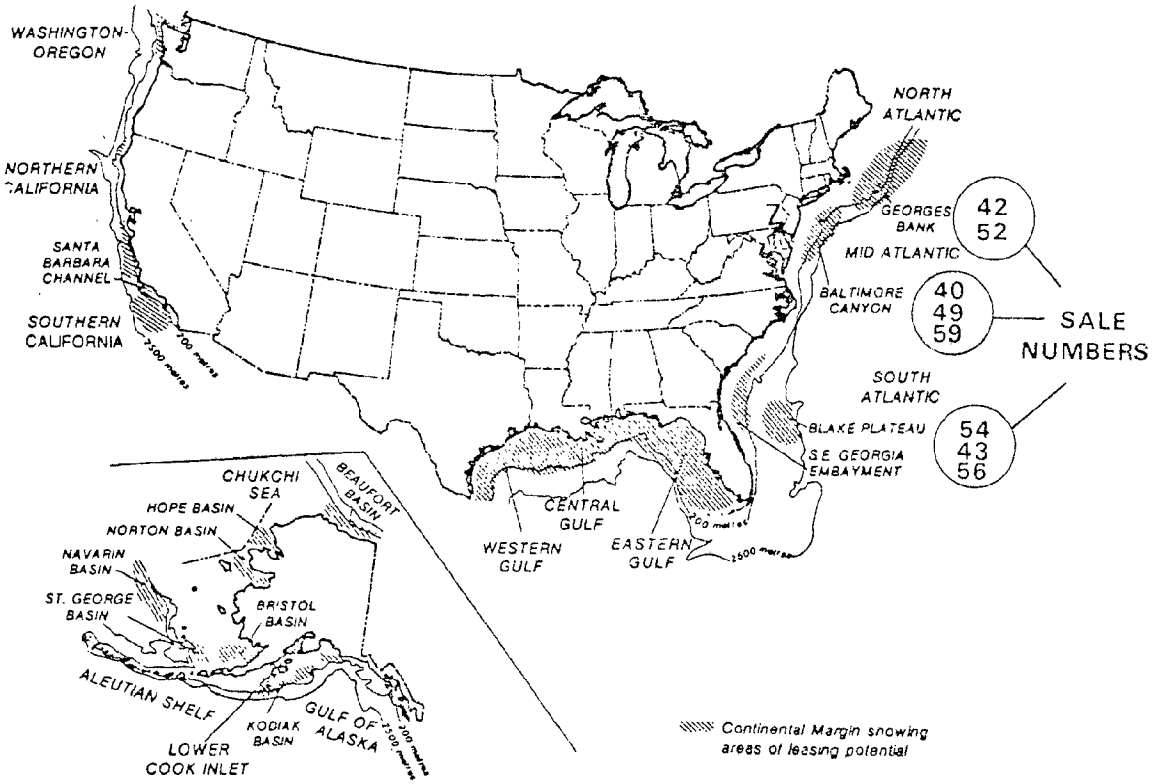
Government. The phrase *Outer Continental Shelf* (OCS) was defined in the Outer Continental Shelf Lands Act of 1953 (67.Stat. 462; 43 U.S.C. 1331-1343, 1964) as the subsea lands lying seaward of the territorial limit of the states and extending to the boundary of federal and international claims of jurisdiction. This Act, The Submerged Lands Act of 1953 (67 Stat. 29; 43 U.S.C. 1301-1315), and a series of United States Supreme Court cases establish federal control, ownership and jurisdiction over the sea bed and subsea soil beyond the three mile territorial limit[1] of the states. Thus, the coastal states retain control, ownership, and jurisdiction over, and consequently the right to develop the mineral resources of, the subsea lands extending out to the territorial limit.

The Outer Continental Shelf Lands Act also authorizes the Secretary of the Interior to establish rules and regulations implementing the Act and to lease offshore tracts for mineral and resource exploration and exploitation. Between 1954 and 1974 the U.S. Department of the Interior sold 2,384 oil and gas leases comprising 10,884,624 acres. The following map (Figure II-1) indicates the general areas of OCS lands for which lease sales have been proposed. Lease Sale No. 40, or the first Balitmore Canyon lease sale, was held in August, 1976. But on February 17, 1977 the United States District Court of the Eastern District of New York enjoined all related activities of Lease Sale No. 40. The Court held that the Department of the Interior had not met the requirements of the National Environmental Policy Act. Figure II-1 also shows the location of seven proposed Atlantic Ocean lease sales; these include: The North Atlantic or Georges Bank Lease Sale (No. 42), the

1. The territorial limit is approximately 12 miles in the case of Texas and the Gulf Coast of Florida.

FIGURE II-1

Areas of the OCS Under Consideration for Leasing



SOURCE: *Leasing and Management of Energy Resources on the Outer Continental Shelf,* Bureau of Land Management/U.S. Geological Survey, 1976.

South Atlantic or Southeast Georgia Embayment Lease Sale (No. 43), the second Mid-Atlantic or Baltimore Canyon Lease Sale (No. 49), the second South Atlantic or Blake Plateau Lease Sale (No. 54), the second North Atlantic Lease Sale (No. 52), the third South Atlantic Lease Sale (No. 56), and the third Mid-Atlantic Lease Sale (No. 59).

It is highly probable that the development and production of the oil and gas in these lease sales will have significant impact on New Jersey and Middlesex County. This chapter will discuss the following: (1) the phases of OCS oil and gas activity; (2) the types of OCS facilities and their requirements and impacts; and (3) three projections of potential development of OCS facilities in Middlesex County.

A. PHASES OF OCS OIL AND GAS ACTIVITY

The process of offshore oil and gas activity is commonly divided into five phases: (1) leasing, (2) exploration, (3) development, (4) production, and (5) shutdown. For a given petroleum field, the phases may encompass a period ranging from 15 to 40 years. Figure 2 showed the phases in the life of a hypothetical oil and/or gas field and illustrated the fact that these phases may overlap considerably. For example, exploration activities continue after development activities have begun, and production will begin before development is completed. Continuation beyond the exploration phase, however, is entirely dependent upon the discovery of economically recoverable reserves of oil or gas.

The five phases of OCS oil and gas activity are described below as they relate to time involved, industry activities, federal government activities, state and local activities and potential onshore facilities.

1. Leasing

Time:

Approximately 19 months from "call for nominations" to the actual lease sale: geophysical exploration (by industry) may have begun many years before.

Industry Activities:

Preparation of internal market and capability analyses; preliminary geophysical exploration (under permit from USGS); nomination of tracts for consideration in the lease sale; preliminary location analysis for staging areas; and possibly onshore site acquisition.

Federal Government Activities:

The leasing process, managed by the Bureau of Land Management (BLM), includes: environmental baseline studies; "call for nominations" by the oil and gas industry of tracts it believes hold the greatest promise for oil and gas; draft (DES) and final environmental statements (FES) prepared by BLM in cooperation with USGS and the Fish and Wildlife Service (FWS); these are submitted to the Council on Environmental Quality (CEQ) and made available to the public; a decision to lease is made by the Secretary of the Interior based on the FES and an internal decision document; at the lease sale itself tracts of the OCS are offered to the "highest responsible qualified bidder," with or without stipulations. Any bid may be rejected.

State and Local Activities:

Participation in the call for nominations, in which state and local governments—and citizens—may identify tracts which should not be considered for leasing ("negative nominations") or upon which special conditions should be imposed; participation in tract selection meetings and review and comment on draft environmental statements (DES). Planning may begin for siting and providing public services in future phases.

Onshore Facilities:

Geophysical and geological exploration vessels will use existing ports.

2. Exploration Phase

Time:

One to seven years from lease sale: an average of two years for discovery of economically recoverable oil or gas reserves and five years or more for identification of size and area of the find; up to five years until lease abandonment if no discovery is made.

Industry Activities:

Additional geophysical surveys to locate geological structures favorable for oil and gas; exploration plans submitted to USGS and "notices" of support activities submitted to appropriate Governors; exploratory drilling by drilling companies (under contract to the oil companies which lease tracts); if discovery is made, intense supplementary exploration, possibly for many years, to establish the area and size of the field, and to ensure that all possible geological structures containing oil and gas have been located; preparation of internal development projections, preliminary field development plans and financial estimates. If no commercial discovery is made, industry will abandon the lease and onshore service bases.

Federal Government Activities:

USGS supervises operations: reviews, accepts and approves exploration plans, issues drilling permits, monitors the drilling procedures; Environmental Protection Agency (EPA) issues pollution control permits; the Corps of Engineers (COE) and U.S. Coast Guard (USCG) regulate navigation.

State and Local Activities:

Assume regulatory and permitting authority over the siting and operation of service bases and portions of operations within the limits of state waters; plan for siting of potential onshore facilities if discovery is made, mitigating employment and environmental impacts, and for providing and financing public services. (May be involved in planning and permits for anticipatory siting—see below).

SOURCE: The Conservation Foundation, David C. Williams and Jeffrey A. Zinn, (ed.), Source Book: Onshore Impacts of Outer Continental Shelf Oil and Gas Development, May, 1977, pp. 8-9.

Onshore Facilities:

Temporary service bases are established, generally located in existing developed harbors, with associated repair and maintenance yards and general shore support (heliports may be established at existing airports); as a rule no new facilities are constructed but industry may anticipate discovery and plan for and option land for permanent service bases; options for pipe coating yards and platform fabrication yards may also be taken; state and local government may be involved in permits for these facilities.

3. Development Phase

Time:

Four to nine years—starting with the discovery of economically recoverable resources and extending through initial pipeline installation or tanker operations.

Industry Activities:

Application to USGS and COE for development drilling permits; Field Development Plans submitted to adjacent states; development drilling and production platforms put in place.

Federal Government Activity:

USGS reviews and approves field development plans, and issues permits for development drilling and OCS gathering lines; COE issues permits for drilling structures and pipelines in navigable waters; BLM issues permits for pipeline rights-of-way on the OCS; the Office of Pipeline Safety (DOT), Federal Power Commission (FPC) and Interstate Commerce Commission (ICC) are involved in regulation of common carrier pipelines. EPA and the Occupational Safety and Health Administration (OSHA) issue permits and regulate operating activities.

State and Local Activities:

Issue permits for nearshore and onshore pipeline rights-of-way, land use, and construction of onshore and nearshore facilities; regulate water and other resource uses, hazards to the environment, and other activities; plan siting of service bases and other onshore facilities listed below (service bases generally are not federally regulated); provide public services for employees and induced population, many of them at a temporarily high level for the relatively short-term development phase.

Onshore Facilities:

Permanent service bases
Repair and maintenance yards
General shore support
Platform fabrication yards
Platform installation service bases
Pipelines and landfalls
Pipeline installation service bases
Pipe coating yards
Partial processing plants
Gas processing and treatment plants
Marine terminals

Essentially all major facilities for the production phase are installed during the development phase.

4. Production Phase

Time:

Ten to 25 or more years—from first petroleum landing onshore to field shutdown.

Industry Activities:

Operation of facilities constructed during the development phase; activities to maintain and improve the rate and volume of production: construction of additional production platforms, new wells and well "workover," additional pipelines, storage facilities; and regular servicing of wells and platforms.

Federal Government Activities:

Monitoring and regulating of routine operations, by USGS, COE, USCG, EPA, BLM, OSHA, FPC, DOT and ICC, and others; respond to oil spills; possible additional leasing.

State and Local Activities:

Provision of public services for onshore facilities and added population: monitoring onshore petroleum operations; anticipation of employment decline during production phase and eventual shutdown.

Onshore Facilities:

Additional pipelines (see Development Phase)

5. Shutdown Phase

Time:

One to three years from end of production phase; representative cumulative time from lease sale—25 years.

Industry Activities:

Dismantling offshore facilities and sealing all wells with cement 15 feet below the surface of the seabed; closing or reducing onshore facilities as production ceases.

Federal Government Activities:

Monitoring and enforcing abandonment regulations, by USGS.

State and Local Activities:

Mitigating past impacts, covering the loss of accustomed revenues, and efforts to maintain the economic base.

Onshore Facilities:

Facilities identified above are closed or shifted to other uses.

B. Description, Impacts and Requirements of Onshore Facilities[2]

There are various types of onshore facilities that are directly associated with OCS oil and gas activities. These facilities carry out many different functions including: supporting and servicing offshore activities, transporting, storing, treating, and processing of oil and natural gas. This sub-section will present a brief description of each facility and some of the impacts and requirements of each facility.

1. Temporary Service Bases

Temporary service bases serve as a logistical link between onshore and offshore activities. These bases generally support initial exploratory drilling operations and their main activity is the transfer of materials and workers between onshore and offshore operations. Service bases may be established by the oil companies, or service companies that supply drilling fluids and muds, tools and other items. A typical base would include:

* berth space for supply and crew boats
* dock space for loading and unloading
* warehousing and open storage areas
* a helipad
* space to house supervisory and communication personnel

A typical temporary service base exhibits the following impacts and requirements.

Land	5-10 acres on all weather harbor Warehouse: 1/2 acre/rig; open storage: 1 acre/rig; operations and office space; helipad; 1 acre/rig (may be elsewhere); parking area.
Waterfront	200 feet of wharf/rig; 15-20 feet water depth at pier.

2. Most of the information used in this sub-section was derived from Factbook: Onshore Facilities Related to Oil and Gas Development published in 1976 by the New England River Basins Commissions (NERBC) under agreement with the Resource and Land Investigations (RALI) Program of U.S. Department of the Interior's Geological Survey. See also, The United States Congress Office of Technology Assessment, Working Papers: Coastal Effects of Offshore Energy Systems, November, 1976 and The Conservation Foundation, Source Book: Onshore Impacts of OCS Oil and Gas Development, 1977.

Water	5.2 million gals/rig/year for supply boats; 13,272 barrels of fuel/rig/year at drilling site.
Labor	45 onshore service base jobs/rig
Composition	75% local jobs
Wages	Approx. $735,000/year; $17,000 average wage.
Capital Investment	$150,000 - $250,000 for land leasing and construction
Air Emissions	Hydrocarbons from fuel storage tanks and vehicle operation
Wastewater Contaminants	Hydrocarbons, heavy metals from bilge and ballast-water
Noise	Up to 85 decibels, 24 hours/day
Waste	Up to 6 tons/day including oil contaminated drill cuttings

2. Permanent Service Bases

Permanent service bases perform the same functions as temporary bases, but differ primarily in size, intensity, activity and ownership. They generally operate during development drilling and provide the same types of goods and services as those needed during exploratory drilling. Permanent bases are usually established by oil or service companies. They are usually located at or close to temporary bases and within 200 miles of rigs.

IMPACTS AND REQUIREMENTS:

Land	25-50 acres on all-weather harbor; 10,000 square feet for permanent office and communications space; 1 acre/platform for helipad; remainder for warehouses and open storage.

Waterfront	200 ft. of wharf/platform; 15-20 ft. water depth at pier.
Water	8.2 million gallons/platform/year during development drilling. Little during production.
Fuel	54,000 barrels of fuel/platform/year during development. 19,200 barrels of fuel/platform/year during production.
Labor	50-60 jobs/platform during drilling; 50% local initially, rising to 80% local.
Wages	Approximately $1 million; average wage $17,000.
Capital Investment	$1-3 million.
Air Emissions	Hydrocarbons from fuel storage and vehicle operations.
Wastewater Contaminants	Hydrocarbons, heavy metals from bilge and ballast water.
Noise	Up to 85 decibels; 24 hours a day.
Solid Waste	Up to 6 tons/year during drilling.

3. Steel Platform Installation Support Bases

Steel platform installation support bases are very similar to temporary service bases. They perform services for installation of platforms and are normally established by companies involved in platform installation. They are usually located as close as possible to areas of installation and other service bases.

IMPACTS AND REQUIREMENTS:

Land	Approx. 5 acres of waterfront land.
Wharf Space	200 feet/4 platforms installed.
Water Depth	15-20 feet at pier.
Sea Access Clearances	Channel roughly 5 times width of largest barge. Vertical clearance roughly the length of the platform base.
Fuel	Diesel fuel requirements: 100,000 gals/derrick barge/month; 150,000 gals/tug/month.
Transportation	1 supply boat/platform; 1 crew boat/platform; 1 helicopter/platform.
Offshore Labor	Approx. 100/installation spread; 25% local jobs
Offshore Wages	Average wage $18,000
Onshore Labor	25 workers/installation spread; 50% local jobs
Environmental Impacts	Roughly the same as temporary service base.

