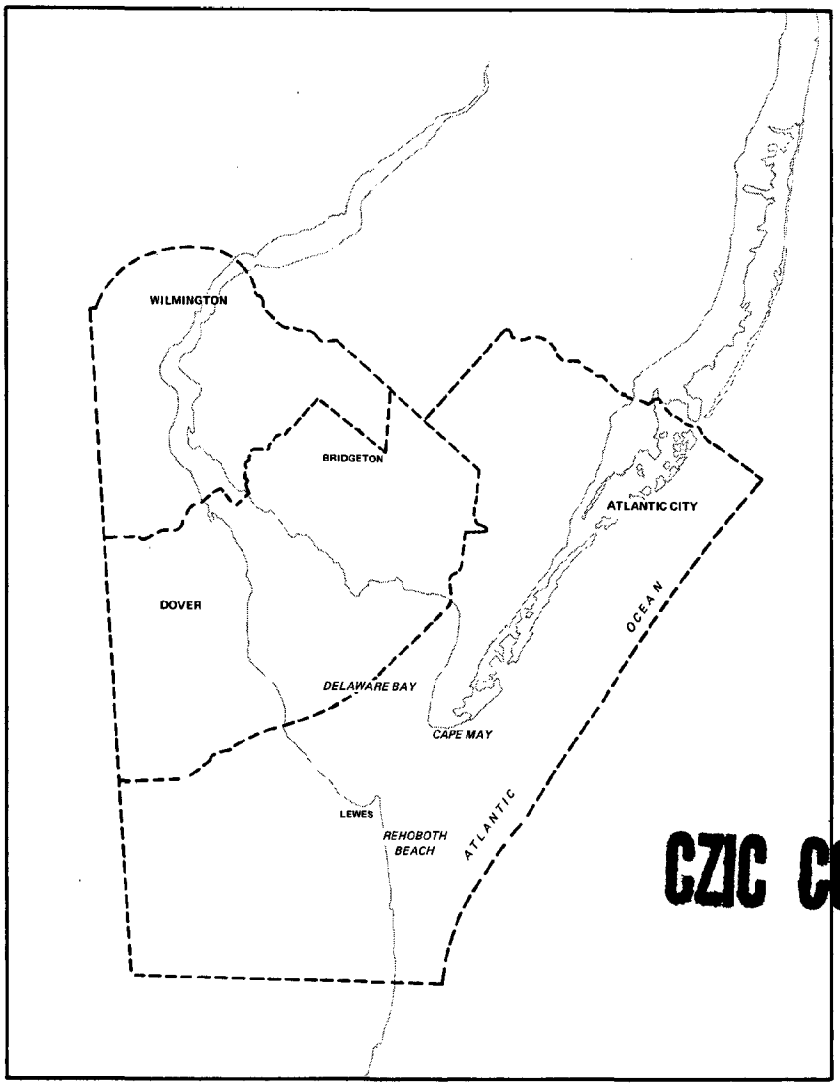
PRESENT USES, POTENTIAL DEVELOPMENTS, AND CROSSING REQUIREMENTS IN THE LOWER DELAWARE RIVER AND BAY AREA



A study prepared for
THE DELAWARE RIVER AND BAY AUTHORITY

by

URS Corporation and Arthur D. Little, Inc.

MARCH 1980

CZIC COLLECTION

HT
393
.C3
P74
1980

Coastal Zone Management Program

PRESENT USES, POTENTIAL DEVELOPMENTS, AND CROSSING REQUIREMENTS IN THE LOWER DELAWARE RIVER AND BAY AREA

A study prepared for

THE DELAWARE RIVER AND BAY AUTHORITY

by

URS Corporation and Arthur D. Little, Inc.

March 1980

Property of CSC Library

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

HT393 .C3 P74 1980
7061352

DEC 2 6 1996

THE DELAWARE RIVER AND BAY AUTHORITY

Governor of Delaware
PIERRE S. duPONT

Governor of New Jersey
BRENDAN T. BYRNE

AUTHORITY MEMBERS

DELAWARE	NEW JERSEY
GARRETT B. LYONS, D.D.S. Chairman	CLARENCE B. McCORMICK Vice Chairman
REMSEN C. BARNARD, III	JOSEPH J. FABI, JR.
ALFRED LEO DONNELLY	ANGELO J. FALCIANI
ERNEST E. KILLEN	JOHN VINCI

WILLIAM J. MILLER, JR.
Director

THEODORE C. BRIGHT
General Manager

O. FRANCIS BIONDI
Legal Counsel - Delaware

CHARLES HENRY JAMES
Legal Counsel - New Jersey

JOSEPH J. RILEY, D.O.
Secretary

March 1980

URS CORPORATION
150 EAST 42ND STREET NEW YORK, NEW YORK 10017
TEL: (212) 953-8600 TELEX: 12-5312 URS-NYK

Arthur D. Little, Inc.
ACORN PARK · CAMBRIDGE, MA. 02140
(617) 864-5770 TELEX: 921436

April 1, 1980

Mr. William J. Miller, Jr.
Director
The Delaware River and Bay Authority
P. O. Box 71
New Castle, Delaware

Re: Present Uses, Potential Developments and Crossing Requirements -- The Lower Delaware River and Bay Area

Dear Mr. Miller:

In accordance with our agreement, we are pleased to transmit our report addressing and fulfilling the basic study objectives to:

- Analyze regional transportation systems and their present and future adequacy;
- Study the need for additional crossings;
- Examine regulatory responsibilities, resources and roles of various governmental agencies in the River and Bay region; and
- Investigate the types of development concepts and potentials which could be appropriate for the Lower River and Bay Area.

The findings of our study are that while additional fixed crossing facilities cannot be justified at this time, there are other needs and conditions which should be addressed. Many of them have the support of officials in both States; however, they require specific actions to enable them to be developed or advanced. Since the Authority represents an institutional resource of considerable potential in the Bay Area, its use for such purposes should be examined.

The Authority has a unique position as: (1) the only Bi-State New Jersey-Delaware institution; and (2) the only institution with legally defined and established responsibilities focused on the Lower River and Bay as a unit. In addition, it has substantial institutional authority under its Bi-State Compact; there are extensive checks and balances to assure that the Authority continues to act in the best interests of the two States as interpreted by the Governors and the Legislatures of each; and the Authority has financial and staff capabilities and potentials which can be readily used to address identified needs of the Region.

The following functions should be undertaken by the Authority to initiate such activity:

- The establishment of a division within the Authority to be responsible for the Bi-State monitoring of environmental and development activities and potentials within the Bay and its shoreline areas;

- The coordination of Bi-State conservation and development for the Bay Area, consistent with Delaware and New Jersey policies and regulations; and

- After preliminary State approvals, the preparation of development plans for Bay-oriented projects when such development would not otherwise occur.

The benefits of Authority involvement in these areas would be the achievement of consistent Bi-State conservation and development in accordance with State policies and the development of clearly needed marine-related projects without the use of State resources. At the present time State agencies generally have other priorities as well as limited resources and, most importantly, they do not have the basic responsibility to identify and accomplish development and make preliminary investments for needed projects which can significantly enhance the well-being of the people of the Bi-State area.

* * * * * *

We wish to take this opportunity to acknowledge the considerable assistance and cooperation of many government agencies, public officials and private individuals who contributed greatly to the execution of this study. Officials of the State of Delaware Office of Management, Budget and Planning and the Governor's Office in New Jersey were of special assistance, as were the staff of the Delaware River and Bay Authority.

Very truly yours,

Raymond Tillman
URS CORPORATION

John M. Wilkinson
ARTHUR D. LITTLE, INC.

EXECUTIVE SUMMARY

INTRODUCTION

Background

The lowermost reaches of the Delaware River and the Delaware Bay have been and remain today of great economic and environmental significance to the two States joined by these waters. Both New Jersey and Delaware benefit greatly from the river and bay as a ship channel, safe harbor, seaport region, recreational area and environmental resource. In earlier times these waters were rich as well in the diversity and productivity of their fish, shellfish, and wildlife species and habitat, and perhaps they may become so again.

Over the years, the inhabitants of both New Jersey and Delaware have separately established laws, policies, institutions, and regulations which at one and the same time seek development and conservation of the natural resources surrounding the lower river and bay. Sometimes in concert with federal and local agencies, each State has managed its roughly one-half of the river and bay for these often conflicting objectives. Still, with one exception, the two States do not have a mechanism to plan for, develop, conserve, and manage this great natural water resource as a unit.

The exception is the Delaware River and Bay Authority. Created by an interstate Compact approved by the United States Congress in 1962, this agency of the two State governments of New Jersey and Delaware was organized for the purposes of (i) developing and operating crossings over the Delaware River and Bay at any location south of the boundary line between the State of Delaware and the Commonwealth of Pennsylvania, (ii) developing and operating "... any transportation or terminal facilities which border on or are adjacent to the River and Bay" south of this boundary line, and (iii) the performance of such other functions as might be entrusted to it by concurrent legislation of the two States.

Objectives

Following recommendations of the University of Delaware, College of Marine Studies, and Rutgers University, Water Resources Research Institute, the Authority funded this Study to analyze transportation developments in the lower river and bay region, to consider possible additional crossing requirements, and to identify and describe other marine-related development potentials and needs, all within the framework of the existing multiplicity of governing bodies each partially but not solely concerned with the lower river and bay, and with special emphasis on the institutional and regulatory problems posed by this situation.

Scope of Study

The scope of study has been broad and comprehensive -- an evaluation of the region's historical economic setting or "base" for development and its future trends, development potentials and environmental concerns arising from this base, the institutional setting that exists to deal with these development potentials, and the institutional and policy constraints that may impede needed actions and developments in the future of the bay region. Finally, with these conditions and assessments presented, the Study considers required functions with respect to interstate coordination, environmental planning and development activities in the Bay area.

Summary of Major Findings

The Study concludes that the Delaware Memorial Bridge and the Cape May-Lewes Ferry crossings are adequate to satisfy trans-bay crossing requirements for the remainder of this century.

The Study concludes that the ports of Wilmington, Philadelphia and Camden, with implemented expansion plans, will be able to handle forecasted tonnage through 1990. The Study concludes that the current lightering operation in the Lower Bay vis-a-vis more formal offshore port development requires continuing examination.

The Study concludes that the considerable overlap of regulatory functions among institutions in the region is largely a function of the federal division between State and national responsibilities or between State governments. Both federal and State agencies seek to improve water quality, preserve wetlands, protect fish and wildlife, and regulate land uses. Moreover, four different port agencies are chartered to function in the region. These several functional overlaps will persist, with attendant uncertainty as to future development in the bay area.

The Study identifies the following development potentials:

- additional marinas
- boating and fishing facilities at Cape May or Lewes
- monitoring of Baltimore Canyon possibilities
- monitoring of dredge disposal activities and beach restoration needs
- coordination of Bi-State planning

The basis for these major findings is set forth in summary in the following pages and developed in detail in the main report to the Authority.

THE SETTING FOR REGIONAL GROWTH AND DEVELOPMENT

The Economic Setting

The Delaware River and Bay Authority (DRBA) region is defined in this study to include the entire State of Delaware (New Castle, Kent, and Sussex Counties) and the four counties of southern New Jersey (Cape May, Atlantic, Cumberland, and Salem). This region had a 1977 population of slightly over 1,000,000 and encompassed about 3,620 square miles of land area, largely in flat coastal plains. It includes significant amounts of prime agricultural lands, woodlands and environmentally sensitive wetlands, as well as major recreational resources, such as beaches, and the urbanized areas of Wilmington, Newark, Dover, Milford, Lewes, Cape May, Salem, Bridgeton, Millville, Vineland and Atlantic City.

The economic setting for growth and development in this region is largely established by:

- trends in the larger Middle Atlantic Region;
- the shifting economic base and environmental influences in each of three subregions;
- the resources of the Delaware River and Bay and their uses;
- the regional transportation system.

The region is closely linked to the larger six-state Middle Atlantic region -- a region whose population grew between 1.0% and 1.5% per year during the 1950's and 1960's but remained largely stable in the 1970's. Trends in this larger region clearly have implications for the DRBA region, both for its economic development and for its regional transportation facilities. This Middle Atlantic region supplies most of the visitors who support the strong and growing tourist economy of the coastal areas, and it provides a significant share of the market demand for many of the agricultural and fishery products of the coastal and central areas of DRBA region.

In addition, the future of the DRBA region's important petrochemical industry is strongly linked to the future of that industry throughout the entire Middle Atlantic region, which is now being strongly challenged by rapidly growing areas in Texas and Louisiana. The Middle Atlantic region is a major source of cross-bay transportation demand both on the Delaware Memorial Bridge (where less than 10% of the traffic is estimated to be local commuters) and on the Cape May-Lewes Ferry (largely long-distance recreational traffic) as well as marine transportation demand within the Bay, since 80% of the traffic and lightering activity is related to crude petroleum, most of which is for refineries located outside the DRBA region.

The DRBA region consists of three functional subregions -- a relatively narrow, urbanized and industrialized corridor to the northwest including Wilmington, Newark and Pennsville, a relatively narrow coastal recreation corridor to the southeast including Atlantic City, Cape May, Lewes and Rehoboth Beach, and a largely agricultural midsection including the cities of Milford, Dover, Bridgeton, Vineland and Millville. Each of these three subregions has a different economic base and a significantly different set of environmental resources and conditions. Consequently, each has been characterized by a significantly different development history and each has a different potential future in the context of emerging regional trends.

The industrialized and urbanized subregion of New Castle and Salem Counties has better access to the rest of the Middle Atlantic region and to the Delaware River and Bay than do the other two subregions. The area is linked across the Delaware River and Bay by the twin spans of the Delaware Memorial Bridge and has historically been less isolated than other regions. Environmental concerns and resistance to growth and industrial development have not been pronounced.

Consequently, this urban area was the most rapidly growing of the three subregions in the 1950's and 1960's, with a booming population growth of over 3% per year. It grew at more than twice the rate of the larger Middle Atlantic region, as the petrochemical industry expanded and as it and other less developed segments of the urbanized Northeast Corridor began to fill in. However, since 1970, there has been a distinct slowing of population growth in this subregion to about 0.4% per year, trailing significantly behind that of the other two subregions since that time. State projections of future population growth of about 1% per year in this subregion through 1995 anticipate that growth will again pick up but will continue to trail that of the other two subregions.

Given recent trends, even these projections may be on the high side unless the competitive position of the entire Middle Atlantic region and particularly the petrochemical industry can be improved. The prospects for this subregion are therefore likely to be stability or modest growth with continuing local efforts to stimulate economic and industrial development in the City of Wilmington, at the Port of Wilmington, and in those areas along the Delaware River which are designated by both States as being suitable for additional industrial development.

The coastal recreation subregion including Sussex, Cape May and Atlantic Counties has had good access to major population centers of the Middle Atlantic region (New York, Philadelphia and Baltimore) and is now linked across the Delaware Bay by the Cape May-Lewes Ferry service, initiated in 1964. It has extensive recreational resources with good boat access to the ocean and bay and with extensive public access to the shoreline. It has historically been a highly seasonal area with summer weekend populations totalling three times the year-around populations. With increasing retirement migration, increasing leisure time, and the new Atlantic City casino development, this subregion has now become the

fastest growing part of the DRBA region -- despite existing environmental factors such as wetlands, limited water supply and current gasoline and/or related energy considerations.

From a relatively modest rate of population growth of 1.5% per year during the 1950's and 1960's, its rate of growth has increased to close to 2% per year since 1970 and is projected to exceed 3% per year through 1995. This projected growth anticipates that about 55% of the total population growth anticipated in the DRBA region through 1995 (about 200,000 people) will occur in this coastal area -- an area which now has only about one-third of the region's total population. This growth could be even more rapid if Atlantic City development is accelerated. Twelve casinos are projected to add a permanent population of 200,000 in the Atlantic City area alone. If the Baltimore Canyon becomes a major oil or gas field, or if the commercial fishing industry more fully exploits the 200-mile limit out of Lewes or Cape May, growth would further accelerate. Despite severe environmental conditions, the prospects for this subregion are likely to be rapid economic and population growth, with continuing local efforts to manage or control growth and restrict development that might degrade sensitive wetland or shoreline environments.

The agricultural and less urbanized midsection, including Cumberland and Kent Counties, has limited access to the rest of the Middle Atlantic region and has no cross-bay link within the subregion. The area has historically been relatively isolated from the rest of the Middle Atlantic region. Its development has been largely a function of agricultural or fishery resources (poultry in Delaware, truck farming in New Jersey, oyster farming in the Bay) and special developments associated with the glass industry in Millville and Bridgeton, New Jersey, and the government and military in Dover, Delaware. Excluding Dover Air Force Base, this subregion has grown steadily at 1.5% to 2.0% per year since 1950 and is projected to continue to do so through 1995.

Although the oyster industry was hit hard by the blight during the 1950's, and although the agricultural sector has been adversely affected by competition, both industries appear to be making a comeback with increased outputs in recent years. Combined with the strong glass manufacturing industry and the strong government sector in Dover, prospects for this subregion are for moderate growth with no particular surprises or shifts. Significant development within the wide bands of wetlands, bordering both sides of the Bay, will depend greatly on satisfying environmental concerns.

In addition to considering the setting for regional growth and development in the DRBA region as affected by the larger Middle Atlantic region and the three smaller subregions, it is important to consider the lower Delaware River and Bay itself. This encompasses about 625 square miles between the Pennsylvania State line and Cape May/Cape Henlopen or about one-sixth the land area of the region. This area consists largely of shallow waters and tidal mudflats and wetlands which represent valuable and environmentally sensitive habitats. It is an area which formerly

provided an important recreational and fishing resource and which now accommodates an important marine transportation system including the Port of Wilmington, the lightering area off Big Stone Beach and the narrow ship channel. It is a resource which is gradually being cleaned up after years of industrial, agricultural and urban pollution. It is also a resource which has been subject to competing demands in the past (e.g. oil ports, pipelines, nuclear power plants, recreation, fishing and marine farming) and which may have substantial potential in the future.

Lightering activity in the Lower Bay doubled between 1972 and 1977 and prompted the Coast Guard to request an expansion of the lightering area in 1979. The 1977 lightering activity of 341,000 barrels per calender day virtually makes the area a de facto off-shore port, and construction of additional refinery capacity along the Delaware River could further increase pressure to expand the lightering area or develop an oil port.

Oyster planting in the Bay reached a record level in 1978, and considerable research is now being conducted by both Rutgers University and the University of Delaware on expanded aquaculture possibilities in the Bay. Recreational fishing has also improved dramatically in the Bay, with the best fishing in recent years now being the vicinity of Brandywine Light. These and other factors point to good, but as yet unclear, prospects for expanded use of the Bay.

A final important factor in establishing the setting for regional growth and development is the regional land and marine transportation system. Prior to 1950, there were no interstate highways, neither the New Jersey nor the Delaware Turnpike had been completed, and there were no major East-West Expressways. The only bay or river crossing in the DRBA region was the New Castle/Pennsville Ferry, and the only crossings of the Chesapeake Bay were by ferry. During the 1950's and 1960's there were major improvements in roadways and crossings which significantly altered accessibility patterns and led to the rapid integration of the DRBA region into the larger Middle Atlantic region. There is not much likelihood of additional significant changes to the regional land transportation system and accessibility pattern, and the prospect is therefore for continued improvements to the existing system and continuing reinforcement for the development pattern of the 1950's and 1960's.

There has not been as significant a change in the regional marine transportation system as in land transportation facilities, but marine transportation continues to shift significantly nonetheless. Crude oil which previously moved in shallow draft tankers began to shift to deep draft tankers in the late 1960's and 1970's, requiring lightering to move the cargoes up the Delaware River. Increased containerization of general cargo in the 1970's also began to affect the adequacy of port facilities and the competitive advantage of different ports, stimulating a major capital investment program in the Port of Wilmington. Finally, increased recreational boat registrations, which reportedly increased by 10% to 15% per year in the 1960's, have put considerable strains on marina and recreational boating facilities already limited by dredging and wetland restrictions.

The Institutional Setting

This study also examines a host of formally constituted institutions and institutional functions and responsibilities.

The Delaware River and Bay Authority was created by Compact between the States of New Jersey and Delaware and approved by Act of Congress in 1962. It assumed operation of the Delaware Memorial Bridge in 1962 and a second span was added to the Delaware Memorial Bridge in 1968. The Authority also initiated operation of a ferry service between Cape May and Lewes. Since completion of the second bridge span, the Authority has not undertaken any new construction projects or services.

The interstate Compact creating the Authority authorizes it to do the following:

> "(a) The planning, financing, development, construction, purchase, lease, maintenance, improvement and operation of crossings between the States of Delaware and New Jersey across the Delaware River and Bay at any location south of the boundary line between the State of Delaware and the Commonwealth of Pennsylvania as extended across the Delaware River to the New Jersey shore of said river, together with such approaches or connections thereto as in the judgment of the AUTHORITY are required to make adequate and efficient connections between such crossings and any public highway or other routes in the State of Delaware or in the State of New Jersey; and
>
> (b) the planning, financing, development, construction, purchase, lease, maintenance, improvement and operation of any transportation or terminal facility within those areas of both States which border on or are adjacent to the Delaware River or Bay south of the aforesaid line and which in the judgment of the States is required for the sound economic development of the area; and
>
> (c) the performance of such other functions as may be hereafter entrusted to the AUTHORITY by concurrent legislation expressly in implementation thereof."

Three other public transportation and developmental agencies are chartered to undertake tasks which at least partially overlap the responsibilities of the Delaware River and Bay Authority. They are the Delaware River Port Authority, the South Jersey Port Corporation, and the Port of Wilmington. In addition, the Delaware Transportation Authority has certain responsibilities for financing and operating transportation facilities within the State of Delaware.

The Delaware River Port Authority is an agency created by an interstate compact between Pennsylvania and New Jersey. It is authorized to construct and operate bridges, tunnels, and mass transportation links between Pennsylvania and New Jersey. Construction and operation of port facilities and study and promotion of the Delaware River ports are also part

of its charter. It now owns and operates four bridges across the Delaware River, three at Philadelphia and the Commodore Barry Bridge at Chester. It also operates the Lindenwold high-speed rail line between southern New Jersey and downtown Philadelphia. Its World Trade Division actively promotes the use of all Delaware Valley ports, and while it does not own or operate any port facilities of its own, its charter permits it to operate ports in two counties of Pennsylvania and all seven counties in the southern half of New Jersey.

The South Jersey Port Corporation was created in 1968 by the New Jersey Legislature to take over existing public port facilities in Camden. The Corporation is chartered to provide port facilities in seven counties of southern New Jersey, including all of the shoreline of the Delaware River and Bay below the head of navigation. At the present time, the Corporation operates two marine terminals in the Port of Camden, but has no plans to open port facilities at other sites.

The Port of Wilmington is a municipal facility operated by the Department of Commerce of the City of Wilmington. The port is planning new container handling facilities, and has proposed expansion onto the Delaware Riverfront from its present site on the Christina River.

While each of these three agencies is chartered to operate port or terminal facilities in a part of the Delaware River and Bay Authority's jurisdiction, only the Port of Wilmington is actually doing so at this time. The most extensive publicly-owned port facilities in the Delaware Valley are controlled by the Philadelphia Port Corporation, which took over and expanded port facilities formerly owned by the City of Philadelphia. All of these facilities are located in Philadelphia County.

Other institutions involved in the Delaware River and Bay are primarily of a regulatory nature. The government agencies which will have the greatest effect on the future of the Delaware River and Bay are those which regulate water quality -- directly or through control of alterations in wetlands or bottom lands -- and those which regulate shoreline land use. Also important are federal agencies which exercise controls on navigation, offshore port development, and the production and transportation of energy. Local land use, zoning, and building agencies govern most projects along the shore, but these controls are similar to those encountered in any development.

State and federal policies are generally designed to improve water quality and protect the bay's important tidal wetlands. Both States encourage consolidation of new industrial development in the northern subregion. New development is preferred around Wilmington and in developed areas north of Pennsville, where local infrastructure already exists. Some development is also encouraged in smaller cities to the south. Development in the wetlands along both sides of the Bay is controlled through coastal facility siting laws and wetlands preservation statutes in each State. The Delaware Coastal Zone Act prohibits new heavy industry and bulk terminal facilities within the coastal zone, except for docking

facilities in the Port of Wilmington.* The Coastal Area Facilities Review Act (CAFRA) in New Jersey, which applies to the entire Bay shore south of Pennsville, regulates a wider range of coastal development, including large housing and recreation projects, although no project is barred absolutely by the terms of the statute.

In New Jersey, the major permit programs governing coastal development -- coastal siting, wetlands preservation, underwater lands -- are administered by the Division of Coastal Resources, Department of Environmental Protection. In Delaware, the Department of Natural Resources and Environmental Conservation administers the wetlands, underwater lands and beach erosion programs, while the Office of Management, Budget and Planning administers the Delaware Coastal Zone Act.

The permit program of the U.S. Army, Corps of Engineers, under the Rivers and Harbors Act and the Federal Water Pollution Control Act covers the broadest range of potential developments along the Delaware River and Bay. Essentially all alterations of wetlands, all dredging, and underwater dumping of dredge spoil or fill require a Corps permit, awarded only after consideration of comments on the environmental effects by the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the U.S. Environmental Protection Agency. Certification of consistency with State water quality law is also required for projects receiving a permit under the Federal Water Pollution Control Act.

Any project which will discharge pollutants into the Delaware River or Bay requires a State Water Pollution Discharge permit and a National Pollution Discharge Elimination System (NPDES) permit. An NPDES permit is issued by the Delaware State government under a delegation agreement with the U.S. Environmental Protection Agency. New Jersey is preparing for delegation, but NPDES permits for sources in New Jersey are still issued by the U.S. Environmental Protection Agency. Most major discharges are also subject to review by the Delaware River Basin Commission.

While a port within the Bay or State territorial waters will require basic permits issued by the Corps of Engineers, the U.S. Coast Guard administers the issuance of permits for offshore oil ports under the Deepwater Ports Act. Coast Guard officials also issue permits for the construction of bridges across navigable waterways and promulgate navigation regulations which control ship traffic in the Bay, including the designation of specific lighterage areas for the transfer of oil from large tankers to smaller vessels.

DEVELOPMENT POTENTIALS AND CONSTRAINTS

Within this setting for regional growth and development the study investigated development potentials and constraints of possible significance and performed detailed assessments of these factors in four general areas of special pertinence to the study effort. These areas are:

*A special permit may allow manufacturing uses.

- river and bay crossings;
- conventional and offshore ports;
- commercial fisheries and aquaculture;
- recreational boating and shoreline development.

In terms of expanded or additional crossings, the study examined two potential locations -- one to replace the Cape May-Lewes Ferry, the other half-way between the Ferry and the Delaware Memorial Bridge. For both of these locations the study concludes that existing crossings would be adequate to carry additional traffic projected through the year 2000 and that major desire lines of travel would be adequately met by existing crossings, though less significant desire lines (e.g., Dover-Atlantic City) would be better served by an additional or improved crossing. The study also concludes that toll revenue bond financing for such a crossing would not be feasible in the foreseeable future, and that traffic volumes would not be sufficient to justify such a major capital investment (estimated at $1.0 to $1.3 billion in 1990) for a crossing to replace the ferry. The study proposes a method for evaluating the economic development benefits that might derive from the construction of a new crossing. However, on this point as well, the study finds that overall transportation cost savings and net economic benefits are not likely to be significant for either crossing location, given the similar nature of the local economies that would be joined by the crossing, the limited amount of travel which could be generated, and the orientation of major urban areas to existing routes and crossings.

While the study finds no justification for construction of a new fixed crossing during the next 20 years, it does conclude that:

1. continuing increase in ferry service capacity will be required into the 1990's; this need could be met by additional, larger and/or faster vessels and extended hours of operation;

2. by about the year 2000 there probably will be significant changes in travel patterns, motor vehicle usage, and ferry characteristics which will require the re-examination of the feasibility of both expanded ferry service and a fixed crossing.

In terms of conventional and offshore ports, the study concludes that the general cargo ports on the Delaware River at Philadelphia, Camden, and Wilmington have all developed expansion plans which, if implemented, should enable this "complex" of ports to handle forecast tonnages through 1990. At the Port of Wilmington, in particular, the proposed new multi-purpose crane and other recommended expansion measures should be sufficient to serve anticipated levels of commerce to 1990.

The study does conclude, however, that the continued adequacy and desirability of the lightering operation vis-a-vis a more formal offshore port requires continued examination. The current lightering operation may be adequate and more cost-effective than an offshore port, but additional oil imports in deeper draft tankers could strain the capacity of this lightering operation. Additional imports would at the same time enhance the financial feasibility of the various types of offshore oil ports previously proposed. Such additional imports are not likely, however, unless the region's refining capacity is significantly increased. Additional imports are questionable in light of strong federal policy to prevent any increase in foreign oil imports. Should there be moderate additional deep-draft tanker imports, these may still not be sufficient to warrant the very high costs of a deepwater port off the Atlantic Coast. For the more financially feasible deepwater port options within the bay to become viable, current political and environmental opposition would have to be offset by convincing proof that a fixed deepwater port within the Bay would pose a smaller ecological threat than the current lightering operation.

Given the lack of additional development potentials identified for cargo ports, and given the high degree of uncertainty surrounding the prospects of an offshore oil port, the study concludes that there should be:

1. continued monitoring of lightering volumes, oil imports and Delaware Basin refinery capacity;

2. additional and more specific financial feasibility and risk assessment studies of Delaware Bay and Atlantic Ocean oil port options and expanded lightering should be performed, should the demand for lightering activities grow significantly or otherwise exceed perceived safe levels.

As for constraints, any new bulk product unloading facility on the Delaware side of the Bay is currently illegal under the Delaware Coastal Zone Act, except in the Port of Wilmington. While such a terminal is not illegal under New Jersey law, State officials have expressed reservations about locating such a terminal within the Bay because of the damage which could be done to wetlands, shellfish beds, spawning areas and beaches by a major oil spill within the Bay. An oil transfer port located well offshore beyond the Delaware Capes would appear preferable under current State laws and environmental policies.

Modification and expansion of existing port facilities is generally accepable under current State land use and coastal management plans. Any such project would require a Corps of Engineers permit, as well as a State permit for the use of any underwater lands. A State wetlands permit would also be required if tidal marshland is to be filled and altered. Federal environmental officials working with the Corps of Engineers seek to minimize any disruption of wetlands and to avoid filling shallow water areas wherever possible. They prefer docks and terminal structures located on floats or pilings and sometimes seek compensating restoration of degraded wetlands when filling activities are permitted. Any permit applicant who requires additional dredging to serve an expanded port must provide space for dredge spoil disposal.

In terms of commercial fishing and aquaculture, the study concludes that both of these activities have considerable promise but as yet unproven development potential. The newly instituted 200-mile limit now gives preferential access to American fishermen for the fishery resource within this limit, 44% of which was harvested by foreign fishermen in 1974. In addition, worldwide consumption of fish increased by over 50% between 1963 and 1975, and U.S. per capita consumption of fish has increased at an annual average rate of 3.9% since 1967. This potentially increased supply combined with the rapidly growing demand may be particularly significant for the DRBA region, specifically at Cape May or Lewes. These two harbors already have the best conditions for accommodating fishing vessels south of New York City and north of Norfolk, Virginia.

They have also historically been the center of the Middle Atlantic fishing industry. Although fish catches have declined to about 20% of their 1956 levels almost exclusively due to reduced catches of menhaden, most fishermen and industry representatives interviewed by the Delmarva Advisory Council in 1978 were "positive" that there were sufficient fish and shellfish resources off the mid-Atlantic coast to warrant increasing the size or number of their vessels. The species identified as having the greatest potential for expanded Middle Atlantic catches by the domestic fishing fleet were squid, mackerel, hake, and herring, now 90% harvested by foreign fleets. Realizing this potential is dependent upon successful entry into the export market.

Commercial aquaculture is viewed by the study as an activity with considerable promise. Oyster farming in the Delaware Bay was nearly eliminated by disease in the early 1950's. It has now begun to expand once more, and aquaculture throughout the country has grown to encompass such commercially viable enterprises as farming of trout, salmon, crab, lobster, catfish, shrimp, abalone, kelp and seaweed. However, domestic aquaculture still represents only 3% of the domestic fishery harvest, compared to a 10% share of the fishery harvest worldwide. With the gradual cleaning up of the Bay and with the establishment and expansion of important University of Delaware marine research and development facilities at Lewes and at BiValve and Cape May by Rutgers University, additional development potentials for aquaculture are likely to be identified in the future.

Given the strong development possibilities but limited current activity in commercial fishing and aquaculture, the development potentials identified are:

1. expansion of export capability including storage, processing and distribution for the commercial fishing industry operating out of Cape May or Lewes;

2. improved facilities at Lewes or Cape May, particularly should fish catches expand significantly;

3. more detailed feasibility studies for facilities development for specific potentials identified in Breakwater Harbor or Cape May Inlet;

4. monitoring of aquaculture research efforts and their implications for specific expanded development potentials in the Delaware Bay.

Enhancement of fisheries resources in bay and adjoining waters of the coastal shelf is entirely consistent with State and federal efforts to preserve the wetlands and waters of the Bay so important in creating these resources. The 200-mile limit created by the Fisheries Conservation Management Act offers new opportunities for American fishermen in harvesting fish formerly taken by foreign nations. Because the most popular fish in the American market are often overfished by American fishermen, major expansion must be based on the marketing of currently unpopular species or the sale of such species in foreign markets.

While State and federal governments are anxious to expand the fishing industry, there is no single program for providing the necessary facilities for expansion. The federal government provides technical and financial assistance to fishermen, and States can use economic development funds to encourage some aspects of the fishing industry.

An expanded fishing industry is generally consistent with land use and coastal zone plans. Any fish processing plant that returns wastes to the Bay would require State and federal permits. Depending on the site, federal and State permits may be required for dredging or filling, alteration of wetlands, or creation of new piers and bulkheads. In New Jersey, a fishing processing plant or new terminal would probably require a CAFRA permit.

With continued improvement in water quality, large scale aquaculture operations for several species might be located in the extensive shallows on either side of the Bay. At the moment, no agency in either State has a program to bring aquaculture projects to commercial viability, although the universities are developing extensive new knowledge. Aquaculture operators will find relatively few permitting problems, although they will need to lease or otherwise obtain approval for use of the bottom lands owned by each State and they could require a permit under the Federal Water Pollution Control Act.

In terms of recreational boating and shoreline development, the study identifies a wide variety of development potentials, most of which are in the immediate vicinity of Cape May and Lewes or upriver from Pennsville, New Jersey or Delaware City, Delaware. Development potentials along the remainder and largest share of the Delaware Bay shoreline are found to be severely constrained and virtually precluded by environmental constraints.

Recreational boating in particular represents an increasingly significant development potential on the bayshore in the vicinity of Cape May and Lewes. This is because demands are continuing to increase, although at a slower rate than in the 1960's, while the ability to expand marina capacities is being increasingly restricted in the congested inland waterway and wetland areas. The desirability of recreational boating access to the Bay has also increased with the improved fishing and recreational potential. Those protected areas near the Capes without wetland problems now have expanded potential for recreational boating development.

Additional shoreline development potentials identified by the study include beach restoration and development, dredge spoils disposal, port-oriented industrial, foreign trade or specialized facility development, and outer continental shelf (OCS) support. Several beach restoration projects along the Bay shore are being funded under a special Corps of Engineers demonstration project, and these beaches may enjoy renewed although probably still limited potential in the future. Dredge spoils disposal requirements generated by regular maintenance dredging of the ship channel have required the setting aside of extensive shoreline areas along the lower Delaware River for disposal sites. Additional sites or disposal methods will clearly be needed in the future and represent a variety of development potentials and constraints. The potential for special port-oriented development (e.g. industrial parks, foreign trade zones, and specialized coal shipping terminals) exists primarily in the vicinity of the Port of Wilmington, while the potential for OCS support exists at the Port of Wilmington and at Lewes and Cape May as well as Atlantic City. The future requirements for OCS support are, of course, highly uncertain, given the unclear future of Baltimore Canyon exploration and development.

Given this diversity of shoreline development possibilities, the study identifies the following development potentials:

1. facilitation of additional private marina development at appropriate locations;

2. investigation of possible joint public/private developments of combined recreational boating and commercial fishing facilities at Cape May or Lewes;

3. continued monitoring of the Baltimore Canyon situation in order to anticipate specific development potentials;

4. continued monitoring of Corps of Engineers activities (beach restoration and dredge spoils disposal), and Port of Wilmington activities to identify any development needs not being addressed by these agencies;

5. coordinated bi-state planning and development of shoreline resources.

Any development potentials will depend on the site and scope of the particular project. In general, any project is likely to require a Corps of Engineers permit for dredging, filling or construction in the water, as well as State underwater land permits, and wetland permits if a wetland site is chosen. In New Jersey major marine and recreational development will also require a CAFRA permit. To minimize opposition under current permit policies, a project should avoid filling or altering wetlands and should require as little maintenance dredging as possible. Access channels should be flushed by natural tidal action. Based upon current demands and these environmental constraints, the most likely sites for new marina

facilities are at Lewes and immediately north of Cape May. It is possible that a new marina could be combined with the creative use of dredge spoil to create an artificial island, breakwater, or peninsula, but opposition can be expected if the waters filled are particularly productive of fish or shellfish. New Jersey has four marinas, including one on Delaware Bay. Delaware operates a network of small boat launching ramps and is currently reconstructing a 250-vessel marina at the Delaware Seashore State Park.

TABLE OF CONTENTS

		Page
I.	BACKGROUND OF THE DELAWARE RIVER AND BAY REGION	I-1
I.A	A DEFINITION OF THE DELAWARE RIVER AND BAY REGION	I-1
I.A.1	The DRBA Region	I-2
I.A.2	The Larger Middle Atlantic Region	I-5
I.A.3	The Functional Subregions of the DRBA Region ..	I-8
I.B	A REVIEW OF THE REGION'S HISTORICAL GROWTH AND DEVELOPMENT	I-12
I.B.1	The Period Before 1600	I-14
I.B.2	The Period From 1600 to 1800	I-14
I.B.3	The Period From 1800 to 1950	I-16
I.B.4	The Period From 1950 to 1970 - The Rapid Incorporation of the DRBA Region into the Northeast Corridor	I-20
I.C	RECENT TRENDS IN THE REGION (1970-1979) AND KEY FACTORS AFFECTING ITS FUTURE	I-27
I.C.1	Population Trends and Forecasts	I-27
I.C.2	Agricultural Trends and Forecasts	I-28
I.C.3	Commercial Fishing Trends and Prospects	I-36
I.C.4	Manufacturing Trends and Prospects	I-39
I.C.5	Tourism and Marine Recreation - Trends and Prospects	I-46
II.	HIGHWAY TRANSPORTATION FACILITIES	II-1
II.A	EXISTING NETWORK	II-1
II.A.1	DRBA Facilities	II-1
II.A.2	DRPA Bridges	II-8
II.A.3	New Jersey Highways	II-10
II.A.4	Delaware Highways	II-13
II.A.5	Maryland and Virginia Facilities	II-16
II.B	PROPOSED HIGHWAY FACILITIES	II-18
II.B.1	Proposed New Jersey Highway Improvements	II-18
II.B.2	Proposed Delaware Highway Improvements	II-22
II.B.3	Proposed Regional Highway Improvements in Other States	II-27

TABLE OF CONTENTS (continued)

		Page
II.C	TRAFFIC GROWTH TRENDS	II-29
II.C.1	Facilities of Delaware River and Bay Authority	II-30
II.C.2	Facilities of the Delaware River Port Authority	II-34
II.C.3	New Jersey Highways	II-35
II.C.4	Delaware Highways	II-41
II.C.5	Maryland and Virginia Facilities	II-45
II.C.6	Intermodal Diversion Potential	II-47
II.C.7	Effect of Energy Conditions	II-51
II.D	ADEQUACY OF HIGHWAY SYSTEM	II-54
II.D.1	Delaware River and Bay Crossings	II-57
II.D.2	New Jersey Highways	II-64
II.D.3	Other Delaware Highways	II-66
II.E	NEED FOR ADDITIONAL CROSSINGS	II-67
II.E.1	Additional Capacity	II-68
II.E.2	Improvement of the Regional Transportation System	II-68
II.E.3	Stimulation of Area Development	II-71
III.	MARINE TRANSPORTATION	III-1
III.A	INTRODUCTION	III-1
III.B	WATERBORNE COMMERCE	III-2
III.B.1	Area and Port Activity, 1956-1977	III-3
III.B.2	Imports	III-7
III.B.3	Exports	III-25
III.B.4	Coastwise and Internal Commerce	III-37
III.B.5	Future Trends	III-41
III.C	TRENDS IN VESSEL USAGE	III-49
III.C.1	Vessel Types	III-49
III.C.2	Inbound Vessels - Wilmington Harbor	III-51
III.C.3	Future Vessel Trends	III-52
III.C.4	Navigational Considerations	III-55
III.D	PORT FACILITIES	III-57
III.D.1	Wilmington	III-58
III.D.2	Other Facilities, Wilmington-to-the-Sea	III-62

TABLE OF CONTENTS (continued)

		Page
III.D.3	Philadelphia	III-62
III.D.4	Camden	III-64
IV.	INSTITUTIONS, PLANNING AND REGULATIONS	IV-1
IV.A	THE INSTITUTIONAL SETTING FOR PROGRAMS IN THE BAY AREA	IV-2
IV.A.1	Port and Waterway Facility Programs	IV-2
IV.A.2	Environmental Protection Programs	IV-4
IV.A.3	Land Use Planning	IV-10
IV.A.4	Other Significant Programs	IV-14
IV.B	OPERATION OF MAJOR PROGRAMS, PLANNING AND REGULATION ACTIVITIES IN THE DELAWARE RIVER AND BAY	IV-15
IV.B.1	U.S. Army Corps of Engineers	IV-15
IV.B.2	National Marine Fisheries Services (NMFS)	IV-20
IV.B.3	Fish and Wildlife Services (F&WS)	IV-22
IV.B.4	Environmental Protection Agency (EPA)	IV-25
IV.B.5	United States Coast Guard (Department of Transportation)	IV-27
IV.B.6	Delaware River Basin Commission	IV-30
IV.B.7	Delaware Coastal Zone Act	IV-32
IV.B.8	Coastal Area Facility Review Act (CAFRA) New Jersey	IV-37
IV.B.9	New Jersey Welands Law	IV-42
IV.B.10	Delaware-Wetlands Act	IV-44
IV.B.11	Subaqueous Lands - Delaware	IV-48
IV.B.12	Underwater Lands - New Jersey	IV-50
IV.B.13	Land Use Planning	IV-52
IV.C	PUBLIC AUTHORITIES UNDERTAKING PORT OR TRANSPORT PROJECTS IN THE DELAWARE BAY AREA	IV-61
IV.C.1	Delaware River Port Authority	IV-61
IV.C.2	South Jersey Port Corporation	IV-64
IV.C.3	Philadelphia Port Corporation	IV-66
IV.C.4	Wilmington Port	IV-67
IV.C.5	Delaware River and Bay Authority	IV-69
IV.D	INSTITUTIONAL ANALYSIS OF HYPOTHETICAL PROJECTS	IV-79
IV.D.1	Fixed Crossing	IV-81
IV.D.2	Expansion of Conventional Port Facilities	IV-83
IV.D.3	Deepwater Port Development	IV-85
IV.D.4	Fishing Port Development and Fisheries	IV-88
IV.D.5	Marina Development	IV-89

TABLE OF CONTENTS (continued)

		Page
IV.D.6	Other Shoreline Development	IV-91
IV.D.7	Dredge Spoil Disposal	IV-93
IV.D.8	Aquaculture	IV-95
IV.D.9	Comparison of Projects and Controlling Agencies	IV-97
IV.E	IMPROVING INSTITUTIONAL COORDINATION	IV-99
IV.E.1	Closer Integration of Land Use Plans and Environmental Permits	IV-99
IV.E.2	Consolidation of State Permits for Waterfront Development	IV-101
IV.E.3	Clarification of Port Jurisdiction	IV-103
IV.E.4	A Planning and Development Agency for the Delaware River and Bay	IV-105
V.	DEVELOPMENT POTENTIALS AND CONCEPTS	V-1
V.A	CROSSINGS	V-2
V.A.1	Locations of Possible Crossings	V-2
V.A.2	Regional Economic Analysis of Development Potential	V-6
V.A.3	Bridge Location and Cost Factors	V-7
V.A.4	Ferry Service	V-8
V.A.5	Existing Public Policy and the Institutional Environment	V-13
V.A.6	Role of the DRBA	V-14
V.B	CARGO PORT DEVELOPMENT	V-14
V.B.1	Planned Improvements	V-15
V.B.2	Future Adequacy of Existing and Planned Facilities	V-15
V.B.3	Existing Public Policy and the Institutional Environment	V-17
V.B.4	Role of the DRBA	V-18
V.C	DEEPWATER PORT DEVELOPMENT	V-19
V.C.1	Development Potentials	V-19
V.C.2	The Development Needs	V-21
V.C.3	Existing Public Policy and the Institutional Environment	V-21
V.C.4	Role of the DRBA	V-22
V.D	COMMERCIAL FISHERIES	V-23
V.D.1	Development Potentials	V-23
V.D.2	The Development Needs	V-25

TABLE OF CONTENTS (continued)

		Page
V.D.3	Locational Considerations	V-25
V.D.4	Existing Public Policy and the Institutional Environment	V-26
V.D.5	Role of the DRBA	V-28
V.E	AQUACULTURE	V-28
V.E.1	Development Potentials	V-28
V.E.2	Development Needs	V-29
V.E.3	Existing Public Policy and the Institutional Environment	V-29
V.E.4	Role of the DRBA	V-29
V.F.	RECREATIONAL BOATING MARINAS	V-30
V.F.1	Development Potentials	V-30
V.F.2	Development Needs	V-30
V.F.3	Locational Considerations	V-31
V.F.4	Existing Public Policy and the Institutional Environment	V-31
V.F.5	Role of the DRBA	V-32
V.G	SHORELINE DEVELOPMENT POTENTIAL	V-32
V.G.1	Development Potentials	V-32
V.G.2	Development Needs	V-34
V.G.3	Public Policy and Role of the DRBA	V-34
V.H	BI-STATE DELAWARE BAY-ORIENTED PLANNING AND DEVELOPMENT FUNCTIONS	V-34
	APPENDIX A	A-1
	APPENDIX B	B-1

I. BACKGROUND OF THE DELAWARE RIVER AND BAY REGION

This introductory section provides a background description of the Delaware River and Bay and its surrounding area. It also summarizes those factors and trends that have affected or are likely to affect the area's future and the present or potential activities of the Delaware River and Bay Authority (hereinafter, the DRBA or the Authority). The section includes three parts:

- A definition of the primary DRBA region and its three subregions and the larger Middle Atlantic region.
- A review of the region's historical growth and development.
- A profile of recent trends in the region's economic base and a discussion of key factors affecting the region's future.

I.A A DEFINITION OF THE DRBA REGION

The interstate compact creating the Delaware River and Bay Authority gives it responsibility for certain public projects in the Delaware River and Bay and along their shorelines from the Pennsylvania-Delaware border to the Atlantic Ocean. In order to understand the DRBA's present activities and future role in the area, it is important to first understand the resources, roles, and interrelationships of the regions affecting and affected by the Authority's activities. In this context four points are worth emphasizing:

- The counties of New Jersey and Delaware which abut the Authority's area of interest represent a slice of the recreational, agricultural, and urbanized corridors of the large Middle Atlantic Region -- a slice whose future is therefore closely linked to that of the larger region and dependent on its shifting comparative advantages relative to other segments of the region.
- The use of the lower Delaware River and Bay is a key determinant of the region's overall role. The region consists largely of shallow waters and tidal mudflats and wetlands which represent valuable and environmentally sensitive habitats. It is a region which formerly provided an important recreational and fishing resource and which now accommodates an important and well protected marine transportation system including the Port of Wilmington, the lightering area off Big Stone Beach and the ship channel. It is a region which is gradually

being cleaned up after years of industrial, agricultural and urban pollution. It is a region which has been subject to competing demands in the past (e.g., oil ports, pipelines, nuclear power plants, recreation, fishing, and marine farming) and which may have substantial potential in the future.

- The regional transportation system plays a key role in determining the area's role. The major long distance auto and truck corridor of the Eastern Seaboard bisects the Authority's area of interest at the Delaware Memorial Bridge and is paralleled by important coastal recreation corridors for both automobiles and boats crossing the Bay between Lewes and Cape May. A major marine transportation corridor (particularly for petroleum and petroleum products) bisects the Authority's area of interest in the other direction through the lower Delaware River and Bay and is paralleled by important recreational corridors linking the coastline with major population centers. These corridors and their links (e.g., the bridge and ferry crossing) play a large part in determining locational advantages for different activities and will therefore continue to play a large part in influencing subregional roles.

- The major natural resources supporting the area's economic base include the shoreline beaches supporting tourism along the Atlantic Coast and some portions of the Delaware Bay, the sand deposits supporting the glass manufacturing industry in southern New Jersey, the agricultural resources supporting truck farming and the poultry industry, and commercial fishing and tourism along the coastline. These resources and others, including the yet undefined oil and gas resources of the Outer Continental Shelf, will continue to have a major influence over the region's role.

Defined below in more detail are the DRBA region, the larger Middle Atlantic region, and the three functional subregions of the DRBA region.

I.A.1. The DRBA Region

For purposes of this study, the DRBA region is defined as the entire State of Delaware (New Castle, Kent and Sussex Counties) and the four counties of southern New Jersey (Cape May, Atlantic, Cumberland, and Salem). Gloucester County, New Jersey, although represented on the Authority, was not included due to its much closer linkage with the Philadelphia/Camden metropolitan area.

As shown in Exhibit I-1, the New Jersey and Delaware portions of this region are connected by the two crossings currently operated by the

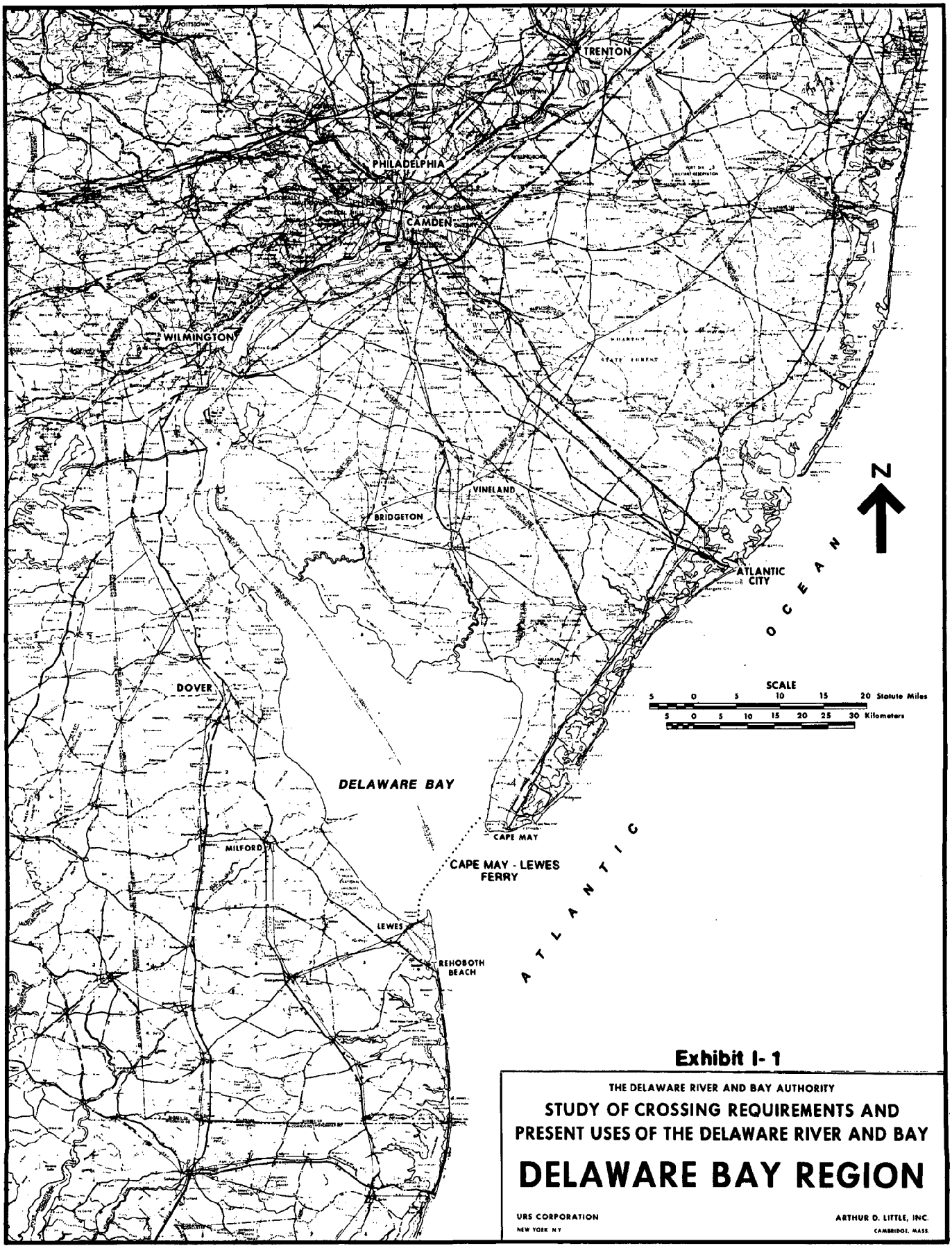


Exhibit I-1

THE DELAWARE RIVER AND BAY AUTHORITY

STUDY OF CROSSING REQUIREMENTS AND PRESENT USES OF THE DELAWARE RIVER AND BAY

DELAWARE BAY REGION

URS CORPORATION
NEW YORK N.Y.

ARTHUR D. LITTLE, INC.
CAMBRIDGE, MASS.

Authority -- the Delaware Memorial Bridge and the Cape May-Lewes Ferry. These two crossings accommodated 18,820,000 vehicles in 1978, of which 81% were passenger automobiles. Over 99% of these vehicle crossings were made on the Delaware Memorial Bridge.

The DRBA region has about 3,620 square miles of land area, consisting primarily of flat coastal plains. A minor portion of the land area is in the upland Piedmont plateau, extending inland from the fall line, but the major portion of the land area is in poorly drained coastal wetlands. Land that is well drained is excellent agricultural land, and about 36% of the region's total land area was in farms in 1974, according to the U.S. Census of Agriculture.

A large part of the New Jersey Pine Barrens, as well as substantial amounts of Delaware woodlands are also in the DRBA region. Urban land uses are concentrated in the Wilmington-Salem area and on the Atlantic shoreline. Additional smaller urban clusters include the inland towns of Dover and Milford, Delaware, and Vineland, Millville and Bridgeton, New Jersey.

The DRBA region has about 625 square miles of Delaware River and Bay waters inside Cape May and Cape Henlopen. From the entrance of the bay to the anchorage area off Big Stone Beach, the controlling depth in the channels and ship traffic area is 55 to 100 feet. The 800 to 1000-foot-wide ship channel up the remainder of the river and bay is regularly dredged to a controlling depth of 40 feet at mean low water. Except for an area near the two capes, the rest of the Delaware River and Bay waters are relatively shallow with depths of less than 4 to 6 feet prevailing for about the first 1/2 mile off shore and less than 10 to 15 feet in most of the remaining waters. The bottom sediments of the Delaware River and Bay are primarily sand outside of a line running from Lewes, Delaware, to Port Norris, New Jersey (the Maurice River), and mud from that line up the bay and river.

The shoreline of the region along the Atlantic Coast and for a short distance into the bay from each cape consists primarily of sandy beaches -- many of them State or city parks. With few exceptions the remainder of the bay shoreline from just inside the capes to Delaware City, Delaware and Pennsville, New Jersey is a two- to five-mile-wide strip of wetlands -- much of it included in national or State wildlife areas. North of Delaware City and Pennsville, the Delaware River shoreline has been largely developed with transportation facilities and industrial uses -- although a number of open areas remain, several of which are used for dredge spoils disposal.

The DRBA region had an estimated permanent population of 1,040,000 in 1977 and has experienced population growth rates ranging from 2.8% per year in the 1950's to 1.6% per year in the 1960's and 1.1% per year between 1970 and 1977. The region is heavily urbanized in the north with 38% of the region's permanent population living in New Castle County which has 12% of the region's land area. The region also has a large seasonal fluctuation in population. On a typical August weekend,

the Atlantic Coastline reportedly experiences a threefold population increase over its permanent population. On these weekends, the coastal population of over 1,000,000 persons would exceed the total permanent population of the rest of the DRBA region.

The economic base of the DRBA region consists primarily of manufacturing, agriculture and tourism. The manufacturing base is made up largely of food products and glass manufacturing in the central part of the region and petrochemical industries and research in the northern portion. The agricultural base is made up largely of poultry products, corn, and soybeans in the south and vegetables or truck farming in the north. The tourism base is closely tied to entertainment and gambling along the New Jersey ocean shoreline and fishing and swimming at the capes and along the ocean shoreline in Delaware.

The transportation system of the DRBA region includes a major East Coast marine traffic corridor which runs through the Delaware River and Bay, and includes the Port of Wilmington, the Chesapeake and Delaware Canal, and the Big Stone Beach oil lightering area. The DRBA region's transportation system also includes the major East Coast vehicle corridor which runs north and south along Interstate 95 and the New Jersey Turnpike (including the Delaware Memorial Bridge) and the major East Coast rail corridor. In addition to these major corridors, the region is crossed by marine transportation channels for recreational boating and commercial cargo on the inland and intracoastal waterways maintained by the federal government and by smaller channels such as the Lewes-Rehoboth Canal, the Cape May Canal, and numerous bays and inlets along the Atlantic Coast. The region is also crossed by a second vehicle transportation corridor -- the Coastal Route, primarily a recreational route including the Garden State Parkway and Route 9 in New Jersey, the Cape May-Lewes Ferry, and Route 14 and 1 in Delaware

I.A.2 The Larger Middle Atlantic Region

The DRBA is an integral part of the larger Middle Atlantic region, which encompasses the Eastern Seaboard from Norfolk, Virginia to the New York City area (see Exhibit I-2). For statistical purposes, we define this larger region as the States of New York, New Jersey, Pennsylvania, Maryland, Delaware, and Virginia, as well as the District of Columbia.

In addition to the two Delaware River and Bay crossings operated by the DRBA, this larger region includes numerous other crossings of the Delaware River, many operated by a similar bi-state New Jersey/Pennsylvania authority -- the Delaware River Port Authority. It also includes crossings of the Hudson River and New York Harbor, operated by the bi-state Port Authority of New York and New Jersey, and crossings of the Chesapeake Bay, not operated by bi-state authorities.

The Middle Atlantic region has a land area of about 152,000 square miles, more than 40 times that of the DRBA region. This land includes the flat

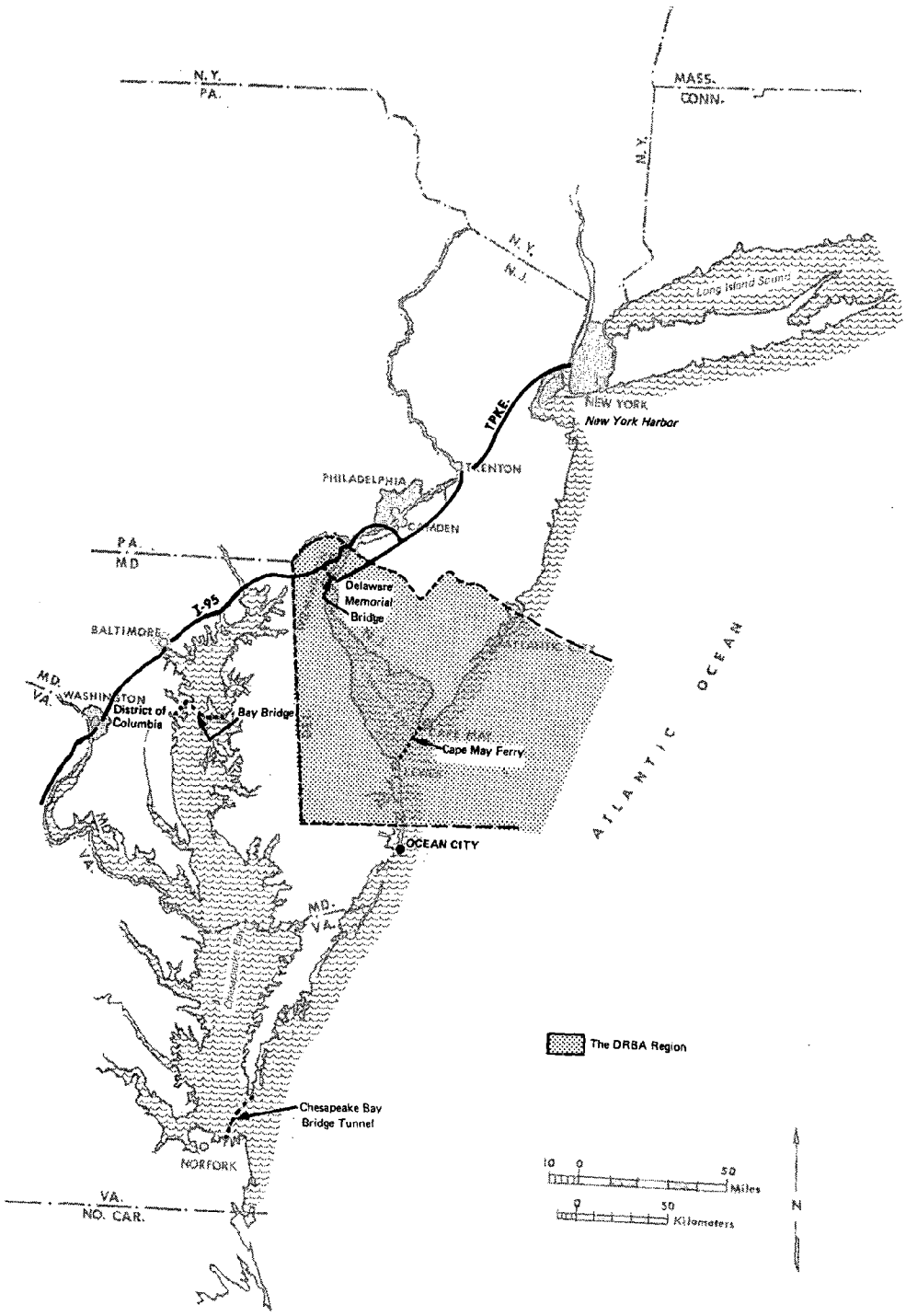


EXHIBIT I–2
THE LARGER MIDDLE ATLANTIC REGION

coastal plains of New Jersey and the Delmarva Peninsula and large portions of the Piedmont Plateau and rolling foothills inland toward the Appalachian Mountains. Like the DRBA region, this Middle Atlantic region includes a band of agricultural land uses separating the tourist and recreation developments along the Atlantic Coastline from the heavily industrialized and urbanized Northeast Corridor. This larger region also includes a second band of agricultural uses flanked by tourist and recreational development near the Appalachians to the west of the Northeast Corridor.

In addition to the Delaware River and Bay, this larger region includes two other large and important bodies of water -- the Chesapeake Bay and the Hudson River/Long Island Sound. Both are larger than the Delaware River and Bay, and both have larger areas of deeper water near shore, making them more attractive for recreational boating and shoreline development. The shorelines of these other two areas are less dominated by wetlands and consequently are more extensively developed than is the Delaware Bay shoreline. The Atlantic shoreline is similar throughout this entire Middle Atlantic region, although it is more intensively developed to the north and less developed to the south than is the Atlantic Coastline of the DRBA region.

The Middle Atlantic region had 47,074,000 permanent residents in 1970 or about 50 times the population of the DRBA region. In 1970 this region contained 23% of the nation's population and 25% of the nation's manufacturing employment, most of it within 200 miles of the Delaware Memorial Bridge. This larger region grew more rapidly than did the DRBA region in the 1950's, but its annual rate of growth declined to about 1.1% between 1960 and 1970 or about two-thirds the growth rate of the DRBA region during that period.

The economic base of this larger region is more diversified than that of the DRBA region, although light manufacturing and particularly petrochemicals remain a very strong component. Agriculture is somewhat less important in this region than in the DRBA region, and tourism is less of a traditional economic "base" component due to the fact that most of the tourism originates within this larger region.

The transportation system of the Middle Atlantic region includes extensions to the marine traffic corridors of the DRBA region. The system also includes extensions of the two major north-south land traffic corridors crossing through the DRBA region and several east-west corridors running from the Atlantic Coastline to the Northeast Corridor through the Appalachians to the Midwest.

The DRBA region and the Middle Atlantic region are linked in the following ways:

- Cross-bay passenger automobile traffic, representing about 81% of total cross-bay traffic within the DRBA region, consists largely of vehicles with an origin and/or a destination outside of the DRBA region. At the Delaware Memorial

Bridge, a large portion of the passenger vehicles reportedly move through the DRBA region along the I-95/Turnpike corridor or between the shoreline resorts of the DRBA region and other population centers of the larger Middle Atlantic region, primarily the Philadelphia, Baltimore and Washington areas.

- It is reported that cross-bay commercial traffic consists primarily of vehicles with an origin and/or a destination outside of the DRBA region.

- The majority of waterborne commerce in the Delaware River and Bay moves through the DRBA region to the Philadelphia area.

- Many of the agricultural and fishery products of the DRBA region are sold in the fresh produce or fish markets in the Middle Atlantic States and distributed to the New York, Philadelphia, Baltimore and Washington markets.

- Industrial and manufacturing production within the DRBA region is not geared to a local DRBA regional market, and most products are distributed outside of the region to either the Middle Atlantic or national market.

- The visitor-oriented Atlantic Coastline and the Delaware Bay Shoreline are recognized as important national as well as regional resources. Most visitors to this shoreline come from other parts of the Middle Atlantic states outside of the DRBA region.

I.A.3 The Functional Subregions of the DRBA Region

The DRBA region can usefully be characterized as having three distinct functional subregions as numbered in Exhibit I-3 and as follows:

1. the industrialized and urbanized northern subregion

2. the agricultural and rural central subregion

3. the visitor-oriented and recreational coastal subregion.

I.A.3.a The Industrialized and Urbanized Northern Subregion

This subregion is dominated by the Northeast Corridor and the Wilmington Standard Metropolitan Statistical Area, which includes Salem County, New Jersey, and New Castle County, Delaware. Functionally defined, it would include the cities of Wilmington, Newark and Pennsville and only the northern portions of New Castle and Salem Counties. For statistical purposes, we define it to include all of the Counties of New Castle and Salem.