4. Repair and Maintenance Yards

Repair and maintenance yards consist of many firms of varying capabilities which provide services to operators of vessels and equipment involved in OCS development. Most medium-sized vessels can be serviced in harbors that customarily handle large fishing fleets while larger

vessels and semi-submersible rigs must be serviced in major shipyards.

A repair yard catering specifically to the petroleum industry is not likely to be sited on a new site in a frontier area. Most services can be provided by existing repair facilities in fishing ports and larger ports.

5. Transportation Facilities

There are two major types of transportation facilities involved in the movement of oil and natural gas--pipeline systems and tanker systems. These types of facilities may be used separately or in combination. Pipeline systems may include the following components: pressure source, gathering stations, a landfall and an onshore destination. An oil company may construct its own pipeline, or a consortium of oil companies may construct a common carrier pipeline. Tanker systems are composed primarily of tankers and marine terminals. Marine terminals consist of berthing capacity for vessels, loading and/or unloading equipment, storage tanks, terminal control and safety equipment and harbor and navigation facilities.

IMPACTS AND REQUIREMENTS:

(1) Pipelines and Landfall Facilities	
Route	Shortest distance, as modified by anchorages, active faults, shifting bottom sediments, rock outcrops, areas environmentally sensitive.
Shore Approach	Gently sloping sand or shingle preferred, avoid shifting currents and sediments.
Landfall	50-100 foot right-of-way. 40 acres of pumping station, if required. 60 acres for terminal, if required.

Offshore Labor	250-300 jobs per lay barge spread.
Offshore Wages	$5.5 million annually per lay barge spread. Average unskilled wage: $15,000. Average skilled wage: $25,000.
Onshore Labor	Negligible - 20 workers; 15 local to operate terminal or pumping station.
Onshore Wages	$16,000 average annual.
Capital Investment	Varies with pipe diameter from $700,000/mile for 8" pipe to $2 million/mile for 42" pipe. Shore terminal - $2.5 million.
Air Emissions	Minimal; chiefly hydrocarbons, nitrogen oxides and sulfur oxides from compressors along route.
Noise	90-100 decibels from compressors; 140 decibels from annual pipeline venting.

(2) Tanker Systems - Marine Terminals

With most of the land taken up by storage tanks, the size of a terminal depends on the throughput from offshore, the number of berths at the terminal, the size and frequency of tankers, and the extra storage needed to provide for loading downtime. Data below are for a 250,000 bbl/day throughput mid-depth terminal with storage capacity of 1 million barrels in four 250,000 bbl tanks.

Land	Approx. 30 waterfront acres, assuming no processing, largely for storage tanks.
Water Depth	50-60 feet sheltered water at mid-depth pier or mooring buoy.
Fresh Water	Limited, assuming no processing.

Energy	8 million kwh/year at tank farm 1 million kwh/year at terminal 11,800 barrels of fuel/year
Construction Labor	560 workers, 20% local jobs
Construction Wages	$19,600 average annually.
Operation Labor	10-90 (depending on degree of contract labor used), 70% local jobs
Capital Investment	Approx. $50 million
Air Emissions	Hydrocarbons from tanks and transfers, exhaust emissions from vessels and compressors.
Wastewater Contaminants	BOD;COD; suspended solids; oil and grease from bilge, ballast, and storm water; chronic small spills; potential for large spills.
Solid Wastes	Contaminated sludge and sediments.

6. Pipeline Installation Support Bases

Pipeline installation support bases are required to serve in the installation of pipelines. These waterfront bases are established by oil or service companies during exploration and can be used to serve many installation activities. Some of the vessels serviced include barges and tug boats. These support bases usually operate for a short period of time unless a large volume of pipelaying is expected.

IMPACTS AND REQUIREMENTS:

Land	Approx. 5 acres (pipe is stored at the pipecoating yard).

Waterfront	200 foot wharf/spread; 15-20 foot depth; wide enough channel to maneuver barges (5 times width of barge).
Fuel	50,000 gallons/lay barge; 180,000 gallons/jet barge.
Labor	Approx. 25 onshore jobs; 50% local jobs
Wages	Approx. $425,000 annually. Average wage $17,000. (In cold climates, labor and wages are likely to be seasonal).
Environmental Impacts	Site alteration and construction impacts, air emissions, wastewater, noise, solid wastes and aesthetic impacts are similar to temporary service bases.

7. Partial Processing Plants

Partial processing plants remove impurities from the oil well stream. Natural gas is usually separated at the production platform. Partial processing plants reduce water and sediment content of oil well stream to approximately 1%. They may be located offshore or onshore depending on the relative costs, mode of transportation and nature of the well-stream.

IMPACTS AND REQUIREMENTS:
(Most figures for plant processing 100,000 bbls/day gross fluids)

Land	15 acres/100,000 barrels processed; 33% oil treatment and storage; 49% gas treatment and liquid petroleum gas storage; 9% water treatment; 9% metering and recording unit.
Waterfront	Not required.
Water	10,000 gals/month.

Energy	1.5 million cu. ft./day gas; 400,000 kwh/month.
Labor	150 construction jobs for 15 months; 10 jobs during operation.
Wages	$14,400/year average wage.
Capital Investment	$13 million.
Air Emissions	Hydrocarbons, hydrogen sulfide, sulfur oxides, nitrogen oxides.
Wastewater Contaminants	Suspended solids, oil and grease, heavy metals, phenols, halogens, chromium.
Noise	80-90 decibels from pumps; 81-96 decibels from flarestacks; 81-96 decibels from treating vessels.

8. Gas Processing Treatment Plants

Gas processing treatment plants recover liquifiable hydrocarbons not removed by normal separation methods from the raw gas stream before it enters a commercial transmission line. There are no standard sizes or designs for gas plants, single plants are specifically designed for the particular gas stream they process.

IMPACTS AND REQUIREMENTS:
(For a 1 billion cubic feet/day facility)

Land	50-75 acres.
Water	200,000 gals/day.
Energy	5.4 million kwh/month; 360 million cu. ft./month natural gas from feedstock.

Construction Labor	500 workers for 1 1/2 years.
Operation Labor	45-55 workers; 60% local jobs
Operation Wages	Approx. $750,000/year. $15,500 average annually.
Capital Investment	$85 million.
Air Emissions	Hydrogen sulfide, sulfur oxides, hydrocarbons, particulates, carbon monoxide, nitrogen oxides.
Wastewater Contaminants	Dissolved hydrocarbons, sulfuric acid, chromium, zinc, phosphates, bases, sulfite.
Noise	80-100 decibels from boilers, compressors and flarestacks; 24 hours/day.
Solid Wastes	Sludges, scale, spent dessicants, filtration media, oil absorbants.

9. Refineries

Refineries consist of a series of units designed to produce a number of petroleum products by physically or chemically altering all or part of a crude oil stream. The complexity and scale of a refinery depends on the type of crude oil being refined and the number and characteristics of the products desired. Other refinery components include: storage tanks, influent and effluent water treatment.

The principal factors influencing the industry's decision to establish a new refinery are the nature of the market, the source of crude and the available water depth. A site that is located in a strong petroleum market, close to a guaranteed source of crude oil (import or local)

and along a navigable waterway will usually be an attractive site to refiners.

IMPACTS AND REQUIREMENTS:

(Moderately complex 250,000 bbl/day refinery)

Land	1000-1500 acres clear, flat, industrially zoned land.
Water	10.5 million gals/day withdrawn;
Energy	1.45 million kwh/day; 19,800 bbls/day fuel oil.
Construction Labor	1800 average over 3 years; 3500 peak employment; 70% local jobs
Construction Wages	$38.5 million; $18,000 average annual.
Operation Labor	410; 80% local jobs
Operation Wages	$6.5 million; $15,250 average annual.
Capital Investment	$500-750 million.
Air Emissions	Carbon monoxide, sulfur oxides, nitrogen oxides, hydrocarbons, and particulates from processing, process machinery, leaks from valves, seals, and storage tanks, and vehicle emissions.

Wastewater Contaminants	Thermal effluent, anti-fouling chemicals, a variety of contaminated process waters, BOD, COD, etc.
Noise	50 decibels at boundary.
Solid Waste	Contaminated process solids and effluent solids requiring special handling, variety of general packaging and domestic solid waste.

10. Platform Fabrication Yards

Platform fabrication yards are large waterfront sites on which drilling and production platforms are entirely or partially constructed. There are two major types of platform fabrication yards--steel platform fabrication yards and concrete platform fabrication yards. These yards are purchased and constructed by platform construction companies. The layout, size, requirements and impacts of these yards are determined by the complexity and number of platforms being constructed.

a. Steel Platform Fabrication Yards

These are large waterfront facilities consisting mostly of cleared land, warehousing, machine shops, and administrative offices.

IMPACTS AND REQUIREMENTS:

Land	200-1000 acres on navigable waterway.
Waterfront	15-30 ft. depth at pier.
Sea Access	210-350 ft. (horizontal clearance and vertical).
Water	100,000 gallons/day (for 9 platforms and no steel rolling); 1.24 million gallons/day (for 2-4 platforms with steel rolling).
Labor	250-500 workers/steel platform; 80% local jobs
Wages	Average wage $19,000.
Capital Investment	$30-60 million (start-up capital only).
Wastewater Contaminants	Heavy metals, particulates.
Solid Waste	Packaging materials, metal scraps, debris.
Air Emissions	Sand and metal dust from sand blasting; hydrocarbons and organic compounds from paint evaporation; carbon monoxide, sulfur oxides, nitrogen oxides from vehicles.
Noise	80-100 decibels; 24 hours a day.

b. Concrete Platform Fabrication Yards

Concrete platform fabrication yards are constructed on waterfront sites

with considerable open space. The platforms are built in large, deep dredged dry dock basins, separated from deep adjacent water by a dam.

IMPACTS AND REQUIREMENTS:

Requirements of concrete platform fabrication yards in some ways differ markedly from steel. The 30-80 foot bases are constructed in dry dock and then floated a few hundred yards at most to very deep (150-300 feet) water for construction of the tall pillars upon which the deck section is attached. Thus the single most important requirement is a large open site with immediately adjacent very deep water.

Land	Minimum 50 acres/platform.
Water Depth	35-50 feet at pier; 150-300 feet adjacent.
Sea Access Clearances	Over 400 feet (vertical).
Water	40,000 gal/day at a one-platform yard; 165,000 gal/day at peak activity.
Energy	3 megawatts: 45,000 gal. diesel fuel stocked; 11 tons gas stocked.
Labor	350-450 average; 600-1200 peak; 85-90% local jobs
Wages	$8.8 million annually; $19,500 average wage.
Air Emissions	Sand, cement, and metal dust; hydrocarbons and organic compounds; carbon monoxide; sulfur oxide, nitrogen oxides from vehicles and equipment.
Wastewater	Particulates, heavy metals, chemicals.
Noise	80-100 decibels, 24 hours.
Solid Waste	Packaging materials, metal scraps, contaminated and uncontaminated debris.

11. Pipe Coating Yards

Pipe coating yards are industrial facilities that coat steel pipe with mastic (a protective coating or cement) and weight it with concrete before it is submerged. This process helps prevent corrosion and overcome flotation.

There are two types of pipe coating yards--permanent plants that consist of about 100-150 acres and "portable plants" or "railhead operations" that can be built on 30 acres of land. Approximately 95% of a yard is used for outdoor storage of pipe.

IMPACTS AND REQUIREMENTS:

Land	100-150 acres on waterfront. 30 for portable facility; 95% storage, 5% operations.
Marginal Wharf	750 feet.
Water Depth	20-30 feet at pier.
Water	3000-15,000 gals/day.
Energy	1 million KWH; 12-13 million cu. ft./yr. gas.
Capital Investment	$8-10 millions; $1 million for portable plant.
Air Emissions	Particulate matter, nitrogen oxides, sulfur oxides, carbon monoxide, hydrocarbons.
Wastewater Contaminants	Hydrocarbons, alkaline substances, particulates, metal fragments.
Noise	90-100 decibels (uncontrolled).
Solid Waste	Concrete, metal scraps, contaminated and uncontaminated debris.

Labor	100-200 workers during season (March-September).
Wages	$2 million (assuming 175 workers); average wage $11,500.

12. Tank Farms

The tank farm is a portion of a system that receives, transports temporarily stores, blends, and distributes petroleum, raw materials, petroleum products, and related substances. Tank farms may be located adjacent to refineries, marine terminals, or pipelines.

The storage vessels used at tank farms may be characterized as closed storage vessels and open storage vessels. The closed storage vessels include fixed roof tanks, pressure tanks, floating-roof tanks and conservation tanks; open storage vessels include open tanks, reservoirs, pits and ponds.

Land	Tank Farm Capacity 1,000,000 2,000,000 3,000,000 3,500,000	Land (ACS.) 17 37 50 58
Freshwater	Limited (assuming no processing)	
Energy	8 million KWH/year for a tank farm with a 1 million barrel capacity (in four 250,000 barrel tanks)	
Air Emissions	Hydrocarbons from evaporation from storage tanks and transfer operations. Exhaust emissions from vessels and compressors.	
Wastewater Contaminants	BOD, COD, suspended solids.	
Solid Waste	Contaminated sludge precipitated during storage.	

C. The Potential for OCS Related Facilities Locating in Middlesex County

This section will present and discuss three projections of OCS-related facility development--high development, medium development, and low development possibilities.The projections are based on different assumptions of: (1) the amounts of oil and gas discovered, and their production rates and (2) the effects of the permit procedure of the Coastal Area Facilities Review Act (CAFRA) and other state and local regulatory policies on development in other coastal counties. The discussion of each projection will contain a tentative allocation of the numbers and kinds of facilities that are likely to locate in Middlesex County.

These tentative allocations are not intended to be predictions but rather are presented to provide a picture of onshore development as it might occur under each set of assumptions. These allocations of OCS-related development in Middlesex County will be carried out judgementally from projections made by the Bureau of Land Management (BLM) of the U.S. Department of the Interior and other organizations such as the Office of Technology Assessment (OTA), the Council on Environmental Quality (CEQ), and the American Petroleum Institute (API). These projections are displayed in Table II-2. The great variance between different projections is caused by the uncertain nature of geological estimates and the different methods used to determine the number of facilities needed to support OCS exploration, development drilling and production activities.

The number of facilities that will be required and developed depends on many factors including: (1) the quantities of oil and gas found; (2) how many strikes are made, and by which companies; (3) where the strikes occur and;(4) the rates of production. The production rate factor, although very important, is very difficult to predict.[3] Peak production rates for the

3. For example, past production wells have exhibited rates ranging from 250 to 950 barrels of oil per day.

TABLE II-2
PROJECTIONS OF OCS-RELATED FACILITIES GENERATED BY
ATLANTIC COAST ACTIVITIES

	ATLANTIC COAST	BALTIMORE CANYON						GEORGES BANK	SOUTHEAST GEORGIA EMBANKMENT
					OCS SALE NO. 40				
	USGS*	CEQ	API	USGS 1975	BLM/FEIS SALE, NO. 40	OTA	BLM/DEIS SALE, NO. 42 & No. 43	BLM/DEIS SALE NO. 42	BLM/DEIS SALE NO. 43
Undiscovered Recoverable Resources Oil (Billion Barrels)	0-6	-	6.0	3-5	2.6	1.8-4.6	0.4-1.4	0.18-0.65	0.28-1.0
Undiscovered Recoverable Resources Gas (Trillion Cubic Feet)	0-22	-	32.0	15-25	12.8	5.3-14.2	2.6-9.4	1.2-4.3	1.9-6.8
Peak Production Rate Oil (Million Barrels Per Day)	-	0.5-1.5	1.1	-	0.74	0.3-0.7	0.32	0.053-0.181	.056-0.170
Gas (Billion Cubic Feet Per Day)	-	1.8-3.6	8.0	-	4.4	0.9-2.0	3.08	0.47-1.54	0.47-1.4
Rigs									
Exploratory	-	4-10	15	-	10	5-10			
Development	-	11-24	80	-	15	11-24			
Platforms	-	30-74	180	-	10-50	25-52		10-25	20-75
Support Bases	-	-	5.5	-	4	-	-	2-3	1-3
Pipeline	-	-	-		4 (Tot. 810 miles)	2 (80 mi. ea.)	Offshore: 100-450 mi. Onshore: 35-120 mi.	Offshore: 500-750 mi. Onshore: 25-50 mi.	Offshore: 160-320 mi.
Pipeline Terminals/Tank Farms	-	-	8	-	1-4	2/2	-	0-1	1-2
Platform Fabrication Yard			Brown & Root's Va. Proposal Cited. (980 Acres)		Brown & Root's Va. Proposal Cited (980 Acres)	Brown & Root's Va. Proposal Cited (980 Acres)			1100 Acres for possible platform fabrication. In addition to planned Brown & Root's proposal
Gas Processing Plants	-	4-8 (0.5 BC FCPD)	8 (1 BCFGPD)	-	8 (0.5 BCFGPD)	3-7 (0.3-0.5 BCFG PD)	3-8 (0.3-015 BCFG PD)	1-3 (0.3-0.5 BCFGPD)	1-2 (0.3-0.5 BCFGPD)
Refineries	-	Additional Capacity of 0.56-1.68 MMBO PD by 2000							
Petrochemical Complexes	-	1-6 (1 billion lb./hr. olefins complexes)							

*USGS, Geological Estimates of Undiscovered Recoverable Oil and Gas Resources in the U.S., 1975.