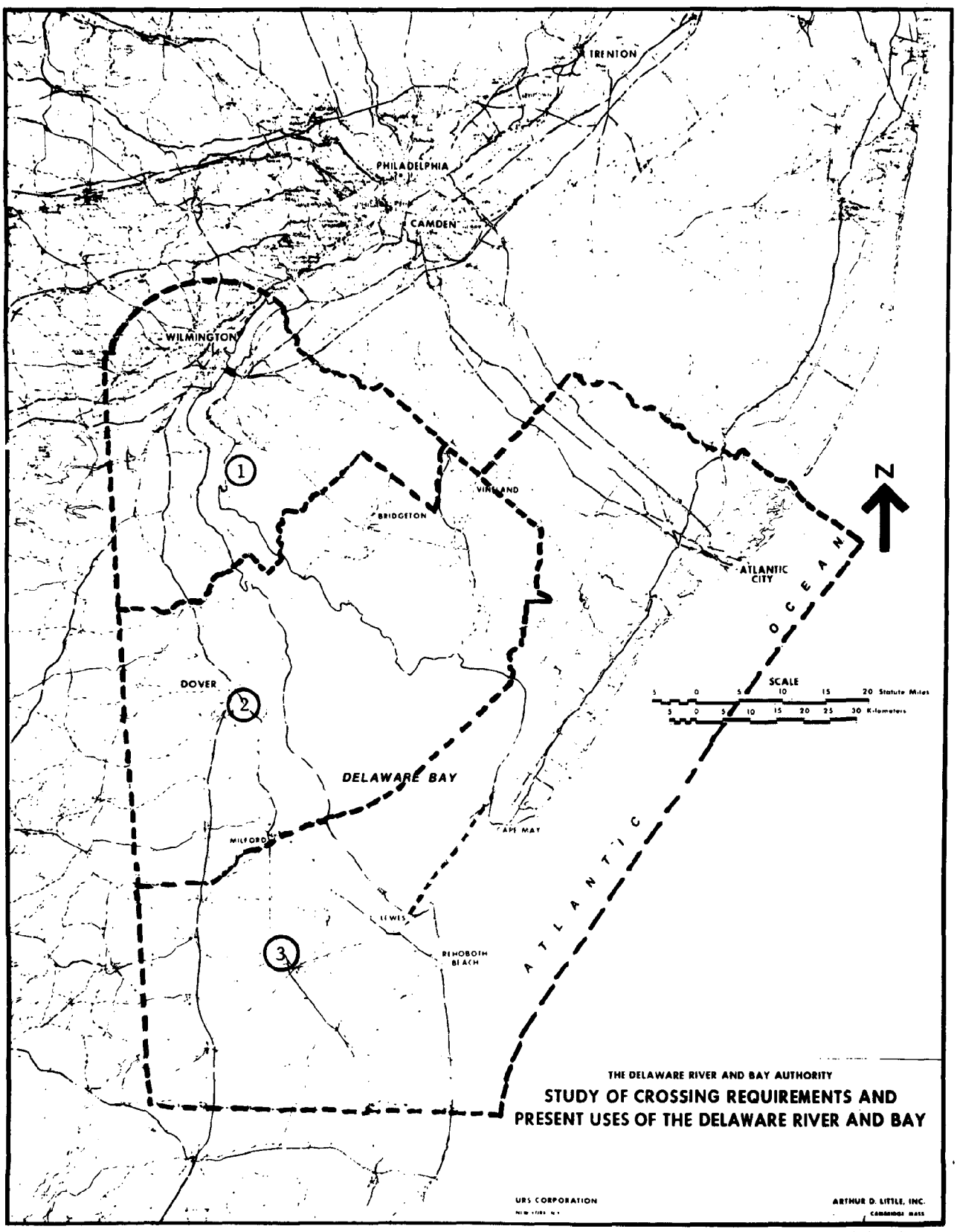

TRENTON
PHILADELPHIA
CAMDEN
WILMINGTON
VINELAND
BRIDGETON
ATLANTIC CITY
OCEAN
N
SCALE
5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
DOVER
DELAWARE BAY
MILFORD
CAPE MAY
LEWES
REHOBOTH BEACH
ATLANTIC
1
2
3
THE DELAWARE RIVER AND BAY AUTHORITY
STUDY OF CROSSING REQUIREMENTS AND
PRESENT USES OF THE DELAWARE RIVER AND BAY
URS CORPORATION
ARTHUR D. LITTLE, INC.

Exhibit I-3

This subregion included 803 square miles of land area (about 22% of the region's total) and 460,500 inhabitants or 44.3% of the region's permanent population in 1977. Its growth is heavily influenced by changes in the petrochemical industry and by trends and developments along the entire Northeast Corridor. It grew very rapidly (at an annual rate of 2% to 4% during the 1950's and 1960's) as it and other less developed segments of the Northeast Corridor began to fill in. Since the late 1960's, growth has slowed to less than 0.5% per year. It has now stabilized as a major manufacturing area and center for the petrochemical industry.

Manufacturing employment numbered approximately 58,000 in 1970 and accounted for 32.4% of the employment in this subregion. This percentage of employment in manufacturing is significantly higher than the approximately 15% in the rest of the DRBA region and 25.2% nationwide. Close to three-fourths of this manufacturing employment is accounted for by five firms, three of which are major chemical firms and two of which are vehicle assembly plants. This subregion also includes the Getty Oil Company refinery complex at Delaware City, the nuclear power plant in Lower Alloway Creek Township, New Jersey, and the Port of Wilmington.

This relatively small subregion is bisected in one direction by one of the East Coast's major marine transportation corridors, the Delaware River, and in another direction by the East Coast's major vehicle transportation corridor, Interstate 95, the New Jersey Turnpike, and the Delaware Memorial Bridge. The marine transportation corridor accommodated approximately 134,000,000 tons of waterborne commerce in 1977, while the vehicle transportation corridor accommodated approximately 18,600,000 vehicles in 1978 (at the bridge). Both corridors experienced traffic increases in excess of 20% between 1964 and 1974, and both have had a leveling off of traffic volumes in the last four years.

The Delaware River and Bay shoreline in this subregion is more intensively developed and has less extensive wetlands than elsewhere in the DRBA region. The Christina River, with the Port of Wilmington, represents the main break in the Delaware River's western shoreline. It accommodates considerable marine traffic and has controlling depths of 38.7 ft. at Wilmington to 6 ft. at Newport, Delaware. The Salem River with the upstream city of Salem, New Jersey represents the major break in the eastern shoreline of the Delaware River. The Salem River is now relatively shallow and has little marine traffic, however there is a potential for increased use for marine transportation.

I.A.3.b The Agricultural and Rural Central Subregion

The central subregion is primarily an agricultural region, but it includes a significant cencentration of glass manufacturing in Millville and Bridgeton, New Jersey, the state capital of Dover, Delaware, and the Dover Air Force Base. Functionally defined, it would include all of Kent and Cumberland Counties and some of Sussex, New Castle, and Salem Counties. For statistical purposes, we define it to include only the counties of Kent and Cumberland.

This subregion has about 30% of the DRBA region's land area (1,097 square miles) and had about 225,000 inhabitants or 21.6% of the DRBA's permanent population in 1977. It is heavily influenced by governmental activities and by trends in the agricultural economy and food processing industry. It grew rapidly during the 1950's from a population of 126,500 to 172,600. Much of this growth was due to the reactivation of Dover Air Force Base. By the 1970's growth had slowed to about 1% per year, but Kent County, Delaware continued to grow at about twice the rate of Cumberland County, New Jersey. This was due to continuing growth of the state capital of Dover. Manufacturing employment of 24,000 in 1975 included 5,500 in food products and 8,200 in glass and clay products. Dover Air Force Base employs about 5,000 military and civilian personnel.

This central subregion is bisected in one direction by the widest part of Delaware Bay, at the southern end of which are extensive oil lightering operations to transfer oil from deeper draft tankers to shallower draft barges. There is no land transportation corridor bisecting the region in the other direction, although crossings have been proposed in the past, for example, a Delaware Bay Bridge from Sea Breeze, New Jersey to Bombay Hook Point.

The shoreline is the least intensively developed of the three subregions due to tidal mud flats and wetlands which extend two to five miles inland. Both the Delaware and New Jersey shorelines have a number of small beaches, broken by the Cohansey and Maurice Rivers on the New Jersey side, and the St. Jones and Mispillion Rivers on the Delaware side. Each of these four rivers links an inland city to the shoreline, and each has limited recreational boating and marine development at the river mouth or upstream at the cities of Dover and Milford in Delaware and Bridgeton and Millville in New Jersey.

I.A.3.c The Visitor-oriented and Recreational Coastal Subregion

The southeastern subregion is largely dependent on the summer tourist trade. Functionally defined, this subregion would include a five-mile band of development along the Atlantic Coastline including narrow extensions along the bay shoreline from Cape May and Lewes northward. It would include Atlantic City, Ocean City and Wildwood in New Jersey, as well as Bethany Beach, Rehoboth Beach and Fenwick Island in Delaware. For statistical purposes, we define it to include all of the Counties of Atlantic, Cape May and Sussex.

This subregion included 48% of the DRBA region's land area (1,720 square miles) and 354,900 inhabitants or 34% of the region's permanent population in 1977. It has been heavily influenced by recent trends in retirement migration, second homes, and tourism. It includes several parks and beach areas as well as the commercial and recreational fishing and boating centers of Cape May and Lewes. It is now also being affected by casino gambling in Atlantic City. This subregion grew relatively slowly during the 1950's and 1960's, from a year-round population of 230,800 in 1950 to 313,700 in 1970. Since 1970 its growth has accelerated while

that in the other subregions has declined. Between 1970 and 1977 it grew at about two and one-half times the rates of the other two subregions. In addition to this growth in year-round population, summer populations have increased dramatically with the growth in accommodations and campground facilities. The population on a typical summer weekend is about three times the year-round population, or over 1,000,000 people.

Total non-food manufacturing employment in this subregion numbered about 15,400 in 1975. This represents about 15% of the subregion's total employment compared to over 32% represented by non-food manufacturing employment in the northern subregion. On the other hand, trade and service employment numbered about 43,000 or close to one-half of the subregion's total employment compared to about one-third in trade and service employment in the northern subregion. Atlantic City casino development is projected to increase permanent employment by 90,000 assuming 12 casinos,[1] doubling the subregion's permanent employment and increasing population by some 200,000 people.

This coastal subregion is bisected by the lower Delaware Bay, the Intracoastal Waterway, and the Route 9/Garden State Parkway/Route 14 corridor which is joined by the DRBA ferry service linking Lewes and Cape May. Its shoreline is a combination of primarily wildlife management areas in the wetlands and summer home development along scattered beaches. In the Lewes and Cape May areas, the shoreline includes both residential and visitor-oriented uses with marina development along the Lewes-Rehoboth Canal and the Cape May Inlet. There is currently little marine or commercial recreation development along the Cape May Canal or within the Breakwater Harbor at Lewes. The most intensive park and visitor-oriented development is concentrated along the Atlantic Coastline.

I.B A REVIEW OF THE REGION'S HISTORICAL GROWTH AND DEVELOPMENT

The pre-history and subsequent growth and development of the region covers the period from its formation due to receding glaciers to the north about 15,000 years ago to the most recent period of rapid urbanization in the 1960's. Trends since 1970 are considered "current" and are discussed in Section I.C. Here, we review the European discovery and colonization in the 1960's, the expansion of agricultural and fishing through the 1700's and 1800's, the development of commercial and industrial centers in the late 1700's and 1800's, the establishment of glass manufacturing in the mid-1700's, the establishment of a strong petrochemical industry beginning in 1802, the maturing and partial decline of the agricultural, fishery and petrochemical sectors in the 1950's and 1960's, and the rapid urbanization of the northern part of the subregion following the construction of the Delaware Memorial Bridge and an effective regional transportation system in the 1950's.

[1]Center for Urban Policy Research, Rutgers University, New Brunswick, New Jersey, 1978.

This historical perspective provides several important insights into the current and future roles of the region:

- The development of the regional transportation system has continued to reinforce the isolation and conservative rural subculture of southern New Jersey and the Delmarva Peninsula. Following the demise of shallow draft marine traffic in the 1800's, and following the construction of the Chesapeake & Delaware Canal and the establishment of the lowest river and bay crossing at New Castle in the early 1800's, most transportation developments have tended to increase the capacity of through corridors and marine terminals serving Wilmington and areas further North.

- Most of the DRBA region south of Wilmington did not have good access to important industrial resources (e.g. iron and coal) and was largely bypassed by the industrial revolution. Until the growth of tourism, most of this region was largely dependent on the agricultural and fishing economies (glassmaking was the exception).

- The industrial base of the region, primarily in the Wilmington area, has been eroded by improved transportation systems nationwide and by the shifts of relative market strengths and competitive advantage to the South and West. Although more recently developed than other industrial bases in the Northeast, some of the industrial plant is relatively obsolete. Industrial bases related to fishing and agricultural production suffered a precipitous decline after World War II, and much of the remaining physical plant may be too obsolete to take advantage of new opportunities.

- The rapidly increasing use of the Upper Delaware River and its shoreline in the Philadelphia area continued to cause downstream problems which reduced its downstream potential.

- Although the region lagged behind the growth of other parts of the Northeast until the 1950's, transportation improvements and overcrowding elsewhere helped stimulate a rapid catching up period for the DRBA region in the 1950's and 1960's. Rapid urbanization of the Wilmington area and increased development along the Atlantic Coastline characterized the rapid but late incorporation of this region into the larger Northeast Corridor system.

I.B.1 The Period before 1600

The Delaware River and Bay was formed in large part following the last recession of the glaciers about 15,000 years ago. At that time the Brandywine and Schuylkill Rivers eroded toward the east to meet the Delaware (they had previously flowed directly to the ocean), and massive amounts of debris were deposited as sand and clay over the coastal lowlands by the Delaware. The lower estuary then flooded with the rising ocean water, giving the bay its present form. The Delaware River Basin and its geological regions are illustrated in Exhibit I-4.

Prominent among the Indians living along the Delaware prior to the time of European exploration were the Lenni Lenape, "who fished, hunted and cultivated fields of corn, squash, beans, sweet potatoes and a hearty tobacco."[1]

I.B.2 The Period from 1600 to 1800

During the period from 1600 to 1800 the region was explored and settled by the first European colonists and became a major center for agriculture, shipbuilding, flour milling, fishing, lumbering and trade.

The Spanish and Portuguese explored the Atlantic Coastline of the Middle Atlantic region in the 16th century, but Henry Hudson's Half Moon was the first European ship known to have sailed up the Delaware (August 28, 1609). He named it the South River and gave the Dutch their initial claim to the area. The area was named Delaware Bay after Lord de la Warr by Sir Samuel Argull in 1610, and Cape May and Cape Henlopen were named by Cornelius Jacobsen May who explored the Bay in 1614.

The first European community was a 1631 Dutch settlement near Lewes (Zwaanendael) which was burned by Indians within a year.[2] The Swedes and Finns established the next settlement near Wilmington in 1636. A succession of 13 Swedish expeditions then established settlements from Cape Henlopen into Pennsylvania. The Swedish settlements were taken over by the Dutch in the mid-1600's, and the Dutch built Fort Casimir and New Amstel (now New Castle) in the 1650's. The Dutch developed extensive diking and agricultural uses during this period. The Dutch also followed the usual colonial practice of purchasing tracts of land from the Indians to protect their title while also carrying on an active trade.

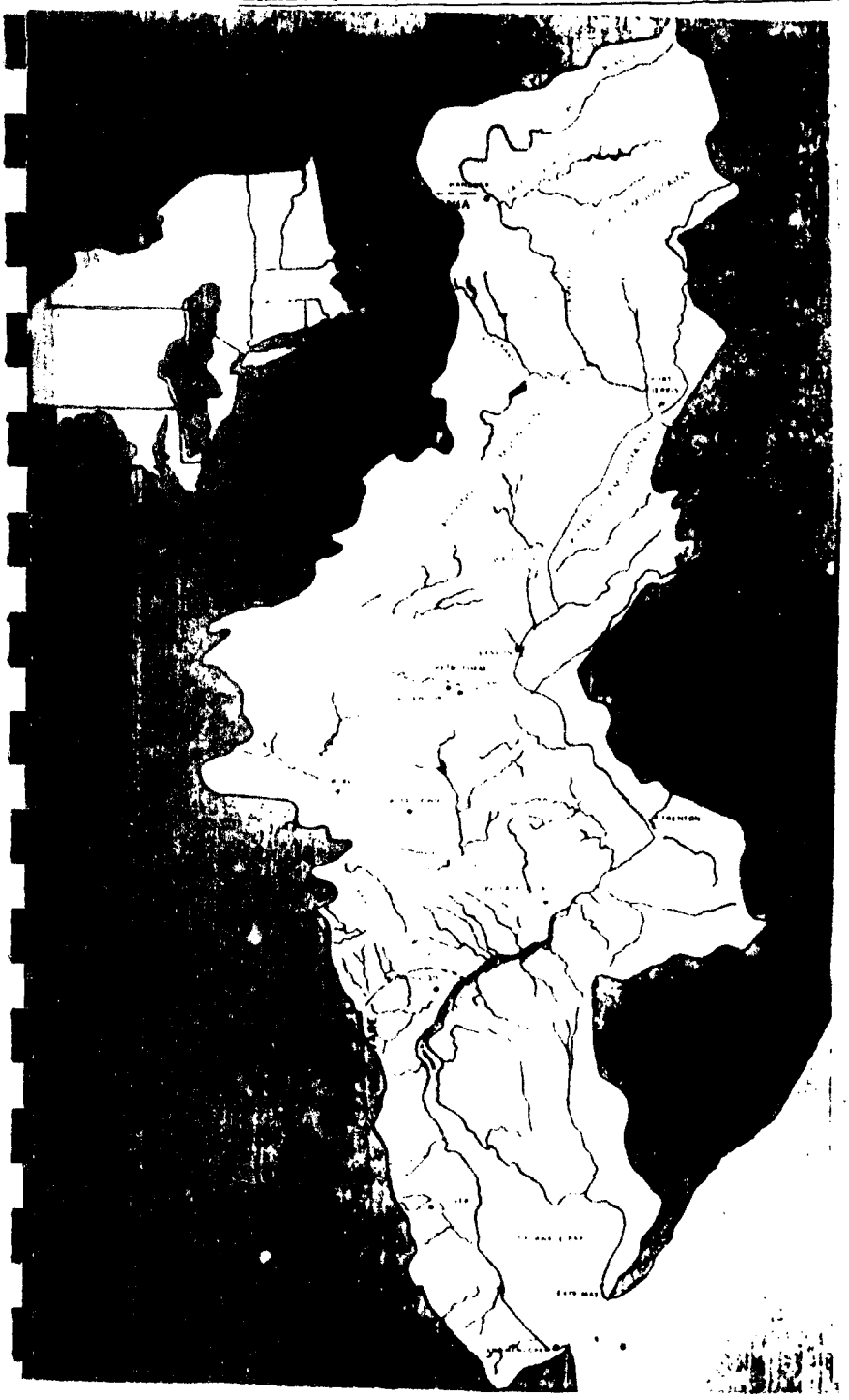
Following the English victories over the Dutch in 1664, the Dutch and Swedish settlements were taken over by the English, with the Dutch and Swedish colonists permitted to retain their lands after subscribing to

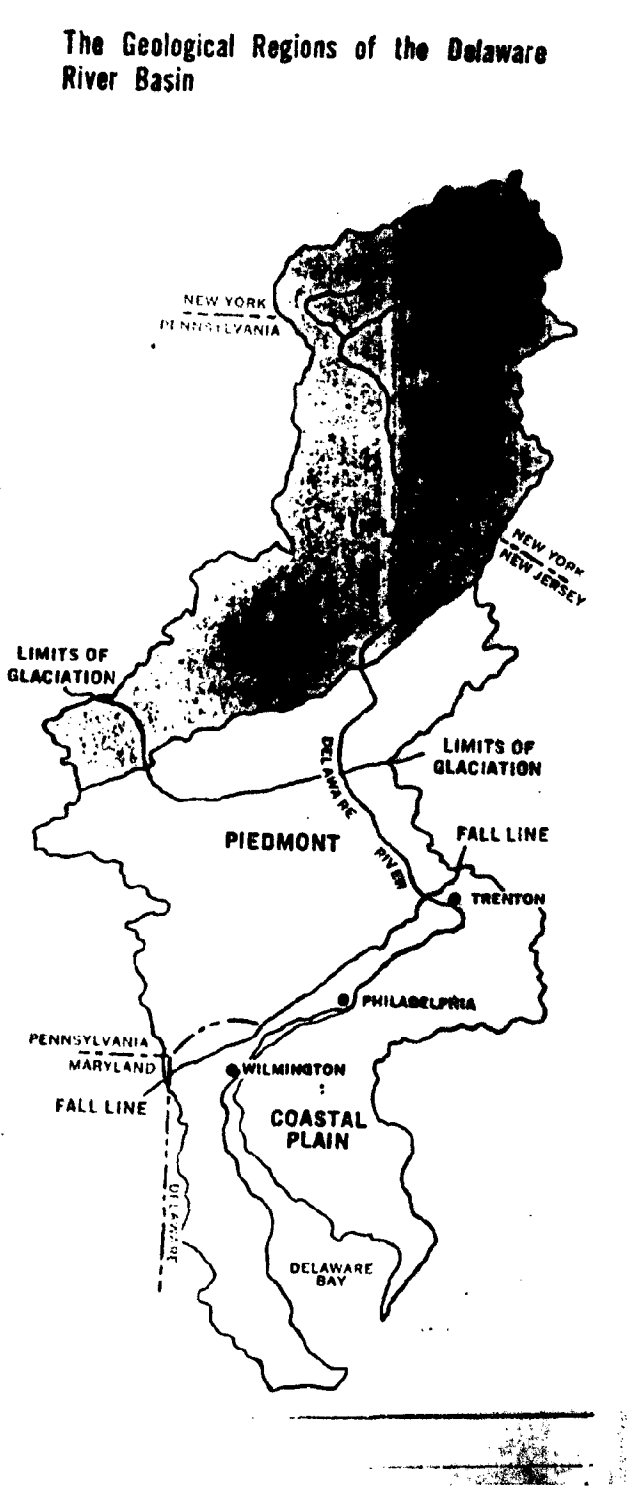
---

[1] U.S. Executive Office of the President, Council on Environmental Quality, The Delaware River Basin, An Environmental Assessment of Three Centuries of Change (1975).

[2] Delaware State Planning Office, Delaware Preliminary Comprehensive Development Plan (1967).

Exhibit I-4 - The Delaware River & Bay Basin





Source: U.S., Executive Office of the President, Council on Environmental Quality, The Delaware River Basin, An Environmental Assessment of Three Centuries of Change (1975).

an oath of allegiance to the King of England. The Quakers began to arrive in 1677 with William Penn taking title to large amounts of land received from Charles II of England. Following settlement by the English, the region was settled successively by the Germans, the Scots, and the Irish. From 1682, when Charles II granted William Penn land on the west side of the Delaware below Pennsylvania, a boundary dispute between William Penn and Lord Baltimore continued until the boundaries of Delaware were officially proclaimed in 1775, the northern boundary being an arc with a 12-mile radius from the New Castle Courthouse.

Until the mid-1700's the region remained primarily agricultural with communities linked by the rivers and a few roads and with Philadelphia being the center of trade with England. In 1738, the first glassmaking industry was established in New Jersey. Following the Revolutionary War, the region's recovery was assisted by the invention of automatic flour milling machinery. The mills along the Brandywine in Wilmington shipped about 300,000 bushels a year during this period. By 1800, the Delaware Basin had become a major center of American commerce and industry.

> "Flour, leather, textiles and paper were produced in the Brandywine Valley just above Wilmington. The Delaware was also the Nation's shipbuilding center, with water transportation assured by an extensive network of ports along the upper estuary. Many towns on the bay were shipping points for wheat, rye, corn, tobacco and livestock grown in the interior and for the burgeoning oyster business. In the upper basin and in many communities around the timber, industry flourished, feeding raw materials to the paper mills and shipyards in the Philadelphia and Wilmington areas."[1]

By the end of the 1700's, the Delaware River also began to assume importance as a potential supply of drinking water. Over one-third of Philadelphia's population had fled the city in the 1970's when disease resulting from well contamination killed thousands."[2]

I.B.3 The Period from 1800 to 1950

During the period from 1800 to 1950, the region's industrial development became established in the Wilmington area, its fishing and agricultural sectors prospered, and its population increased to 675,000 (1950 Census). However, the shifts to coal for power and the shift to iron for ships caused the decline of a number of smaller towns along the lower Delaware River and Bay. The DRBA region did not grow as rapidly as the Philadelphia area, which had a population of 2.9 million by 1930.

---

[1]Council on Environmental Quality, op. cit., p. 5.

[2]Pennsylvania Department of Health, Chronology of Milestones, Pennsylvania's Clean Streams Program, p. 12 (1970).

Between 1801 and 1804 three important events occurred that were to have a major long-term impact on the DRBA region.

- On January 21, 1801, ferry service between New Castle, Delaware and Pennsville, New Jersey began and was to continue as the sole Delaware River and Bay crossing in the DRBA region until the construction of the Delaware Memorial Bridge in 1951.

- In 1802, E.I. Dupont, a French chemist who had worked with LaVoisier, was encouraged by President Jefferson to establish the DuPont Powder Mills just above Wilmington -- mills that were to grow into the chemical complexes that still dominate the region.

- On May 2, 1803, the Chesapeake and Delaware Canal Company was organized in Wilmington with construction of the canal connecting the Delaware and Chesapeake Bays beginning on May 2, 1804.

These three events were the basis for integration of the northern portion of the region into the urban-industrial development of the Northeast Corridor, while they also served to perpetuate the role of southern New Jersey and the Delmarva peninsula as rural agricultural and fishing areas.

Following the War of 1812, economic activity in the DRBA region and in the rest of the Delaware Basin increased significantly, with a number of factors contributing to the further industrialization of the northern part of the region and the continuing isolation of southern New Jersey and the Delmarva peninsula.

- Steamboats began replacing sailing vessels in the river and bay in 1816, and the wooden shipbuilding industry went into a rapid decline.

- A Delaware Bay breakwater was completed in 1834, but safe deep harbors or shoreline loading areas existed primarily along the 100 miles of river and bay from Delaware City to Trenton.

- Adequate supplies of water power for the mills and of fresh processing or cooling water for industries existed primarily north of Wilmington.

- The Chesapeake and Delaware Canal was opened in 1829; other canals and railroads soon followed, linking Philadelphia to the Schuylkill coal region and to the Ohio Basin, thus offsetting an earlier advantage gained by New York with the completion of the Erie Canal.

Due to these and other factors, most of the increased economic activity in the 1800's occurred from Wilmington north where the cities had good access to the essential natural resources of the industrial revolution (water, coal, wood and iron) and a prime location supported by the nation's continuing westward expansion. Philadelphia, for example, grew sevenfold in 30 years -- from a population of 80,000 in 1830 to 566,000 in 1860.

Much of the DRBA region was largely bypassed by the industrial revolution. From 1850 to 1900, as timber resources in the coastal plain were exhausted, and as the economic and industrial importance shifted from wood to iron and from water to coal, the natural advantages of the upper basin for industrial development increased and the smaller towns of the lower basin went into a period of economic decline. The exceptions to this were provided by the thriving glass industry in South Jersey and the bay and ocean fishing industry. As noted in one report:

> "by the mid-1820's, fish from the Delaware Basin were being exported by wagon and boat, not only to places like New York and Baltimore but also to international markets as distant as China."[1]

The character of the region again underwent dramatic change in the early 1900's. With the advent of the internal combustion engine, continued industrial expansion was no longer dependent on the river. The railroads and trucks began to move goods both within and between cities. Plants expanded near major roads, and truck farming as well as food processing became a dominant feature throughout the DRBA region. Recreational access to the shoreline was no longer as dependent on railroads and river boats as it had been during the 1800's, and the recreational centers of the Upper Delaware Bay served by these boats began to lose an important competitive advantage. Petroleum refineries and related petrochemical industries also expanded rapidly, particularly toward the end of this period.

Throughout this period the overlapping and sometimes conflicting uses of the Delaware River and Bay continued to increase. Major conflicts and problems of the Delaware River and Bay and its shoreline began to become evident in the late 1940's.[2] Increased dumping of untreated effluent resulted in dangerous depletions of the river's supply of oxygen. Even in the late 1940's, 85% of Philadelphia's sewage was still being dumped into the river without treatment. Increased dumping of industrial wastes along the Delaware resulted in dangerously high concentrations of toxic wastes, as 92% of Pennsylvania industries were not treating wastes discharged into the river in the 1940's. Increased dredging of the ship channels increased turpidity and required expanding soils disposal sites

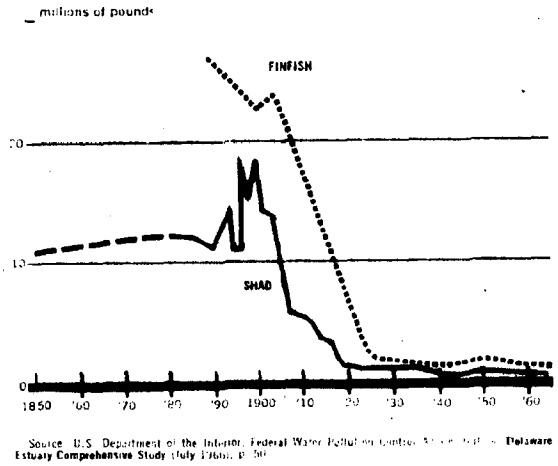
---

[1] U.S. Water Pollution Control Administration, Delaware Estuary Study, Preliminary Report and Findings, p. 50 (1966).

[2] Council on Environmental Quality, op. cit., pp. 9-21.

along the shoreline and in wetlands. Increased withdrawals of fresh water and out-of-basin diversions to New York created potential downstream problems of salt-water intrusion. Increased usage of the shoreline for factories, refineries, and railroads blocked public access to the shoreline for recreational use. Increased food processing and use of fertilizer resulted in an overloading of the river with phosphates, nitrates, and other nutrients. Increased commercial ship traffic and recreational boating sometimes came into conflict. Increased commercial fishing seriously depleted fish stocks.

The lack of effective solutions to these problems was in large part responsible for the 95% decline in Delaware River and Bay fish catches between 1900 and 1920 (see Exhibit I-5) and for the major declines in recreational uses of the lower river and bay between 1930 and 1950. By the end of this period there was a realization that some remedial action was necessary. Regulations governing industrial pollution were promulgated, and limited action was taken by the City of Philadelphia, among others. However, major sewer improvement programs did not come until comprehensive federal law was enacted in 1965 and 1972.



Source: U.S. Department of the Interior, Federal Water Pollution Control [illegible] - Delaware Estuary Comprehensive Study (July 1966), p. 50.

Exhibit I-5 - Weight of Fish Catches in the Delaware River - 1850-1965

Source: Council on Environmental Quality, op. cit., p. 19.

I.B.4 The Period from 1950 to 1970 - The Rapid Incorporation of the DRBA Region into the Northeast Corridor

Until the 1950's the DRBA region along with the rest of the Delmarva Peninsula to the south had been somewhat isolated from the rapid growth and development occurring along other parts of the Northeast Corridor and Atlantic Coastline. From 1950 to 1970, however, the DRBA region experienced the same rapid urban growth and shoreline development trends previously experienced elsewhere in the northeast. Improved accessibility of the region to major markets and population centers and overcrowding elsewhere in the Middle Atlantic Region were factors contributing to these trends. Described below is the changing role of the DRBA region during this critical period in terms of: the changing regional land transportation and accessibility, the changing patterns of marine transportation, population growth, the region's shifting economic base, and the changing institutional environment and public policy.

I.B.4.a The Changing Regional Transportation System and Accessibility Patterns, 1950-1970

Land transportation systems in the DRBA region changed dramatically during the period from 1950 to 1970. These changes in turn significantly altered regional accessibility and travel patterns as well as land use and development trends.

Prior to 1950, there were no interstate highways, neither the New Jersey nor the Delaware Turnpike had been completed, and there were no major east-west expressways. The only bay or river crossing in the DRBA region was the New Castle/Pennsville ferry, and the only crossings of the Chesapeake Bay were by ferry. It reportedly took over four hours to drive from Philadelphia to Cape May or from Baltimore to the Delaware shore and over four hours to drive from Wilmington to either New York City or Washington, D.C. Even downtown Philadelphia and Baltimore were over two hours away from Wilmington, and there was only limited intercity travel, much of it by rail. Most longer-distance, land-based commerce also moved by rail, and interstate trucking was a much smaller industry than it is today. Since 1940 motor vehicles have tripled their share of intercity freight traffic, while the railroad share has been reduced by about one-third.

Decisions made after World War II and in the early 1950's soon changed the entire nature of the land-based transportation system. Major road improvements included:

- the New Jersey Turnpike, completed to the Delaware Memorial Bridge during 1951;
- the Delaware Turnpike and John F. Kennedy Expressway, completed in 1963;
- the Garden State Parkway, completed in 1954;

- the Atlantic City Expressway, completed in 1965;

- the Interstate Highway System authorized by Congress in 1955, and not yet complete (I-95, I-295, I-495).

Major water crossing improvements included:

- The first span of the Delaware Memorial Bridge, completed in August 1951, replacing the New Castle/Pennsville ferry to link the Delaware and New Jersey Turnpike.

- The second span of the Delaware Memorial Bridge, completed in 1968.

- The Cape May-Lewes ferry service, initiated in 1964, providing the first reasonable link between the road networks of the New Jersey coast and those of the Delaware coast.

- The Chesapeake Bay Bridge Tunnel, completed in 1964, linking the DRBA region's coastal routes with Norfolk, Virginia to the south.

- The Bay Bridge across the Chesapeake Bay near Annapolis, the first span of which was completed in 1953, providing improved links between the Baltimore/Washington area and the Delmarva Peninsula including the coastal resorts of the DRBA region.

- The Walt Whitman Bridge, completed in 1957, and other bridges across the Delaware River at Philadelphia, providing improved links between Philadelphia and the DRBA region's coastal resorts in South Jersey.

With these major improvements in roadways and crossings, regional accessibility for commercial, commuter, and recreational travel changed significantly over the 1950 to 1970 period. With these changes in accessibility, traffic patterns changed, and the DRBA region became a more integral part of the entire Northeast Corridor and Middle Atlantic region.

Driving time from Washington, D.C. along the corridor through Wilmington to New York City was reduced to approximately four and one-half hours or 50% of its pre-1950 length. This improved accessibility greatly increased the Wilmington area's relative locational advantage for industrial location and development. The number of vehicles crossing the Delaware River at Wilmington increased from about 3 million per year in 1950 (the last year of the ferry operation) to 6.4 million per year in 1952 (the first full year's operation of the single bridge span) to 16.5 million in 1970.

Driving time from the Philadelphia or North Jersey areas to the South Jersey coastal resorts and from Baltimore and Washington to the Delaware coastal resorts was reduced to about two hours or 50% of the pre-1950 length. This improved accessibility further increased the relative attractiveness of the DRBA region's Atlantic coast resorts to the populations of the larger metropolitan areas. The traffic volumes along East-West Corridors increased dramatically as did visitor-days spent along the Atlantic coastline of the DRBA region.

Trucking became increasingly competitive with rail and, by 1970, 3.0 million commercial vehicles were crossing the Delaware Memorial Bridge annually.

Some rail lines were abandoned, service frequencies were reduced, and the larger Middle Atlantic region as well as the DRBA region became generally more dependent on roads and less dependent on rail service for commercial, commuter and recreational travel.

I.B.4.b Changing Patterns of Marine Transportation - 1950 to 1970

Marine transportation also changed dramatically during this period, again altering use of the Delaware River and Bay. Between 1952 and 1970, net tonnage of waterborne commerce on the Delaware River from Trenton to the sea increased from 71 million to 124 million tons.[1] Most of this growth was due to increases in the tonnage of crude petroleum and petroleum products, with crude petroleum alone acounting for 47 million of the 124 million tons of freight traffic in 1970. Within the DRBA region, the activity at Wilmington Harbor increased from 2,238,000 tons in 1952 to 2,760,000 tons in 1970, an increase of 23%. Lightering activity in Lower Delaware Bay amounted to 1,549,000 tons in 1970. Elsewhere in the Delaware Basin, marine commerce increased more rapidly, with activity at Philadelphia harbor increasing from 38,321,000 tons in 1952 to 52,224,000 tons in 1970, an increase of 36%.

Toward the end of this 1950-1970 period two important changes began to affect marine transportation in the Lower Delaware River and Bay: (i) containerization of general cargo began to affect port facilities and the competitive advantage of different ports, and (ii) the increasing trend to deeper draft vessels - particularly tankers - began to require rapidly growing lightering operations involving additional smaller tankers and barges in the Lower Bay. The number of tankers and barges using the Big Stone Beach anchorage area increased from about 100 in 1960 to about 450 in 1970.

In addition to the rapidly increasing commercial marine traffic, pleasure boating also increased dramatically during this period, with boat registrations in New Jersey and Delaware increasing by 10% to 15% each year

[1] U.S. Department of the Army, Corps of Engineers, Waterborne Commerce of the United States, Part I, Waterways & Harbors, Atlantic Coast, 1952-1970.

during the 1960's.[1] Extensive marina expansion occurred all long the inland waterway on the Atlantic Coasts of both New Jersey and Delaware, but there was little development along the bay shore. This was due to the extensive wetlands, shallow waters, pollution and lack of road access and other natural advantages along both sides of the bay.

I.B.4.c Population Growth - 1950 - 1970

Between 1950 and 1970, the DRBA region's permanent population grew from 625,720 to 964,418, an increase of 54% in just 20 years. Over one-half the population increase occurred in the City of Wilmington and New Castle County with increases of 66% during this period. Although smaller in absolute numbers, large percentage increases in population were also registered by Kent County (116%), Cape May County (60%), and Cumberland County (37%). Salem, Sussex and Atlantic Counties had 20-year population increases of 20% to 30%. During the 1950's and 1960's the northern and central subregions grew at about twice the rate of the coastal subregion as the petrochemical and research complexes near Wilmington expanded and as congestion in other parts of the Northeast Corridor increased. See Table I-1 of 29 tables in the Statistical Appendix to this Section.

The overall population growth rate of 54% for the region was double the rate for the Middle Atlantic region and significantly above the 34% growth registered for the U.S. during this period. During the 1950's, for example, the Wilmington-Salem Standard Metropolitan Statistical Area (SMSA) grew at about twice the rate of the Philadelphia and Baltimore SMSAs, and net inmigration to the Wilmington-Salem SMSA during this decade represented 12.5% of its 1960 population compared to 3.9% in the Philadelphia SMSA, and 5.4% in the Baltimore SMSA. Despite this larger relative growth, the 1960 population of the Wilmington SMSA represented 5.7% of the combined population of the Philadelphia, Baltimore and Washington SMSAs.

The growth in a region's housing stock and households is often a better indicator of regional change than is population, particularly as it relates to changing travel demands and needs for additional transportation facilities. As shown in Table I-2, the region's housing stock grew at a slighter faster rate than did population. This more rapid growth was particularly evident in the 1960's as household size began to decline. It was also more evident in the coastal subregion, where the housing stock grew almost twice as fast as the population between 1950 and 1970, due in part to the rapid growth of second homes. Only Kent County population grew more rapidly than the housing stock during this

[1]Pleasure boat registrations in New Jersey increased from 39,000 in 1964 to 86,000 in 1970--an increase of 120% in 6 years, as reported by the New Jersey Department of Environmental Protection, Division of Marine Services.

period, a likely reflection of the fact that group-quarters housing at Dover Air Force Base is not counted as housing units.

Much of this population and housing growth was due to the postwar baby boom, but it was also fueled by the reactivation of Dover Air Force Base, by substantial employment increases in New Castle and Cumberland Counties, and by expanding second-home communities and some retirement migration to the coastal areas.[1]

I.B.4.d The Region's Shifting Economic Base

As noted previously, the DRBA region's economy has been based historically on agriculture (primarily vegetables, corn, and poultry), on fishing (primarily menhaden and oysters), on manufacturing (primarily food processing, apparel, clay and glass products and petrochemicals) and on tourism and recreation. During the 1950's and 1960's there were important changes in all of these sectors as well as in their relative importance to the region's economy.

As shown in Table I-3, overall employment increased by 53.6% during this 20-year period with the largest percentage increases in Kent County (a 121.6% increase largely due to a more than ten-fold increase in government and military employment), in New Castle County (a 74.1% increase due to substantial increases in both manufacturing and service employment), and in Cape May County (a 58.6% increase due to increased tourism). The composition of the region's employment also changed, with agriculture and fisheries employment declining in importance, and with wholesale and retail trade, services, and government employment increasing in importance. These trends generally paralleled national trend as shown in Table I-4.

Agricultural and fisheries employment declined by 54.1% during the period, and its share of the region's total employment declined from 8.9% to 2.7% (Table I-5). This trend paralleled the national decline in agricultural employment of 51.6% to a 4.4% share of the total U.S. employment. The cause of this decline was largely mechanization in the agricultural sector, although farm acreage also declined by 22.0% (see Table I-6). The value of farm products sold actually increased by 74.0% in constant dollars during this 20-year period (see Table I-7). This increase was substantially larger than that for the U.S., primarily due to the rapidly growing poultry industry in Delaware.

Commercial fishing in the region declined substantially during this 20-year period. The value of the fish catch declined largely due to declines in the landings of oysters and menhaden. In Delaware the landings of all fish and shellfish declined from 176 million pounds in 1951 to 10

[1]The reactivation of Dover Air Force Base brought a military population to Kent County ranging from 5,500 to 8,000 between 1955 and 1970. An additional 1,200 civilians and 11,500 dependents were attached to the Base in 1970.

million pounds in 1970, and the dockside value of this catch declined from $3.8 million to $1.7 million. For the three Middle Atlantic States of Delaware, New Jersey and New York, landed catches declined by 47.3% from 1,007,000,000 pounds in 1950 to 531,000,000 pounds in 1970, with the value of the catch remaining about constant due to increased prices.

Manufacturing employment grew by 47.3%, almost double the nation's 25.0% growth in manufacturing employment, during this period (see Table I-8). Both the Wilmington and Baltimore metropolitan areas maintained a strong competitive advantage for industrial location, despite their locations within a larger region with a mature economy and a relatively slow economic growth rate. Manufacturing employment in the Wilmington area grew by about 40% between 1950 and 1960 alone, and by 1960 the Wilmington-Salem SMSA had a higher concentration of manufacturing employment than did either the Philadelphia or Baltimore SMSAs. This growth in the region was primarily due to increases in the chemical, food processing, and clay and glass products industries. By 1970, the region's manufacturing base was still dominated by the chemical industry with 28.1% of the region's manufacturing employment. Transportation equipment, glass and clay products, apparel, and food processing together accounted for an additional 49.0% (see Table I-9). The region's manufacturing firms produced goods valued at $3,946,500,000 in 1970 with a value added of $1,837,100,000. As illustrated in Table I-10, 60% of the value of the region's goods are shipped out of New Castle and Salem Counties, reflecting the relatively high ratio of value per employee in the chemical and vehicle assembly firms concentrated in these two counties.

Employment in personal and business services, in finance, insurance and real estate, and in wholesale and retail trade, expanded more rapidly than overall employment during this period. This development paralleled national trends toward the increasing share of employment in the service sector. In the DRBA region this trend was due in part to the development of Wilmington as an important regional finance and service center, in part to the reactivation of Dover Air Force Base and the expansion of government employment in Wilmington and Dover, and in part to the continuing growth of tourism along the Atlantic Coast. Employment in personal and business services and in finance, insurance and real estate increased to a total of 108,014 (28.9% of the total regional employment). The highest percentage shares of this employment were in New Castle County which functioned increasingly as a regional service center and in Cape May and Atlantic Counties where tourism was strongest (see Table I-11). Wholesale and retail trade employment increased by 67.3% to a total of 72,871 (19.5% of the total regional employment). As with the other services, the highest percentage shares were in New Castle, Cape May and Atlantic Counties (see Table I-12). Table I-13 tabulates retail sales in the region for the years 1967 and 1972. The higher per capita sales in Cape May and Atlantic Counties again illustrate the importance of tourism to the local economy.

I.B.4.e The Changing Institutional Environment and Public Policy in the DRBA Region

The 1950-1970 period also witnessed a substantial change in the role of institutions and public policy in the region. In 1962, the first bi-state agency of the governments of New Jersey and Delaware was formed--The Delaware River and Bay Authority. The 1934 U.S. Supreme Court decision resolving the Delaware-New Jersey boundary dispute had removed a major barrier to interstate cooperation.[1] After protracted negotiations, the two States entered into a Compact permitting the Authority to plan, finance, and operate crossings of the Delaware River and Bay. The Compact also authorized the Authority to plan, develop, and operate transportation and terminal facilities in the bi-state area bordering the bay, provided that both legislatures approved such projects. This Compact was approved by the U.S. Congress in September 1962. The first span of the Delaware Memorial Bridge had been built by the Delaware Highway Department and opened in 1951. In 1962 the DRBA took over this span and financed the second span which opened in 1968. The new Authority also initiated ferry services between Lewes and Cape May in 1964.

Institutional controls over the Delaware River and Bay environment also changed dramatically during the 1950-1970 period. Increasing environmental knowledge and concern was translated by political action into an array of regulatory programs at both the State and federal levels. These new programs were generally designed to protect rich ecological resources such as the Delaware Bay wetlands and to temper development programs with an institutionalized concern for preserving natural habitats. While some have criticized these regulatory programs for slowing the pace of development around the bay, others have praised them for preserving and enhancing the bay for fishing and recreation. Among these programs were:

- The National Environmental Policy Act of 1969 requiring the preparation of environmental impact statements for any significant project involving federal actions (e.g., financing, operation, regulation).

- The Federal Water Pollution Control Act Amendments of 1972 which limit the pollutants discharged by cities and industries and provide funds for treating municipal sewage.

[1]This boundary situation continues to be a problem between the States, especially as a result of the Delaware Coastal Zone Act which prohibits certain heavy industry facilities from Delaware waters, and therefore, from Salem County. In addition, the Act forbids multi-use piers and requires permits for all single manufacturing use piers in Delaware waters. In addition, there have been instances in Salem County in which permits were needed to be obtained from both States for the use of subaqueous lands.

- Wetlands preservation controls enacted in New Jersey and Delaware to require special permits before wetlands could be altered for any purpose.

The changing institutional environment is discussed in more detail in Section IV.

I.C RECENT TRENDS IN THE REGION (1970-1979) AND KEY FACTORS AFFECTING ITS FUTURE

Since 1970 the region's growth has slowed considerably, and the higher growth rates have shifted from the Wilmington metropolitan area to the Atlantic Coast. Manufacturing output has declined, while agricultural and fishery production have increased. Larger tankers and increased crude oil imports have caused a tenfold increase in lightering activity in the lower bay, while general cargo traffic at Wilmington and Philadelphia has declined. Casino gambling activity has been legalized in Atlantic City, but the two recent energy crises have hurt the resort economy elsewhere along the coast. These trends affect cross-bay traffic demands, the need for crossings, and other potential activities within the region. In order to shed light upon the future role of the region and the Authority, the nature of these trends and how they are likely to affect the region's and Authority's future are described here.

I.C.1 Population Trends and Forecasts

Population trends in the DRBA region and in the entire Northeast are critical determinants of lower river and bay crossing traffic demands, marine commerce, and shoreline land use. The rate of population and household growth influences recreational demands on the river and bay, on the bay shoreline and along the entire Atlantic Coast, thereby influencing a major component of traffic at the Delaware Memorial Bridge and the Cape May/Lewes Ferry. Such growth also influences general traffic volumes throughout the region and on the bridge and ferry. It also influences the nature of the regional market for goods and services, thereby influencing agricultural and fishery production, some local manufacturing, and commercial freight traffic on or across the bay.

Since 1970, population growth rates of the 1950-1970 period have declined substantially, and growth has shifted from the Wilmington metropolitan area to the Atlantic Coast. Regional population has grown by 8.0%, with growth along the Atlantic Coastline occurring at about four times the rate of the northern subregion (Table I-14). Wilmington, like many other central cities, lost population, in part due to lower birth rates and smaller households and in part due to net outmigration from central cities in line with national trends (see Exhibit I-6). The City experienced a population decline of 20.5% between 1960 and 1975 (19,675 persons) and New Castle County as a whole, which had 38% of the DRBA's 1977 population, also experienced small population declines from 1972 to 1977. The coastal subregion, on the other hand, grew at close to 2% per

year between 1970 and 1977, as retirement migration and coastal recreation activities increased.

Although these recent population growth rates are above the national and northeast growth rates (see Exhibit I-7), they are still about one-half the rates experienced in the 1950's and 1960's. This is in part due to a lower birth rate, and in part due to national trends in interregional migration (see Exhibit I-8). These recent trends provide one basis for projecting the future of the DRBA region, Should these trends in economic adjustment and demographic change continue, the region is projected to grow by approximately 379,000 people or 36% over the next 18 years (see Table I-15). This growth is equivalent to about 1.8% per year and would occur primarily along the Atlantic Coast. With the rest of the northeast corridor (including Wilmington-Salem) projected to stabilize, there would be a slight increase in the relative importance of the Atlantic Coastline but no significant change or growth in the DRBA region's role in the Middle Atlantic region's economy or regional transportation system. Recent "policy projections" by Cape May and Sussex Counties and by the State of New Jersey use much lower population growth rates along the coast.[1]

The rate of household growth is equally if not more important for the purposes of projecting and understanding future traffic, commerce, and recreation demands. The rate of growth in the number of households in the DRBA region and in the whole northeast has actually been higher in recent years than it was in the 1960's. This is in large part due to the new households being formed by the baby boom generation born in the late 1940's and 1950's. It is this continued growth in households that has fueled and is likely to continue to fuel increased traffic and recreational demands in the region for the next 10 to 15 years.

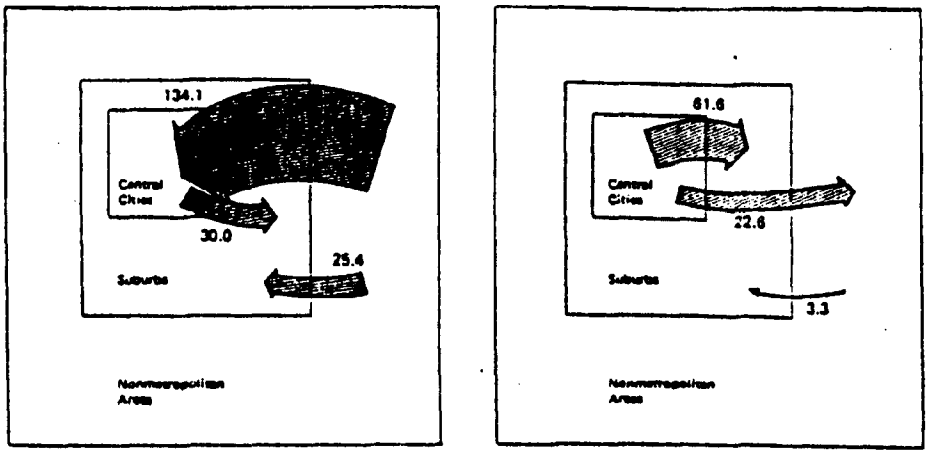
I.C.2 Agricultural Trends and Prospects

The agricultural sector, including manufacturing of food and kindred products, is a major component of the economic base in southern New Castle and Salem Counties, as well as in Kent, Cumberland, Cape May and Sussex Counties. In 1974, this sector accounted for direct employment of approximately 30,000 or about 9% of the region's total employment (see Table I-16). The estimated 1974 value of on-farm agricultural production was $443 million.

---

[1]New Jersey "Policy Projections" for Atlantic and Cape May Counties call for a 66.0% population growth for the 1975-2000 period. This compares to trend projections of 126.3% for Cape May County and 74.2% for Atlantic County. Sussex County policy projections call for a 23% increase between 1975 and 1995 compared to a trends projection of a 51.1% increase.

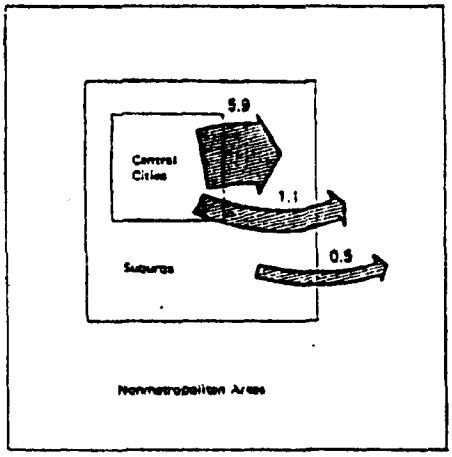
Exhibit I-6 - U.S. Net Workforce Flows 1960-1963 and 1970-1973 (1,000's)



Note: Width of arrows is proportional to volume of net flows between the areas.

SOURCE: Regional Economic Analysis Division (1976) Work-Force migration patterns, 1960-1973. Survey of Current Business October: 23-26.

NET RESIDENTIAL FLOWS, 1970-1975
(000,000's)



Note: Width of arrows is proportional to volume of net flows among the three areas.

SOURCE: U.S. Bureau of the Census (1975) Mobility of the population of the United States: March 1970 to March 1975. Series P-20, No. 285 in Current Population Reports. Washington, D.C.: U.S. Department of Commerce.

From: Brian J.L. Berry and Donald C. Dahmann, "Population Distribution in the United States in the 1970's, Assembly of Behavioral and Social Sciences, National Research Council, National Academy of Sciences, Washington, D.C., 1977.

Exhibit I-7 - Percent Change in Population by State - 1970 to 1978

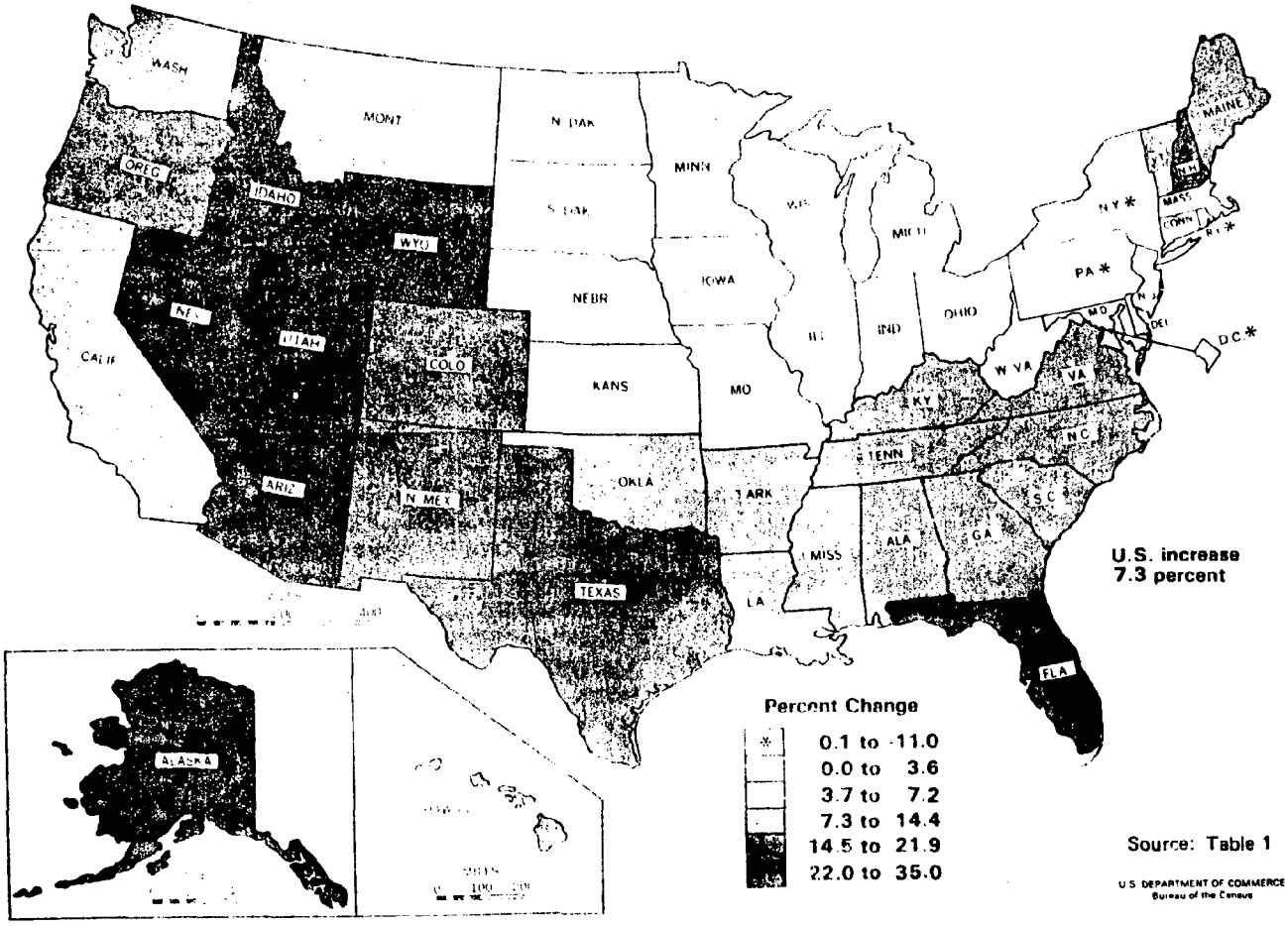
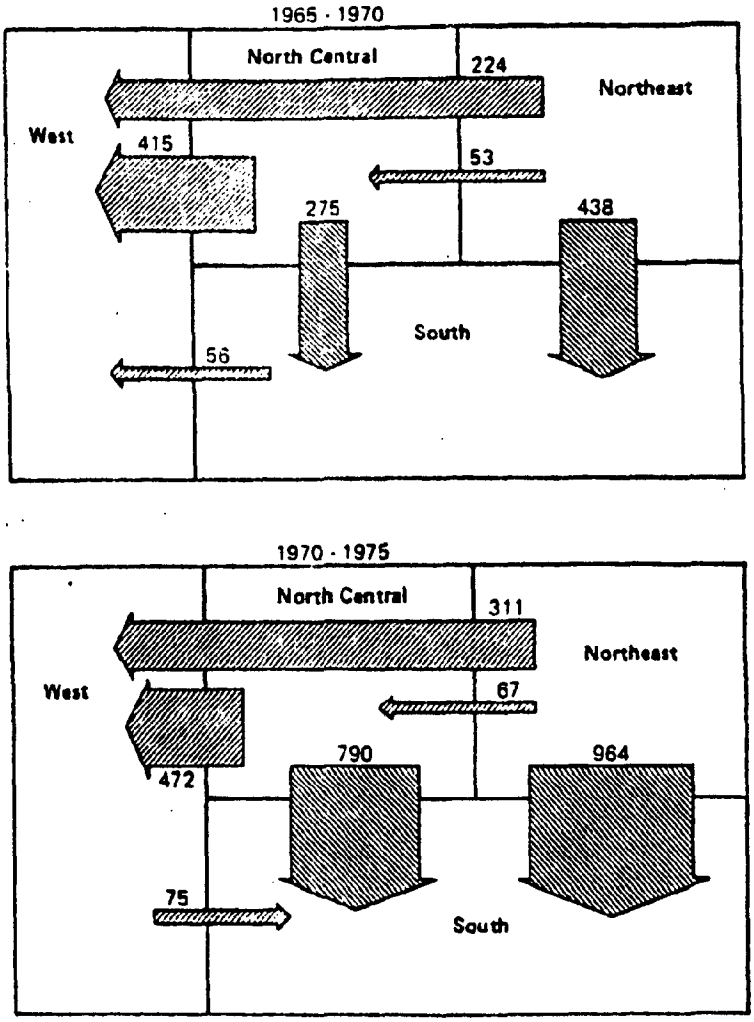


Exhibit I-8 - Net Interregional Migration 1965-1970 and 1970-1975



Note: Width of arrows is proportional to volume of net interregional migration flows. Figures accompanying arrows indicate numbers of net interregional migrants in thousands. Total numbers of interregional migrants for both periods appear in Table 4.

SOURCES: U.S. Bureau of the Census. Census of Population: 1970. Washington, D.C.: U.S. Department of Commerce. U.S. Bureau of the Census (1975) Mobility of the population of the United States: March 1970 to March 1975. Series P-20, No. 285 in Current Population Reports. Washington, D.C.: U.S. Department of Commerce.

From: Brian J.L. Berry and Donald C. Dahmann, "Population Distribution in the United States in the 1970's," Assembly of Behavioral and Social Sciences, National Research Council, National Academy of Sciences, Washington, D.C., 1977.

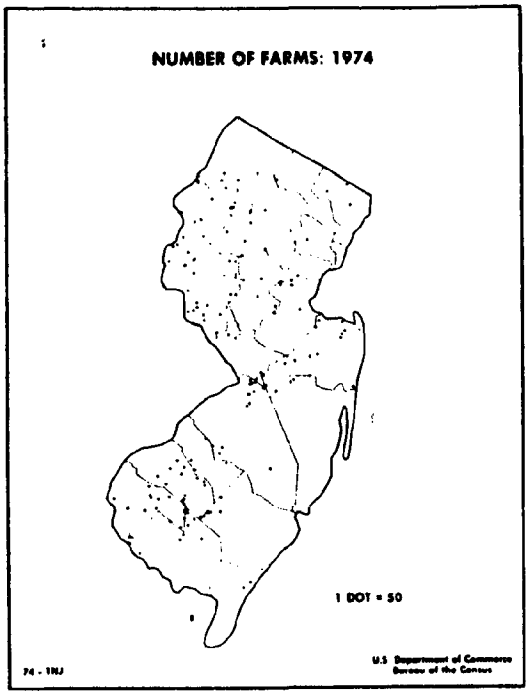
This agricultural sector has also gone through substantial changes in the past ten years with the continuing decline of vegetable production and food processing, the continuing strength of the poultry industry, and recent increases in corn and soybean production. It is relevant to the DRBA's activities in two potentially important ways: (i) it is an important contributor to the economic vitality of the region and plays a particularly critical role in Sussex, Salem, Kent and Cumberland Counties, (ii) it generates commercial truck traffic and may begin to play a larger role in waterborne commerce. The Port of Wilmington is exploring grain and poultry export, and farm products accounted for 50% to 60% of all dry bulk cargo exports from the Delaware Basin ports between 1963 and 1977.

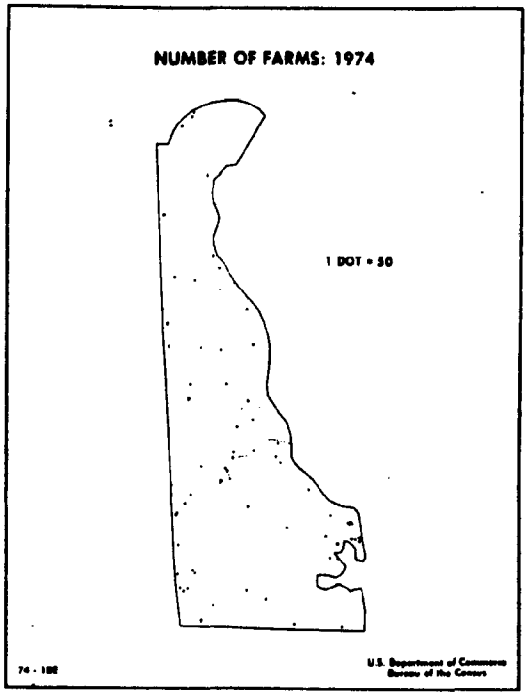
I.C.2.a On-farm Agricultural Production

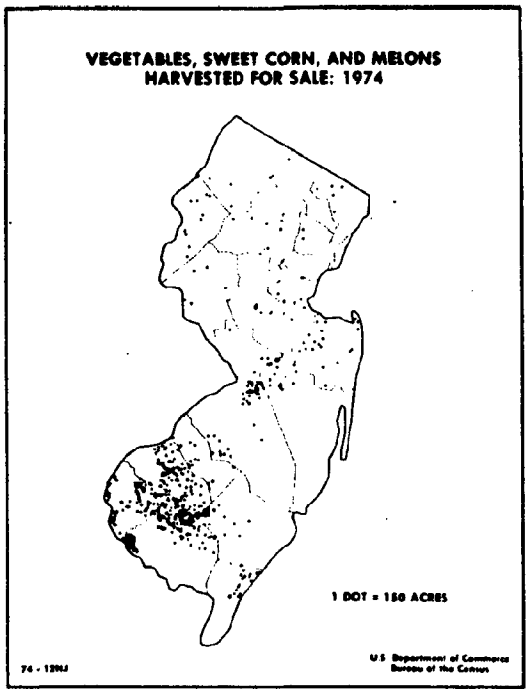
Farm acreage in the region declined by a reported 68,754 acres or 7.5% between 1969 and 1974 (Table I-17). This acreage amounted to approximately 853,000 acres in 1974 or 36.2% of the region's total. Over 50% was in Sussex and Kent Counties. This decline represents a continuation of the rate of decline experienced since 1950 but also represents a slower rate of decline than for most other middle and south Atlantic states.

On the other hand, harvested acreage in the region increased by about 40,000 acres or 7.2% in the same period to a 1974 total of 597,000 acres. Table I-18 illustrates the trends in individual crops and poultry production by county between 1969 and 1974. Vegetable, sweet corn and melon acreage declined from 103,843 to 87,243 acres (a decline of 16%), while soybean and field corn acreage increased from 149,031 to 233,788 acres (an increase of 56.9%). In 1974, approximately 68% of the harvested acreage was in corn and soybeans, while vegetable acreage has declined even more rapidly with the closure of several large food processing firms in New Jersey (H.J. Heinz, P.J. Ritter, Seabrook Farms). The poultry industry expanded during this same period. The number of broilers sold increased by 10.3%, from 112,905,000 to 124,640,000, and the number of hens sold increased by 41.9%, from 1,117,000 to 1,585,000.

Exhibit I-9 illustrates the distribution of farms and vegetables, sweet corn and melon acreages in the region. Totale 1974 farm acreage was concentrated in Kent and Sussex Counties (62.2% of the region's total) while there was very little in Cape May and Atlantic Counties (4.8% of the region's total). Vegetable acreage in 1974 was concentrated in Salem and Cumberland Counties (52.2% of the region's total) where vegetable acreage accounted for about 46,000 acres or about 37% of the harvested acreage in these two counties. Most of this acreage was in tomatoes, peas, and beans. Field corn and soybean acreage was concentrated in Kent and Sussex Counties (77.6% of the region's total) where field corn and soybean acreage accounted for about 315,000 acres or about 58.3% of the harvested acreage in these two counties.







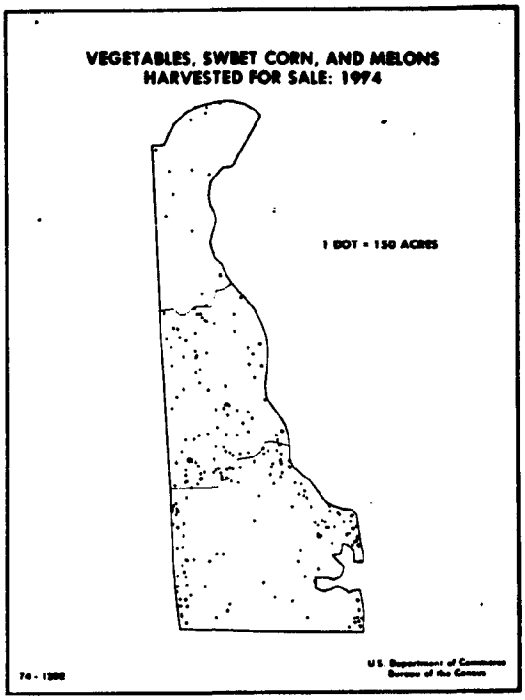


Exhibit I-9 - Distribution of Farms and Vegetables/Sweet Corn/Melon Acreages in the DRBA Region - 1974

Source: U.S. Department of Agriculture, 1974 Census of Agriculture

These different cropping patterns produced a much higher crop value per harvested acre in Salem and Cumberland Counties (about $500-$600 per harvested acre) than in Sussex County (about $125/acre). However, the concentration of the high-value poultry industry in Sussex County, 89.7% of the region's market value of poultry products, meant that about 56% of the region's total market value of farm products was produced in Sussex County. Table I-19 shows the 1969 and 1974 values of farm products for each county and for the region. These values increased by 34.1% between 1969 and 1974, reflecting major increases in both poultry and grain production. This table also illustrates that about 45% of the value of farm production is in poultry. Exhibit I-10 illustrates the distribution of these product values.

Since 1974, harvested acreages and the total value of agricultural production have declined slightly. Declines in the value of agricultural production have been particularly significant for vegetables. With the re-establishment of some food processing operations in New Jersey (e.g., Seabrook Bros. & Sons, Inc.), and with increasing demands for poultry products, local officials are hopeful for stabilization and possibly growth in the value of agricultural production. Increasing costs of transportation and energy, decreasing labor advantage on the West Coast, and increasing problems of water supply throughout the West should improve the relative competitive advantage of this region for agricultural production -- particularly for the fresh food market.

I.C.2.b Food Processing

Closely tied to this on-farm agricultural production are the food processing industries referred to as the "manufacturing of food and kindred products" (SIC Code 20). Employment in this sector was estimated at 11,569 for the DRBA region in 1976. Several larger firms have relocated, closed or severely curtailed operations in recent years (e.g., H.J. Heinz, Seabrook Farms, P.J. Ritter, American Clam Company) while others have opened new operations (e.g., Gorton's Seafood). Employment in these industries is an important component of the region's economic base, particularly in Cape May, Cumberland, Kent, and Sussex Counties where this employment represents about 27% of all manufacturing employment. The value-added by this manufacturing amounted to $529,600,000 in 1976, or 17.1% of the total value-added by all manufacturing in the DRBA region. The value of processed or manufactured food shipments was $1,590,000,000 for 1976, or 19% of the total value of manufacture shipments. Employment changes in this industry between 1974 and 1976 are listed in Table I-20.