Baltimore Canyon tracts have been projected to range from 0.3 to 1.5 million barrels of oil per day and from 1.8 to 9.0 billion cubic feet of natural gas per day. The actual production rates cannot be predicted at this time, however, the rates will have a major effect on the timing, pace and intensity of development and production. This section will employ a different range of production rate for each projection.

1. HIGH DEVELOPMENT PROJECTION

The high development projection is based on two fundamental assumptions. The first assumption is that there will be a relatively high find of oil and gas reserves in the Baltimore Canyon and the other Atlantic lease sale tracts. The Baltimore Canyon lease sale No. 40 will be assumed to hold approximately 1 to 2.6 billion barrels of recoverable resources of oil and 6 to 9 trillion cubic feet of recoverable resources of natural gas. The high figure is taken from an early projection made by the Bureau of Land Management. The entire Atlantic Coast will be assumed to hold approximately 4 to 6 billion barrels of recoverable resources of oil and 14 to 22 trillion cubic feet of recoverable resources of natural gas. Lease Sale No. 40 production rates will be assumed to range from 0.5 to 0.7 million barrels of oil per day and 2.0 to 4.0 billion cubic feet of gas per day. For the purposes of all three projections it will be assumed that the amount of crude oil entering Middlesex and Union Counties from the Atlantic tracts will range from 0 to .594 million barrels of oil per day (MB/D). This assumption is based on projections that all of the oil (or 0. - .181 MB/D) from the Georges Bank Sale No. 42,[4] and one half of the oil (or .0 to .370 MB/D) from Baltimore Canyon Sale No. 40,[5] and one fourth of the oil (or .0 to .043 MB/D) from Southeast Georgia Embayment Sale No. 43 will be shipped to refineries in Middlesex and Union Counties. Under the high development projection it will be assumed that .396 to .594 MB/D of oil will be transported to refineries in Middlesex and Union Counties.

---

[4] These figures are derived from United States Department of the Interior, Draft Environmental Statement, OCS Sale No. 42, and Final Environmental Statement, OCS Sale No. 40

[5] This projection is based on an assumption that one-half of the oil from lease sale No. 43 will be shipped to the refineries in the Delaware River Region and that one-half of this oil will be shipped to refineries in Middlesex and Union Counties.

It will also be assumed that one-half of the daily peak production of gas (or 1 to 2 billion cubic feet of gas per day) will be piped to Middlesex County for processing.

The second assumption is that the CAFRA permit procedure will significantly limit the development of OCS-related facilities in the coastal zone areas within the jurisdiction of the act and, consequently, facility developers will tend to locate in non-CAFRA areas such as Middlesex County. This assumption is related to a pre-supposition that coastal towns in CAFRA will seek to limit development of activities that might jeopardize their existing tourist based economies.

(a) Probable Offshore Activities

1. Exploration - Exploratory drilling will probably begin shortly after the legal problems of lease sale No. 40 are resolved. Various sources have projected different figures for exploratory rigs, but most sources seem to agree that 4 to 10 rigs will be used for the lease sale 40 tracts.

2. Development - Development drilling rigs will probably be installed approximately 2 to 3 years following the first discovery. The sources are also in disagreement on the number of development rigs needed, but the projections range from 5 to 15 rigs for lease sale No. 40. Similarly, the projections of needed platforms vary greatly, but generally range from 10 to 50.

3. Transportation of Oil and Gas - Alternative methods for transporting the oil and gas to onshore processing facilities will be analyzed several years before production begins. Pipelines appear to be the most probable method of transport from the Baltimore Canyon. The most recent BLM figures project 450 miles of offshore pipelines and 50 miles of onshore pipelines for the high find projection.

(b) Probable Onshore Facilities

The level of onshore activity is closely related to the level of offshore activity. Exploration will be the major offshore activity during the first several years of the high development projection. Development drilling and production activities may continue for as long as 30 years during which time permanent service bases and other activities will develop and operate.

Some facilities will operate to serve the activities in other lease sale areas such as the Georges Bank and the Southeast Georgia Embayment. For example, refineries, marine terminals, and petrochemical plants in Middlesex County may be used to store and/or process oil products from other OCS lease sale tracts.

This subsection will discuss the onshore facilities that are likely to be generated by activities in the Baltimore Canyon and other Atlantic lease sale tracts and make tentative allocations of the number and types of facilities that may locate in Middlesex County.

1. Temporary Service Bases - A temporary service base has already been established in Rhode Island and will probably be sufficient to support most exploration activities in the Baltimore Canyon and the Georges Bank.

2. Permanent Service Bases - As discoveries are made permanent bases will be established. BLM originally projected a need for 4 bases, but these figures may be subject to change due to the reduced projections of likely finds. Presumably 3 or 4 permanent service bases will be needed to support a relatively high find of 1.4 billion barrels. If one or two bases locate in Maryland or Delaware and one base in Southern New Jersey then one or two bases could locate in the Middlesex County area.

3. Pipeline and Platform Installation Support Bases - Most sources have not projected numbers of pipeline and platform installation support bases that will be generated by Baltimore Canyon activity. In Estimates for New England the Resource and Land Investigations (RALI) project estimated a need for 2 pipeline installation service bases and 2 platform installation service bases for an expected find in the Georges Bank of 2.4 billion barrels of oil and 12.5 trillion cubic feet of natural gas. Reasoning by analogy, at least 1 pipeline installation service base and 1 platform installation service base will be needed to support Baltimore Canyon activity. Under the high impact projection it is possible that both would locate in Middlesex County.

4. Repair and Maintenance Yards - "Repair and Maintenance Yards" is a phrase that refers loosely to the many firms that provide repair services for OCS-related vessels. Existing repair facilities are usually employed and therefore it is likely that CAFRA will not bar repair activities from existing yards (if any) in the coastal zone. Middlesex County repair and service facilities will presumably service a significant number of mid-size vessels.

5. Pipe Coating Yards - Most sources make no projections of the number of pipe coating yards that will be needed to support the Baltimore Canyon activities. The RALI estimates for New England project a need for 2 pipe coating yards to support the laying of 2,000 miles of offshore pipe. Existing New Jersey plants should be able to supply the 450 miles of pipe needed for lease sale No. 40 under the high impact projection. In this case a 25-30 acre "railhead operation" might be located along the Raritan or Arthur Kill. On the other hand it is possible that a new full scale pipe coating yard would seek to locate along either channel.

6. Pipeline Landfalls - The BLM has estimated a need for 1 to 4 pipeline landfalls for the Baltimore Canyon. Gas pipeline landfalls tend to locate close to the nearest transmission line. Oil pipeline landfall sites will probably be influenced by proximity to refineries. Considering the existing gas transmission lines and refineries in Middlesex County it is possible that one gas landfall and one oil landfall would seek to locate in the county.

7. Tank Farms - Tank farms are oil and petroleum product storage facilities that are located near pipelines, marine terminals or refineries. If an oil pipeline is landed in Middlesex County then 1 or 2 tank farms may seek to locate near the landfall and/or a refinery and/or a partial processing treatment plant.

   A marine terminal may be built in Middlesex County to receive crude oil from non-Baltimore Canyon Atlantic lease sale tracts. A tank farm might be colocated with the terminal.

8. Platform Fabrication Yards - Brown and Root, Inc. a platform fabrication company has purchased a large tract of land and has begun to construct a platform fabrication yard in Virginia. The Bureau of Land Management has concluded that an additional yard will be needed to support the activities in the Southeast Georgia Embayment.

   The Virigina yard will be able to supply the platforms needed in the Baltimore Canyon. A new yard will not be developed in Middlesex County because there are no sites that meet industrial location requirements.

9. Gas Processing Plants - Gas processing plants are generally located somewhere between the pipeline landfall and the gas company's transmission lines. The capacity of gas processing plants range from two million to two billion cubic feet per day. The size and specifications of an individual facility depend on several factors, including the size of the gas deposit, the expected rate of production, the composition of the gas and the market prices of the various hydrocarbon products.

   The BLM has concluded that 3 to 8 plants with capacities ranging from 0.3 to 0.5 billion cubic feet of gas per day will be needed to process gas from lease sale 40. If eight are needed, and gas pipelines are landed in Middlesex County, then 1-3 gas processing plants will probably seek to locate in the county.

10. Refineries - There are many complex factors that influence decisions to construct new refineries. The discovery of oil in the Baltimore Canyon and other Atlantic lease sale areas merely adds the factor of a local supply to this decision-making process.

    If this local supply of crude oil is used to replace imported oil,[6] then it will not have a significant affect on decisions to build new refineries or to increase the capacity of existing refineries. If barrel for barrel replacement does not occur, then new refineries and/or additional capacity may be needed. (For a further discussion of these assumptions, see chapter III.

    It is also difficult to predict the exact location of any new refineries. It is arguable, however, that Middlesex County will be attractive to the oil industry as a location for refineries. This agrument is eased on the grounds that the county: (1) has the transportation facilities needed by refineries, and (2) is located in the center of the northeast's market area.

    For the purposes of the high development projection it will be assumed that a refinery capacity will increase in Middlesex County by .396 to .594 MB/D to refine crude oil supplies from the Baltimore Canyon and other Atlantic lease sale areas.

6. This assumption of barrel for barrel replacement was made by BLM in the Draft Environmental Impact Statement of OCS Sale No. 40.

11. Marine Terminals - Under the high development projection it is assumed that there will be high finds in the Georges Bank and the Southeast Georgia Embayment. If this occurs then tankers will probably be used to ship crude oil to the Mid-Atlantic states for refining. Some of this crude oil will presumably be processed at the refineries in and near Middlesex County and in this case at least one marine terminal will be built in Middlesex County. Another may be built in the Delaware River - Philadelphia area.

12. Partial Processing Plants - If crude oil is transported by tanker from the Georges Bank and the Southeast Georgia Embayment, then it will probably be partially processed offshore. Crude from lease sale 40 tracts will probably be transported by pipeline and partial processing may take place onshore. In this case, partial processing plants with a total output of up to 370,000 barrels of oil per day will be needed in or near Middlesex County. This quantity refers to the amount of oil produced after partial processing. When processing occurs onshore pipelines actually carry many more barrels of gross unprocessed fluids containing gas, oil and water.

    Considering the high daily production rate under this projection and the fact that the EXXON refinery is located in Union County and the Chevron and inactive Hess refinery are located in Middlesex County seems likely that partial processing plant(s) with a total capacity of 370,000 BOPD will seek to locate in Middlesex County.

Table II-3 summarizes the number and types of onshore facilities that may locate in Middlesex County if the assumptions of the high development projection hold.

TABLE II-3
ONSHORE FACILITIES THAT MAY SEEK TO LOCATE IN
MIDDLESEX COUNTY - HIGH DEVELOPMENT PROJECTION

1-2 permanent service base
1 pipeline installation support base
1 platform installation support base
1-2 pipeline landfalls
2 tank farms
1-3 gas processing treatment plants
0-1 refinery
1 marine terminal
Partial processing plant(s) Total Output
Capacity of up to 370,000 BOPD

2. MEDIUM DEVELOPMENT PROJECTION

The medium development projection is based on two assumptions. The first assumption is that there will be a medium sized find of recoverable resources of oil and gas in the Baltimore Canyon and the other Atlantic lease sale tracts. The Baltimore Canyon lease sale No. 40 will be assumed to hold approximately .4 to 1 billion barrels of recoverable resources of oil and 2.6 to 6 trillion cubic feet of recoverable resources of natural gas. The entire Atlantic coast will be assumed to hold approximately 2 to 4 billion barrels of recoverable resources of oil and 6 to 14 trillion cubic feet of recoverable resources of natural gas. The low values of these ranges are the quantities associated with a 25 percent probability (1 in 4 chance) that at least these amounts will be found. The high values are the quantities associated with a 75 percent probability (3 in 4 chance) that at least these amounts will be found.[7] Lease Sale No. 40 production rates will be assumed to be 0.2 to 0.5 million barrels of oil per day and 1.0 to 2.0 billion cubic feet of gas per day. It is likely that .198 to .396 million barrels of oil per day and .5 to 1. billion cubic feet of gas per day will be transported to Middlesex and Union Counties. The second assumption is that the CAFRA permit procedure and local regulations will only place moderate limits on the development of OCS-related facilities in the coastal zone areas within the jurisdiction of the act and consequently some facilities will be able to locate in counties within the CAFRA coastal zone.

Probable Onshore Facilities

Under the assumptions of the medium development projection it seems likely that most OCS-related facilities would locate in other states or in

---

[7] These and other figures have been drawn from Geological Estimates of Undiscovered Recoverable Oil and Gas Resources in the United States, Geological Survey Circular 725, 1975, pp. 28-31.

other coastal counties of New Jersey. Some of the facilities that would probably not seek to locate in Middlesex County include temporary and permanent service bases and platform fabrication yards.

Table II-4 summarizes the number and types of onshore facilities likely to be built in Middlesex County if the assumptions of the medium impact projection hold true.

TABLE II-4
ONSHORE FACILITIES THAT MAY SEEK TO LOCATE IN
MIDDLESEX COUNTY - MEDIUM IMPACT DEVELOPMENT PROJECTION

1 gas processing treatment plant
1-2 pipeline landfalls
1 pipeline installation support base
1 marine terminal
Partial processing plant (Total output capacity of up to 247,000 BOPD)

3. LOW DEVELOPMENT PROJECTION

The low development projection is also based on two assumptions. The first assumption is that there will be a low sized find of recoverable oil and gas resources in the Baltimore Canyon and the other Atlantic lease sale tracts. The Baltimore Canyon lease sale No. 40 will be assumed to hold approximately 0 to .4 billion barrels of recoverable resources of oil and 0 to 2.6 trillion cubic feet of recoverable resources of natural gas. The entire Atlantic Coast will be assumed to hold approximately 0 to 2 billion barrels of recoverable resources of oil and 0 to 6 trillion cubic feet of recoverable resources of natural gas. Baltimore Canyon production rates will be assumed to range from 0 to 0.2 million barrels of oil per day and 0 to 1. billion cubic feet of gas per day. It will also be assumed that 0 to .198 billion barrels of oil per day will be shipped to refineries in Middlesex and Union Counties from all of the Atlantic lease sale tracts. Natural gas, however, will be processed in other counties that are closer to the lease sale 40 tracts. The second assumption is that CAFRA and other state and local regulations will not significantly prohibit or limit development of OCS-related facilities in the other coastal counties of New Jersey.

Probable Facilities

Under the assumptions of the low development projection it is likely that no support bases, gas processing plants, partial processing plants, pipeline landfalls, or refineries will be built in Middlesex County. A marine terminal, however, may be needed to unload and store crude oil tankered in from lease sale 40 tracts. Tankers will probably be used because the production rate will not justify construction of a pipeline. Under this projection local repair and maintenance yards may increase their activity.

4. SUMMARY

The following table (Table II-5) summarizes the onshore facilities that will probably be generated if the assumptions of the various projections hold true.