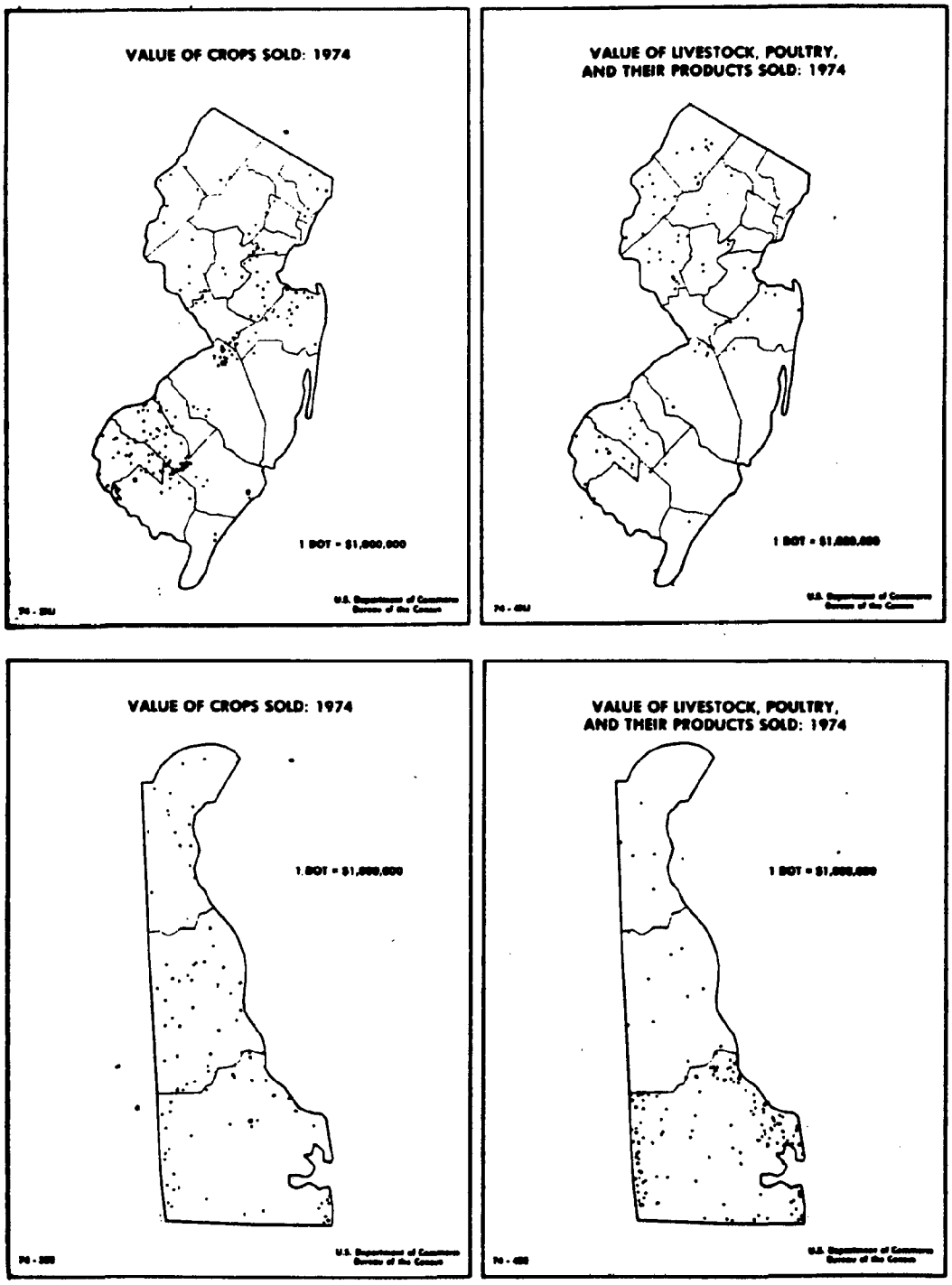


Exhibit I-10 - Distribution of Agricultural Product Values in 1974 $

Source: U.S. Department of Agriculture, 1974 Census of Agriculture

I.C.3 Commercial Fishing Trends and Prospects

Commercial fishing is an important component of the economic base in Atlantic, Cape May, and Cumberland Counties and once was important in Sussex County. In 1978, the dockside value of fish and shellfish landings in the DRBA region was an estimated $31 million. The direct ment in fisheries in 1974 included 1,814 fishermen and 1,085 engaged in seafood processing.

Commercial fishing is now going through major changes with the institution of the 200-mile limit and the rapidly increasing worldwide and domestic demand for fish and shellfish.

Commercial fishing is relevant to the DRBA's activities in the following ways:

- The fisheries present special needs in terms of shoreline land uses for processing and facilities for the commercial fishing fleet. Two abandoned Menhaden plants represent special problems and opportunities.

- Aquaculture research and marine farming are important and potentially expanding activities in the Lower Delaware Bay.

- Fish and shellfish (particularly clams) are regularly transported for processing or marketing on the Cape May/Lewes Ferry.

- The Port of Wilmington is exploring fish exporting possibilities, and both Cape May and Lewes are assessing the feasibility of expanded fishing port or fish processing facilities.

- Both New Jersey and Delaware are seeking financing and support for expanded facilities to take advantage of the new 200-mile limit.

- The fishery resources, particularly the oyster beds, are environmentally sensitive. Potential DRBA activities such as dredging would have to address these problems.

Until recently, commercial fishing in the Middle Atlantic states had steadily and rapidly declined from its peak in the mid-1950's. The total catch declined from 1,054,000,000 pounds in 1956 to 140,000,000 pounds in 1970, an 87% decline in 14 years. The value of this catch in the same period declined from $76 million to $52 million, due primarily to overfishing of menhaden and 923,000,000 pounds decline in catch in this period. Oyster catches also declined by about 7,000,000 pounds (87%) due to the blight. Declines continued into the early 1970's, but since 1974, there has been a substantial resurgence, with pounds of fish

landings increasing by 13% between 1974 and 1978 and value of catch increasing by 194% to a 1978 total of $30,921,000 (see Table I-21).

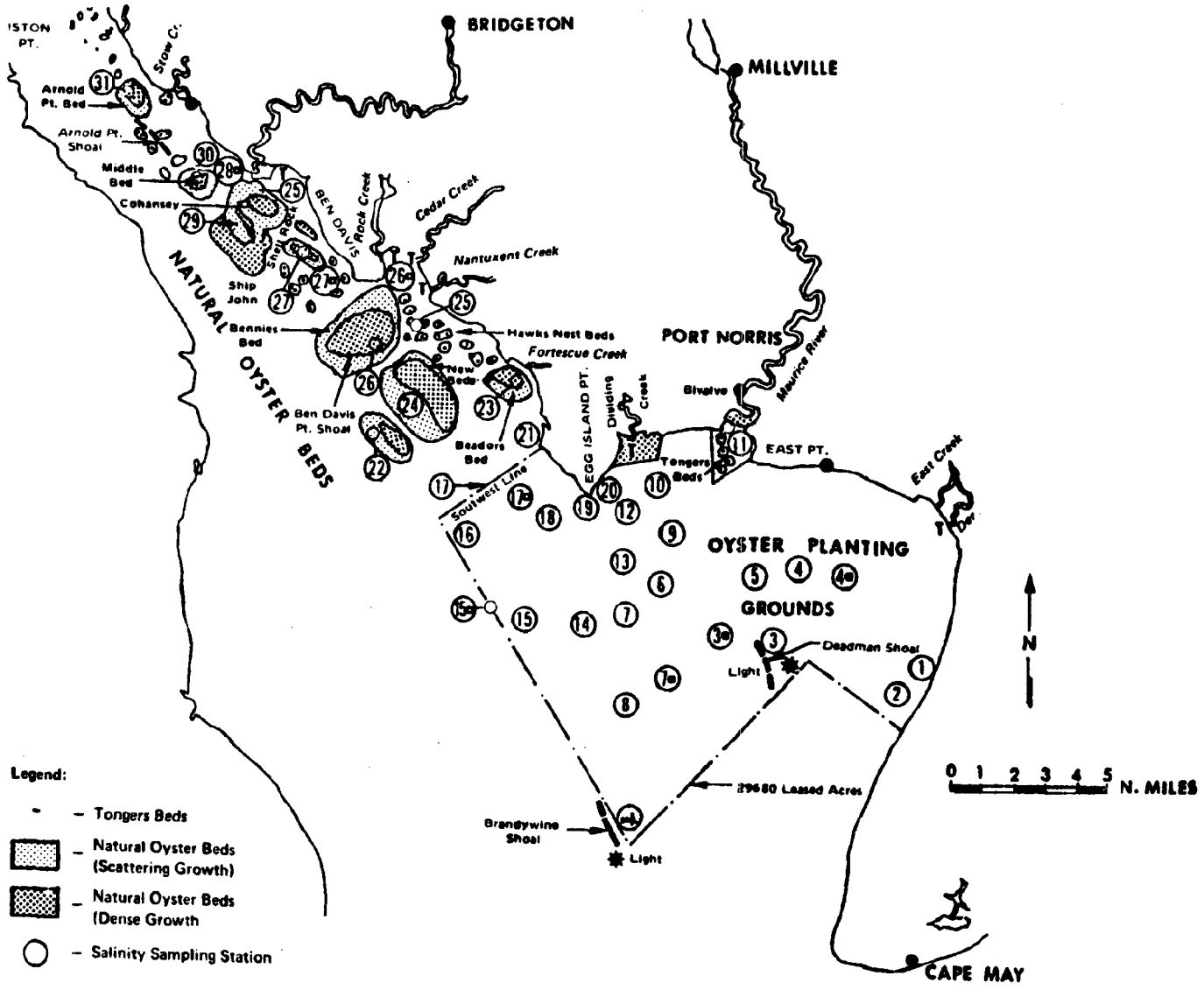
Increased domestic and worldwide demand for fish and the resultant higher prices have renewed interest in the further expansion of commercial fishing in the Middle Atlantic region. U.S. per capita consumption of fresh and frozen finfish has increased at an average annual rate of 3.9% since 1967, and the world market has grown even more rapidly.

The two major potentials for expansion of the commercial fishing industry are the 200-mile limit, particularly as it affects squid, mackerel, hake, and herring, and aquaculture, particularly as it affects oysters. In terms of offshore fishing and the 200-mile limit, a recent survey by the Economic Development District Agency for the Delmarva Peninsula found that 85% of fishermen and processors surveyed felt that the fishery resources and market prices were sufficient to support industry expansion. Although surfclams and menhaden are being fished near or beyond their sustainable yield, National Fishery Marine Service studies show significant "underfishing" for many species. The Fishery Conservation and Management Act of 1976 established preferential American access to fishery resources within 200 miles of the coast. Since 44% of the volume of fish caught in U.S. coastal waters north of Cape Hatteras were caught by foreign fishermen, this Act could open up a substantial opportunity for U.S. fishermen (see Table I-22). The species having the greatest potential are squid, mackerel, hake, and herring, for which 90% of the recorded catch was previously harvested by foreign fleets. While some of these species would probably require an expanded export market, a recent feasibility study for Middle Township in Cape May County found that there was an adequate domestic market and supply of suitable finfish (primarily whiting and hake) to support additional fish processing capacity of 12 million to 20 million pounds per year. The 200-mile limit is not likely to have a significant impact on the shellfish industry (except possibly scallops) or industrial fish such as menhaden, due to overfishing and the current U.S. dominance.

Aquaculture or marine farming is the second major potential for expansion of the commercial fishing industry. The focus of most of the aquaculture research in the delaware Bay to date has been on the oyster, currently farmed on both the New Jersey and Delaware sides of the Bay, with activity centered at Port Norris and Bivalve on the New Jersey side. Exhibit I-11 illustrates the location of the natural oyster beds and the oyster planting grounds on the New Jersey side. Although the oyster landing declined dramatically in the early 1950's as a result of disease, it has recently begun to make a comeback, and the disease has apparently run its course. In 1978, there were more oysters planted in the New Jersey beds than ever before, and it is hoped that the improved production will continue.

Both the University of Delaware, College of Marine Studies, at Lewes and the Rutgers University Research Laboratories in Bivalve and Cape May conduct oyster research as well as other research into aquaculture

Exhibit I-11 - Location of Oyster Beds - on the New Jersey Side of the Delaware Bay



possibilities. Although aquaculture now provides for less than 3% of domestic fishery production, compared to 10% worldwide, the percentage is growing. In addition to shellfish farming, there have been successful experiments and domestic commercial enterprises in lobster, shrimp, fish, seaweed, and saltmarsh farming, all of which may have relevance to the long-term future use of the Delaware Bay. As noted in a recent request from the U.S. Department of Commerce for a study of future capital requirements of the U.S. aquaculture industry, considerable capital investment requirements are anticipated. Although most financing will likely come from private sources, additional assistance from government agencies will be needed.

I.C.4 Manufacturing Trends and Prospects

Manufacturing has long been an important component of the economic base in the DRBA region. In 1970, it directly accounted for 28.4% of the region's total employment, for 44.7% of the total in Salem County, 41.5% in Cumberland County, and 30.4% in New Castle County. Since 1970 there has been a significant decline, production workers employed declining from 72,300 to 62,100 by 1976, a decrease of 14.1%, and non-production manufacturing workers declining from 44,500 to 41,800, a decrease of 6.1%. During this same period, manufacturing value-added remained constant at $3,095,000,000, and the value of the region's manufacturing shipments increased by 25.1% to $8,369,000,000. Since there were declines in both manufacturing value-added and value of manufacturing shipments in all counties except New Castle and Salem, the higher regional totals are likely the result of increasing values of the petrochemical and possibly vehicle assembly output in the Wilmington area. Table I-23 lists county-by-county changes in key manufacturing indicators.

The decrease in manufacturing employment between 1970 and 1976 parallels trends in the New England and Middle Atlantic Region and the nation. Manufacturing employment has not been growing as rapidly as other sectors nationally, and most growth has occurred outside the New England and Middle Atlantic Regions (Table I-24). Although the 1974-1975 recession contributed to the decline in manufacturing employment nationally, the decline within the DRBA region has been relatively steady since 1969.

Despite these recent declines, most projections for the DRBA and Middle Atlantic Regions still call for growth in this sector through 1995. For example, the Delaware Office of Management, Budget & Planning projects an increase in manufacturing employment for Delaware from the 1976 level of 66,000 to a 1995 level of 90,000. Between 1976 and 1978, however, there was almost no change in Delaware's manufacturing employment, despite increases of about 10% in other non-agricultural employment. Given this fact, combined with the region's concentration of employment in two sectors with questionable regional futures (petrochemicals and vehicle assembly), these projected employment increases may prove to be too high.

The composition of the DRBA region's manufacturing employment in 1976 is shown in Table I-25. As can be seen from this table, the region's manufacturing base is heavily dependent on the prospects of five specific industries: Chemicals Petroleum and Allied Products (SIC 28, 29), Transportation Equipment (SIC 37), Glass and Clay Products (SIC 32), Textiles and Apparel (SIC 22, 23), and Food and Kindred Products (SIC 20). The food processing industry trends and prospects were discussed in the previous section on agriculture. The other four industries are discussed below, with detail provided on the more important and potentially more volatile petrochemical industry.

Chemicals, Petroleum and Allied Products

The petrochemical industry has a higher share of the region's manufacturing employment than any other industry and also represents the region's largest industrial concentration relative to national employment shares for each industry. This is largely due to the headquarters locations of E.I. duPont deNemours & Co. and Hercules Inc. in Wilmington, the two largest employers in 1976 with approximately 9,000 and 2,000 employees respectively within the city. Although the prospects for this industry in terms of domestic petrochemical demand appear strong (Table I-26), recent industry trends raise serious questions about its future within the region. duPont has recently announced termination of its dye manufacturing operations at the Chambers Works in Pennsville, and Hercules had considered a transfer of its corporate headquarters to the South, probably Louisiana or Texas, but has now decided to remain. The duPont decision will reduce employment by a reported 900 production workers.

The duPont decision does not necessarily reflect the major trend in the industry toward concentration of petrochemical production in the Texas-Louisiana area, where the environment is in fact more supportive of the industry in terms of climate, resource availability, taxes, regulations, and labor. Moreover, the number of petrochemical production workers in the region is relatively low already, with over 80% of the industry's local employment being classified as administrative, research, headquarters and auxiliary. However, the national trend toward growth of petrochemical production in the South could have implications for the region's economic base and facilities along the Delaware River.

In addition to facing serious challenges in the chemical industry, the region could be facing some challenges relative to the petroleum refining industry. Although the Getty refinery in Delaware City is the only major refinery in the DRBA region, there are others immediately to the north along both sides of the Delaware River (see Exhibit I-12). These refineries make the Delaware Basin the largest concentration (68.7%) of refining capacity on the East Coast. However, with 40% of the nation's demand for refined petroleum products, the East Coast has only 12% of the nation's refining capacity. About two-thirds of the region's demand is met by importing refined products from other regions via the Plantation and Colonial pipelines, and there has been pressure to expand the region's refining capacity. A Shell Oil proposal for a new 150,000-barrel/day refinery was blocked several years ago by the passage of a

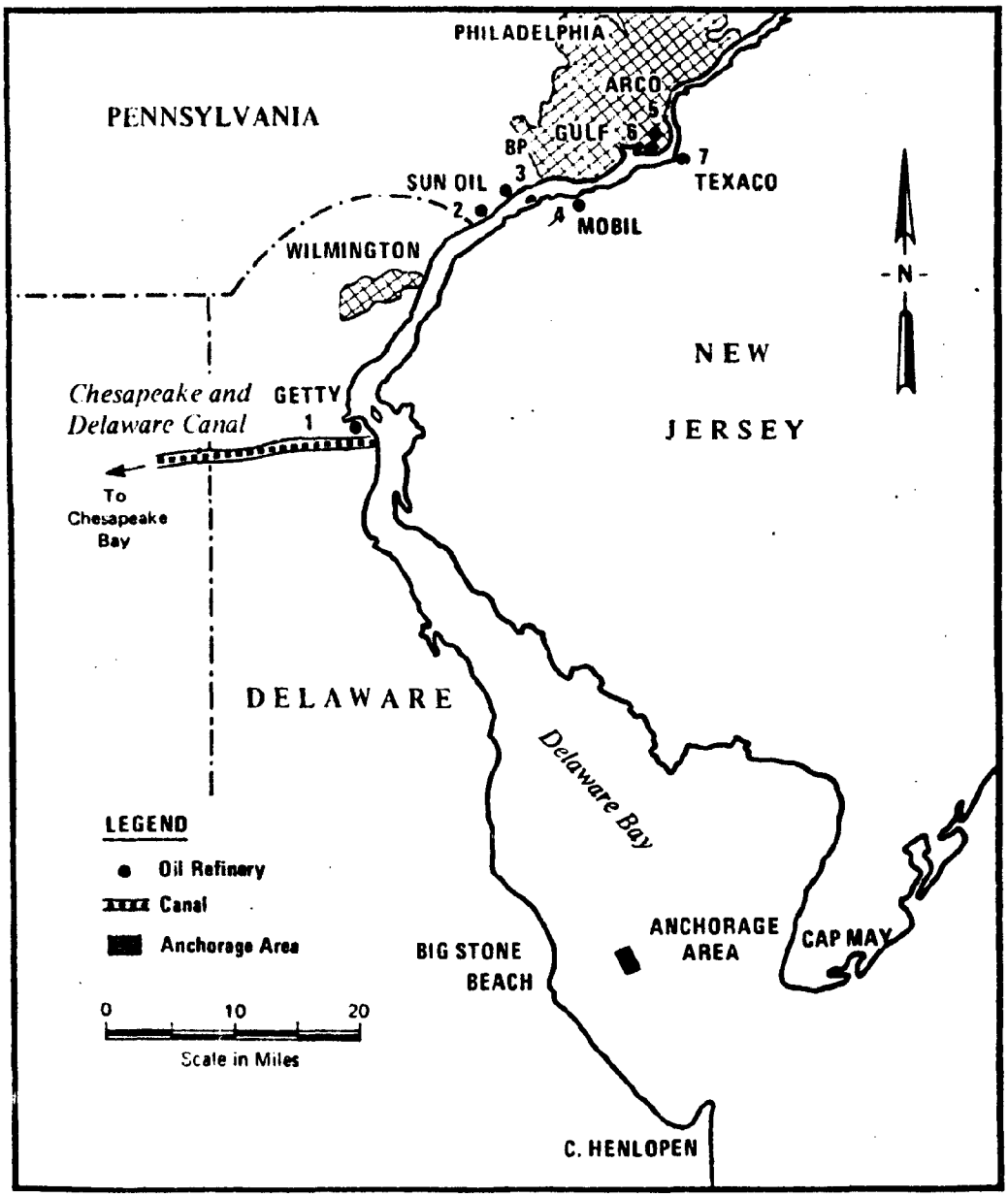


Exhibit I-12 - Location Map, Delaware Valley Refineries and Lower Bay Lightering Area

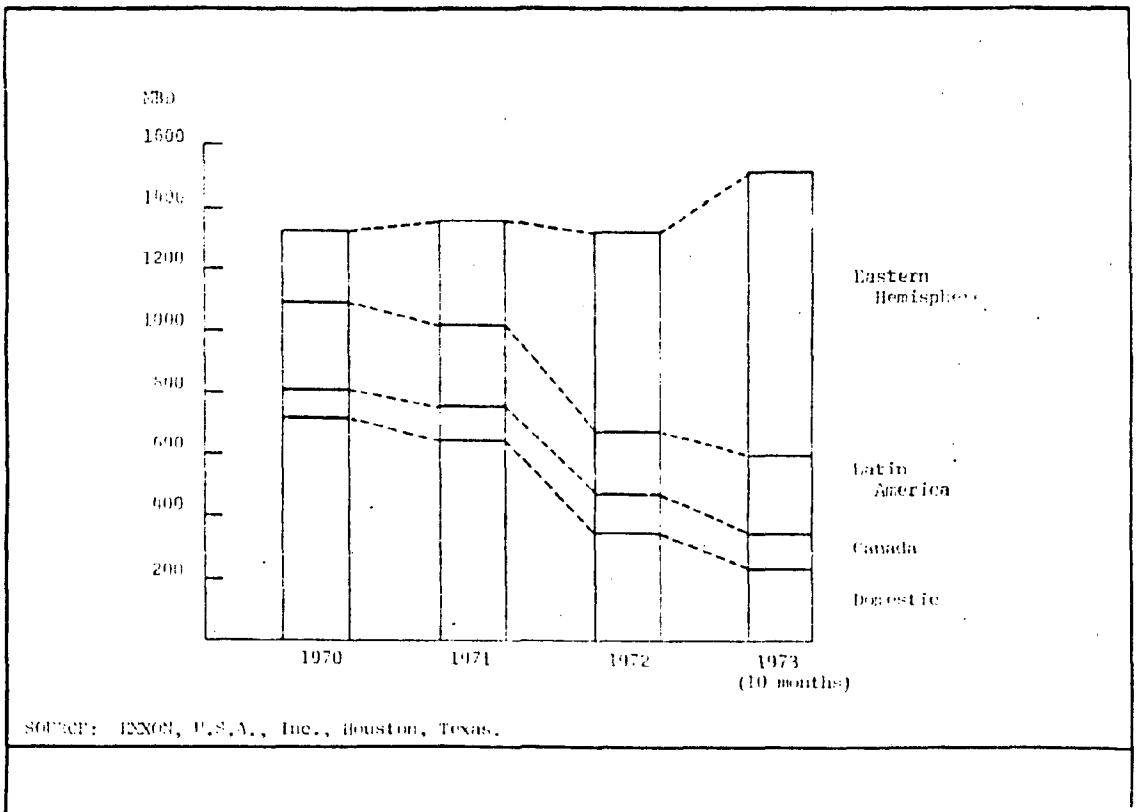
Delaware Bill forbidding refineries in the Coastal Zone. Although there are still active proposals for new refineries in Eastport, Maine (Pittston) and Norfolk, Virginia (Colonial), it is uncertain when, if ever, new refinery capacity will be built on the East Coast.[1] Like the chemical industry, petroleum refineries are likely to turn increasingly to the Texas-Gulf region for expansion. Deepwater off-shore ports are now going forward in that region, people there are used to the oil business, the infrastructure is there, the weather is better, and there are less environmental problems than in the DRBA region. Added capacity in the Delaware Basin is most likely to be associated with expansion of existing facilities.

One implication of this prospect is that the volume of lightering in the Lower Bay is likely to level off. As shown in Table I-27, while volume of Delaware Bay oil imports involving lightering increased dramatically from 19.3 million barrels per year in 1970 to 124.4 million barrels per year in 1977, this volume is not sufficient to provide the throughput necessary to make an off-shore deepwater port in the Atlantic a viable project in terms of oil transshipment.[2] This increase in the 1970's was due in large part to the increasing dependence of Delaware Bay refineries on crude oil imports from the Mideast (see Exhibit I-13) transported in very large deep draft tankers. However, despite this increase, less than half the crude oil needs of the Delaware Basin refineries required lightering in 1977, and while some feel that continually increased dependence on Mideast imports justifies a deepwater port off the Delaware or New Jersey shore, opening of the Suez Canal has made shallow draft vessels not involving lightering again more viable. Thus, even with substantially increased dependence on Mideast imports, it is unlikely that lightering activity will increase to the level required to justify an off-shore port. Recent developments make such a need even less likely, since there will now be a cap on crude oil imports and an increasing percentage of these imports is likely to come from the Western Hemisphere. The effort to reduce or stabilize crude oil imports may fail, and expansion of regional refinery capacity may occur. Tables I-28 and I-29 provide an estimate of the potential economic impacts on the Middle Atlantic region and on Cumberland and Cape May Counties of a hypothetical increase in refining capacity and development of an off-shore port.

---

[1] A new proposal for a $400 million 175,000-barrel-a-day refinery is also reportedly being studied for Camden. New Jersey officials have met with International Consolidated Oil Company and given preliminary support. Also, a Portsmouth, Virginia refinery development was recently announced.

[2] A throughput of 400,000 barrels-per-day was found to be necessary to justify a $1/2 billion deepwater port 10 miles off-shore in Boston Harbor. (Arthur D. Little, Inc. report to the New England Regional Commission, 1974).



SOURCE: EXXON, U.S.A., Inc., Houston, Texas.

Exhibit I-13 - Source of Crude Oil for East Coast Refinery Runs

Another aspect of the petroleum industry that has been of recent concern to the DRBA region has been the Baltimore Canyon potential. However, since drilling began in March, 1978, there have been no significant oil finds, and at this writing only one well has reported a good flow of natural gas (see Exhibit I-14). As a result, several oil companies have withdrawn and only 16 of the 45 companies qualified to bid on the second lease sale participated. Those companies that have remained bid conservatively in the second lease sale. Average bids in the first sale were $11.8 million per tract; average bids in the second sale were $950,000 per tract. Brown & Root, Inc. has reportedly decided not to build a $45 million facility near Cape Charles, Virginia, for fabricating off-shore drilling platforms.

Transportation Equipment

Vehicle assembly plants in New Castle County are also an important part of the region's economic base, employing approximately 9,000 workers and more production workers than the region's petrochemical industry. This industry also provides support for the volume of exports handled at the Port of Wilmington. However, the industry's two major facilities have been affected by both the recent dip in new car sales and the problems of downsizing.

Glass and Clay Products

The first glass manufacturing operation began in Millville and Bridgeton in the 1700's. Millville is now the headquarters for Wheaton Industries, with major facilities at Owens-Illinois and other glass manufacturers as well. Over 90% of this industry's employment in the DRBA region is on the New Jersey side of the Bay, where there are five establishments employing more than 1,000 workers. The high quality sands in the region and the extensive manufacturing facilities will probably support the industry's continued strength locally. Although the one-third reduction of Owens-Illinois's work force in 1978 presented a severe employment problem, most of the 700 who were laid off reportedly found work locally in the glass manufacturing industry.

Textiles and Apparel

Unlike the other three industries discussed, this industry is characterized by a large number of smaller firms and, although it employed about 9,000 workers in 1976, only one establishment employed between 500 and 1,000 employees, and none employed more than 1,000. There were, however, over 50 firms in the DRBA region employing between 50 and 500 employees, and despite recent declines, it remains an important part of the region's economic base -- particularly in Cumberland and Atlantic Counties. Its future in the region remains a question, although the recent opening of new firms and expansion of others in Cumberland County is clearly a positive development following the county's loss of 625 jobs in 1976-1977 due to the closure of four apparel firms in Vineland and Millville.

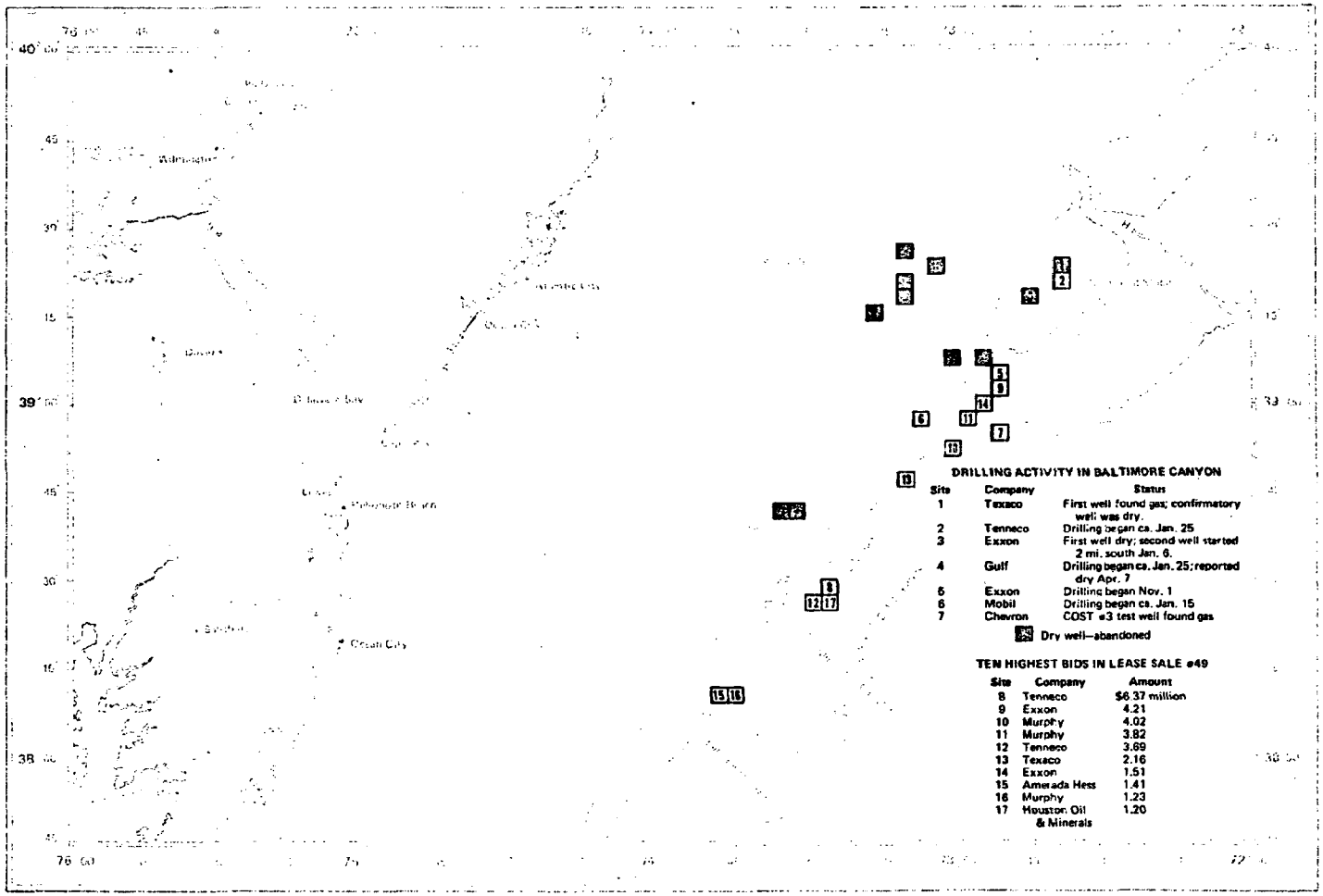


Exhibit I-14 - Mid-Atlantic Outer Continental Shelf Oil and Gas Exploration

I.C.5 Tourism and Marine Recreation - Trends and Prospects

This component of the region's economic base has been the most rapidly growing in recent years and has been principally responsible for the net inmigration between 1970 and 1977 of the estimated 39,100 households to the three counties of the coastal subregion of the DRBA region. Growth has been so rapid in these areas that serious problems of growth management such as sewer capacity, water supply, housing and condominium development have developed all along the Atlantic Coast. These problems have developed at the same time that communities in New Castle, Cumberland, and Salem Counties are trying hard to promote growth or prevent decline.

Whether this growth along the Atlantic Coast will continue, whether the energy crisis or environmental concerns will bring it to a halt, or whether legalized casino gambling will cause it to increase further is a subject now being hotly debated in communities throughout the coastal subregion. What eventually transpires over the next twenty years will clearly have a major impact on transportation demands and on shoreline land use throughout the DRBA region.

I.C.5.a The Potential Impact of Casino Gambling on the DRBA Region

Casino gambling represents a new development likely to significantly affect the region -- particularly on the New Jersey side. Resorts International Casino opened its doors in Atlantic City at the end of May 1978 and has generated far more activity than was at first anticipated. Two additional new casino projects have now been approved, five casino/renovation projects are under construction, and ten additional casino developments are at some stage of the approval process (see Exhibit I-15).

Should the "success" of casino gambling in Atlantic City continue, an additional 90,000 permanent jobs are forecast for Atlantic County, assuming a total of 12 new casinos (see Exhibit I-16).[1] This increase would translate into an additional permanent population of 200,000 for Atlantic and Cape May Counties, an increase of 79% over the 1977 population, and approximately 20,000 additional visitor-days on the Atlantic coastline each year, including new non-gaming tourists and conventions.[2]

The origins of these additional visitors and their impact on traffic volumes, as forecast by the New Jersey Department of Transportation, are illustrated in Exhibit I-17. Additional visitors coming by way of

[1]Rutgers University, Center for Urban Policy Research, Casino Impacts - Atlantic County, New Jersey (1978).

[2]Economics Research Associates, The Evaluation of Casino-Hotel Development on the Demand for Housing in the Atlantic City Area (September, 1979).

Exhibit I-15

ACTIVE CASINO PROJECTS IN ATLANTIC CITY
May 1979

CASINO

RENOVATION PROJECTS UNDER CONSTRUCTION

Boardwalk Regency (formerly Howard Johnson's Regency)
Caesar's of N.J.
Bally-Park Place (formerly Dennis Hotel, Marlborough-Blenheim Hotels)
HiHo Claridge (formerly Claridge Hotel)
Penthouse (formerly Holiday Inn)
Phoenix Hotel & Casino (formerly Ambassador Hotel)
Adamar of N.J. Subsidiary

RENOVATION PROJECTS IN APPLICATION PROCESS

Resorts International (for former Chalfonte Hotel)
Ritz Hotel and Casino (for Ritz Apartments)
Shelburne Benihana (for former Shelburne Hotel)
Metropole Hotel and Casino (for former Morton Hotel)

NEW PROJECTS IN APPLICATION PROCESS

Dunes Hotel and Casino (site of former President Hotel)
Golden Nugget Hotel and Casino (site of former Strand Hotel)
Holiday Inn Hotel and Casino (marina location)
Jersey Hotels, Inc. (White Horse Pike location)
Sahara Hotel and Casino (President Hotel site) Del E. Webb
Plaza Hotel and Casino (Mississippi and Columbia Avenues)

NEW PROJECTS - APPROVALS OBTAINED

Playboy Hotel and Casino
Great Bay Hotel and Casino

NON-CASINO HOTEL

Howard Johnson

Source: Atlantic County Division of Economic Development
Atlantic County Growth Trends Report, May 1979, pg 16

Exhibit I-16

PROJECTED EMPLOYMENT AND POPULATION IMPACT
OF ATLANTIC CITY CASINO DEVELOPMENT

Employment Growth Due to Casino Development

Casino's	4	8	12
Direct Employment	8,753	17,753	26,753
Indirect Employment	19,693	39,940	60,190
Summer	3,280	6,656	10,030
TOTAL	31,726	64,349	96,973

Atlantic County Population Growth Due to
Casino Development

Casino's	4	8	12
Population Growth Impact	57,832	127,468	200,588

Source: Rutgers University, Center for Urban Policy Research, based on study by Economics Research Associates

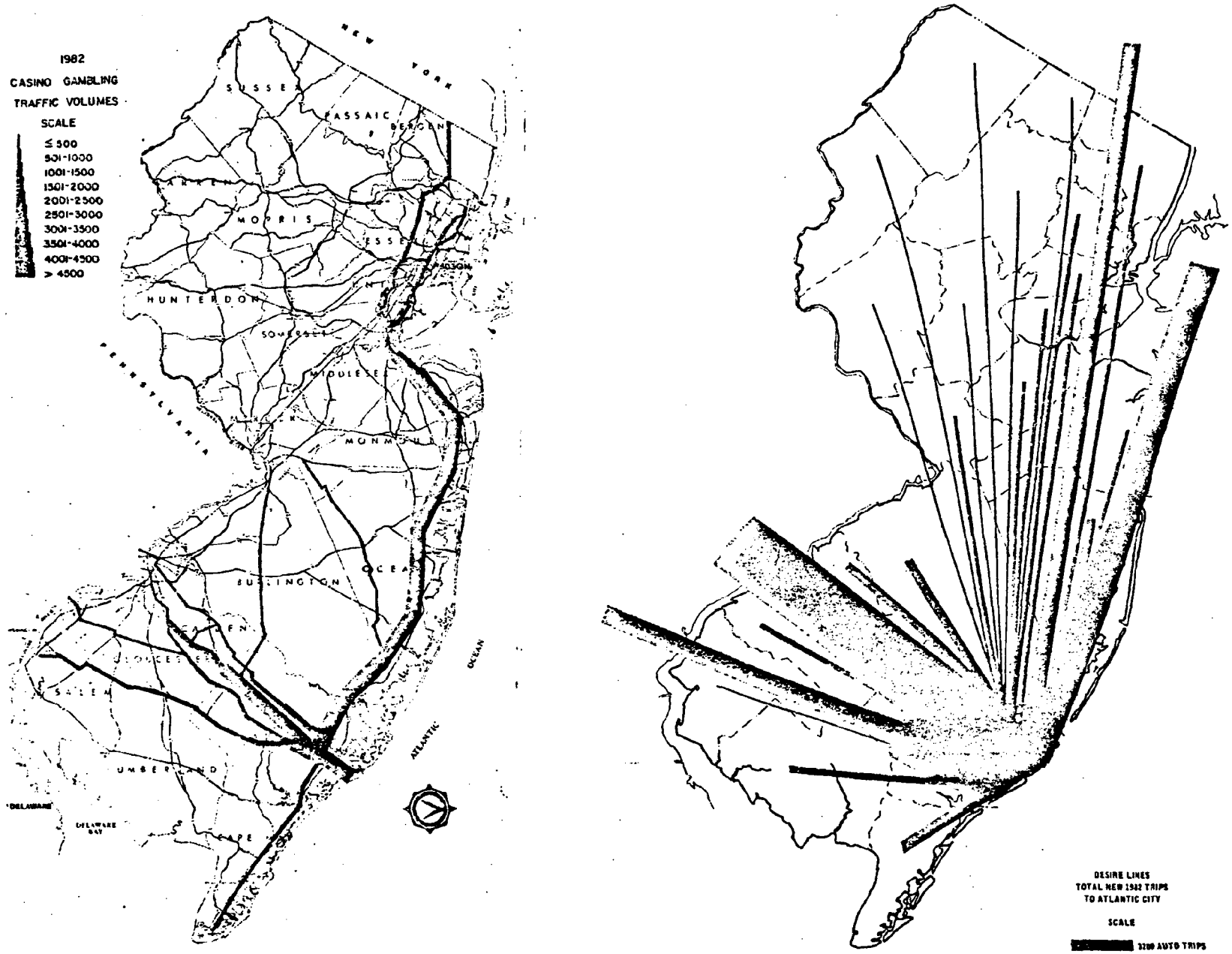


Exhibit I-17 New Trips to Atlantic City - Projected Desire Lines and Traffic Volumes - 1982
Source: New Jersey Department of Transportation

the Delaware Memorial Bridge were projected to increase peak bridge traffic on a 1982 August weekend by 1100 vehicles or 3%, assuming four to six casinos. Traffic impacts on Atlantic City to date include a 60% increase from the previous year on the Atlantic City Expressway at the Pleasantville Toll Plaza, a 10% to 15% increase from the previous year on U.S. 30/White-Horse Pike (October -December 1978), and an 8% to 10% increase from the previous year on U.S. 40/Black Horse Pike (October-December 1978).[1] Air traffic has also increased into Atlantic City by about 300 aircraft per month or 90% in January-February 1979 and by about 2000 passengers per month or 60% in January-February 1979.

An additional impact of casino gambling will be to increase the competitive advantage of Atlantic City for light industrial development. Improved access by more scheduled air service and a lower tax rate due to increased tourism revenues are likely to complement an already desirable location on the Atlantic Coast.

Should the success of Atlantic City foster approval of casino gambling in other nearby locations, the employment and population impact could be considerably less than forecast. If casino gambling is approved in New York, as is being proposed at limited locations, it could make Atlantic City increasingly dependent on visitors from the Philadelphia, Baltimore and Washington areas.

I.C.5.b The Potential Impact of Local Environmental and Public Facility Constraints on Tourism and Marine Recreation

The Atlantic Coastline has severe environmental and public facility constraints which are being increasingly recognized by local policy-makers attempting to provide for a realistic future:

- Lack of an adequate water supply has forced Cape May County to consider tradeoffs between increases in year-round population levels and increases in tourism levels that can be accommodated.

- Extensive wetlands and wetlands regulations have curtailed marina and marine recreation development.

- In order to reflect State policy, and severe constraints on further growth, the State of New Jersey has proposed county population levels lower than those projected by the County of Cape May.

[1]New Jersey Department of Transportation, as reported in Atlantic City Growth Trends Report, 1979, Atlantic County Division of Economic Development.

- In order to reflect a local concern about sewer capacity and the county's ability to accommodate rapid growth, Sussex County officials have asked for a lower level of population growth to be used than was previously projected by the state.

As these constraints become more familiar, it is likely that growth will be further constrained along the Atlantic Coast, but pressures for recreational development and use are likely to mount and spill over to developable portions of the Delaware Bay shoreline.

I.C.5.c The Potential Impact of the "Energy Crisis"

The Arab oil embargo of 1974 caused a sharp falloff in recreational traffic and tourism along the Atlantic Coast, but recovery to the pre-embargo levels was reportedly quick, once supplies of gasoline became available -- despite the higher prices. Although it would be natural to expect the same to happen following this year's "energy crisis," the effects of this crisis may be somewhat longer term. Prospects of continued gasoline shortages -- combined with higher prices -- may permanently alter travel and recreational patterns as the nation tries to move toward greater independence from the oil exporting nations. Without prospects of quick technological breakthroughs on synthetic fuels or automobile mileage, energy conservation may be practiced by some combination of reduced travel and increased shifts to more energy efficient modes. Although it was originally anticipated that resort areas such as the DRBA region's coastline would actually benefit from restricted availability of gasoline, it may be that this resort area will also be hurt albeit less than the more distant areas. Although vacationers spending a week or more may not be diverted from the coastal resorts, second-home owners and weekend or one-day commuters may be much more impacted.

II. HIGHWAY TRANSPORTATION FACILITIES

One of the principal objectives of this regional study is to analyze and describe the highway transportation facilities which exist today in the area of the Delaware River and Bay between New Jersey and Delaware, and to consider the need for possible additional crossings between the two States. In consideration of this objective, the overall adequacy of the existing highway system was evaluated. This was done with respect to the type and degree of current usage, the aggregate burden placed on the facilities, and future travel demand and needs considering the planned highway improvements. The evaluation included the analysis of present and future traffic, as well as the need for a new crossing.

With respect to the following text, frequent referral to Exhibit II-1, the Mid-Atlantic Region, and Exhibit II-2, the Delaware Bay Region, is useful.

II.A EXISTING NETWORK

As shown in Exhibits II-1 and II-2, a focal point of the existing highway network serving the Delaware Bay region and the Northeast Corridor is the Delaware Memorial Bridge, operated by the Delaware River and Bay Authority (DRBA). Connecting the New Jersey Turnpike and I-295 in New Jersey with I-95 and US 13 in Delaware, it is a key link in the movement of traffic between Camden, Atlantic City, New York and points north, and the Delmarva Peninsula, Norfolk, Baltimore, Washington and points south. As part of the I-95 and connecting route system, it serves eastern seaboard traffic between Maine and Florida.

In addition to the Delaware Memorial Bridge, the highway system serving and feeding traffic into the Delaware River and Bay region includes the Cape May-Lewes Ferry, also operated by the DRBA, the bridges of the Delaware River Port Authority (DRPA), the highway systems of New Jersey, Delaware and Maryland, and to a lesser extent, certain highway facilities in Virginia and Pennsylvania.

II.A.1 DRBA Facilities

The DRBA presently operates two highway facilities in the Delaware Bay Region: the Delaware Memorial Bridge over the Delaware River between Pennsville, New Jersey and New Castle, Delaware, and the Cape May-Lewes Ferry across lower Delaware Bay between Cape May, New Jersey and Lewes, Delaware.

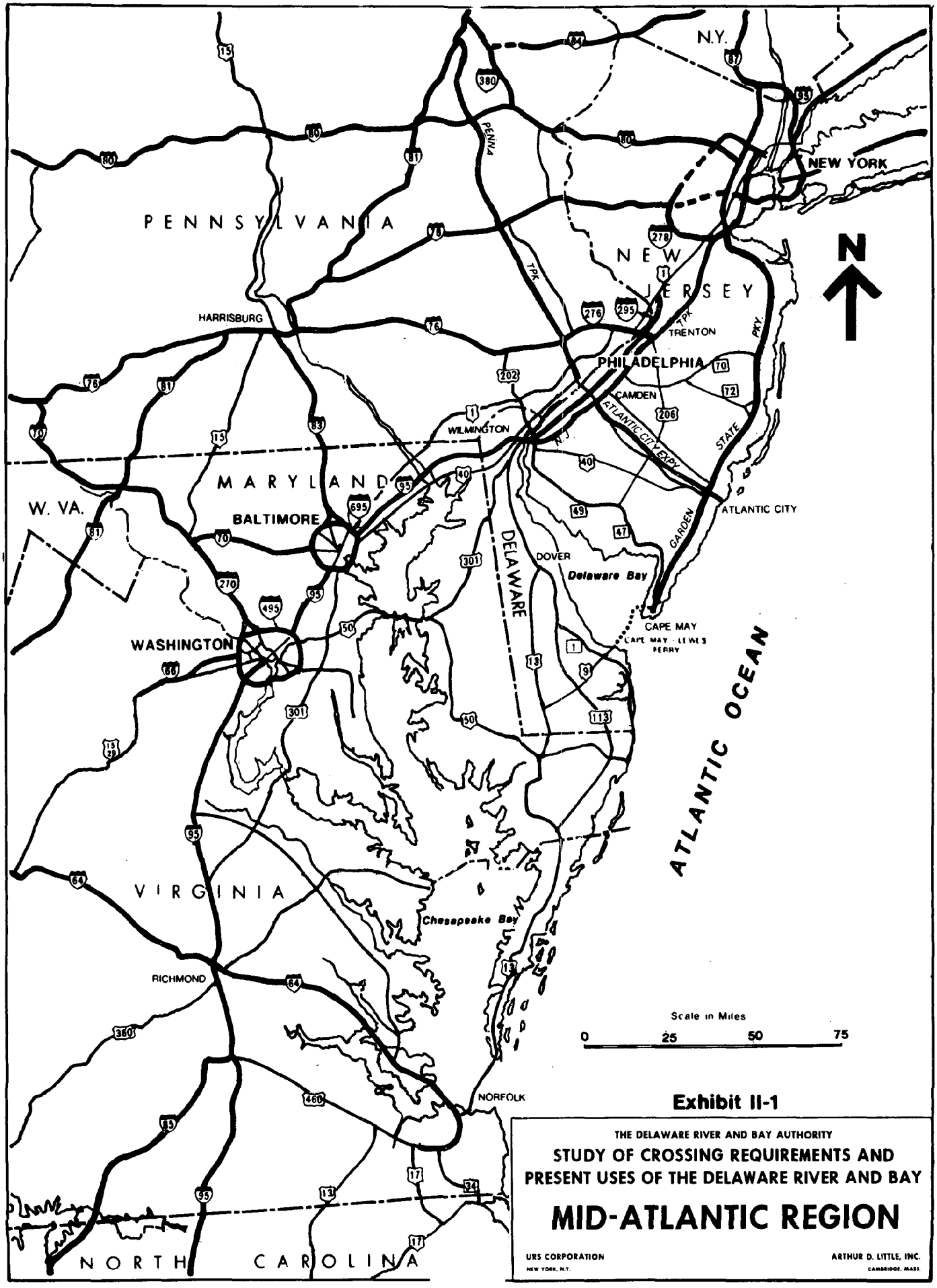


Exhibit II-1

THE DELAWARE RIVER AND BAY AUTHORITY

STUDY OF CROSSING REQUIREMENTS AND PRESENT USES OF THE DELAWARE RIVER AND BAY

MID-ATLANTIC REGION

URS CORPORATION
NEW YORK, N.Y.

ARTHUR D. LITTLE, INC.
CAMBRIDGE, MASS.

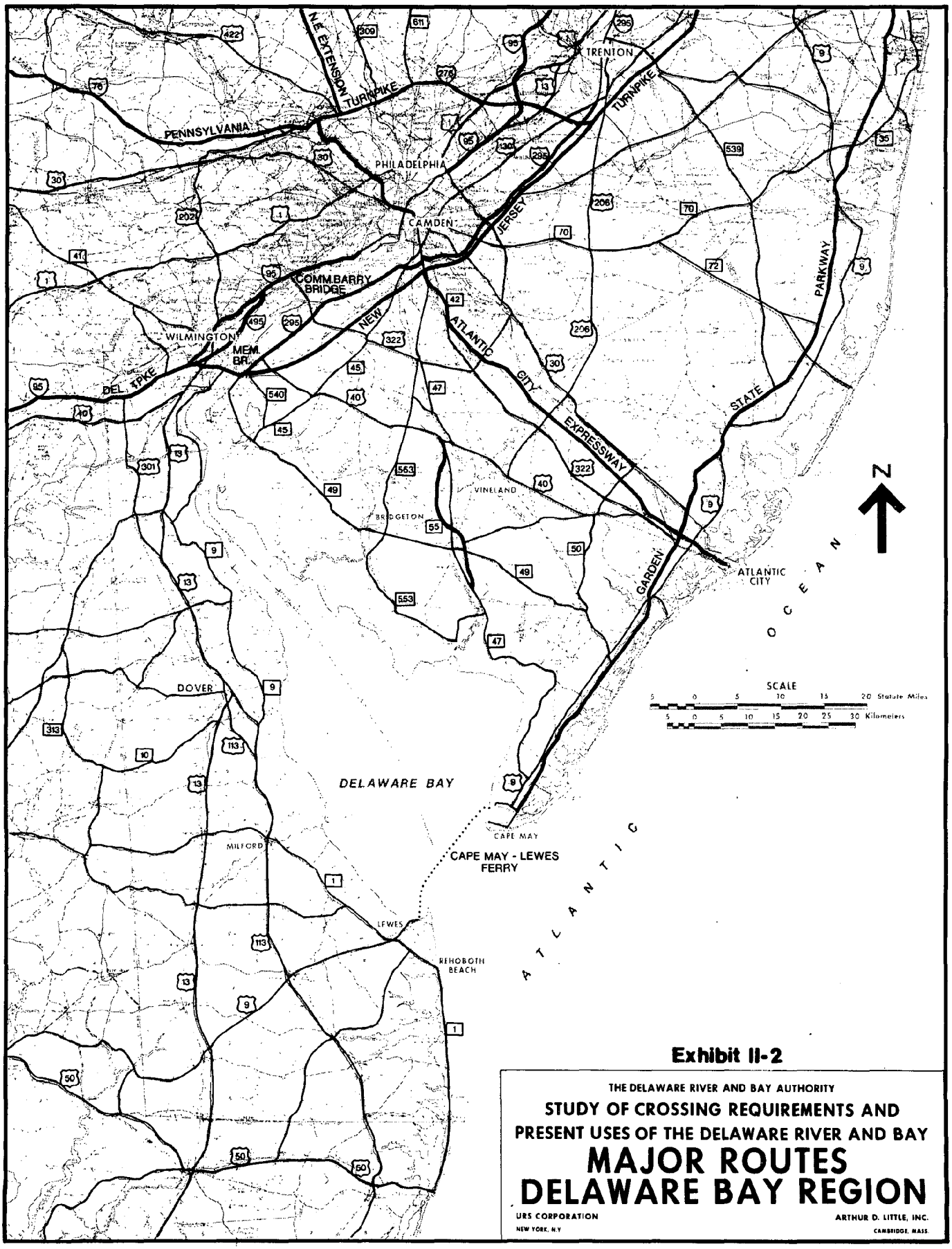


Exhibit II-2

THE DELAWARE RIVER AND BAY AUTHORITY

STUDY OF CROSSING REQUIREMENTS AND PRESENT USES OF THE DELAWARE RIVER AND BAY

MAJOR ROUTES DELAWARE BAY REGION

URS CORPORATION
NEW YORK, N.Y.

ARTHUR D. LITTLE, INC.
CAMBRIDGE, MASS.

II.A.1.a Delaware Memorial Bridge

The Delaware Memorial Bridge connects the New Jersey Turnpike, I-295 and other state highways in New Jersey with I-95, US 13, US 301 and US 40 in Delaware. The places in and around the surrounding region served by these routes are listed in Table II-1 on the following page. The Bridge acts as a "funnel" for the several routes feeding into it on each side of the Delaware River.

The Delaware Memorial Bridge was opened to traffic on August 16, 1951, and carried four lanes of traffic, two in each direction, in a single suspension span. A parallel suspension span was opened to traffic on September 12, 1968. With each span carrying one-way traffic, the Twin Bridges are capable of handling eight lanes of traffic, four in each direction. Cross-overs have been constructed on each approach, and together with lane signals on the spans, the Authority has the flexibility of closing lanes and even an entire span during light traffic periods for repairs and general maintenance.

The traffic capacity of the Twin Bridges' eight lanes is 5,400 vehicles per hour in each direction on the basis of a traffic mix during peak hours of 13 percent commercial traffic and an approach grade of four percent. Taking into account the relationship of the peak hours to the annual average daily traffic (AADT) and a directional split of 50-50 during peak hours, the hourly capacity of 10,800 corresponds to an estimated capacity of 123,000 vehicles per day. This is not the limiting capacity, since in theory the bridge could carry far larger volumes per day simply by extending the number of hours of peak flow.

In contrast, the actual AADT during 1978 was 50,980, representing only 41 percent of the estimated capacity. Of this traffic, 19 percent was trucks. In the estimate of total capacity, a Level of Service "E" was used, which represents maximum traffic volumes at congested conditions. Further details on capacity and level of service follow under Section II.D.

Bridge tolls are collected at an 18-lane toll plaza located on the Delaware side. The plaza itself is split, with nine eastbound and nine westbound toll lanes separated by an island which encompasses the Authority's administration building, parking lots and maintenance garages. The toll plaza also includes a special lane in each direction for extra-width vehicles.

Of the nine toll lanes in each direction, three are unattended and are equipped with automatic toll collection equipment. In terms of capacity, the nine toll lanes in each direction have, on the basis of an average rate of 500 vehicles per hour per lane, a traffic capacity of approximately 4,500 vehicles per hour in each direction. Hourly traffic counts made in July 1978 indicate a peak hour count of approximately 3,000 vehicles per hour in each direction, indicating that the toll plaza is operating at about 67 percent of capacity during the annual

Table II-1. Highways Radiating from the Delaware Memorial Bridge

Side	Route	Places Served*
East (New Jersey)	N.J. Tpk.	Northern New Jersey, New York New England
	I-295	Camden, Trenton
	US 40	Atlantic City
	NJ 49	Bridgeton, Cape May
	US 130	Northwest Salem and Gloucester Counties
West (Delaware)	I-95	Baltimore, Washington and South
	US 40	Baltimore and West
	US 13	Wilmington, Delmarva, Peninsula, Norfolk via Chesapeake Bay Bridge-Tunnel
	US 301	Annapolis and South via Chesapeake Bay Bridge

*Refer to Exhibit I-1 of the Mid-Atlantic Region

peak summer hours. The present toll schedule for the Bridge, which has been in effect since January 1, 1970, is shown in Table II-2 along with the toll schedule for the Cape May-Lewes Ferry.[1]

II.A.1.b Cape May-Lewes Ferry

The Cape May-Lewes Ferry is an important transportation link between the Delmarva Peninsula, which includes the State of Delaware and the Eastern Shore counties of Maryland and Virginia, and the resort areas of southern New Jersey.

Operation of the Ferry began in July 1964 with the purchase of four vessels from the Chesapeake Bay Ferry District, which until April 15, 1964, operated these ferries between Kiptopeke on Virginia's Eastern Shore and Little Creek, just east of Norfolk. (On April 15, 1964, the Chesapeake Bay ferries were replaced by the opening of the Chesapeake Bay Bridge-Tunnel, the alignment of which is roughly the same as that of of the previous ferry route. The Bridge-Tunnel is discussed further in Section II.A.5).

The four ferries transferred from Chesapeake Bay to Delaware Bay service were replaced in 1974 by three new shallow-draft vessels capable of making the 16-mile crossing between Cape May and Lewes in 70 minutes. The ferries each have the capacity of transporting 100 vehicles and 700 passengers per trip.

The most recent Ferry Schedule indicates service frequencies depending on the season as follows:

Season	No. of Daily Departures (1)	Average Headway (hours)
Oct.-May	4	3-1/2 - 4
June, Sept.	6	1-1/2 - 3-1/2
July-Aug.	10	1-1/3 - 2

(1) Scheduled in each direction, except during extremely cold weather when service has been curtailed in the past due to ice conditions in the Cape May Canal.

As would be expected, the Ferry Schedule is geared to the seasonal traffic demand, which in 1978 varied from a low average daily traffic (ADT) of 138 vehicles per day in February (24 percent of the 1978 annual ADT of 582) to an average daily traffic of 1,530 vehicles per day in August (263 percent of the 1978 annual ADT). By contrast, the Delaware Memorial Bridge traffic varied from a low ADT of 36,107 vehicles per day in January (71 percent of the annual ADT of 50,980) to an ADT of 65,688 vehicles per day in July (129 percent of the annual ADT).

[1]New toll rates will be implemented on September 1, 1979.

Table II.2 Toll Schedules - DRBA Facilities

DELAWARE MEMORIAL BRIDGE

Class	Description	Axles	Toll
1	PASSENGER CARS - (all types)..... including - Light delivery trucks (reg. wt. 2 tons or less); hearses (except in funeral processions); motorcycles	2	$ .50
	Book of 20 accommodation tickets		10.00
2	TWO-AXLE TRUCKS..... Including - all types with reg. wt. over 2 tons; buses and tractors	2	.75
	Book of accommodation tickets		15.00
3	THREE-AXLE TRUCKS..... Including - Tractors or combination tractors and trailers; passenger cars with one axle trailer; buses (all three-axle types)	3	1.00
	Book of 20 accommodation tickets		20.00
4	FOUR-AXLE TRUCKS..... Including - Tractors or combination tractor and trailer; passenger cars with two-axle trailer	4	1.50
	Book of 20 accommodation tickets		30.00
5	TRUCKS AND TRUCK COMBINATIONS (per axle).....		.35
	FIVE AXLES	5	1.75
	Book of 20 accommodation tickets		35.00
6	NON-REVENUE VEHICLES..... Including - Bridge maintenance, funeral processions ambulance, fire and police vehicles	Var.	
7	VEHICLES REQUIRING SPECIAL PERMIT..... Including - Contractors' equipment and machinery; all vehicles exceeding one or more of the limitations of Delaware or New Jersey law	Var.	3.50
8	COMMUTATION TICKETS.....		.20
	Book of 50 tickets - Good for one calendar month only, issued to passenger cars only		10.00
9	SHOPPERS TICKETS		.35
	Book of 20 tickets - Good for three calendar months only, issued to passenger cars only		7.00
10	TRUCKS AND TRUCK COMBINATIONS SIX AXLES or more (per axle).....		.35

CAPE MAY-LEWES FERRY

Class	Description	Toll
1	Passenger cars, station wagons, motorbike, motorcycle, carry-all, pick-up, panel, self-contained camper, with two axles and four tires (overall length up to 20') including driver.....	$ 8.00
4	20' to 25'	10.00
5	25' to 35'	13.00
6	35' to 45'	15.00
7	45' to 55'	18.00
8	55' to 65'	22.00
10	Over 65'	32.00
11	Bicycle (ridden or hand carried) including passenger	3.50
12	Over width vehicles All vehicles exceeding one or more of the limitations of Delaware and New Jersey	*
	Foot passengers Vehicle occupants after 6th birthday (other than driver)...	2.00
	Foot passengers and vehicle occupants before 6th birthday..	1.00
	Foot passengers (round trip same day).....	3.50
	Bus passengers (other than driver)	1.25
	Special group rates - Round trip (50 or more persons)	3.00

* Double rate of length

The seasonality of the Ferry operation is due to the activity in the area it serves, namely the resort and agricultural areas of southern New Jersey (Cape May, Cumberland and Atlantic Counties) and the Delmarva Peninsula (Sussex County, Delaware and the Eastern Shore counties of Maryland and Virginia) as shown in Exhibit II-2.

The Cape May-Lewes Ferry is part of Route US 9 in both New Jersey and Delaware, and, as such, serves as a link in the Ocean Highway routing between New York and Norfolk via the Garden State Parkway in New Jersey and US 13 on the Delmarva Peninsula (see Exhibit II-1).

II.A.2 DRPA Bridges

The Delaware River Port Authority (DRPA) operates the following four bridges upstream from the Delaware Memorial Bridge between Pennsylvania and New Jersey.

Bridge	Miles[1] Upstream	Location	
		Pennsylvania	New Jersey
Commodore Barry	13	Chester	Bridgeport
Walt Whitman	27	South Philadelphia	Gloucester City
Ben Franklin	30	Center City Phila.	Camden
Betsy Ross	35	North Philadelphia	Pennsauken

[1]From Delaware Memorial Bridge

Of the four DRPA bridges, the Commodore Barry Bridge is the one most directly competitive to the Delaware Memorial Bridge and serves the Delaware Bay region (see Exhibit II-2). The other three DRBA bridges carry traffic primarily between the City of Philadelphia and suburban New Jersey and between Philadelphia and Atlantic and Cape May Counties in New Jersey.

The Commodore Barry bridge, which was open to traffic in February 1974, is located roughly halfway between the Delaware Memorial and Walt Whitman Bridges. In 1978 the Commodore Barry bridge carried an annual average daily traffic volume of 13,300, which was 21 percent of the total of 62,200 carried by the Delaware Memorial and the Commodore Barry bridges combined. With the traffic capacity of its five existing lanes (the center lane of which is reversible) at 75,000, expressed in AADT terms, the Commodore Barry Bridge presently is operating at 18 percent of capacity.

In terms of trip origins and destinations, this Bridge "competes" to some degree with the Delaware Memorial Bridge. Traffic data compiled from roadside-interview surveys conducted in 1969 at the Delaware Memorial bridge toll plaza[1] indicated that some 1.1 million vehicles per

[1]No surveys have been conducted since.

year, or 3,000 per day[1] would divert from the Delaware Memorial Bridge to the Commodore Barry Bridge by the time the Commodore Barry Bridge was open in 1975. These 3,000 vehicles represent approximately six percent of the Delaware Memorial Bridge traffic (1975 annual ADT was 48,400) and 31 percent of the total traffic on the Commodore Barry Bridge (the 1975 annual ADT was 9,800).

Another indicator of the "commonality" of trips on the Delaware Memorial and Commodore Barry Bridges was the resultant drop in traffic on the Delaware Memorial Bridge, from 51,800 vehicles per day in 1973 to 46,000 in 1974. This drop was caused by two factors: the "energy crisis," which began in November 1973, and the opening of the Commodore Barry Bridge in February 1974. The two factors were isolated as follows:

(A)	Annual growth trend increment, 1971-73	=	1,700
(B)	Actual 1973 AADT	=	51,800
(C)	Projected 1974 AADT, if "energy crisis" had not occurred and Commodore Barry Bridge had not opened	=	53,500
(D)	Actual 1974 AADT	=	46,100
(E)	Differential: (C) - (D)	=	7,400
(F)	Portion of Differential attributed to "energy crisis"	=	4,400
(G)	Portion of Differential attributed to opening of Commodore Barry Bridge	=	3,000

Further data on traffic growth trends are listed in Section II.C of this Chapter.

Tolls on the DRPA bridges are somewhat higher than those on the Delaware Memorial Bridge, as shown in Table II-3. Although the passenger car toll on the Commodore Barry Bridge is only 10 cents or 20 percent higher than that on the Delaware Memorial Bridge, the truck tolls are considerably higher on the Commodore Barry Bridge, in the range of 100 to 150 percent. This may partially account for the fact that while a trip, say, from New York to Wilmington is 10 miles shorter via the Commodore Barry Bridge as compared to the Delaware Memorial Bridge, only six percent of

[1]Trips between Wilmington and northern New Jersey and beyond.

the Delaware Memorial Bridge traffic is diverted to the Commodore Barry Bridge. Another reason for the apparently low diversion is the superior approach road system to the Delaware Memorial Bridge on the New Jersey side of the river via both the New Jersey Turnpike and I-295, while the only practical New Jersey approach to the Commodore Barry Bridge is via I-295 and US 130. These approach routes are shown on Exhibit I-2 and described further in Section II.A.3.

Table II.3. Toll Schedule - DRPA Facilities

Vehicle Classification	DRPA Commodore Barry Bridge*	DRBA Delaware Memorial Bridge**
Passenger cars and light trucks	$ .60	$ .50
Passenger car with 1-axle trailer	.90	1.00
Passenger car with 2-axle trailer	1.20	1.50
Motorcycles	.35	.50
2-axle, 6-tire trucks	1.50	.75
3-axle trucks	2.25	1.00
4-axle trucks	3.00	1.50
5-axle trucks	3.75	1.75
Extra axles (trucks)	.75	.35
2-axle bus	.80	.75
3-axle bus	1.20	1.00
Commuter	.40***	.20
Car Pool	.10****	--

*In effect since February 1, 1978.

**Similar classifications shown for comparative purposes.

***The 40-cent commuter rate shown is a nominal average per trip, consisting of $6 for a 30-day decal plus $.25 cash per trip for each of 40 trips.

****The 10-cent car pool commuter rate applies to cars occupied by three or more persons and the $4 books of 40 tickets are valid until the end of the calendar month following the month it was purchased.

II.A.3 New Jersey Highways

For the purpose of this study, the principal highways in New Jersey serving the Delaware Bay region are divided into the following two categories (see Exhibit II-2):

	Highways Radiating from Delaware Memorial Bridge	Cape May-Lewes Ferry
Limited-access	NJ Turnpike I-295	Garden State Parkway
Non-limited access	US 130 US 40 NJ 49 County 540	US 9 NJ 47 County 585

II.A.3.a Delaware Memorial Bridge

The New Jersey Turnpike, a 118-mile toll road, runs from the Delaware Memorial Bridge (Interchange 1) to a junction with I-95/80 and US 46 (Interchange 18), four miles west of the George Washington Bridge. It was opened to traffic in stages between November 5, 1951 and January 15, 1952, three to four months after the opening of the Delaware Memorial Bridge in August 1951. The original Turnpike consisted of four lanes, two in each direction, except for a 20-mile section in northern New Jersey. Since that time, portions of the Turnpike have been widened and two spurs were built to link the Turnpike with the Holland Tunnel (Interchange 14C) and the Pennsylvania Turnpike (Interchange 6). The section north of New Brunswick (Interchange 9) carries four three-lane roadways, six lanes in each direction, with the two center roadways reserved exclusively for passenger cars. The 30-mile section north of I-287 I-287 (Interchange 10) is designated I-95, as this is the junction south of which I-95 is proposed to be constructed on a new alignment west of Princeton and Trenton by the late 1980's. This will link I-95 with the existing Scudders Falls Bridge over the Delaware River and the completed section of I-95 in Pennsylvania. Illustrative Turnpike tolls within its closed system of toll collection from the Delaware Memorial Bridge northward are listed below.