TABLE II-5
SUMMARY OF DEVELOPMENT PROJECTIONS

DEVELOPMENT PROJECTIONS	ASSUMPTIONS	ONSHORE FACILITIES LIKELY TO LOCATE IN MIDDLESEX COUNTY
1. High Impact	a. High find of recoverable oil and gas Sale No. 40 - 1.0 to 2.6 billion barrels of oil 6.0 to 12.8 trillion cubic feet of gas Atlantic Total - 4. to 6. billion barrels of oil 14 to 22 trillion cubic feet of gas Production Rates - 0.5 to 0.7 million BOPD 2.0 to 4.0 billion CFGPD Middlesex & Union Counties - .396-.594 million BOPD 1.0 to 2.0 billion CFGPD b. State and local policies significantly limit development of OCS-related facilities in the CAFRA coastal zone.	1 or 2 permanent service bases 1 pipeline installation support base 1 platform installation support base 1 or 2 pipeline landfalls 2 tank farms 1-3 gas processing treatment plants Refinery (capacity of .396-.594) 1 marine terminal Partial processing plant (Up to 370,000 BOPD capacity needed)
2. Medium Impact	a. Medium find of recoverable oil and gas Sale No. 40 - 0.4 to 1.0 billion barrels of oil 2.6 to 6.0 trillion cubic feet of gas Atlantic Total - 2.0 to 4.0 billion barrels of oil 6.0 to 14 trillion cubic feet of gas Production Rates - 0.2 to 0.5 million BOPD 1.0 to 2.0 billion CFGPD Middlesex & Union Counties - .198 to .396 million BOPD .5 to 1.0 billion CFGPD b. State and local policies moderately limit development of OCS-related facilities in the CAFRA coastal zone.	1 gas processing treatment plant 1 or 2 pipeline landfalls 1 pipeline installation support base 1 marine terminal Partial processing plant (Up to 247,000 BOPD capacity needed)
3. Low Impact	a. No or low find of recoverable oil and gas Sale No. 40 - 0. to .4 billion barrels of oil 0. to 2.6 trillion cubic feet of gas Atlantic Total - 0. to 2.0 billion barrels of oil 0. to 6.0 trillion cubic feet of gas Production Rates - 0 to 0.2 million BOPD 0 to 1.0 billion CFGPD Middlesex & Union Counties - 0 to .198 million BOPD No gas b. State and local policies do not significantly limit development of OCS-related facilities in the CAFRA coastal zone.	1 marine terminal

III. THE DEMAND FOR PETROLEUM AND PETROLEUM-RELATED FACILITIES

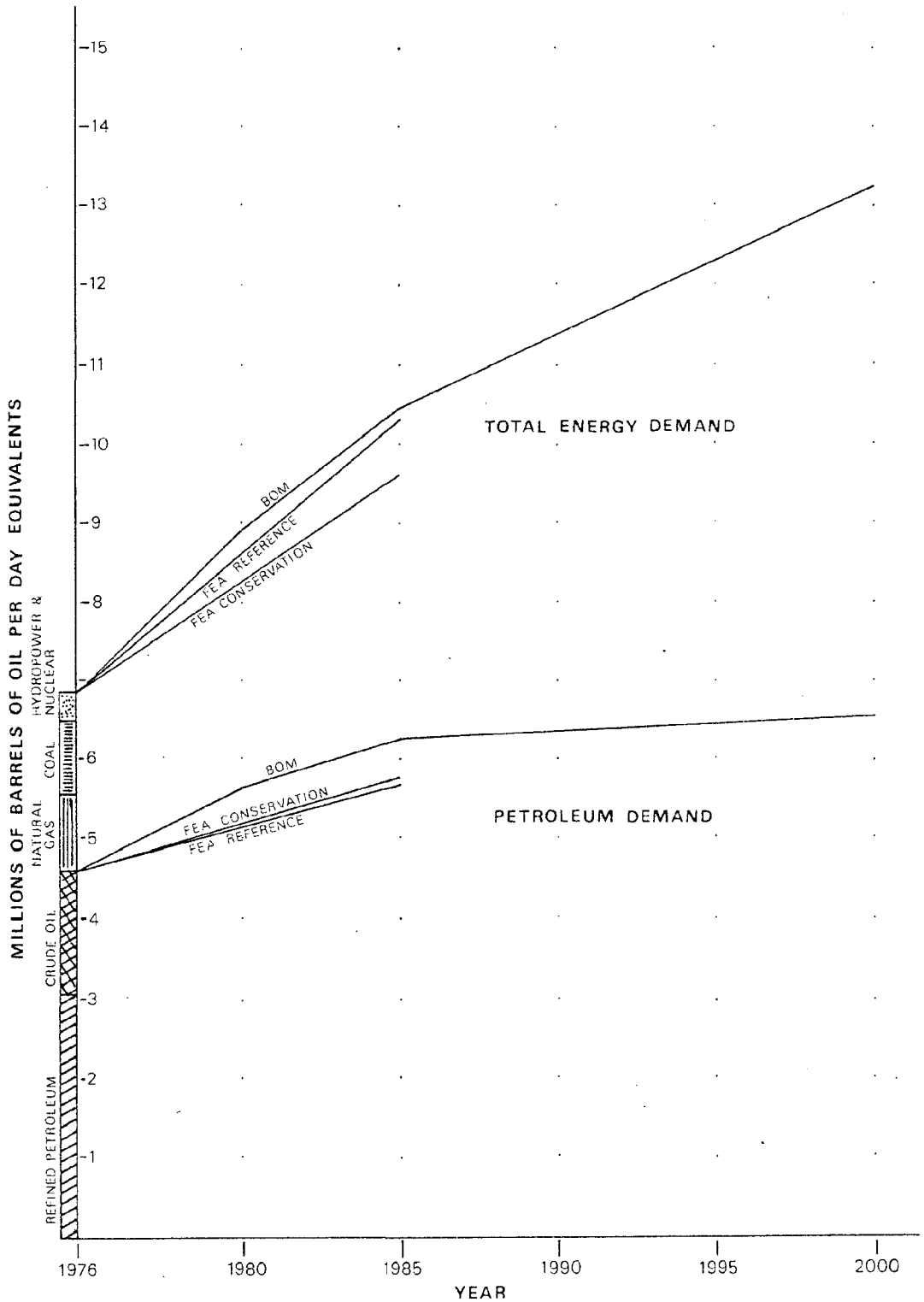
A. Projections of Future Energy and Petroleum Demands

The discussion in Chapter I of current petroleum supply and demand for the United States as a whole, the North Atlantic Coast, and Middlesex County in particular, clearly indicates the existing patterns of oil transport, processing, and delivery. Chapter II identifies the range of facilities associated with OCS activities and the potential for OCS related facilities locating in Middlesex County. It is not only appropriate but essential to investigate future petroleum demand in order to fully examine the potential range of future growth of petroleum related facilities that might occur in Middlesex County. Projections of future petroleum demand for the North Atlantic Coast are shown in the bottom portion of the graph in Figure III-1. Petroleum, as of 1975, was being supplied to the region in the form of crude oil (35%) and refined petroleum products (65%). The upper portion of Figure III-1 shows the projected demands for total energy for the North Atlantic Coast. It is assumed that future total energy demand will be met by the five basic energy forms that are meeting current demands. The following chart presents these basic energy forms and their percentage of total 1975 energy demand.

Energy From:	% of Total Demand -1975
Oil	66%
Coal	15
Natural Gas	14
Nuclear	3
Hydropower	2

FIGURE III-I

PROJECTED DEMAND FOR TOTAL ENERGY AND PETROLEUM PRODUCTS IN THE NORTH ATLANTIC COAST REGION



SOURCE: Graph data from U.S. Congress, Office of Technology Assessment (Working Papers:) Coastal Effect of Offshore Energy Systems, November 1976

Both the upper and lower portions of the graph shown in Figure III-1 consist of three separate projections, two by the U. S. Federal Energy Administration (FEA) and one formulated by the Bureau of Mines (BOM) of the U. S. Department of Interior,

Originally formulated as part of the 1976 National Energy Outlook, the FEA's projections are based on the agency's econometric model and reflect variations in such broad types of energy demand determinants as energy prices, economic conditions, population, and the potential for energy conservation. One scenario, the reference case, assumes "business as usual" economic conditions and does not include conservation measures of the type likely to be prompted by governmental intervention, although it does reflect some conservation resulting from higher energy prices and new natural gas prices.

The FEA conservation scenario assumes that stringent government conservation policies and programs will be instituted. Improved auto efficiency, van pooling programs, increased airline load factors, better conservation, and peak load management by utilities are all assumed as means to limit the demand for petroleum. On the supply side, major assumptions include: (1) restrictions on nuclear power plant construction (no projects beyond currently granted construction permits) and, (2) environmental restrictions on mining and burning coal.

Even with the institution of government conservation policy and programs as assumed in the FEA conservation scenario, petroleum and total energy demand will continue to rise. In fact, petroleum demand under FEA's conservation scenario is actually projected to be higher by 1985 than the projection of

petroleum demand under FEA's reference scenario. Since the development of nuclear and coal fuels is restricted under the conservation scenario, petroleum demand is deduced to be higher than in the reference case which does not assume stringent limitations on other fuel sources.

The projection made by the Bureau of Mines (BOM) (originally published in 1975 in Energy through the Year 2000), is essentially an extrapolation of present trends in energy consumption, with judgement imposed to reflect expectations about limitations to supply. Deregulation of oil and gas is assumed. The potential for conservation was not considered in their forecast, although a projection of a declining trend in energy per value added ratios does inject some measure of increased efficiency.

B. The Potential for New Growth in Petroleum-Related Facilities

The graph shown in Figure II-I presents recently published estimates of the future demand for petroleum and other energy sources in the North Atlantic Region. It is evident that petroleum demand is expected to increase greatly by the year 2000. The following discussion focuses on the possible modes by which petroleum might be supplied to the North Atlantic Region in the future. The purpose of this section is to establish ranges of future energy facility growth and to illustrate and dimensionalize the potential demand for energy facilities. This illustration of the range of possibilities concerning petroleum-related facilities, including OCS facilities, is tentatively presented to generally protray the North Atlantic Region's energy future and the facilities which might locate in Middlesex County.

The 1976 supply of petroleum to the North Atlantic Region totaled 4.6 MB/D and consisted of 1.6 MB/D in crude oil and 3.0 MB/D in refined petroleum products. The amount of crude oil supplied to the Region is approximately equivalent to the regional refinery capacity. By the year 2000 petroleum demand is expected to increase by 1.9 MB/D so that the total amount of petroleum needed to supply the Region would rise to 6.5 MB/D. Future petroleum demand will be satisfied through one of the three possible arrangments:

1) increasing the amount of crude oil supplied to the Region; or

2) increasing the amount of refined petroleum products supplied to the Region; or

3) increasing the amount of both crude oil and refined petroleum products supplied to the Region.

Presently, crude oil facilities consist of refineries, associated marine terminals, storage tanks, and distribution facilities such as railroad tank cars, tank trucks, and product pipelines. The present system of refined petroleum product facilities consists of marine terminals, storage tanks, major product transmission pipelines and pipeline terminals, and distribution

facilities such as railroad tank cars, tank trucks, and product pipelines. To meet future demand, either one of these systems of facilities, or both, might expand in capacity and number of facilities. In addition, with the imminent exploration and potential development and production of oil and gas off the Atlantic Coast, facilities associated with such Outer Continental Shelf (OCS) activities can be expected to locate in the Region, and oil, if found, could contribute to the Region's future petroleum supply.

Offshore oil and gas related facilities may be categorized into two basic groups. The first group consists of those facilites previously unknown in the Region, such as facilities engaged in the exploration and construction phase of OCS activities, but also including some processing facilities associated with the production phase.

TABLE III-1
OCS-Related Facilities new to the North Atlantic Region

exploration and construction phase	permanent service buses pipeline support base platform installation support base platform fabrication yards
production phase	offshore crude oil pipelines partial processing plants gas processing plants

The second group consists of facilities which already exist in the Region, plus refineries and petrochemical firms which may expand their operations as a result of offshore oil.

TABLE III-2
OCS-Related Facility Types Already existing in the North Atlantic Region

exploration and construction phase	refineries petrochemical industries

The following section will discuss the possible means by which petroleum demand may be met in the future. The discussion will consist of three separate scenarios, each with different assumptions regarding:

1) the replacement or non-replacement of offshore oil for the crude oil that is presently being imported into the North Atlantic Region;

2) the growth in refinery capacity in Middlesex County and the North Atlantic Region; and

3) the growth in the capacity of those facilities that transport, store, and distribute refined petroleum products to the North Atlantic Region.

SCENARIO 1

Under this scenario it is assumed that: (1) "barrel-for-barrel replacement" of offshore oil for crude imports will occur; (2) the refinery capacity in the County or Region will not change, (3) the capacities of the Regional facilities to transport and store refined petroleum products will increase to accommodate an additional 1.9 MB/D. Figure III-2 indicates the changes in relative amounts of crude and refined petroleum and the facilities that will be associated with these changes.

Under these assumptions, 0-.594 MB/D of Atlantic OCS oil may be transported to Middlesex and Union Counties for refining. This crude oil would replace an equivalent amount of imported crude and no additional refinery capacity would be needed. Various OCS facilities may locate in Middlesex County to support the development, production and transportation of OCS crude oil. (See Chapter II.)

If the find of recoverable resources of oil off the Atlantic Coast is very low and state and local regulations do not significantly inhibit the development of OCS facilities in other counties in New Jersey, then no or very few facilities will be developed in Middlesex County. The number of OCS facilities likely to locate in Middlesex County will increase proportionately with increases in the amount of discovered recoverable resources of oil and the effectiveness of state and local regulations in limiting development in other coastal counties.

Figure III-2 also indicates that various new regional facilities would be needed to transport, receive, and store 1.9 million barrels per day of refined petroleum products. The County Planning Board has not estimated the number of these facilities that would locate in Middlesex County. It is likely, though, that the County would experience some development since it is already a major port and transshipment point for petroleum products supplying the New York and North Atlantic Region market.

FIGURE III-2
FUTURE DEMAND FOR PETROLEUM AND PETROLEUM RELATED FACILITIES
SCENARIO 1

Assumptions:

1) Barrel for barrel replacement of offshore oil for existing crude oil imports

2) Refinery Capacity: No change in Middlesex County or the North Atlantic Region

3) Refined Petroleum Facilities Capacity: Increase in the North Atlantic Region to accommodate an additional 1.9 MB/D

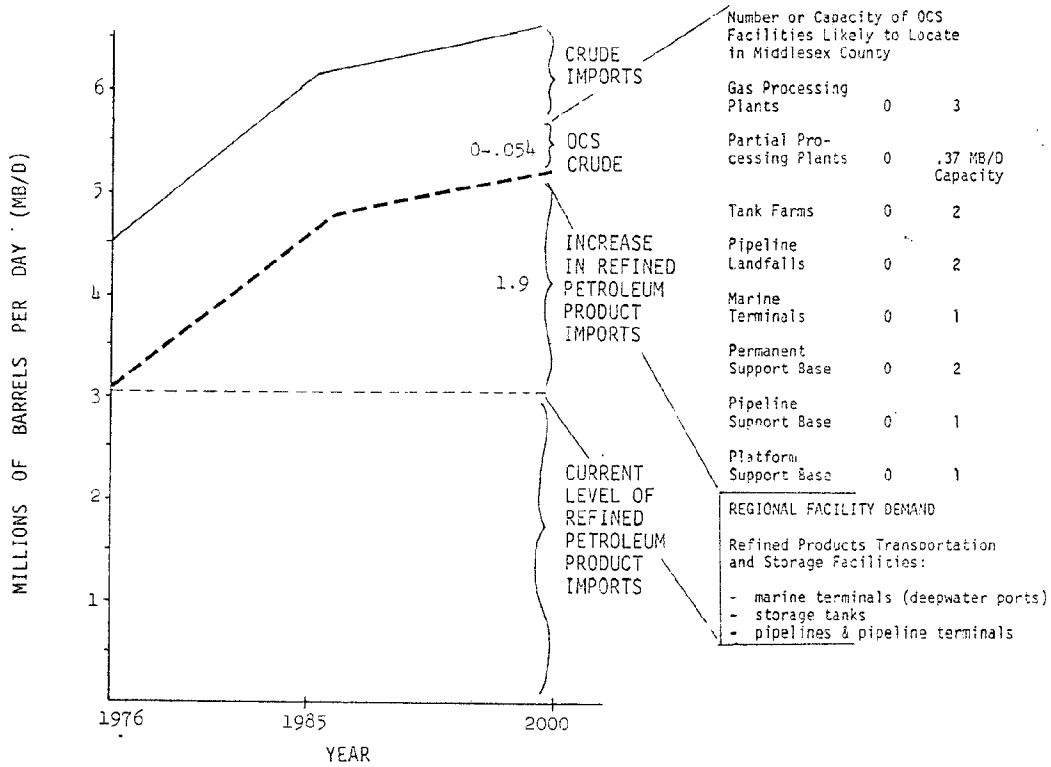


Table III-3 summarizes the land, water supply, energy, and employment requirements of the OCS-related facilities likely to locate in Middlesex County if the high impact development projection were to occur. Table III-4 summarizes the environmental impacts of these facilities under the same high impact development projection.

TABLE III-3

SUMMARY OF REQUIREMENTS OF FACILITIES PROJECTED UNDER THE HIGH DEVELOPMENT PROJECTION

Requirements / Onshore Facilities	# of Facilities Projected	LAND		WHARF SPACE		WATER		FUEL and/or ELECTRICITY		EMPLOYMENT		
		Acres/ Facility	Total Acres	Feet Facility	Total Feet	Gallons/ Facility	Total Gallons	Quantity/ Facility	Total	Workers; Facility	Total Workers	Local Workers (Approximately)
Permanent Service Bases	1-2	25-50	25-100	800	800-1600	41MGY during development 2MGY potable *.112MGD during .005MGD potable	41-82MGY 2MGY potable *.1-.224 MGD development .005-.01MGD potable	216000-27000 barrels/yr. during develp. 76,800-96,000 barrels/yr. during production	216,000-540,000 barrels/yr. during develp. 76,000-192,000 barrels/yr. during production	30-60/platform 250-300/5 platforms during drilling	500-1200 for 10 platforms (2 bases) during drilling	250-600
Pipeline Installation Support Base	1	5	5	200	200	N/A	N/A	50,000 gals./mo. for lay barges 180,000 gals./mo. for burying barges	230,000 gals./mo. for 1 lay barge and 1 burying barge. + deisel oil for tugs	25/pipeline 250-300/lay barge spread	25/pipeline 250-300	13
Platform Installation Support Base	1	5	5	200/ four platforms installed	200+	N/A	N/A	100,000 gals. of deisel fuel/derrick barge/month 150,000 gals./tug per month	37,800,000 - 100,000,000 gals/yr.[1]	100 offshore 25 onshore	125	40
Pipeline Landfalls	1-2	50-100 ft. right-of-way; 40 ac. if pumping station needed; 60 if terminal needed	1-200	-	-	N/A	N/A	N/A	N/A	17 onshore	7-34	N/A
										N/A	N/A	N/A
Tank Farms Capacity (Barrels)	1-2		17-58	-	-	N/A	N/A			N/A	N/A	N/A
1,000,000		17	17-34 or					8 million KWH/yr.				
2,000,000		37	37 or					14 million KWH/yr.				
3,000,000		50	50 or					N/A	N/A			
3,500,000		58	58					N/A	N/A			
Partial Processing Plant (250,000 BOPD capacity)	1		300-340	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gas Processing Treatment Plant	1-3	50-75	50-225	-	-	.2MGD average	.2 to .6 MGD	64.8 million KWH/yr. 360 million cu. ft. of gas/month from plant	64.8-175 million KWH/yr. 360-1080 million cu. ft. gas/month	N/A	N/A	N/A
Marine Terminal (1 Million barrel storage capacity)	1	30	30	N/A	N/A	limited assuming no processing		8 million KWH/yr. tank farm 1 million KWH/yr. terminals 11,800 barrels of fuel/year	9 million KWH/yr. 11,800 barrels of fuel/year	560 constr.(1 yr.) operation 10-9	560 constr.(1 yr.) operation 10-90	112 construction (1 yr.) 6-67 operation

\- = negligable or zero
NA = not available
* Million Gallons Per Day (MGD) figures have been calculated by averaging of monthly and yearly figures
[1]This yearly quantity will vary greatly depending on the number of platforms installed

SOURCE: NERBC, FACTBOOK and Estimates For New England, and the Conservation Foundation, Onshore Impacts of OCS Oil and Gas Development

TABLE III-4

SUMMARY OF ENVIRONMENTAL IMPACTS OF FACILITIES PROJECTED

UNDER THE HIGH DEVELOPMENT PROJECTION

Impacts / Onshore Facilities	# of Facilities Projected	AIR EMISSIONS -- Sources & Tons/Year						MAJOR WASTEWATER POLLUTANTS			
		Hydro-carbons	Partic-ulates	Sulfur Oxides	Nitrogen Oxides	Carbon Monoxide	Hydro-gen Sulfide	Hydro-carbons	Heavy Metals	Antifouling Substances	Suspended Solids
Permanent Service Base	1	Fuel Stor-age 3.0		Mobile Sources	Mobile Sources	Mobile Sources		Runoff			
Pipeline Install-ation Support Base	1	Fuel Stor-age 1.0 to 3.0		Mobile Sources	Mobile Sources	Mobile Sources					
Platform Install-ation Support Base	1	Fuel Stor-age 15 to 40		Mobile Sources	Mobile Sources	Mobile Sources					
Pipeline Landfalls	1-2	Compressors & Pumps		Compres-sors	Pumps	Pumps					
Tank Farms	Two (1 million bbl cap.) 1 (2 mil-lion bbl cap.)	Crude Stor-age tank evapora-tion Transfer losses .1 lb./barrel trans-ferred stor-age									
Partial Processing Plant (250,000 BOPD Capacity)	1	Tank Evapor-ation Leakage Pumps Mobile Sources		Combustion of gas pumps for oil - water separator Mobile Sources	Pumps Mobile Sources	Mobile Sources	leakage		process water		process water
Gas Processing Treatment Plants (.3 to .5 BCFGPD) (assuming sulfer con-tent of 0.9% by volume)	1-3	Process leaks 11,498-56,913 (1958 data)		Sulfur recovery process 580-2871	Process	Process	Sulfur re-covery 142-846 (1958 data)	Process Water	Cooling Water process boiler water	Cooling Water boiler water	
Marine Terminal (1 million barrel storage capacity)	1	Crude Stor-age Tank Evaporation Transfer losses .1 lb./barrel transferred						Runoff Ballast Water			

SOURCES: NERBC, FACTBOOK, and Estimates for New England, and The Conservation Foundation, Onshore Impacts of Oil and Gas Development.

TABLE III-4
SUMMARY OF ENVIRONMENTAL IMPACTS OF FACILITIES PROJECTED
UNDER THE HIGH DEVELOPMENT PROJECTION
(Continued)

Impacts / Onshore Facilities	# of Facilities Projected	NOISE EMISSIONS (decibels; source)	SOLID WASTE
Permanent Service Base	1	Up to 85; 24 hours/day-pumps 90-96; pneumatic power tools 92-100; air compressors	Up to 6 tons/year during drilling
Pipeline Installation Support Base	1	NA	Up to 6 tons/year
Platform Installation Support Base	1	Up to 85; 24 hours/day	Up to 6 tons/year
Pipeline Landfalls	1-2	90-100; compressors 140; annual pipeline venting	NA
Tank Farms	1-2	NA	Contaminated sludge and sediments
Partial Processing Plant	1	80-90; pumps 81-96 at 20 feet; flarestacks 81-96; treating vessels	NA
Gas Processing Treatment Plant	1-3	92-100; air compressors : 81-96 at 20 feet; flarestacks: 24 hours/day 90 at 6 feet; boilers :	Sludges, scale, spent dessicants, filtration media, oil absorbants
Marine Terminal	1	NA	Contaminated sludge and sediments

NA = Not Available
SOURCES: NERBC, FACTBOOK, and Estimates for New England, and The Conservation Foundation, Onshore Impacts of OCS Oil and Gas Development.

SCENARIO 2

Under this scenario it is assumed that: (1) OCS oil will not replace crude oil imports and that the amount of crude oil imported will not change, (2) refinery capacity in Middlesex County will increase by 0 to .594 million barrels per day. for processing of OCS crude, and (3) the capacity of the North Atlantic Region's facilities for transport and storage of refined petroleum products will increase to accommodate an additional 1.3 million barrels per day. Figure III-3 indicates the changes in the relative amounts of crude and refined petroleum and the facilities that will be associated with these changes.

Under those assumptions additional refinery capacity, stimulated solely by offshore oil production, would be developed in Middlesex County. The increased refinery capacity would stimulate an increase in the petrochemical industry resulting in the establishment of 0 to 7 petrochemical complexes in the County.[1] In addition, Figure III-3 indicates that various OCS related facilities may develop in Middlesex County. The number of facilities that are developed depends primarily on the amount of oil discovered in the Atlantic OCS and the effect of state and local regulations in limiting development in other coastal counties.

Figure III-3 also indicates that various new regional facilities would be needed to transport, receive and store 1.3 million barrels per day of refined petroleum products. Some of these might include: marine terminals (a possible deepwater port for refined petroleum products); storage tanks; and/or refined product pipelines from southern refineries. It is likely that the County will

---

[1] Arthur D. Little, Inc. report to the Council on Environmental Quality, Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development Vol. II East Coast, pp. 2-12.

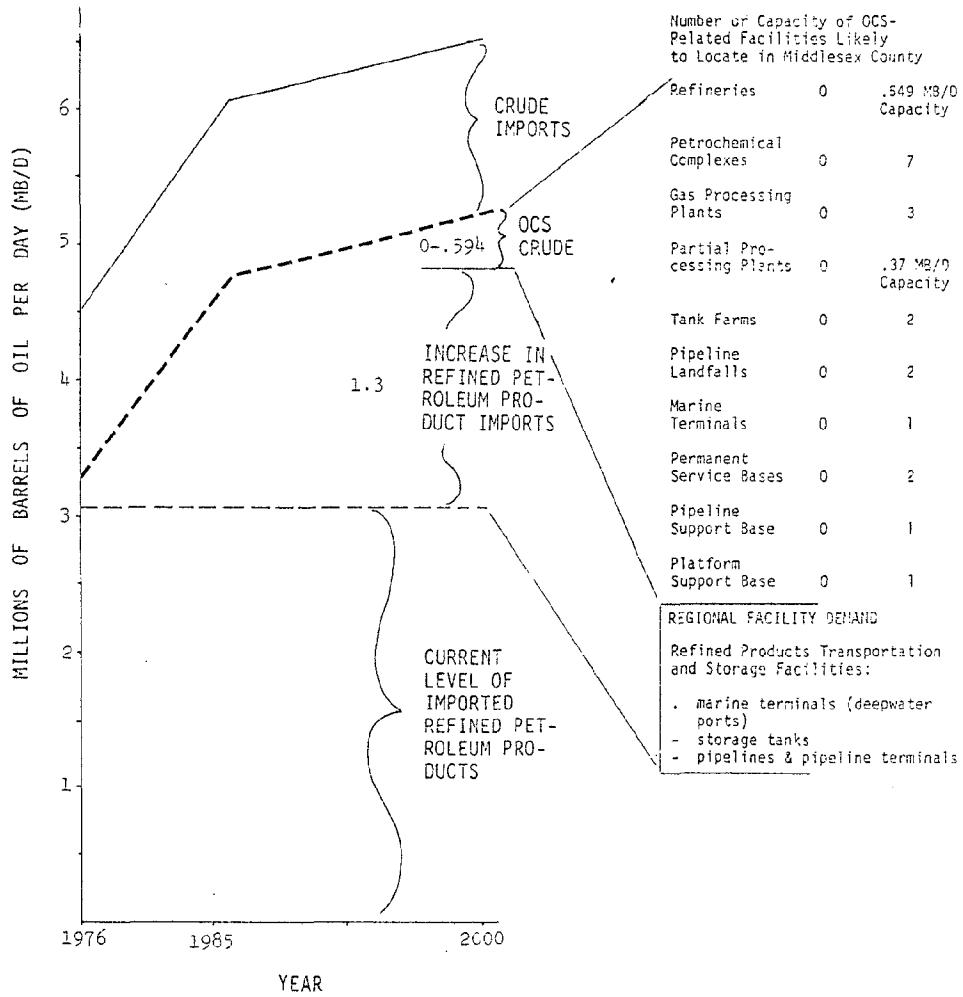
FIGURE III-3
FUTURE DEMAND FOR PETROLEUM AND PETROLEUM RELATED FACILITIES
SCENARIO 2

Assumptions:

1) No replacement of OCS oil for existing crude oil imports

2) Refinery Capacity: 0-.594 MB/D increase in Middlesex County induced by offshore oil

3) Refined Products Facilities Capacity: Increase in North Atlantic Region to accommodate an additional 1.3 MB/D



Number or Capacity of OCS-Related Facilities Likely to Locate in Middlesex County

Refineries	0	.549 MB/D Capacity
Petrochemical Complexes	0	7
Gas Processing Plants	0	3
Partial Processing Plants	0	.37 MB/D Capacity
Tank Farms	0	2
Pipeline Landfalls	0	2
Marine Terminals	0	1
Permanent Service Bases	0	2
Pipeline Support Base	0	1
Platform Support Base	0	1

REGIONAL FACILITY DEMAND

Refined Products Transportation and Storage Facilities:

- marine terminals (deepwater ports)
- storage tanks
- pipelines & pipeline terminals

experience some development of these facilities since it is a major port and transshipment point for petroleum products supplying the New York and North Atlantic Region market.

Table III-5 summarizes some of the impacts associated with refineries and petrochemical complexes likely to locate in Middlesex County under this scenario. The impacts and requirements for the remaining OCS induced facilities can be found in Table III-3 and Table III-4.

TABLE III-5

Selected Impacts Associated with Refineries and Petrochemical Complexes

For a 250,000 bbl/day refinery

Land Requirement	Employment	Water Demand	Environmental Impacts
1000-1500 Acres	410 Operation 80% Local	10.5 mgd brackish	Air quality (especially hydrocarbon emissions) Water quality Noise Solid waste

For 0-7 petrochemical complexes

Employment	Potable Water Demand	Environmental Impacts
0-29,000 Persons	0-162 mgd using present wastewater treatment technology 0-68 mgd using advanced wastewater treatment technology	Air quality Water quality Noise Solid Waste

Source: Arthur D. Little, Inc., report to the Council on Environmental Quality, Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development Vol. II East Coast.

SCENARIO 3

Under this scenario it is assumed that: (1) refinery capacity in the North Atlantic Region will increase by 1.9 million barrels to accomodate both growth in market demand and OCS oil; and (2) the capacity of refined products facilities will not change.

Figure III-4 indicates the OCS and petroleum facilities that are likely to be located in the region and Middlesex County if these assumptions hold true. The graph illustrates that by 2000 approximately 1.9 million barrels of crude oil per day will be entering the North Atlantic Region from the Atlantic OCS tracts and foreign sources. This would require the development of between nine and ten refineries in the Region, each with a capacity of 200,000 barrels of oil per day. Such an increase in refinery capacity would stimulate the development of up to 13 petrochemical complexes in the Region.[2] In addition 6.6 MB/D of crude oil storage capacity would be required.[3]

Table III-6 identifies some selected impacts from petrochemical complexes and storage tanks. Impacts associated with refineries can be found in Table III-5. Impacts and requirements for the remaining OCS induced facilities can be found in Tables III-3 and III-4.

---

[2]Arthur D. Little, Inc. report to the Council on Environmental Quality Potential Onshore Effects of Deepwater Oil Terminal Related Industrial Development Vol. II East Coast, pp. 2-14.

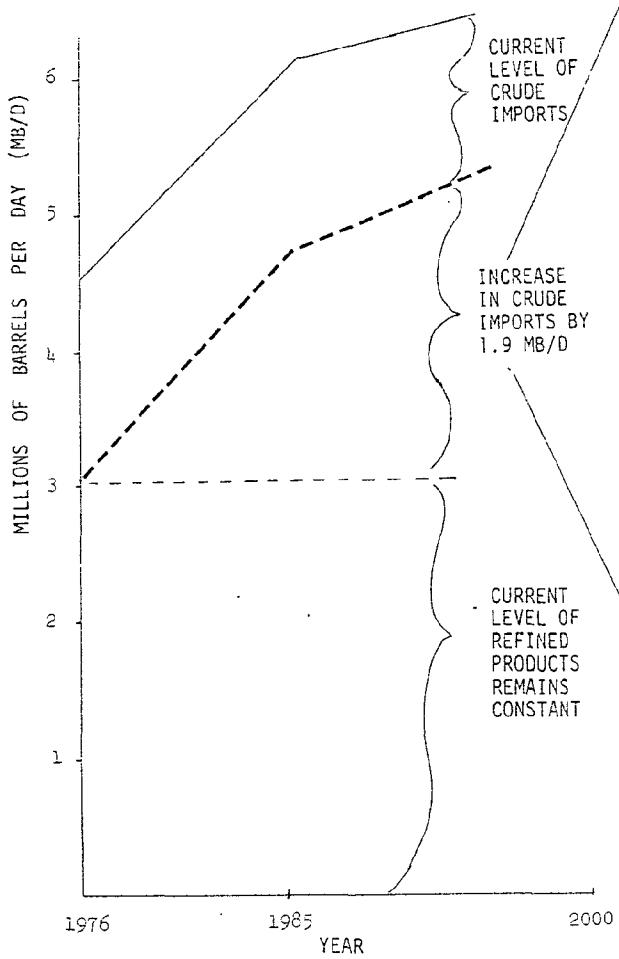
[3]Ibid.