Delaware Memorial Bridge (Interchange 1) to Int.	Location	New Jersey Turnpike Tolls Psgr. Cars	5-Axle Trucks
3	Camden-Philadelphia	$ .35	$1.10
7	Bordentown-Trenton	.70	2.35
11	Woodbridge-G.S. Pkwy	1.15	4.15
14	Newark Airport	1.75	5.70
18	George Washington Br.	2.25	7.00

Interstate Route 295 parallels the New Jersey Turnpike between the Delaware Memorial Bridge and its temporary terminus at US 130 in Bordentown. In several places the two expressways are within sight of each other. The northerly extension of I-295 to a junction with I-95 north of Trenton is not expected to be completed until the late 1980's. From the Delaware Memorial Bridge to NJ 42 in Camden County, I-295 is a four-lane facility (two lanes in each direction), and north of NJ 42, it has six lanes. While I-295 provides service via numerous interchanges to New Jersey communities between Deepwater and Bordentown, the Turnpike serves the longer distance traffic to places north of Bordentown and does provide a measure of local service via four intermediate interchanges south of Bordentown. Also, some long-distance traffic uses I-295 to Bordentown, switching to the New Jersey Turnpike in order to save the Turnpike toll south of that point.

US 130, the predecessor of the New Jersey Turnpike and I-295, now serves the local Salem and Gloucester County communities of Deepwater, Penns Grove and Bridgeport.

US 40 is the direct route between the Delaware Memorial Bridge and Atlantic City, and is mostly an old two-lane highway passing through numerous small communities and the linear strip development between them. The following table shows time-distance comparison between US 40 and the Atlantic City Expressway.

Delaware Memorial Bridge to Atlantic City via	Distance (miles)	Time (minutes)
US 40	66	115
Atlantic City Expressway	79	85
Savings via Expressway	(13)	30

The Atlantic City Expressway is a 44-mile, four-lane toll road, which, together with NJ 42/US 322 and US 30 extend from Atlantic City to Camden. Expressway tolls for the full-length, 44-mile trip are collected at two across-the-road barriers located at Pleasantville and Egg Harbor City, and vary from a combined total of $1.25 for passenger cars to $5.00 for five-axle trucks.

NJ 49 is a two-lane highway leading south from the Delaware Memorial Bridge to Millville in Cumberland County. In Millville, it connects with NJ 47 for most destinations in Cape May County. The alternative routing between the Delaware Memorial bridge and Cape May, bypassing the communities along NJ 49, is via US 40 and the NJ 55 Expressway to NJ 47.

The only other route radiating from the Delaware Memorial Bridge in New Jersey is Salem County Route 540, a two-lane, nine-mile alternative to NJ 49 between the Bridge and Salem, which bypasses Pennsville and the other small communities just south of the Bridge.

II.A.3.b Cape May-Lewes Ferry

The principal approach route to the Cape May-Lewes Ferry in New Jersey is the Garden State Parkway, which runs from a junction three miles east of the Ferry terminal for a distance of 173 miles north to the New York State line, with a 2.5-mile direct connection to the New York State Thruway (I-87). With the exception of the most northerly 10-mile section, which was completed in 1957, the Parkway essentially was opened to traffic during 1954. The number of lanes in the parkway varies from four lanes (two lanes in each direction) for the 90-mile section from Cape May to Lakewood, to a 12-lane section (dual-dual configuration), between Asbury Park and Perth Amboy. At Pleasantville, 38 miles north of its Cape May terminus, the Parkway connects with the Atlantic City Expressway for trips to Atlantic City and Philadelphia; and at Woodbridge, 129 miles north of Cape May, the Parkway connects with the New Jersey Turnpike (I-95) for trips to New York City and New England. In contrast to the Turnpike's closed system of toll collection, Parkway tolls are collected at 11 across-the-road toll plazas and at several ramp locations in the northern section. The main line toll, which has not changed since 1954, is 25 cents for passenger cars at each toll barrier.

Route US 9, the predecessor to the Garden State Parkway, parallels the Parkway from Cape May to northern New Jersey. Its principal function now is to provide local service to the numerous communties through which it passes. For most of its length it is a two-lane highway, but north of Lakewood (100 miles from Cape May) it widens to a four-to-six lane facility with numerous intersections at grade. Further discussion of US 9 is continued in Section II.A.4 in connection with its routing in Delaware.

NJ 47, which intersects the Garden State Parkway and US 9 six miles north of Cape May, runs east to the beaches at Wildwood and west and north to Camden. With the exception of the four-mile section to Wildwood, it is a two-lane facility.

The other route radiating from Cape May and the ferry terminal area is County Route 585, which is the most direct link, via a toll bridge over the Intracoastal Waterway, to the Wildwood communities and beaches.

II.A.4 Delaware Highways

Unlike the New Jersey side of the Delaware River which is rural, the Delaware side in the vicinity of the Delaware Memorial Bridge is the Wilmington urban area. As shown in Exhibit II-1 of the Mid Atlantic Region, Chesapeake Bay divides the area west of the Delaware River and Bay basically into two transportation corridors: (1) the so-called Northeast Corridor, including Wilmington, Baltimore and Washington, and (2) the Eastern Shore or Delmarva Peninsula.

The principal highway facility in the Northeast Corridor is I-95, which, in the Delaware Bay region, connects Philadelphia and Wilmington and extends southwesterly to Baltimore and Washington. Connecting with I-95 at a complex interchange at Christina Marsh, four miles west of the Delaware River, is I-295, the approach route to the Delaware Memorial Bridge, and I-495, which skirts around the east side of Wilmington and rejoins I-95 just south of the Pennsylvania state line.

I-95 itself crosses the narrow "neck" of Delaware between the Pennsylvania and Maryland state lines, a total distance of 24 miles. The southerly or westerly 11-mile section, which was opened to traffic in 1963 under toll operation, is known locally and by investment bankers as the Delaware Turnpike. The northerly 13-mile section, completed in stages during 1966 and 1968, is a four-lane freeway through Wilmington. The Delaware Turnpike section of I-95 is a six-lane toll road, which, combined with its counterpart in Maryland, is officially designated as the John F. Kennedy Memorial Highway.

The Delaware Turnpike opened originally as a four-lane facility, and was widened to six lanes in 1969 to accommodate the high volume of traffic. The Delaware Department of Transportation (DOT) is considering further widening to eight lanes. The annual average daily traffic volume for the Turnpike's fiscal year ended June 30, 1979 and varied from 35,000 at the Maryland line to 77,000 between Del. 7 and Del. 141. The reason for the large variation is that the 35,000 long-distance trips per day crossing the Maryland line combine with 42,000 trips, mostly local, originating in New Castle County. From 1963 through September 1976, Turnpike tolls were originally collected at a mainline barrier between the Maryland line and Del. 896, and on the easterly (northerly) ramps at Del. 896, Del. 273 and Del. 7. On September 30, 1976, the ramp tolls were eliminated, and the barrier tolls were increased to what they are today, starting at 50 cents for passenger cars, up to $1.50 for six-axle trucks, and $7.00 for special-permit vehicles.

The Delaware Turnpike essentially is the "trunk" facility gathering traffic from its three northerly and easterly "branches": I-95, I-295 and I-495. I-295 is the four-mile "branch" which connects the Delaware Turnpike with the Delaware Memorial Bridge for service to New York and beyond via the New Jersey Turnpike, since I-95 which would have provided this service, is not complete in Philadelphia and in the section of New Jersey between Trenton and New Brunswick. The section of I-295 east of US 13 was opened to traffic in 1951 at the same time as the bridge, and west of US 13 in 1963 at the same time as the Delaware Turnpike.

The third "branch" of Delaware's interstate system is I-495, which opened traffic in 1977. From the Christina Marsh interchange to the Pennsylvania line where it rejoins I-95, its six lanes provide an alternate routing for through traffic bypassing the congested section of I-95 in Wilmington; and it serves the Wilmington port area. As such, the Delaware DOT has signed local Wilmington traffic via I-95 and through Philadelphia traffic via I-495. The 1977 AADT along I-95 through Wilmington

was about 42,000 vehicles per day while I-495 carried about 61,000 vehicles per day.

Another route between the Wilmington area and Baltimore paralleling the I-95 toll route is US 40, a four-lane divided highway with numerous intersections at grade, but nevertheless a fairly free-flowing facility. The 1977 AADT near the Maryland state line was 14,600. At State Road, US 40 runs together with US 13 as a six-lane facility with several traffic signals and is congested during peak hours. The 1977 AADT in this section was 51,500. In the vicinity of the Delaware Memorial Bridge US 40 joins I-295 and has an eight-lane roadway.

New Castle County is a highly-developed urban area with many local arterial routes in addition to the major interstate routes, I-95, I-295, I-495 and US 40. Two major US-numbered interstate routes radiate from the Delaware Memorial Bridge to the Delmarva Peninsula: US 13 and US 301. US 13 is the "spine" highway of the Delmarva Peninsula or Eastern Shore. It starts in Philadelphia and passes through all of the communities, industrial areas and the City of Wilmington, paralleling I-95. It runs together with US 40 for several miles south of the Delaware Memorial Bridge, and then heads south for Dover, Salisbury, Maryland and Norfolk via the Chesapeake Bay Bridge-Tunnel. Except for some six-lane sections in the urban areas it serves, US 13 is a four-lane divided highway with numerous intersections at grade and traffic signals at the major crossroads. As the "spine" highway of the Eastern Shore, recreational traffic between the Northeast Corridor cities and the Delaware-Maryland beaches uses US 13 to a great extent, particularly on summer weekends. The 1977 AADT at its southern section near the Maryland border was 11,300 vehicles per day, near the Dover Downs it carried 36,500 vehicles per day, and approaching Route US 40 south of the Wilmington Airport, it carried 22,200 vehicles per day.

In Dover, US 113 branches away from US 13, providing local service to Milford and Georgetown, Delaware, and Berlin, Maryland. It is mostly a four-lane divided highway. Just north of Milford, Del. 1, another branch in the Eastern Shore "tree," leads southeast to Lewes and the Delaware beaches. Del. 1 is a fully dualized four-lane facility, except for a short two-lane section over the Lewes & Rehoboth Canal, known as the Rehoboth Beach Bypass.

US 301, the other major US-numbered interstate route serving the Delmarva Peninsula, connects the Delaware Memorial Bridge with Middletown, Delaware and with the Chesapeake Bay Bridge. With the exception of the four-lane Summit Bridge over the Chesapeake & Delaware Canal, US 301 is a two-lane facility in Delaware; but in Maryland, it is an excellent four-lane, controlled-access divided highway with occasional intersections at grade, some of which are signalized. The 1977 AADT on US 301 was 11,100 at Summit Bridge (which also carries Del. 896) and 5,300 at the Maryland line. Long range plans for the Delaware Department of Transportation call for the replacement of the low-type, two-lane highways-US 301, Del. 896 and Del. 71, connecting with the Summit Bridge by

a high-type facility, similar to the Bridge itself and the four-lane US 301 facility in Maryland. Further discussion of this and other proposed highway facilities in Delaware is continued in Section II.B.2.

US 13 and US 301 are only two of the four bridges which span the Chesapeake and Delaware Canal. The other two bridges, Del. 9 at Delaware City and Md. 213 at Chesapeake City, carry significant amounts of local (non-interstate) commercial traffic.

As mentioned heretofore in Section II.A.3, the Cape May-Lewes Ferry is an integral part of US 9 on both sides of the Delaware Bay. From the Ferry terminal at Lewes, US 9 runs in a southwesterly direction, a distance of 31 miles to Laurel, Delaware, where it terminates at US 13. Three miles outside of Lewes, US 9 connects with Del. 1 (for trips to Dover, Milford and the beaches), and midway between Lewes and Laurel it intersects US 113 at Georgetown. UD 9 is a two-lane facility which, together with US 13, forms a continuous alternative routing between New York City and Norfolk via the Cape May-Lewes Ferry and the Chesapeake Bay Bridge-Tunnel.

II.A.5 Maryland and Virginia Facilities

As shown in Exhibit II-1 of the Mid-Atlantic Region, Chesapeake Bay is the major body of water which separates the highway facilities south of the Delaware Memorial Bridge into two distinct, and very different in character and volume, transportation corridors: (1) Northeast Corridor via I-95 and US 40 and (2) Delmarva Peninsula via US 13 and US 301. These two transportation corridors divide in New Castle County, Delaware, and continue on each side of Chesapeake Bay into the states of Maryland and Virginia.

On the east side of Chesapeake Bay, US 13 (Ocean Highway) continues south from Delaware as a four-lane divided highway through the Eastern Shore Counties of Maryland and Virginia to the Chesapeake Bay Bridge-Tunnel. It passes directly through the city of Salisbury, Maryland and numerous other small communities on the Peninsula. Across the Bay, in Norfolk, Virginia it connects with US 17, the continuation of the Ocean Highway to Wilmington, North Carolina; Charleston, South Carolina; Savannah, Georgia; and Jacksonville, Florida. The key link in the Ocean Highway system is the Chesapeake Bay Bridge-Tunnel, operated by the Chesapeake Bay Bridge and Tunnel District, an 18-mile, two-lane crossing consisting of a series of low- and high-level bridges and two tunnels under the Hampton Roads and Baltimore Channels of the Bay. The Bridge-Tunnel which carried about 5,000 vehicles per day in 1978, replaced the Kiptopeke-Little Creek Ferry in April 1964. Tolls range from $8.00 for passenger cars to over $50.00 for trucks.

The other Eastern Shore "trunk" highway, US 301, continues southwest from Delaware through Maryland as a four-lane divided highway, bypassing the Baltimore-Washington Metropolitan Area and connecting with I-95 in

Richmond, Virginia. The key link in the US 301 routing is the Chesapeake Bay Bridge, operated by the Maryland Transportation Authority, a division of the Maryland Department of Transportation. the first span of the Bridge carrying one lane of traffic in each direction was opened to traffic in 1952, and a second parallel three-lane span was completed in 1973 to meet the high growth in recreational traffic between the Baltimore-Washington area and the Delaware-Maryland beaches, particularly Ocean City, Maryland. In addition to US 301, the Bridge carries US 50, the principal route between Washington and Ocean City. Tolls range from $1.25 for passenger cars to $5.40 for large trucks.

On the west side of Chesapeake Bay, I-95 and US 40 parallel one another from the Delaware line of Baltimore, at which point I-95 continues to Washington and the South; and US 40 continues west to Frederick, Maryland and points west.

I-95 between Wilmington and Baltimore is officially designated as the John F. Kennedy Memorial Highway. In Maryland it continues as a sixlane toll road operated by the Maryland Transportation Authority, of which the Tydings Memorial Bridge over the Susquehanna River is an integral part. Tolls for use of the 42-mile Kennedy Highway are collected at the Tydings Bridge and vary from $1.00 per passenger cars to $3.00 for large trucks. The parallel Susquehanna River Bridge on US 40 is also a Maryland Transportation Authority-operated toll facility. Tolls vary from 50 cents for passenger cars to $1.50 for large trucks, and reduced rate commuter privileges are available.

I-95 is temporarily routed through Baltimore via the Baltimore Harbor Tunnel, and then on to Washington, Richmond and the South. Except during peak commuting and weekend hours when it is congested, the four-lane Tunnel is an ideal routing for I-95 through traffic. During periods of congestion in the Tunnel, changeable-message signs on the approach routes to the Tunnel east and south of Baltimore direct motorists to the alternate route via the outer harbor crossing known as the Francis Scott Key Bridge. Tolls for use of both the Bridge and Tunnel vary from 75 cents for passenger cars to $3.00 for large trucks and commuter ticket books can be purchased.

As described later in Section II.B.3, studies presently are under way by the Maryland DOT's Interstate Division for Baltimore City for the completion of I-95 in Baltimore, including a tunnel under the inner harbor to be known as the Fort McHenry Tunnel.

South of Baltimore, two expressway routes are available for travel to and from Washington: I-95 and Md. 295, the Baltimore-Washington Parkway. No trucks are permitted on the Parkway south of Laurel, Maryland.

Surveys conducted by URS/Coverdale & Colpitts in the early 1970's for the Delaware Department of Transportation on US 301 at the Chesapeake & Delaware Canal and on I-95 at the Delaware Turnpike toll plaza indicated

that for long-distance trips between Wilmington and points north and Washington and points south, approximately 87 percent used the I-95 routing via Baltimore and 13 percent used the US 301 routing via the Chesapeake Bay Bridge and Annapolis. Both routes are comparatively the same in distance, but in terms of time, the I-95 routing is shorter except during peak hours in Baltimore. The slowest segment of the US 301 route is the 15-mile, two-lane section in Delaware between I-95 and the Maryland line. Comparative tolls for passenger cars via the two routes are illustrated in the following table.

I-95 via Baltimore		US 301 via Annapolis	
Facility	Toll	Facility	Toll
Delaware Turnpike	$ .50	Chesapeake Bay Bridge	$1.25
Kennedy Highway	1.00		
Baltimore Tunnel	.75		
Total	$2.25		

In terms of the two routings, travel between the Delaware Memorial Bridge and Norfolk, along the Ocean Highway route (US 13) via the Eastern Shore, is some 80 miles and 1-1/2 hours shorter than the inland route via I-95 to Richmond and I-64 to Norfolk. However, passenger car tolls along the Ocean Highway are $8.50 as compared to $2.50 along the inland route.

For trip ends further south than Norfolk from the Delaware Memorial Bridge, the inland routing via I-95 is more attractive in terms of travel time and mileage than the Ocean Highway.

II.B PROPOSED HIGHWAY FACILITIES

Section II.A of this Chapter described the existing highway network, while this section of the report describes the highway facilities proposed for the future in New Jersey and Delaware in terms of their regional location vis-a-vis the Delaware River and Bay crossings, and the main corridor routes in the other mid-Atlantic states.

II.B.1 Proposed New Jersey Highway Improvements

At the state level, four agencies are responsible for the highway facilities in New Jersey: the New Jersey Department of Transportation, which maintains the state highway system; the New Jersey Turnpike Authority,

which operates the New Jersey Turnpike; the New Jersey Highway Authority, which operates the Garden State Parkway; and the New Jersey Expressway Authority, which operates the Atlantic City Expressway.

II.B.1.a State Highway System

Information on proposed improvements to the state highway system was obtained from the Division of Planning and Research, Bureau of Highway Planning, of the New Jersey Department of Transportation (NJDOT). The Planning staff furnished information from two sources within the Department: Status of Active Projects as of March 31, 1979, compiled by the Bureau of Environmental Analysis, and Status of Plans Report (Active) compiled by the Bureau of Design. In general, emphasis is placed on getting the most out of the existing system in terms of traffic engineering and selected construction projects, plus the completion of the interstate system. On the average projects take 18 months in the environmental assessment stage, 18 months in design, and then two construction seasons to complete. Table II-4 below is a list of active projects which would affect the traffic now using the DRBA facilities when completed.

Table II.4. Status of Active NJDOT Projects*

Route	County	Location	Status	Remarks
I-95	Mercer-Somerset	I-295 to I-287	Location	See note*
I-287	Passaic-Bergen	Montville to N.Y.S.	Location	Last link of I-287
I-695	Somerset	I-95 to I-287	Location	
US 40	Salem	Woodstown Bypass	Location	
US 9	Ocean	Lakewood Bypass	Design	
NJ 147	Cape May	US 9 to NJ 47	Design	
I-195	Mercer	NJ 29 to I-295	Design	
I-295	Mercer	I-295 to US 130	Design	
I-295	Gloucester	Woodbury	Design	Upgrading US 130

*Status of active projects as of March 31, 1979, compiled by the Bureau of Environmental Analsysis.

**The completion of I-95 in New Jersey will result in some traffic diversion from the New Jersey Turnpike and I-295 on the east side of the Delaware River to I-95 on the west side of the Delaware River, which will have an impact on traffic crossing the Delaware Memorial Bridge.

It is very uncertain at this time if the 25-mile section of I-95 between I-287 near New Brunswick and I-295 by Trenton will ever be built. The final EIS is expected by the end of 1980; and a no-build alternative is a possibility. After that, design will take 3 years and, assuming funding is available, construction will take another 3 years; therefore,

I-95 could not possibly be completed until the late 1980's. Meanwhile the New Jersey Turnpike adequately fulfills the traffic demands in the corridor between New York and Delaware, and I-95 serves traffic between the Philadelphia-Trenton vicinity and Wilmington.

Table II-4 indicates significant highway improvement projects which have advanced from the preliminary location/design status of the Bureau of Environmental Analysis to active status under the Bureau of Design. Other lesser projects are also contained in the area's Transportation Improvement Programs and will contribute to the increased capacity and safety of the region's road network.

Status of Active NJDOT Projects*

Route	County	Location	Improvement
US 40	Atlantic	Mays Landing	Intersection US 40, NJ 50
NJ 42	Gloucester-Camden	I-295 to A.C.Expwy	Interchanges
NJ 47	Cape May	Middle Township	Alignment and transition
I-295	Gloucester-Camden		Highway lighting
I-295	Gloucester	Repaupo Rd.-Del.St.	Widening to six lanes
I-295	Salem	NJ 48	Interchange

*From Status of Plans Report (Active), dated March 1979; Bureau of Design.

II.B.1.b New Jersey Turnpike

With the exception of general safety and traffic operational improvements throughout the length of the Turnpike, only minor improvements are planned by the New Jersey Turnpike Authority (NJTA) in terms of their effect on improving access to the DRBA facilities. These are listed below:

Status of NJTP Projects

Location	Improvement	Status/Remarks
Int. 13-A	Newark Airport access	Design complete
Int. 15-W	Toll plaza widening	Accommodate I-280 completion
Int. 10	Park-ride lot	Design complete
NJ 3 to US 46	Widening to 6 lanes	Conceptual planning
-	Full service truck stop	Preliminary feasibility study

No further consideration is being given to the Turnpike extension to Toms River, known as the Driscoll Expressway. The Authority is in the process of selling the right-of-way it had acquired for that extension.

II.B.1.c Garden State Parkway

Several major projects are under construction and in various stages of planning and design by the New Jersey Highway Authority, and on the State-controlled section of the Parkway, by the New Jersey Department of Transportation. Table II-5 lists these Garden State Parkway (GSP) projects from south to north. Most of the improvements noted in the table will benefit those motorists who use the Parkway to reach the Cape May-Lewes Ferry, particularly during the peak summer months.

Table II-5. Status of GSP Projects

Location	Improvement	Status/Remarks
Cape May County Int. 8 to Int. 12 GSP/US 9 combined	Grade separation Stone Harbor Rd.	Long-term plan to reduce summer congestion DOT project
Ocean County Int. 74 Forked River	New ramps to/from south, tolls added to ramps to/from north	EIS in preparation completion in late 1981 if approved
Ocean County Pinewald	New toll ramps to/from north	Same overall project as the Forked River ramps
Ocean and Manmouth Counties Int. 80-83 Int. 83-88 Int. 88-98 Int. 98-102 Int. 102-Plaza	Parkway widening, Toms River to Asbury Park From 4 to 6 lanes 4 lanes, no widening From 4 to 6 lanes From 6 to 8 lanes From 8 to 10 lanes	EIS submitted, approval expected, completion in 1983 Primarily State section
Middlesex and Union Counties	Parkway widening, NJTP to US 22 from 6 to 8 lanes	Under construction, expect completion in 1979, DOT project with HOV lanes
New Gretna Barnegat Toms River Asbury Park Union Hillsdale	Toll plaza widenings	Completion 1981 Completion 1981 Completion 1983* Completion 1983* Completion 1982 Completion 1981

*Indicates completion at same time as Parkway widening.

II.B.1.d Atlantic City Expressway

Casino gambling in Atlantic City has had a substantial effect on the Atlantic City Expressway traffic. Since the opening of the Resorts International Hotel in late May 1978 through April of this year, Expressway traffic has increased 60 percent at its Pleasantville toll plaza (between Atlantic City and the Garden State Parkway) and 26 percent at its Egg Harbor toll plaza (west of the Garden State Parkway). The magnitude of the increases has been spread evenly throughout the year, but in terms of percentages, the increases in the winter months far exceed the summer months because of the lower level of the base traffic volumes to which casino gambling traffic is added.

On the basis of this recent experience, the New Jersey Expressway Authority has been evaluating the traffic trends and the capacity of the Expressway to determine the need for improvements in the future. This evaluation indicates that the four-lane Expressway will have sufficient capacity to carry traffic at an acceptable level of service to about 1985. During the next five years a significant portion of the traffic increase will occur in the winter months, during which time the Expressway has ample reserve capacity.

Improvements are planned, however, at its two main-line toll plazas at Egg Harbor and Pleasantville, which have experienced congestion resulting from increased traffic. The Egg Harbor toll plaza will be widened from eight to twelve lanes, while the Pleasantville toll plaza will be widened from six to eight lanes.

A significant factor in the future growth of Expressway traffic is the fact that the other two state highways leading into Atlantic City, US 30 (White Horse Pike) and US 40 (Black Horse Pike) are semi-urban in character with numerous intersections at grade, both of which presently are operating at or near capacity. Such being the case, the only access route capable of carrying the additional traffic generated by the renewed activity in Atlantic City is the Expressway.

II.B.2 Proposed Delaware Highways Improvements

Planning for future state highway improvements in Delaware is the responsibility of the Delaware Department of Transportation. These programs are developed in terms of short-term proposals through its 6-Year Capital Improvement Program and long-term proposals as designated in its 1995 Transportation Plan. The short-term proposals are formulated by its two line divisions: the Division of Highways for tax-funded projects, and the Delaware Transportation Authority for bond-financed projects. The long-term proposals are formulated by its Systems Planning staff.

II.B.2.a Short-term Program

The most important route in Delaware in terms of providing service to the Delaware River and Bay Region is I-95, and the principal part of I-95 as a feeder route to the Delaware Memorial Bridge is the 11-mile Delaware Turnpike section between the Christina Marsh interchange complex and the Maryland line.

II.B.2.a(1) Delaware Turnpike

As a bond project, the Delaware Turnpike is under the control of the Delaware Transportation Authority, which was created in 1976 by the 128th General Assembly under House Bill 1230 as a division of the State's Department of Transportation. The legislation changed the names of the former Department of Highways and Transportation and Division of Transportation to the Department of Transportation and Delaware Transportation Authority respectively.

As stated in Section 1903 of the bill, the Authority, besides being responsible for the coordination of mass and specialized transportation in the State, operates the Delaware Turnpike and is authorized to finance the cost of transportation facilities, including the Turnpike, "in the name of the State, by the issuance of revenue bonds of the Authority, payable solely from the revenues of the transportation facilities." In accordance with this legislation, the Authority issued $14,850,000 in Transportation Revenue Refunding Bonds in September 1976; and in October 1979, $6,250,000 in Transportation Revenue Refunding Bonds (Series A), $700,000 in Special Obligation Bonds, and $23,000,000 in Transportation Revenue Bonds (Series B); all payable solely from the revenues of the Delaware Turnpike.

In addition to the operation of the Turnpike, House Bill 1230 authorizes the Authority to maintain, repair, and improve such State Highways "as the Authority may deem necessary to assure the economic feasibility and management of the Turnpike."

Pursuant to this legislation, the 1979 Series B bonds in the amount of $23,000,000 were issued to develop the plans for the widening of the Turnpike from six to eight lanes (four lanes in each direction between the Christina Marsh and Del. 273 interchanges) and for improvements to certain feeder roads of the Turnpike and I-95 and I-495, including Del. 7, Del. 273, Del. 896, Ott's Chapel Road, Airport Road, US 202, Del. 92, and several smaller projects.

II.B.2.a(2) Non-Turnpike Projects

The non-Turnpike sections of the interstate system in Delaware are under the jurisdiction of the Division of Highways. The only significant portion scheduled for improvement is the 3-1/2-mile section of I-95 between the Christina Marsh interchange and the first interchange in Wilmington at Maryland Avenue and 2nd Street, which includes a long viaduct over

Amtrak's main line between Wilmington and Baltimore. The widening of this section from four to six lanes is under contract and scheduled for completion in December 1980. Together with the existing six-lane section north of 2nd Street, this widening project will result in a continuous six-lane I-95 facility between the Christina Marsh and Concord Pike (US 202) interchanges. the following table summarizes the existing lane balance status of the interstate routes at the Christina Marsh interchange and the future status after the widening projects are completed.

West of Del. 141			East of Del. 141		
	No. of Lanes (2-Way)			No. of Lanes (2-Way)	
Route	Existing	Proposed	Route	Existing	Proposed
Turn-pike (I-95)	6	8	I-95	4	6
			I-295	4	4
			I-495	4*	4*
		Total		12	14

* I-495 is a six-lane facility, but two of the six lanes are channelized between I-495 and I-295.

Other tax-funded projects within the Division of Highways' Six-Year Capital Improvement Program are listed in Table II-6.

Of the eight projects listed in Table II-6, only the reconstruction of the US 9 bridge over the Lewes & Rehoboth Canal in Sussex County would be of direct benefit to users of a DRBA facility, namely the Cape May-Lewes Ferry. The other seven projects would be of indirect benefit to users of the Ferry and the Delaware Memorial Bridge in terms of the general improvement of the highway system in Delaware.

II.B.2.b Long-term Program

In New Castle County, Delaware, the Delaware Department of Transportation, Systems Planning Section, formulates long range plans through the comprehensive forum of the Wilmington Metropolitan Area Planning Coordinating Council (WILMAPCO). As per 23 U.S.C., "Highways," WILMAPCO is the Metropolitan Planning Organization (M.P.O.) designated to coordinate comprehensive, continuing, forecast land use and transportation planning for the Wilmington, Delaware, Standard Metropolitan Statistical Area (SMSA).

In Kent and Sussex Counties, Delaware, the Delaware Department of Transportation, Systems Planning Section, develops the forecast land use and transportation plan (Kent and Sussex Study) in coordination with the Delaware Office of Management, Budget and Planning, and with the Counties.

Table II-6. Six-Year Capital Improvement Program

New Castle County

- Del. 7, I-95 to Stanton: from 2 to 4 lanes
- Del. 4, Del. 2 to Del. 7: from 2 to 4 lanes
- US 202 (Concord Pike), I-95 to Del. 92 (Naamans Road): from 4 to 6 thru lanes with protected left-turn lanes in the median
- Del. 92 (Naamans Road), U.S. 13 to US 202: from 2 to 4 lanes

Kent County

- Dualization of last link of US 113 from Dover AFB to Little Heaven

Sussex County

- US 9 bridge over Lewes & Rehoboth Canal: reconstruction
- Del. 1 (Rehoboth Beach bypass): from 2 to 4 lanes over Canal
- Del. 20 through Seaford: from 2 to 4 lanes

Source: Delaware Department of Transportation, Division of Highways

In order to maintain a minimum 20-Year horizon land use and transportation plan, the Systems Planning Section is in the final stages of having a WILMAPCO Year 2000 plan adopted and is in the preliminary analysis stage of having a Year 2000 Kent and Sussex Study approved.

Existing adopted plans are for the year 1995. While the short-term projects are selected on the basis of priorities and funding potential, the long-term projects are based on need as determined by future volume/capacity estimates for each link in the state highway system developed in the Transportation Plan. These long-term projects, which overlap with those listed in Table II-6, are set forth in Table II-7.

Of all the projects in the 1995 Transportation Plan, the Del. 896 widening in New Castle County and the need for additional capacity along US 13 through Dover and Smyrna in Kent County are particularly significant because they affect the two "trunk" routes on the Delmarva Peninsula. Del. 896 runs together with US 301 via the Summit Bridge over the Chesapeake and Delaware Canal and connects directly with the Delaware Turnpike section of I-95 just south of Newark. One alternative method of funding the widening of Del. 896, which could accelerate its completion at an earlier date, is its possible financing as a toll-free Turnpike

Table II-7. 20-Year Program in 1995 Transportation Plan

New Castle County

-- Del. 7
  - I-95 to Christiana: now 2 lanes; proposed controlled-access on new alignment, 4-lane divided
  - I-95 to Del.4: now 2 lanes; proposed 4-lane high-type divided or freeway
  - Milltown Road to Pa. State Line: from 2 to 4-lane divided
  - Christiana to US 13: from 2 to 4-lane divided
  - Del. 4 to Stanton: now 2 lanes; proposed 4-lane high-type divided or freeway

-- Del. 141
  - Del. 2 to Lancaster Pike: now 4-lane undivided; proposed 4-lane freeway
  - Lancaster Pike to Barley Mill Road: from 2 lanes to 4-lane freeway
  - Barley Mill Road to Concord Pike: from 2 lanes to 4-lane freeway

-- US 202 (Concord Pike), Del. 141 to Naamans Road: see Table II-6.

-- Del. 92 (Naamans Road), US 13 to US 202: see Table II-6

-- Del. 273, S. Chapel St. (relocated) to Ogletown: from 2 to 4 lanes

-- 12th Street Connector, Hay Road to 11th-12th Streets: now 2 lanes; proposed 2-to-4 lane arterial

-- Delaware Avenue in Newark: from 2 to 3 lanes (1-way street)

-- Del. 896
  - Del. 4 to US 40: from 2 to 4-lane divided
  - US 40 to Middletown: from 2 to 4-lane divided

-- Mill Creek Road, Stoney Batter Road to Del. 41: from 2 to 4-lane divided

-- Del. 4
  - Ogletown to S. College Avenue: from 2 to 4-lane divided
  - Del. 7 to Ogletown: from 2 to 4-lane divided
  - South College Avenue to Elkton Road: new alignment, initially 2 lanes, ultimately 4 lanes; now provided by W. Chestnut Hill Road

-- Otts Chapel Road, I-95 to US 40: improved 2 lanes

-- Del. 72, Cleveland Avenue (Newark) to Possum Park Road: 2 to 4-lane divided

-- DuPont Road, Del. 4 to Del. 2: 2 to 4-lane divided

Kent County

-- Need for additional capacity along US 13 in Dover and Smyrna

Sussex County

-- Del. 404 (Bridgeville bypass)
-- US 113 dualization, Milford to Georgetown
-- Georgetown bypass for US 9 and Del. 18 traffic
-- Del. 8 widening, Dover to Mifflau Road
-- Del. 26 Corridor, Fenwick Island to Dagsboro area

Source: Delaware Department of Transportation
Systems Planning

improvement project, since there is no doubt that it is a feeder route to the Turnpike. The DOT is presently considering this alternative and the legislation which would be required.