FIGURE III-4
FUTURE DEMAND FOR PETROLEUM AND PETROLEUM RELATED FACILITIES
SCENARIO 3

Assumptions:

1) Refinery Capacity: Increase by 1.9 MB/D in the North Atlantic Region induced by OCS oil and growth in market demand

2) Refined Products Facilities Capacity: Remains Constant



Regional Facility Demand

Refineries - 1.9 MB/D Capacity

Petrochemical Complexes - 13

Crude Oil Storage - 6.6 MB/D

Number of Capacity of OCS Facilities Likely to Locate in Middlesex County

	Low Impact	High Impact
Gas Processing Plants	0	3
Partial Processing Plants	0	.37MB/D Capacity
Tank Farms	0	2
Pipeline Landfalls	0	2
Marine Terminals	0	1
Permanent Support Base	0	2
Pipeline Support Base	0	1
Platform Support Base	0	1

TABLE III-6

SELECTED IMPACTS ASSOCIATED WITH PETROCHEMICAL COMPLEXES AND STORAGE TANKS

For 0-13 Petrochemical complexes*

Employment	Potable Water Demand	Environmental Impacts
0-41,500	0-250 mgd using present wastewater treatment technology 0-162 mgd using advanced wastewater treatment technology	Air quality Water quality Solid waste Noise

For Storage Tanks:

Employment	Water Demand	Environmental Impacts
NA	NA	Air quality Water quality

NA = Not Available

*Source: Arthur D. Little, Inc. report to the Council on Environmental Quality, Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development, Vol. II East Coast.

IV. DEVELOPMENT OPPORTUNITIES FOR OCS AND ENERGY FACILITIES

The final report of the Middlesex County Planning Board on energy and OCS facility development will include an assessment of the suitability of specific sites and/or areas in Middlesex County for the development and operation of OCS-related facilities. These judgements of suitability will be based on a balancing of the economic, social and environmental costs and benefits of facility development. They will also be based on a consideration of the existing legal and political constraints on facility development. However, before this suitability assessment is undertaken, an analysis must be made of the specific sites and/or areas in Middlesex County that might be characterized as *development opportunities*. *Development opportunities* are the sites and/or areas that satisfy industrial siting criteria or physical siting requirements for OCS and energy facilities. These industrial siting criteria include:

I. Transportation Access

- A. Major highways (truck access)
- B. Railroads
- C. Ocean Access
  - 1. adequate channel depth
  - 2. channel clearance

II. Land

- A. Size of tract
- B. Vacant or redevelopable
- C. Industrially zoned[2]
- D. Environmental Features

III. Wharf Space - existing, developable

IV. Water Supply - brackish, potable

V. Electricity Demands

---

[1] Appendix I is an outline of the final draft report. Chapter IX will include the suitability assessment and it will be based on information from Chapters VI, VII, VIII.

[2] See the map of Industrial Zoned Land in Appendix B.

There are various general areas in Middlesex County that meet the industrial siting criteria of (1) transportation access (road, rail and ocean),[3] (2) proximity to the Baltimore Canyon, (3) land zoned for heavy industry (4) water supply and (5) electric power for service and support bases, repair and maintenance yards,[4] and pipe coating yards.[5] These areas border on the Arthur Kill and the Raritan River and are shown in figure IV-5. It should be noted that these are general areas and are not specific sites meeting every siting criteria. Some of the land in these areas is vacant and is suitable for development of wharves. The planning board will conduct investigations to determine particular sites in Middlesex County that meet all of the siting criteria for these and other facilities. These investigations will attempt to determine specific tracts of vacant or redevelopable land that are large enough to accommodate these facilities.

[3] The area inland of the Swing Railroad Bridge crossing the Raritan meet the siting criteria of channel clearance for steel platform installation support bases if horizontal clearance in excess of 130 feet is required.

[4] Repair and maintenance services will probably be provided by existing port facilities. If a new facility is needed, then areas along the Arthur Kill and the Raritan River will meet the criteria for a new yard serving most medium sized OCS vessels.

[5] Existing pipe coating yards may be able to supply, coat and store the pipe for the Baltimore Canyon pipelines. In this case, a small port facility for storage and loading and unloading of barges would be required. The siting criteria for this type of facility are met by the general areas bordering the Arthur Kill and the lower Raritan River.

A. Areas Meeting Selected Industrial Siting Criteria of Petroleum Related Facilities

The purpose of this section is to present a preliminary analysis of the general areas in Middlesex County that meet most of the major industrial siting criteria for each of the types of petroleum-related facilities. The industrial siting criteria that have not been used in making this preliminary determination include: (1) the size and vacant or redevelopable nature of the tracts of land;and (2) wharf space availability. Other important factors affecting a decision to build a facility have been considered wherever these factors tend to limit the location of that type of facility. For example, partial processing plants will usually locate somewhere between oil pipeline landfalls and a refinery, and this factor has been taken into account in making the preliminary determination of development opportunities for partial processing plants (See figure IV-2).

1. Refineries

The process involved in making the decisions whether and where to locate a new refinery entails multifarous factors and considerations. The size and complexity of a specific refinery will greatly affect its industrial siting criteria and requirements. For instance, a refinery with a capacity of 250,000 barrels of oil per day usually requires 1,000 to 1,500 acres of flat vacant industrially zoned land, rail and road transportation access, at least 10.5 million gallons of brackish water per day (MGD), and electrical power. The only areas of industrially zoned land in Middlesex County where a refinery could obtain 10.5 MGD of brackish water are located along the Arthur Kill and the lower Raritan River.

Figure IV-1 illustrates the areas meeting the siting criteria and factors of transportation access, heavy industrial zoning, minimum brackish water supply and electrical power for refineries with a capacity of 250,000 barrels of oil per day. The land in these general areas is not necessarily vacant or redevelopable. In addition, the specific zoning and site plan review regulations of various municipalities may not allow the development of refineries and some other OCS facilities.

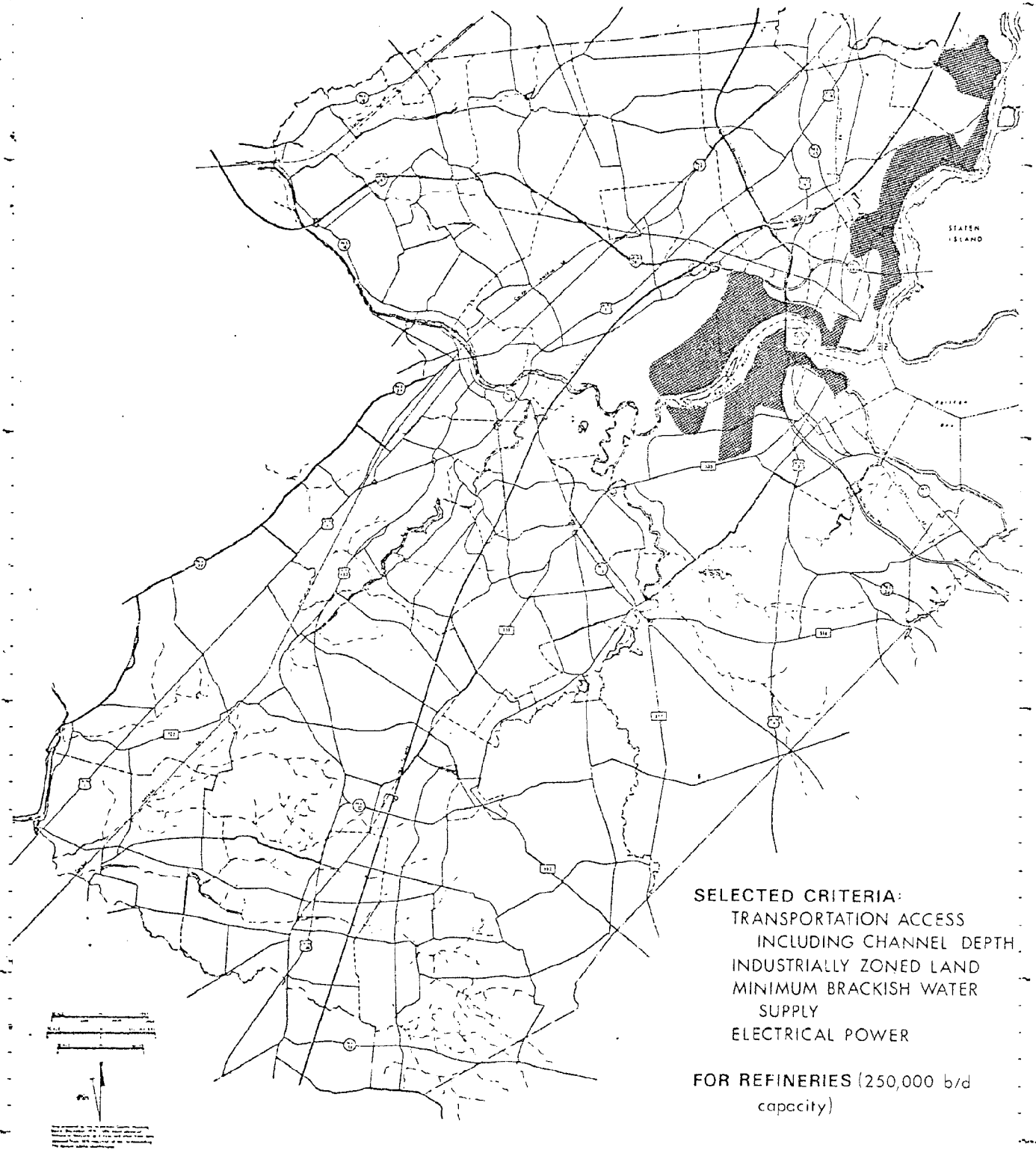
2. Petrochemical Complexes

The primary consideration in petrochemical plant siting is the availability of raw materials or feedstock. Historically, petrochemical plants have been dependent on the output of natural gas processing plants--natural gas liquids such as butane, propane, and ethane--for feedstock material. In addition, gas itself, comprised 90% of methane, is a major raw material and fuel for petrochemical operations. More recently, crude refinery outputs, such as naptha and gas oil, have begun constituting another major source of raw material and fuels for the petrochemical industry..

Petrochemical industries would thus seek to locate either: (1) close to refineries and ports where napthas and crude oil could be imported; or (2) near refined product and/or natural gas pipelines.

Areas in Middlesex County bordering existing natural gas and refined product pipelines can be seen on the map on page 9 .

FIGURE IV-1



AREAS MEETING INDUSTRIAL SITING CRITERIA - REFINERIES

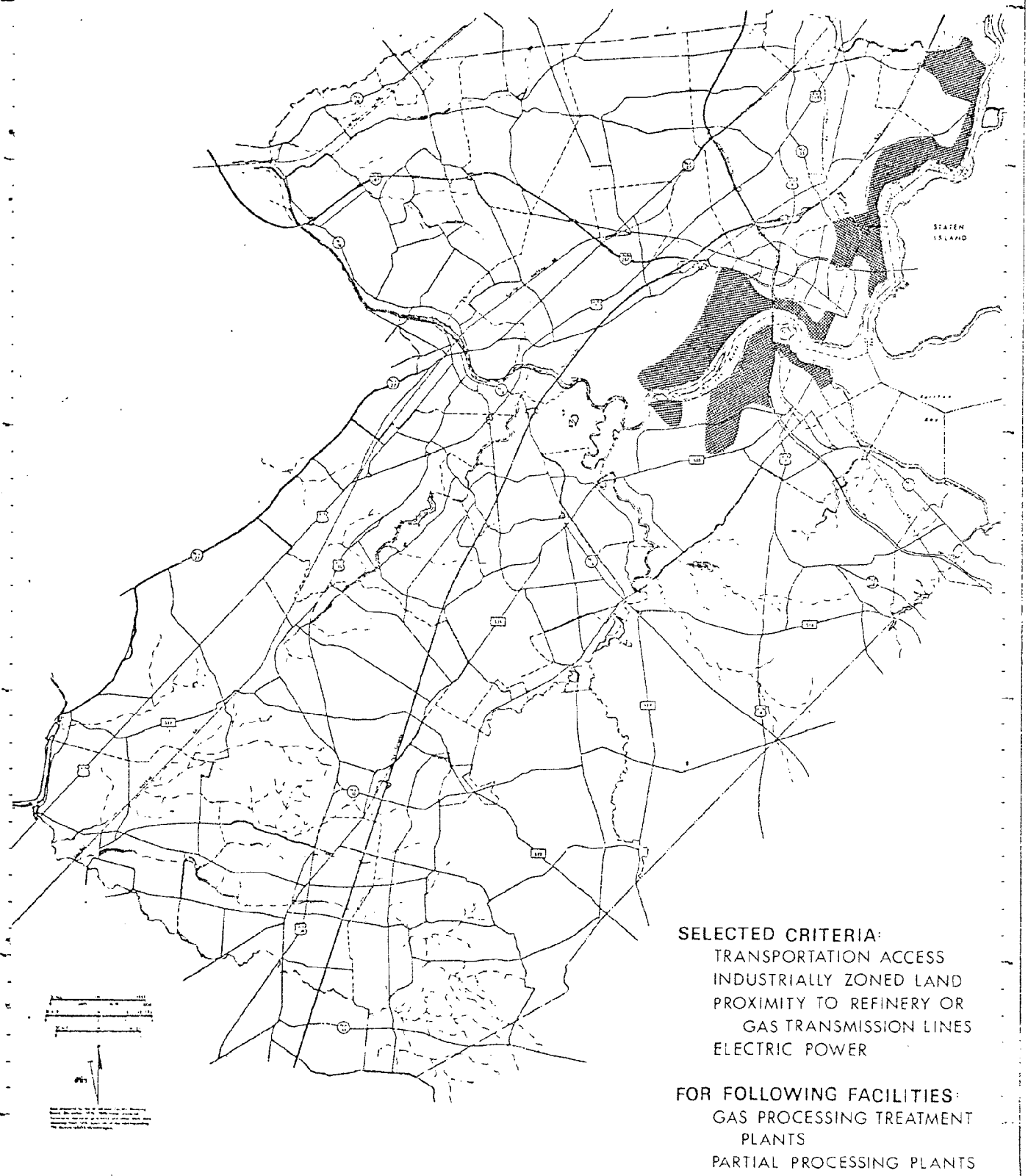
Petrochemical industries seeking to locate near either existing or potential refineries would seek sites in the same areas that meet the industrial siting criteria for refineries (figure IV-1).

3. Gas Processing Treatment Plants and Partial Processing Plants

Gas processing treatment plants recover liquifiable hydrocarbons from the raw gas stream. They are usually located somewhere between the gas pipeline landfall and commercial gas transmission lines. It is most likely that these plants would locate near the Raritan Bay (See figure IV-2) to be close to gas pipeline landfalls and relatively close to commercial gas transmission lines. It is also quite possible, however, that gas processing treatment plants would locate on industrially zoned sites in other parts of the county.

Partial processing plants remove water from the unprocessed oil well stream before it is transported to refineries for final treatment. These plants tend to locate somewhere between the oil pipeline landfall and refineries. Other siting criteria of partial processing plants include: (1) rail access for transportation of natural gas liquids; (2) road access for transport of smaller quantities of natural gas liquids and solid waste; (3) relatively large tracts of land zoned for heavy industry; (4) 200,000+ gallons of water per day; and (5) electric power. The general areas adjacent to the Raritan River and the Arthur Kill meet these basic industrial siting criteria and are relatively close to the refineries and potential sites for landfalls (See figure IV-2).

FIGURE IV-2



AREAS MEETING INDUSTRIAL SITING CRITERIA - PROCESSING

4. Tank Farms

Tank farms store crude oil or refined petroleum products before shipment to refineries or various markets. Tank farms may be associated with refineries, pipelines, and marine terminals.

a. Marine Terminal and/or Refinery Tank Farms

The industrial siting criteria for tank farms associated with refineries and/or marine terminals include: (1) transportation access by rail, road and usually sea, (2) industrially zoned land, (3) small quantities of water, (4) electric power and (5) proximity of refinery or market. Figure IV-3 indicates the areas meeting these basic industrial siting criteria. This map shows that the tanks associated with the marine terminal or refinery can be located inland of the wharves of the marine terminal.

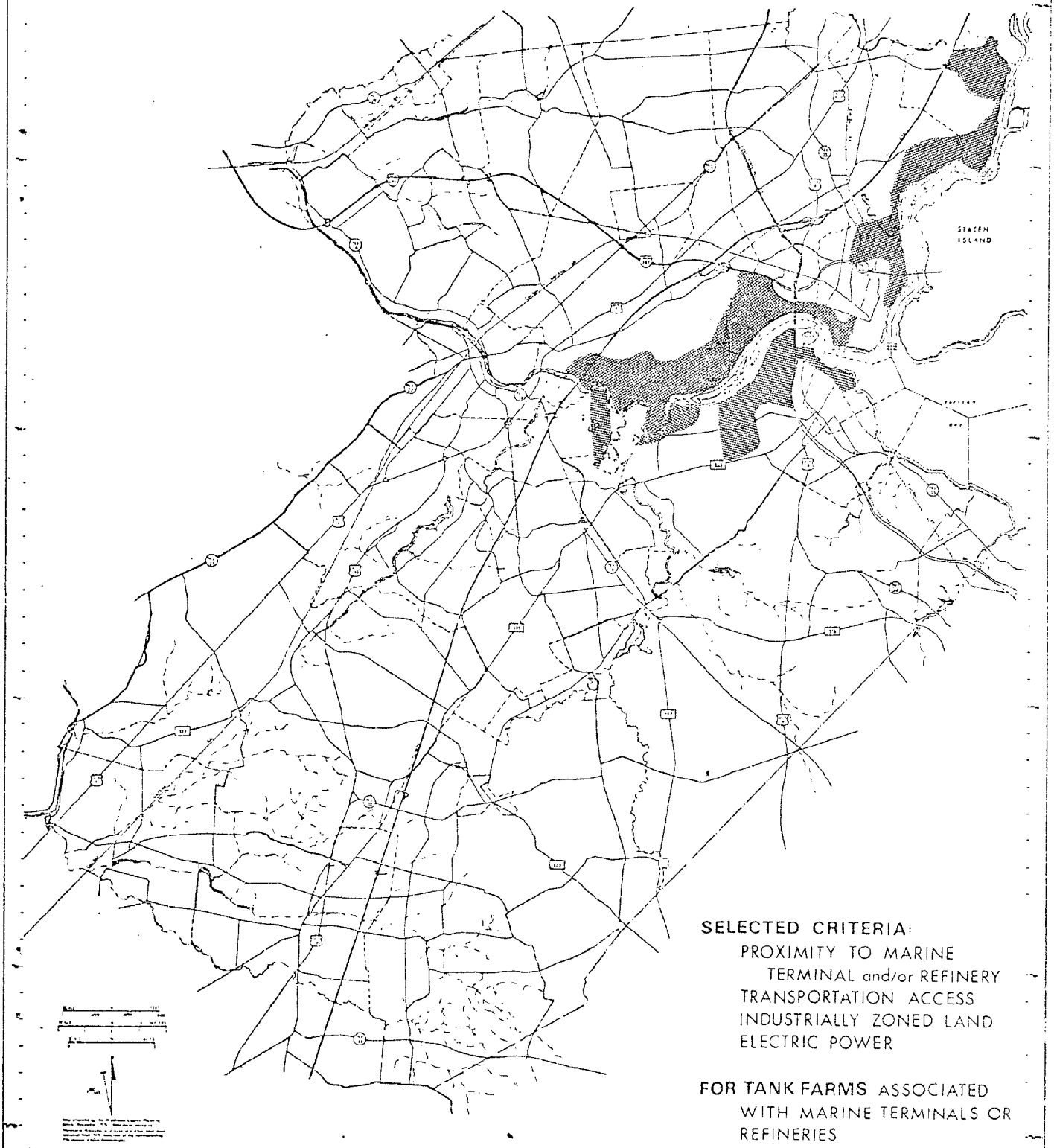
b. Pipeline Tank Farms

If tank farms are associated with pipelines, then many industrially zoned vacant and redevelopable sites throughout the County could meet the siting criteria for tank farms.

The basic industrial siting criteria for tank farms associated with pipelines include: (1) proximity to pipeline, (2) transportation access by road and rail, (3) industrially zoned land, (4) small quantities of water, and (5) some electric power. If new pipelines for crude oil from the Baltimore Canyon are landed in Middlesex County then pipeline tank farms may be located on industrially zoned sites[6] on or near

[6]See the map of Industrial Zoned Land in Appendix B.

FIGURE IV-3



AREAS MEETING INDUSTRIAL SITING CRITERIA-
MARINE TERMINAL and/or REFINERY TANK FARMS

Raritan Bay and relatively close to the refineries in and near Middlesex County. Other pipeline tank farms may be located along existing or new refined product pipelines.[7]

5. Pipeline Landfalls

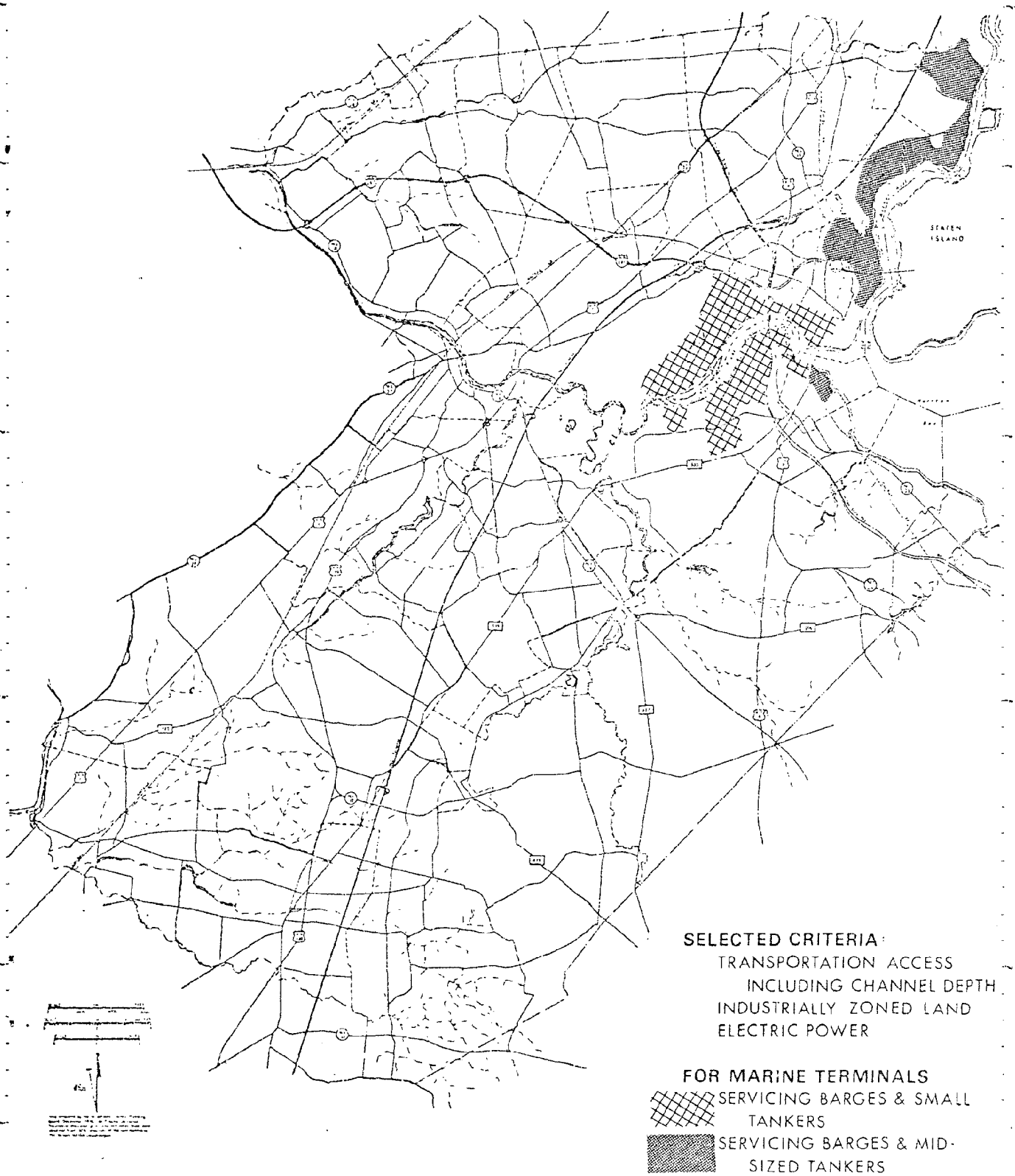
Pipeline landfalls is a phrase used to describe the location where submerged gas and oil pipelines come ashore. These facilities may include a pumping station and some storage tanks. Pipeline landfall facilities are usually located on flat industrially zoned land on or near the ocean, bay or other body of water. No specific channel depths are required and therefore pipeline landfall facilities for Baltimore Canyon pipelines may be located along or near the Raritan Bay or the Arthur Kill.

6. Marine Terminal

Marine terminals receive and store crude oil and refined petroleum products and transfer them to refineries and/or various markets. They usually have special navigational requirements such as turning area, navigational aids and sheltered harbors, depending on the size of the tankers and barges expected to arrive at the terminal. Other industrial siting criteria of marine terminals include: (1) proximity to refineries (if crude oil is received), (2) industrially zoned land, (3) a minimal amount water; and (4) some electrical power. The general areas along the Arthur Kill and the lower Raritan River also meet the industrial siting criteria for marine terminals. However, the areas inland of the Swing Railroad

[7] See the 1977 Energy Facilities Map (page 9) for an indication of existing oil pipelines and pipeline terminals.

FIGURE IV-4



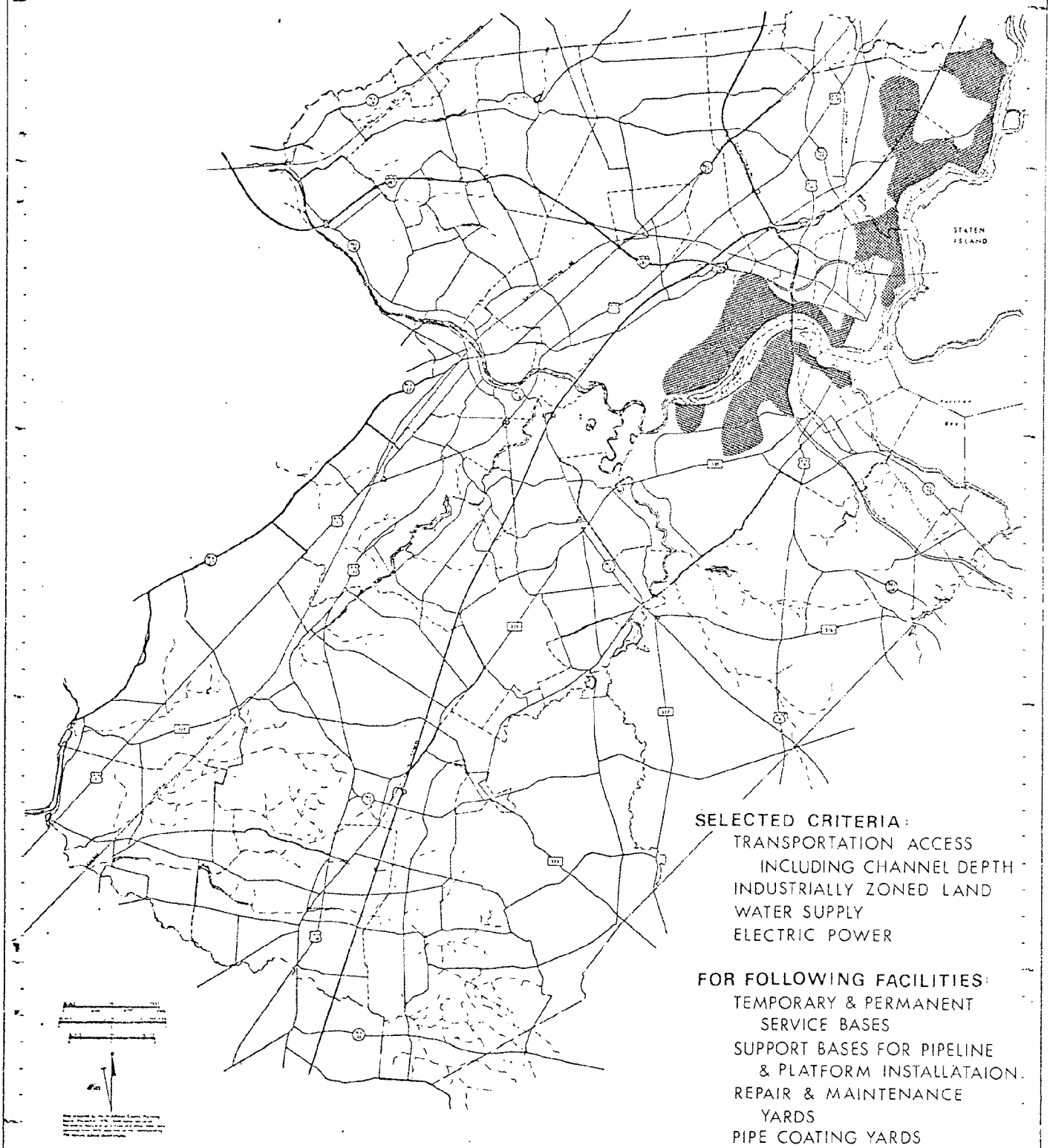
AREAS MEETING INDUSTRIAL SITING CRITERIA - MARINE TERMINALS

Bridge crossing the Raritan between South Amboy and Perth Amboy can only meet the siting criteria for marine terminals serviced by small tankers and barges. This is due to the limited horizontal clearance (132 feet) of the Swing Bridge. Figure IV-4 indicates these general areas meeting the industrial siting criteria.

7. Service and Support Bases, Repair and Maintenance Yards and Pipe Coating Yards

There are two types of service bases--temporary bases and permanent bases—and two types of support bases--steel platform installation support bases and pipeline installation support bases. Repair and maintenance yards and pipe coating yards have siting criteria and physical requirements that are very similar to service and support bases. All of these facilities require transportation access by roads, rail and sea. The channels to the sea must have depths of at least 15 to 20 feet. These bases are usually located within 200 miles of the offshore drilling tracts.

FIGURE IV-5



AREAS MEETING INDUSTRIAL SITING CRITERIA - SERVICE BASES & SUPPORT BASES

APPENDIX A

MIDDLESEX COUNTY OCS AND ENERGY FACILITIES PLANNING
PRELIMINARY TABLE OF CONTENTS FOR FINAL REPORT

I. Abstract

II. Introduction

- A. The Study of Offshore Oil and Coastal Energy Facilities
- B. The Audience
- C. Statement of Purpose
- D. Ojbectives

III. Existing Energy Facilities: Components in a Regional Pattern of Energy Supply

- A. The Current Pattern of Petroleum Supply
  - 1. The United States
  - 2. The North Atlantic Region
  - 3. Inventory of Facilities in Middlesex County
    - a. marine terminals (refined products and crude oil)
    - b. pipelines and pipeline terminals
    - c. refineries
    - d. petrochemical industry
- B. The Current Pattern of Natural Gas Supply
  - 1. Sources of supply
  - 2. Means of transport
  - 3. Demand
  - 4. Inventory of existing facilities
    - a) major interstate pipelines companies
    - b) public utilities
      - 1) distribution pipelines
      - 2) synthetic natural gas plants (SNG)
      - 3) liquified natural gas storage and transfer facilities (LNG)
- C. The Current Pattern of Electrical Energy
  - 1. generating stations
  - 2. transmission and distribution facilities
- D. Research-Nuclear Test Reactor Facility
- E. Summary Statement: An Overview of the Inventory of Energy Facilities in Middlesex County

IV. Outercontinental Shelf Oil and Gas Activities

A. Phases of OCS Oil and Gas Activity

B. Description, Impacts and Requirements of Onshore Facilities

1. Temporary Service Base
2. Permanent Service Bases
3. Steel Platform Installation Support Bases
4. Repair and Maintenance Yards
5. Transportation
6. Pipeline Installation Support Bases
7. Partial Processing Plants
8. Gas Processing Treatment Plants
9. Refineries
10. Platform Fabrication Yards
11. Pipe Coating Yards
12. Tank Farms

C. The Potential for OCS Related Facilities Locating in Middlesex County

1. High development projection
2. Medium development projection
3. Low development projection
4. Summary

V. The Demand for Energy and Energy Facilities

A. Projections of Future Energy Demands

B. The Potential for new Growth in Energy Facilities

1. Petroleum-related facilities

a. refineries, petrochemical industry, marine terminals, pipelines and pipeline terminals
b. deepwater port
c. offshore oil industries

2. Gas facilities

a. liquified natural gas
b. synthetic natural gas

3. Electrical energy facilities
4. Research facilities

VI. Development Opportunities for OCS and Energy Facilities

A. Identification of Industrial Siting Criteria

1. Transportation access

a. major highways (truck access)
b. railroads
c. sea

1) adequate channel depth
2) channel clearance

2. Land

a. size of tract
b. vacant or redevelopable
c. industrial zoning
d. environmental features

3. Wharf Space - existing, developable

4. Water Supply - brackish, potable

B. Define Sites or Areas Meeting Siting Criteria

VII. The Impacts from OCS and Energy Facilities

A. Economic Impacts

1. Direct effects

a. new employment
b. capital investment
c. tax revenues

2. Indirect effects

a. aggregate income effects
b. indirect employment

3. Induced effects - employment

B. Social Impacts

1. Water supply system
2. Sewerage
3. Transportation
4. Housing
5. Educational needs
6. Other public facilities and services

C. Environmental Impacts

1. Air emissions
2. Waste water effluent
3. Noise
4. Solid, toxic, and hazardous wastes
5. Environmentally sensitive areas

a. wetlands
b. floodplains
c. aquifer outcrop areas

VIII. Constraints on Development of OCS and Energy Facilities

A. Legal Constraints

1. Local land use regulations
2. State and Federal regulations

a. air quality
b. water quality
c. wetlands
d. riparian
e. floodplains
f. noise
g. land use

1) CAFRA
2) Coastal Zone Management Program

B. Political Constraints

1. Public opinion and values
2. Local government policy and preferences

C. Land Use Compatibility

Compatibility with existing uses (health, safety, welfare)

a. residential
b. commercial
c. industrial

IX. Suitability Assessment

A. Consider the compatibility of OCS and energy facility development with other coastal concerns

B. Assess the benefits and/or costs of OCS activity and energy facility development to county and municipalities, in terms of employment and tax revenues

C. Assess the constraints to OCS development in terms of the limitation of the land to absorb development; consider land, water and existing infra-structure

D. Evaluate the inventory and identify possible areas which might be suitable for pipeline corridors, corridor areas, OCS staging areas, storage yards, etc.

E. Develop or recommend matrices, indices, etc., that would help local government to assess effects of OCS development

X. Recommend OCS and Energy Facility Siting Policies

A. Use-Location Recommendations Based on Suitability Analysis

B. Design Recommendations

C. Priority Recommendations

XI. County Role in Coastal Energy Facility Siting

A. County/State Relationships

B. County/County Relationships

C. County/Municipal Relationships

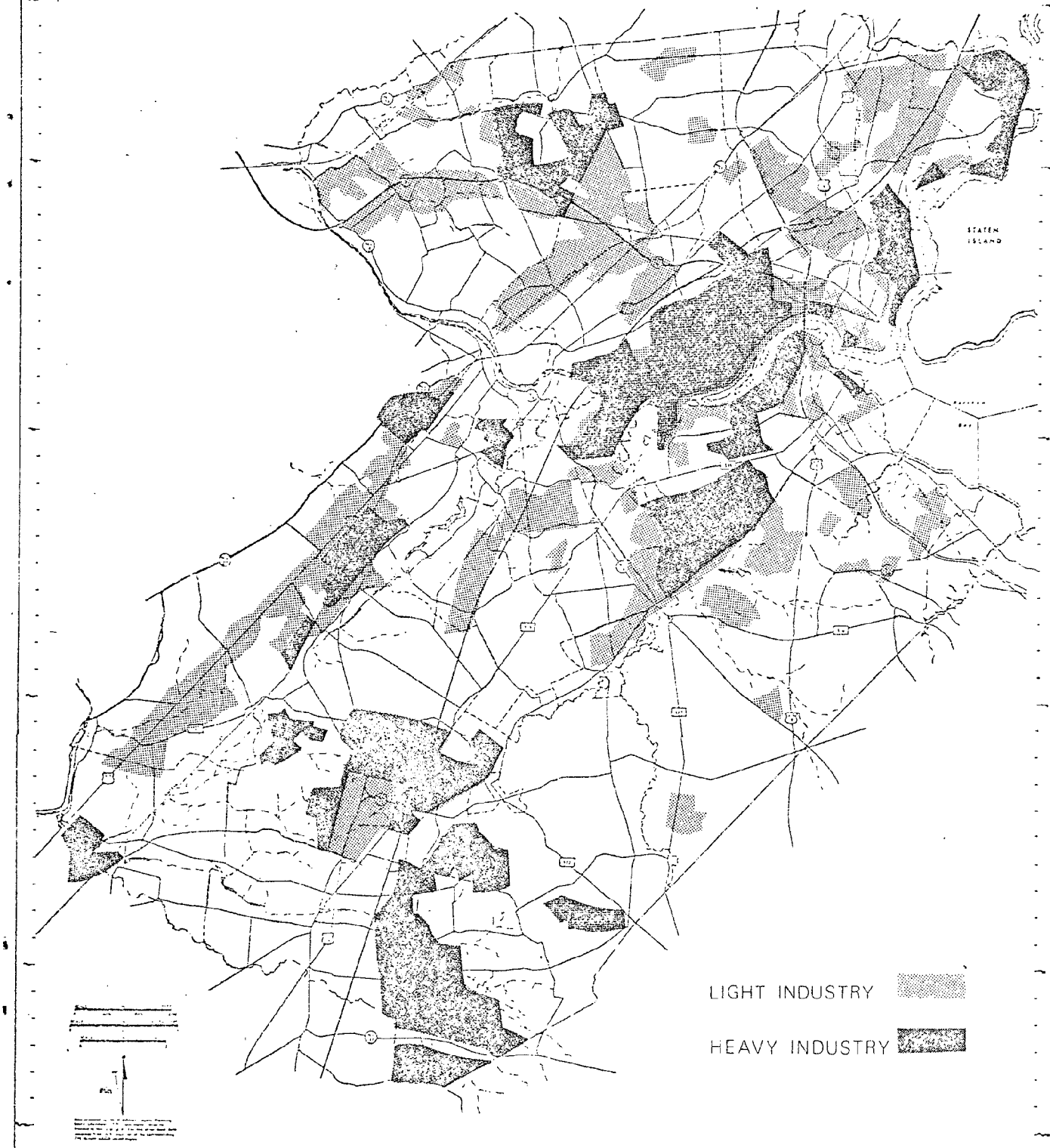
D. County/Public Relationships

XII. County View of State and National Interests in Coastal Energy Facility Siting

XIII. County View of State and Federal Assistance in Coastal Energy Facility Siting

XIV. Conclusion: Summary of Findings

APPENDIX - B



INDUSTRIAL ZONED LAND

BIBLOGRAPHY

Alaska. Department of Community and Regional Affairs. Marine Service Bases for Offshore Oil Development, by Alaska Consultants, Inc. June, 1976.

Arthur D. Little, Inc., Environmental Work Book of the Refined Petroleum Products Pipeline System Between Linden, New Jersey and Macungie, Pennsylvania. Report to Buckeye Pipe Line Company. Contract No. 75401. Cambridge, Mass. Arthur D. Little, Inc. 1973.

Arthur D. Little, Inc., Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development. Report to the Council on Environmental Quality. 4 vols. New York: Arthur D. Little, Inc. 1971.

Berkshire County Regional Planning Commission. Evaluation of Power Facilities: A Reviewer's Handbook. Pittsfield, Massachusetts: Berkshire County Regional Planning Commission. 1974.

Council on Environmental Quality. OCS Oil and Gas - An Environmental Assessment, vol. 4: Potential Onshore Effects of Oil and Gas Production on the Atlantic and Gulf of Alaska Outer Continental Shelf. Report to the President. Washington, D.C.: Government Printing Office. 1974.

Delaware River Basin Commission. Petroleum Pipelines in the Delaware River Basin. [Map Set]. Trenton, N.J.: D.R.B.C. 1973.

Delaware. State Planning Office. Middle Atlantic Governor's Coastal Resources Council. Identification and Analysis of Mid-Atlantic Onshore OCS Impacts. by Resource Planning Associates Inc. Cambridge, Massachusetts. 1976.

Environmental Research and Technology, Inc. Environmental Report on the Proposed Modernization of the Perth Amboy Refinery. 2 vols. Submitted by Chevron Oil Company. Lexington, Massachusetts. ERT. 1973.

Federal Energy Administration. National Energy Information Center. Monthly Energy Review. January 1975.

Mitchell, James K. "Onshore Impacts of Scottish Offshore Oil: Planning Implications for the Middle Atlantic States." AIP Journal. 42 (October 1976): 386-398.

Nardi, Robert J. "Analysis of Air Pollution Emissions - Major Manufacturing Industries." [Unpublished Memorandum]. Middlesex County Planning Board. Environmental Systems Section. March 18, 1976.

New England River Basins Commission. Onshore Facilities Related to Offshore Oil and Gas Development: Estimates for New England. Boston: NERBC. 1976.

New England River Basins Commission. Onshore Facilities Related to Offshore Oil and Gas Development: Factbook. Boston: NERBC. 1976.

New York Sea Grant Institute. Electricity Generation and Oil Refining. by H.G. Mike Jones, Harold Bronheim, and Philip E. Palmedo. Mesa New York Bight Atlas Monograph 25. Albany: State University of New York. 1975.

New York. State Department of Environmental Conservation. Support Bases for Offshore Drilling: The Port of New York Potential, by The Port Authority of New York and New Jersey. Albany. 1977.

Petroleum Extension Service. A Primer of Offshore Operations. Austin: University of Texas at Austin. 1976.

Tri-State Transportation Commission. "Pipelines and the Tri-State Region." Interim Technical Report (unpublished) 4073-3552. New York. 1967.

U.S. Army Corps of Engineers. Philadelphia District, North Atlantic Division. Interim Report, Atlantic Coast Deep Water Port Facilities Study: Eastport, Maine to Hampton Roads, Virginia. Philadelphia. 1973.

U.S. Congress. Office of Technology Assessment. Working Papers for Coastal Effects of Offshore Energy Systems: Oil and Gas Deepwater Ports, Floating Nuclear Powerplants. Washington, D.C.: Government Printing Office. 1976.

U.S. Congress. Office of Technology Assessment. Coastal Effects of Offshore Energy Systems: An Assessment of Oil and Gas Systems, Deepwater Ports, and Nuclear Powerplants Off the Coast of New Jersey and Delaware. 2 vols. Washington, D.C.: Government Printing Office. 1976.

U.S. Department of the Interior, and U.S. Environmental Protection Agency, Office of Research and Development. Onshore Impacts of Outer Continental Shelf Oil and Gas Development: Mid-Atlantic. 2 vols. edited by Devon M. Schneider, American Society of Planning Officials. Washington, D.C. 1977.

U.S. Department of the Interior. Bureau of Land Management. Draft Environmental Impact Statement: Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale, South Atlantic OCS Sale No. 43. 2 vols. Washington, D.C.: Government Printing Office. 1976.

U.S. Department of the Interior. Bureau of Land Management. Draft Environmental Statement: Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale, Offshore the North Atlantic States. [OCS Sale No. 43]. 4 vols. Washington, D.C.: Government Printing Office. 1976.

U.S. Department of the Interior. Bureau of Land Management. Final Environmental Statement: Proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale, Offshore the Mid-Atlantic States, OCS Sale No. 40. 4 vols. Washington, D.C.: Government Printing Office. 1975.

U.S. Department of the Interior. Bureau of Land Management. Geological Survey. Leasing and Management of Energy Resources on the Outer Continental Shelf. Washington, D.C.: Government Printing Office. 1976.

U.S. Department of the Interior. Bureau of Land Management. New York Outer Continental Shelf Office. Economic Study of the Possible Impacts of a Georges Bank Sale. Technical Paper Number 2. New York. 1976.

U.S. Department of the Interior. Bureau of Land Management. New York Outer Continental Shelf Office. Economic Study of the Possible Impacts of a Potential Baltimore Canyon Sale. Technical Paper Number 1. New York. 1975.

U.S. Department of the Interior. Bureau of Mines. Fuels and Energy Data: United States by States and Census Divisions 1973, by Lulie H. Crump, Division of Interfuel Studies. Bureau of Mines Information Circular 8722. Washington, D.C.: Government Printing Office. 1976.

U.S. Department of the Interior. Bureau of Mines. "Petroleum Refineries in the United States and Puerto Rico, January 1, 1975: Crude Oil Capacity." Mineral Industry Surveys. Washington, D.C.: Government Printing Office. 1975.

U.S. Department of the Interior. Bureau of Mines. "Petroleum Refineries in the United States and Puerto Rico, January 1, 1976: Crude Oil Capacity." Mineral Industry Surveys. Washington, D.C.: Government Printing Office. 1976.

U.S. Department of the Interior. Bureau of Mines. "Supply, Demand, and Stocks of all Oils by P.A.D. Districts and Imports to the United States, by Country: 1974 Final." Mineral Industry Surveys. Washington, D.C.: Government Printing Office. 1976.

U.S. Department of the Interior. Bureau of Mines. "Supply, Demand, and Stocks of all Oils by P.A.D. Districts and Imports to the United States, by Country: Year 1975." Mineral Industry Surveys. Washington, D.C.: Government Printing Office. 1976.

U.S. Department of the Interior. Bureau of Mines. "Supply, Demand, and Stocks of all Oils by P.A.D. Districts and Imports to the United States, by Country: Year 1976." Mineral Industry Surveys. Washington, D.C.: Government Printing Office. 1977.

U.S. Department of the Interior. Geological Survey. Geological Estimates of Undiscovered Recoverable Oil and Gas Resources in the United States. Geological Survey Circular 725. Washington, D.C.: Government Printing Office. 1975.

U.S. Department of the Interior. Geological Survey. Mineral Resource Management of the Outer Continental Shelf. Geological Survey Circular 720. Washington, D.C.: Government Printing Office. 1975.

U.S. District Court. Eastern District of New York. "County of Suffolk, et al., Plaintiffs, against Secretary of the Interior, et al., Defendants, National Ocean Industries Association, et al., Intervenor - Defendants; The National Resources Defense Council, Inc., Plaintiff, against Secretary of the Interior, Defendant." Final Memorandum and Order 75 C 208 and 76 C 1229. New York. 1976.

U.S. Federal Energy Administration. 1976 National Energy Outlook. Washington, D.C.: Government Printing Office. 1976.

U.S. Federal Energy Administration. 1977 National Energy Outlook. Washington, D.C.: Government Printing Office. 1977.

U.S. Federal Energy Administration. Office of Oil and Gas. Trends in Refinery Capacity and Utilization: An Interim Update for U.S. Portion Only, by E.L. Peer and F.V. Marsik. Washington, D.C.: Government Printing Office. 1975.

Woodward-Clyde Consultants. Mid-Atlantic Regional Study: An Assessment of the Onshore Effects of Offshore Oil and Gas Development. Clifton, N.J. 1975.

ADDITIONAL PIPELINE MAP CONTACTS

DATE DUE

Texa n
Hous
Transc on
Newar

GAYLORD No. 2333 PRINTED IN U.S.A.

COASTAL ZONE
INFORMATION CENTER

NOAA COASTAL SERVICES CENTER LIBRARY
3 6668 14107 9261