Possible tax-funded alternatives which would provide the additional capacity needed on US 13 through Dover and Smyrna are bypasses around the two cities or the controlling of access with frontage roads. Since both are very costly, the DOT believes that the limited tax funds are better used on numerous other projects elsewhere in the State.

Another alternative to the "piecemeal" improvement to US 13, which has been studied by the DOT in the past, but which is not currently being given further consideration, is the construction of a North-South Extension of the Delaware Turnpike as a bond-financed toll project. As originally proposed, the Extension would have connected the existing Turnpike, midway between the Del. 273 and Del. 896 interchanges, with US 13 and US 113 south of Dover via the Summit Bridge, a total distance of 44 miles. A spur connection to US 301 in Maryland would also be constructed. Such an Extension had been considered as an alternative to both the Del. 896 widening and the Dover and Smyrna bypass projects.

II.B.3 Proposed Regional Highway Improvements in Other States

Certain future improvements in the regional highway networks of the states adjacent to New Jersey and Delaware, particularly Pennsylvania and Maryland, can be expected to influence long-distance travel in the Northeast Corridor, thereby affecting highway usage in the Delaware River and Bay region and, in particularly, that of the Delaware Memorial Bridge.

II.B.3.a Pennsylvania

Although the completion of I-95 in Pennsylvania must be considered together with its completion in New Jersey in terms of traffic diversions from the New Jersey Turnpike-Delaware Memorial Bridge to the I-95 routing on the west side, the following I-95 improvements in Pennsylvania have also been considered with respect to traffic with origins and destinations as far north as Trenton, which are independent of I-95 construction in New Jersey.

According to the Pennsylvania Department of Transportation, two sections of I-95 are now open to traffic. The shorter, 2.2-mile section in Center City Philadelphia has recently been completed, and as of late 1979, it has been opened to traffic despite local environmental opposition.

The other section, 3.5 miles in the vicinity of Philadelphia International Airport, is part of a 12-year road program on-hold, depending on a gas tax increase of 3.5 cents per gallon to be introduced this year in the Pennsylvania legislature. After the 12-year program is reinstated, I-95 is expected to be completed five to six years later.

Once these two sections are completed and opened to traffic, I-95 will be fully open in Pennsylvania. At that time, some traffic bound for the Trenton-Princeton area, which now uses the Delaware Memorial Bridge and I-295 or the New Jersey Turnpike to avoid Philadelphia, could be expected to stay on the west side of the Delaware River on I-95 until crossing the river at Trenton. These diversions would depend on the time of day due to peak-period congested conditions in Philadelphia.

II.B.3.b Maryland

Future highway improvements in Maryland will have only a peripheral effect on motor vehicle travel in the Delaware River and Bay region.

The most significant project in terms of Northeast Corridor travel via I-95 is the Fort McHenry Tunnel in Baltimore, now scheduled for completion by July 1984. The Fort McHenry Tunnel will close the last remaining gap of I-95 in Maryland. Tolls at the Fort McHenry Tunnel are proposed to be the same as those at the Baltimore Harbor Tunnel and the Francis Scott Key Bridge.

Another project which could influence the choice of routing between points south of Baltimore in Maryland and the Delaware Memorial Bridge, is Maryland's DOT plan to construct a new $300 million freeway from Baltimore to Annapolis along the Md. 3 corridor through Millersville. The proposed freeway would upgrade Md. 3 to eight lanes between the Baltimore Beltway (I-695) and Md. 32. The roadway would continue southeast paralleling Md. 178 to US 50 at Annapolis. The alternate proposal to connect Baltimore and Annapolis by upgrading Ritchie Highway (Md. 2) to six lanes was rejected by the DOT. Approval of the project is not expected until late 1980.

In addition, concerning Maryland Route 213, the Philadelphia District of the Corps of Engineers has studied the construction of an additional crossing of the Chesapeake and Delaware Canal. Although no other short-term improvements are scheduled in Maryland which would affect motor vehicle travel in the Delaware River and Bay region, the Maryland Department of Transportation recognizes the need to do something about the low-level bascule bridge over the Kent Narrows on US 301/50, along the approach to the Chesapeake Bay Bridge on the Eastern Shore. During summer weekends when traffic is heavy, any openings of these bridges cause considerable traffic congestion. Although US 50 traffic is "captive" in terms of origin and destination, that portion of the US 301 traffic which has a choice between the I-95 and US 301 routings between Washington and points south and Wilmington and points north, could be influenced by traffic conditions at Kent Narrows.

II.B.3.c Virginia

In Virginia, a new four-lane high-level bridge on US 301 over the Rappahannock River at Port Royal will replace the old two-lane low-level bridge. This plus some planned additional four-lane widening of US 301 in Hanover County should improve the attractiveness of the US 301 routing between Richmond and Wilmington via the Eastern Shore.

II.C TRAFFIC GROWTH TRENDS

This portion of the analysis of the transportation facilities serving the Delaware River and Bay area includes a summary of historical traffic growth in the area; however, before analyzing past traffic trends, a review of related demographic data is required.

Historically, the rate of increase in vehicular travel generally follows changes in population and, more closely, the number of motor vehicles registered. Table II-8 below shows 1950, 1960, 1970 and 1975 population and motor vehicle registrations for the states in the northeast corridor including the District of Columbia which are served by the facilities of the Delaware River and Bay Authority. For comparison, data are included for the total United States. Also shown are the compound average annual growth rates for the periods 1950 to 1960, 1960 to 1970, and 1970 to 1975.

Table II-8. Historical Motor Vehicle Registrations and Population Area Served by Facilities of Delaware River & Bay Authority

	Motor Vehicle Registrations				Population			
	1950	1960	1970	1975	1950	1960	1970	1975
Delaware	108,000	192,000	312,000	351,000	318,000	446,000	548,000	579,000
New Jersey	1,579,000	2,401,000	3,586,000	4,155,000	4,835,000	6,067,000	7,168,000	7,333,000
Virginia	918,000	1,426,000	2,263,000	3,251,000	3,319,000	3,967,000	4,648,000	4,981,000
Washington, D.C.	195,000	206,000	257,000	255,000	802,000	764,000	757,000	712,000
Maryland	685,000	1,155,000	1,872,000	2,423,000	2,343,000	3,101,000	3,922,000	4,122,000
New York	3,735,000	5,067,000	6,718,000	7,591,000	14,830,000	16,782,000	18,241,000	18,076,000
Pennsylvania	3,010,000	4,287,000	5,818,000	7,659,000	10,498,000	11,319,000	11,801,000	11,860,000
Total United States	49,162,000	73,869,000	108,418,000	132,950,000	150,697,000	179,323,000	203,235,000	213,032,000
Average Annual Per Vehicle Per Vehicle	9,020	9,446	9,978	9,634				

	Average Annual Percent Change					
	1950-1960	1960-1970	1970-1975	1950-1960	1960-1970	1970-1975
Delaware	5.9%	5.0%	2.4%	3.4%	2.1%	1.1%
New Jersey	4.3	4.1	3.0	2.3	1.7	0.5
Virginia	4.5	4.7	7.5	1.8	1.6	1.4
Washington, D.C.	0.5	2.2	(-0.1)	(-0.4)	(-0.1)	(-1.2)
Maryland	5.4	5.0	5.3	2.8	2.4	1.0
New York	3.1	2.9	2.5	1.2	0.8	(-0.2)
Pennsylvania	3.6	3.1	5.6	0.8	0.4	0.1
Total United States	4.1	3.9	4.2	1.7	1.3	1.0

As can be seen from the table, the rate of growth in motor vehicle registrations exceeds the growth in population. In 1950, the number of persons per vehicle in the United States was 3.1. By 1975, the number had declined to 1.6. Historically, in general, the number of miles travelled per passenger car has remained fairly constant at 9,000 to 10,000 miles per vehicle per year. As a result, total annual increases in vehicle miles of travel have paralleled the growth in the number of vehicles.

The following analysis of historical traffic growth in the area served by the crossings of DRBA presents a discussion of the changes in traffic volumes and their relationship to these statistics. As in the other sections of the report, the facilities have been divided into those operated by the DRBA, the competing crossings of DRPA, New Jersey and Delaware highways, and highways and crossings in Maryland and Virginia.

II.C.1 Facilities of Delaware River and Bay Authority

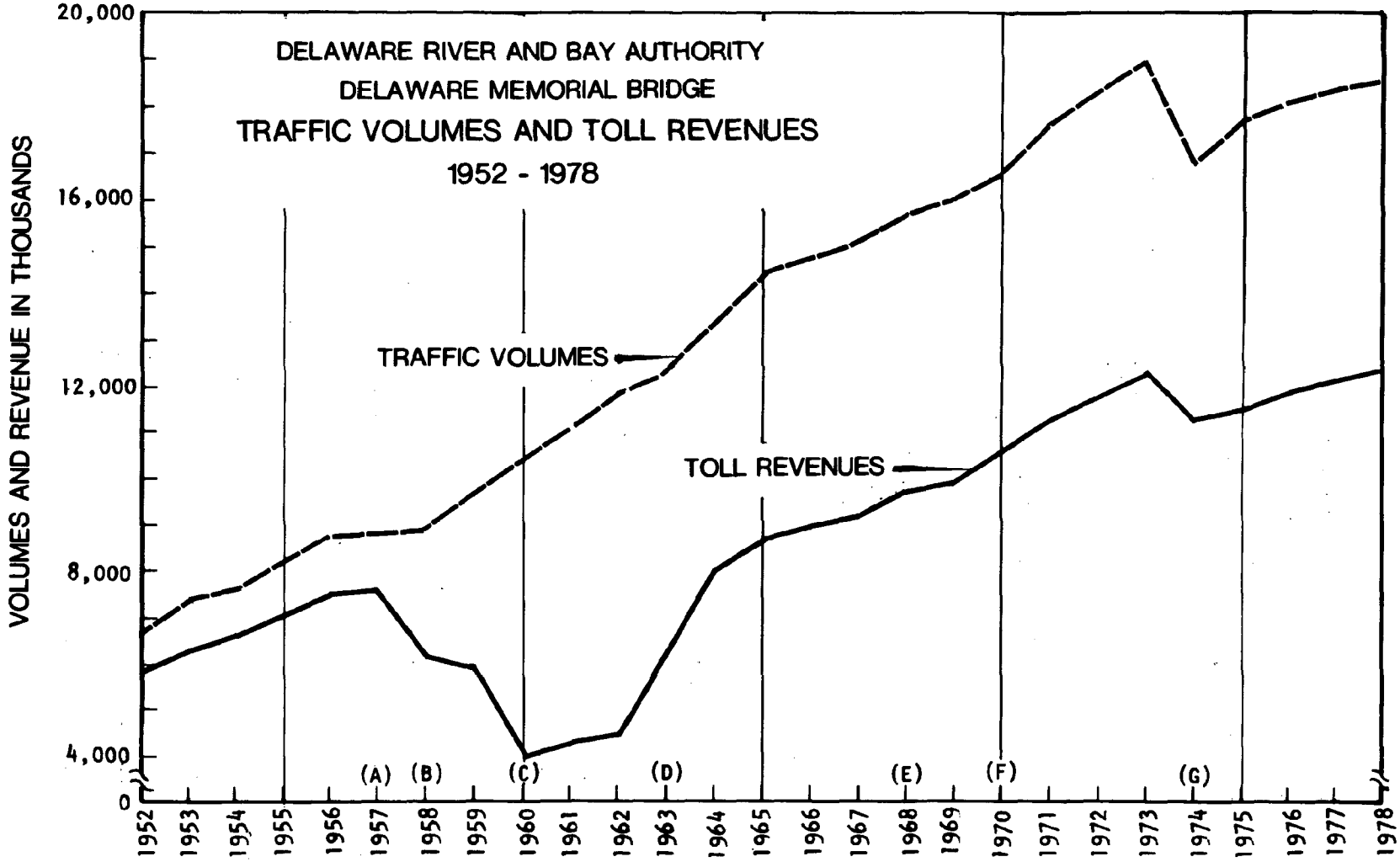
Since it was officially empowered on February 6, 1963, the Delaware River and Bay Authority has operated the Delaware Memorial Bridge. During the summer of 1964, the Authority initiated cross-Bay service via the Cape May-Lewes Ferry.

II.C.1.a Delaware Memorial Bridge

The first span of the Delaware Memorial Bridge was opened to traffic on August 16, 1951. As a result of the increasing volume of traffic carried, it was decided in 1963 to construct a second span which was completed and opened to traffic on September 12, 1968.

Between 1952 and 1978, revenue traffic on the Bridge increased at a compound average annual rate of 4.0 percent. The graph on the following page shows the annual traffic volume and toll receipts for the twenty-seven full years of operation. During the facility's earlier years the rates of increase were significantly greater than the levels of the recent past. The years with the greatest increases were 1953, 1959 and 1964. The increase in 1953 is typical of the traffic development pattern for a new facility. The 1959 increase reflects the introduction of lower tolls on the Bridge and the 1964 increase followed the November 1963 opening of the John F. Kennedy Memorial Highway in Maryland and Delaware, constituting a direct express approach to the Bridge.

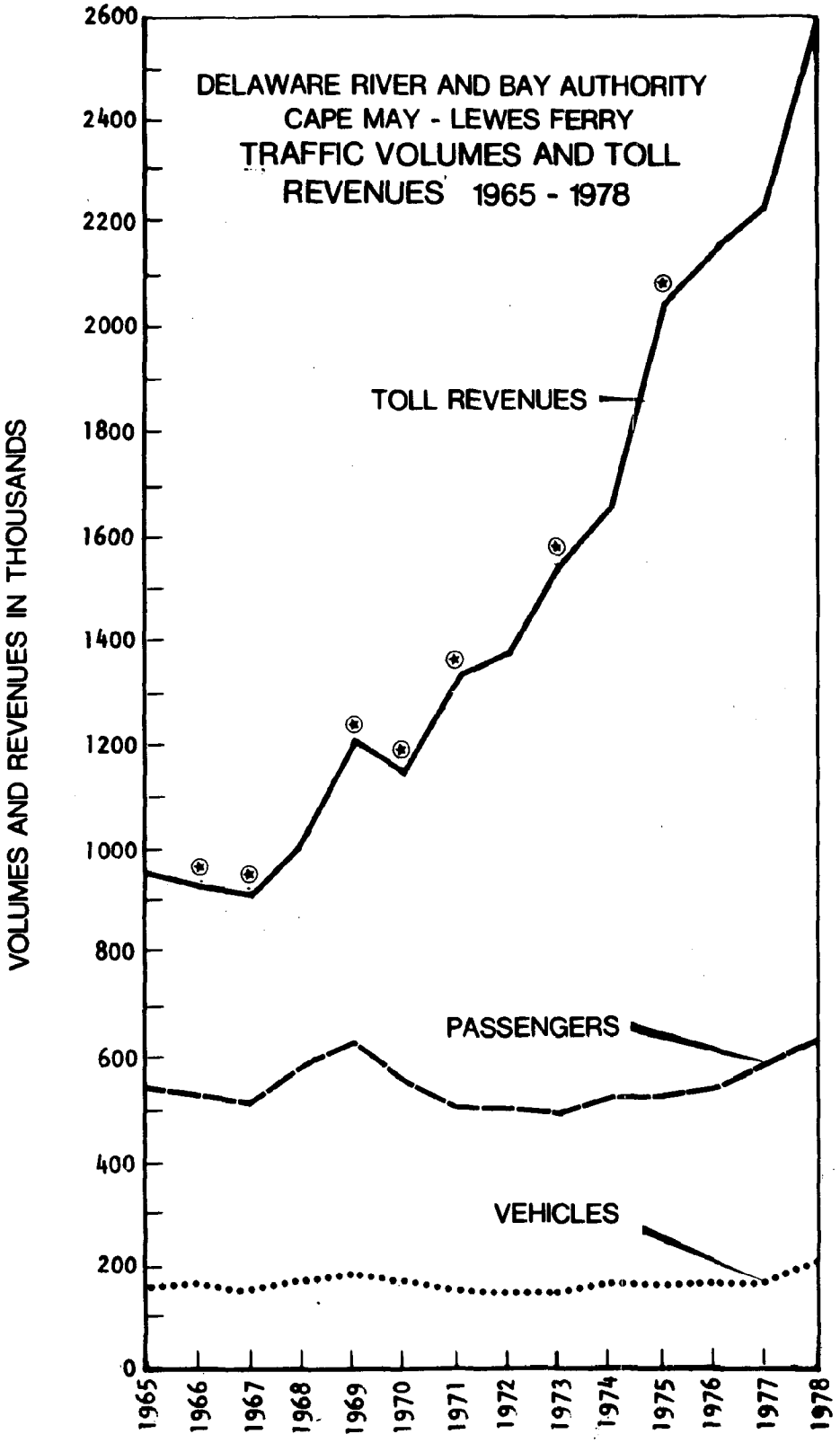
Since 1951, the number of vehicles using the Bridge has increased every year with only two exceptions -- 1957 and 1974. In 1957 traffic decreased by 0.2 percent by reasons of the May 16, 1957 opening of the Walt Whitman Bridge. In 1974, the other year of decline, there was a twofold reason for the reduction in the number of vehicles using the Delaware Memorial Bridge: the energy crisis and the February 1, 1974 opening of the Commodore Barry Bridge. The increase in traffic on the Delaware Memorial Bridge since 1974 has not yet been great enough to bring the total annual traffic volume up to the 1973 level. Total revenue traffic for 1978 was 18,584,000 as compared with 18,876,000 in 1973.



Notes: (A) Walt Whitman Bridge opened to traffic May 16, 1957.
(B) Tolls reduced June 1, 1958.
(C) Tolls reduced January 1, 1960.
(D) Tolls increased July 1, 1963.
(E) Second span opened to traffic September 12, 1968.
(F) Commuter tolls increased January 1, 1970.
(G) Commodore Barry Bridge opened to traffic February 1, 1974 and year of energy crisis.

Source: URS/Coverdale & Colpitts, Inc., March 1979

Exhibit II-3



Source: URS/Coverdale & Colpitts, Inc., March 1979

Exhibit II-4

Since its opening, the toll schedule on the Bridge has been changed four times. Tolls for all vehicle classes were reduced on June 1, 1958 and again on January 1, 1960. On both occasions, total revenues decreased since the increase in the number of vehicles was not great enough to offset the reduced toll charges per vehicle.

On July 1, 1963, tolls for all vehicle classes paying full fare were increased; tolls for commuters were not changed. The result was a reduction in the number of full-fare passenger cars while the number of commuters increased significantly, reflecting the shift of motorists for whom the reduced rate now became economical.

On January 1, 1970, commuter tolls were increased and in the ensuing year the number of commuters declined by almost 300,000. An additional increase in toll rates was instituted on September 1, 1979.

The following table shows the compound average annual growth rates for the periods 1950 to 1960, 1960 to 1970, and 1970 to 1975 for traffic on the Delaware Memorial Bridge. The table also shows the rates of change for population and motor vehicle registrations in New Jersey and Delaware.

Growth Trends in Delaware Memorial Bridge Traffic

	1950-1960	1960-1970	1970-1975
Compound Average Annual Growth Rate	5.8%	4.7%	1.3%

Growth Trends in Population and Motor Vehicle Registrations

	1950-1960		1960-1970		1970-1975	
	Population	Motor Vehicle Regist.	Population	Motor Vehicle Regist.	Population	Motor Vehicle Regist.
Delaware	3.4%	5.9%	2.1%	5.0%	1.1%	2.4%
New Jersey	2.3%	4.3%	1.7%	4.1%	0.5%	3.0%

As can be seen from the table, the rate of growth for Bridge traffic during the 1950's and 1960's falls between the rates of growth in the number of vehicles registered in the states of Delaware and New Jersey. However, during the first half of this decade, Bridge traffic grew at a lower rate and more closely resembles the population trend.

II.C.1.b Cape May-Lewes Ferry

The Cape May-Lewes Ferry started operations on July 1, 1964. Exhibit II-4 on the following page shows the trend in the number of vehicles and passengers carried and gross toll revenues for the 14 full years of operations.

The Authority currently operates three ferries, each capable of carrying 100 vehicles. The schedule for the peak July and August season of 1979 is being expanded to twelve sailings per day, compared to 10 per day in 1978. During the spring and fall, there are six sailings per day and during the winter, four. The Authority plans to further expand its schedule by purchasing an additional ferry boat which will be put into service during the summer of 1981.

As can be seen from Exhibit II-4, the annual number of passengers and the number of vehicles using the Ferry have not changed drastically over the years. The banner year of operations was 1978 when 212,000 vehicles and 642,000 passengers were carried. The increase in the number of behicles for 1978 compared to 1977 was 20 percent and for passengers, 10 percent. One of the reasons for the increase in the demand for ferry service was the opening of casino gambling in Atlantic City at the end of May 1978. To handle the additional traffic, the ferry schedule was expanded for the peak summer months.

Between 1965 and 1978 total toll revenues for the ferry's operations increased at an average annual rate of 8.0 percent, principally as a result of toll revisions. Of the nine revisions in the ferry's history, two of the changes -- on February 1, 1965 and April 1, 1966 -- affected only small portions of total traffic. Of the remaining revisions, the November 1966 adjustment was a decrease and the others were increases. The last toll revision was on January 1, 1975 and another revision became effective on September 1, 1979.

II.C.2 Facilities of the Delaware River Port Authority

The Delaware River Port Authority (DRPA) operates four crossings of the Delaware River between Pennsylvania and New Jersey. The southernmost facility -- the Commodore Barry Bridge -- is the nearest competitor to the Delaware Memorial Bridge since the two bridges are only twelve miles apart and are connected by modern express highways on both sides of the river.

The Commodore Barry Bridge was opened to traffic on February 1, 1974 and connects Chester, Pennsylvania and Bridgeport, New Jersey. The following table presents the annual traffic volume for the four full years of operation and the percent change over the previous year:

Commodore Barry Bridge

	Annual Volume	Percent Change Over Previous Year
1975	3,594,000	--
1976	3,920,000	9.1%
1977	4,450,000	13.5%
1978	4,856,000	9.1%

As would be expected on a new facility, the annual growth rates are high as a result of the gradual shift of route by motorists and the development of "new" traffic induced by the availability of a new facility.

Traffic volumes on the Delaware Memorial Bridge are significantly higher than those on the Commodore Barry Bridge. The following table compares the traffic volumes on the two facilities for 1978.

	1978 Traffic Volume	
	Delaware Memorial Bridge	Commodore Barry Bridge
Passenger cars	15,088,000	4,435,000
Commercial vehicles	3,496,000	421,000
Total	18,584,000	4,856,000

As shown by the table, traffic volumes on the Delaware Memorial Bridge are almost four times as great as those on the Commodore Barry; the high volume is the result of two factors: (1) the Delaware Memorial Bridge is an integral segment of the major north-south through route serving long distance trips in the northeast corridor and (2) tolls on the DRBA facility are lower than those on the DRPA bridge. At the present time, the cash passenger car toll is $.50 and the rates for commercial vehicles range between $.33 and $.375 per axle on the Delaware Memorial Bridge; on the Commodore Barry bridge, the passenger car toll is $.60 and the rate for commercial vehicles is $.75 per axle. Although tolls for commuters are not strictly comparable due to the different methods of collection, the tolls for a regular commuter who makes 50 one-way trips per month is $.30 on the Delaware Memorial Bridge and $.37 on the Delaware River Port Authority facilities. (On the DRPA facilities, commuters must purchase a decal good for thirty days for $6 and pay $.25 per trip.) There is a 10-cent car pool rate in effect on the Delaware River Port Authority crossings; however, in 1978 these transactions accounted for only one percent of total passenger car traffic.

As mentioned previously, the other three Delaware River Port Authority crossings are further north and are not as competitive with the Delaware Memorial Bridge since the connections for through traffic are not as good and the local traffic served is more northerly oriented.

II.C.3 New Jersey Highways

The New Jersey Turnpike and the Garden State Parkway are both "feeder" routes to the facilities of the Delaware River and Bay Authority. The third toll road in New Jersey, the Atlantic City Expressway, serves Delaware Memorial Bridge traffic between the southern United States and Atlantic City and the remainder of the Jersey shore.

The construction of segments of I-295 parallel to the Turnpike between its southern terminus and Interchange 7 near Bordentown has had an

impact on the Turnpike. Since 1969, motorists have had the option of saving a portion of their turnpike toll by travelling on the competing toll-free expressway. However, no matter which route is selected, the motorist will use the Delaware Memorial Bridge as the crossing of the river and the Turnpike for the northern segment of the trip. Table II-9 on the following page shows the traffic volume on the New Jersey Turnpike for the years 1952, 1960, and 1970 through 1978 and the growth trend over this period.

The overall compound average annual increase in traffic for the 27 full years of operation was 7.3 percent. As would be expected, the rates in the earlier years were generally higher. During the current decade there were decreases in 1974 and 1975 reflecting the impact of the first energy crisis. The compound average annual rate of change for the period 1970 to 1978 is 3.8 percent. For comparison, during the period 1970 to 1975 the rate of change for population in New Jersey was 0.5% and for motor vehicle registrations, 3.0 percent.

The Garden State Parkway is the main feeder route north of the Cape May-Lewes Ferry. Traffic from the population centers of northern New Jersey and the remainder of the northeast United States approach the Ferry via this high-speed expressway route. Traffic is highly seasonal at the two southernmost barriers: Cape May, located approximately 23 miles north of Cape May, and Great Egg, 30 miles north of Cape May. In 1978, approximately 38 percent of the total annual volume was handled during the peak months of July and August. As a result, growth trends at these locations reflect increases in tourist activity in southern New Jersey and cannot be compared to traditional demographic data. Table II-10 shows the growth trend for both locations for the years 1970 through 1978.

In 1974, the year of the first energy crisis, there was a decrease at both locations. Other than that, the annual rate of increase at each location has exceeded 5 percent. Undoubtedly, part of the increased growth in the last two years has been a result of increased activity in the Atlantic City area in response to the introduction of casino gambling.

The Atlantic City Expressway, used in connection with I-295 and NJ 42, is the fastest route between the Delaware Memorial Bridge and Atlantic City. Like the southern end of the Garden State Parkway, this road primarily serves vacation traffic and the growth pattern cannot be compared to changes in population and motor vehicle registrations. Table II-11 summarizes historical traffic changes at each of the two across-the-road barriers on this facility: Egg Harbor and Pleasantville.

The changes in traffic volume on this toll road have not followed a consistent pattern. During the first half of the decade there were significant reductions in traffic, especially in 1974 resulting from the energy crisis. In 1975 and 1976, traffic began to return to the Expressway. In 1977 traffic increased as a result of construction and

Table II-9. New Jersey Turnpike, Annual Volume and Growth Trend - 1952 to 1978

	Annual Volume	Percent Change Over Previous Year
1952*	17,948,000	-
1960	49,083,000	13.4%**
1970	89,655,000	6.2[2]
1971	98,554,000	9.9
1972	107,933,000	9.5
1973	110,422,000	2.3
1974	106,628,000	(-3.4)
1975	105,633,000	(-0.9)
1976	109,234,000	3.4
1977	113,664,000	4.1
1978	120,623,000	6.1

*First full year of operations.

**Compound average annual percent change.

Table II-10. Traffic Growth Trends, Garden State Parkway Cape May and Great Egg Barriers

	Cape May Barrier		Great Egg Barrier	
	Annual Volume	Percent Change	Annual Volume	Percent Change
1970	3,433,000	-	3,266,000	
1971	3,709,000	8.0%	3,499,000	7.1%
1972	3,968,000	7.0	3,763,000	7.5
1973	4,388,000	10.6	4,273,000	13.6
1974	4,109,000	(-6.4)	4,095,000	(-4.2)
1975	4,453,000	8.4	4,408,000	7.6
1976	4,958,000	11.3	4,848,000	10.0
1977	5,421,000	5.7	5,147,000	6.2
1978	5,638,000	7.6	5,712,000	11.0

Table II-11. Traffic Growth Trend at Atlantic City Expressway Barriers

	Pleasantville Harbor		Egg Harbor Barrier	
	Annual Volume	Percent Change	Annual Volume	Percent Change
1970	3,376,000	-	3,557,000	-
1971	3,352,000	(-0.7)%	3,622,000	1.8%
1972	3,167,000	(-5.5)	3,738,000	3.2
1973	3,220,000	1.7	4,144,000	10.9
1974	2,918,000	(-9.4)	3,538,000	(-14.6)
1975	3,010,000	3.2	3,728,000	5.4
1976	3,312,000	10.0	4,135,000	10.9
1977	3,705,000	11.9	4,560,000	10.3
1978	5,148,000	38.9	5,274,000	15.7

development activity in preparation for the introduction of casino gambling. The first casino opened Memorial Day weekend of 1978 and the result was an increase in traffic of approximately 39 percent at Pleasantville and approximately 16 percent at Egg Harbor. Another casino was opened in June 1979 and by 1982, a total of six casinos will be in operation in all likelihood.

An additional indication of traffic growth trends in southern New Jersey can be seen in a summary of the traffic counts at the sites of four permanent automatic traffic recorders maintained by the state: I-295 in East Greenwich Township, US 30 in Atlantic City, US 40 in Pleasantville and the Garden State Parkway in Middle Township. These sites are shown on the map (Exhibit II-5) on the following page and the growth trend at each can be seen on the graph (Exhibit II-6).

The I-295 automatic traffic recorder is located in East Greenwich Township in Gloucester County. The compound average annual rate of change at this site was 5.2%; however, the trend was actually a series of increases and decreases. The sharp increases in 1973 and 1976 reflect the completion of additional segments of this New Jersey Turnpike tollfree by-pass.

US 30 and US 40, both serving Atlantic City traffic, have similar growth trends consisting of a moderate increase over the full eight-year period despite some decreases. In 1978, there was an increase of almost 9% on US 30 and almost 6% on US 40 reflecting the impact of the introduction of casino gambling.

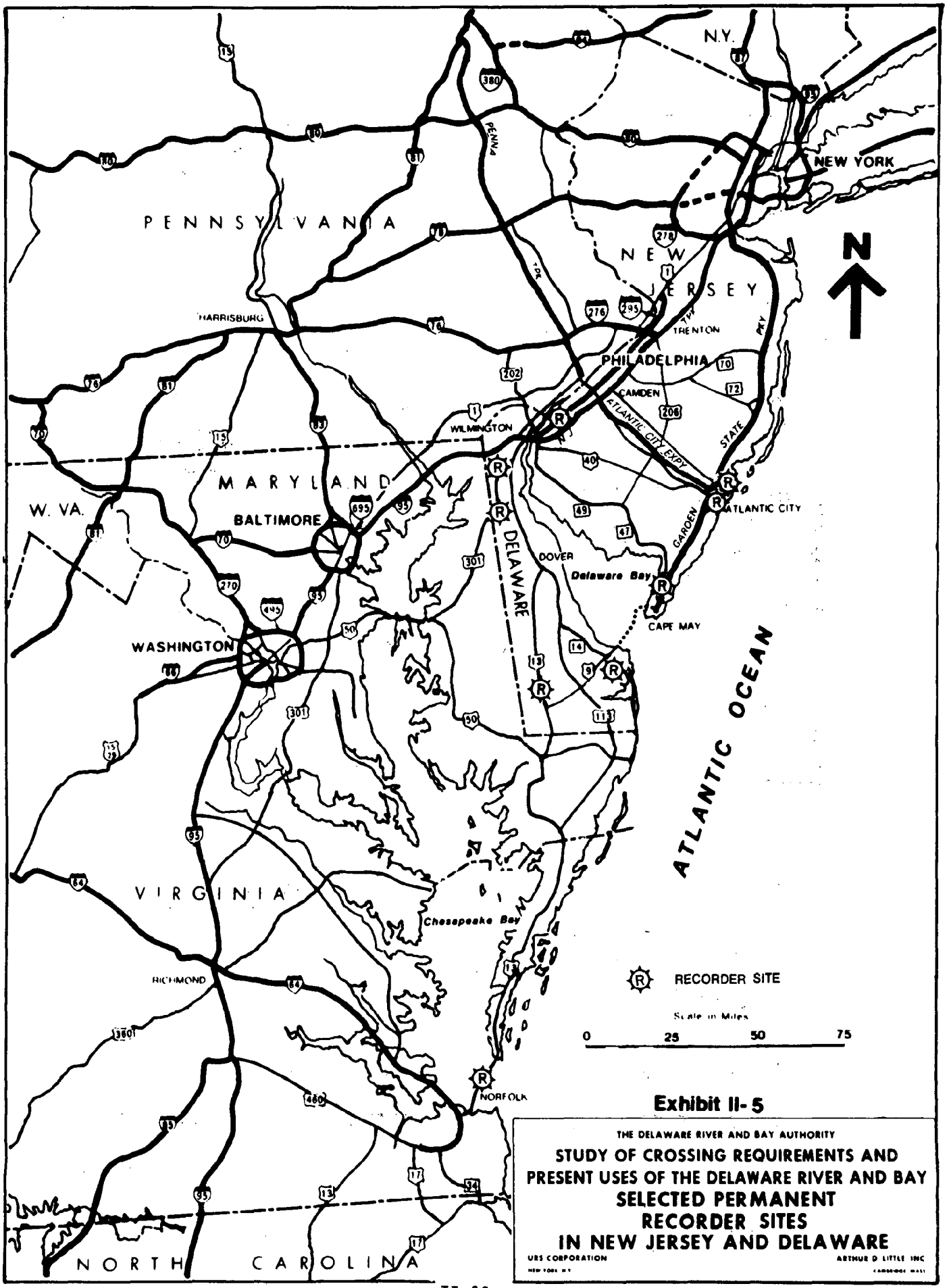


Exhibit II-5

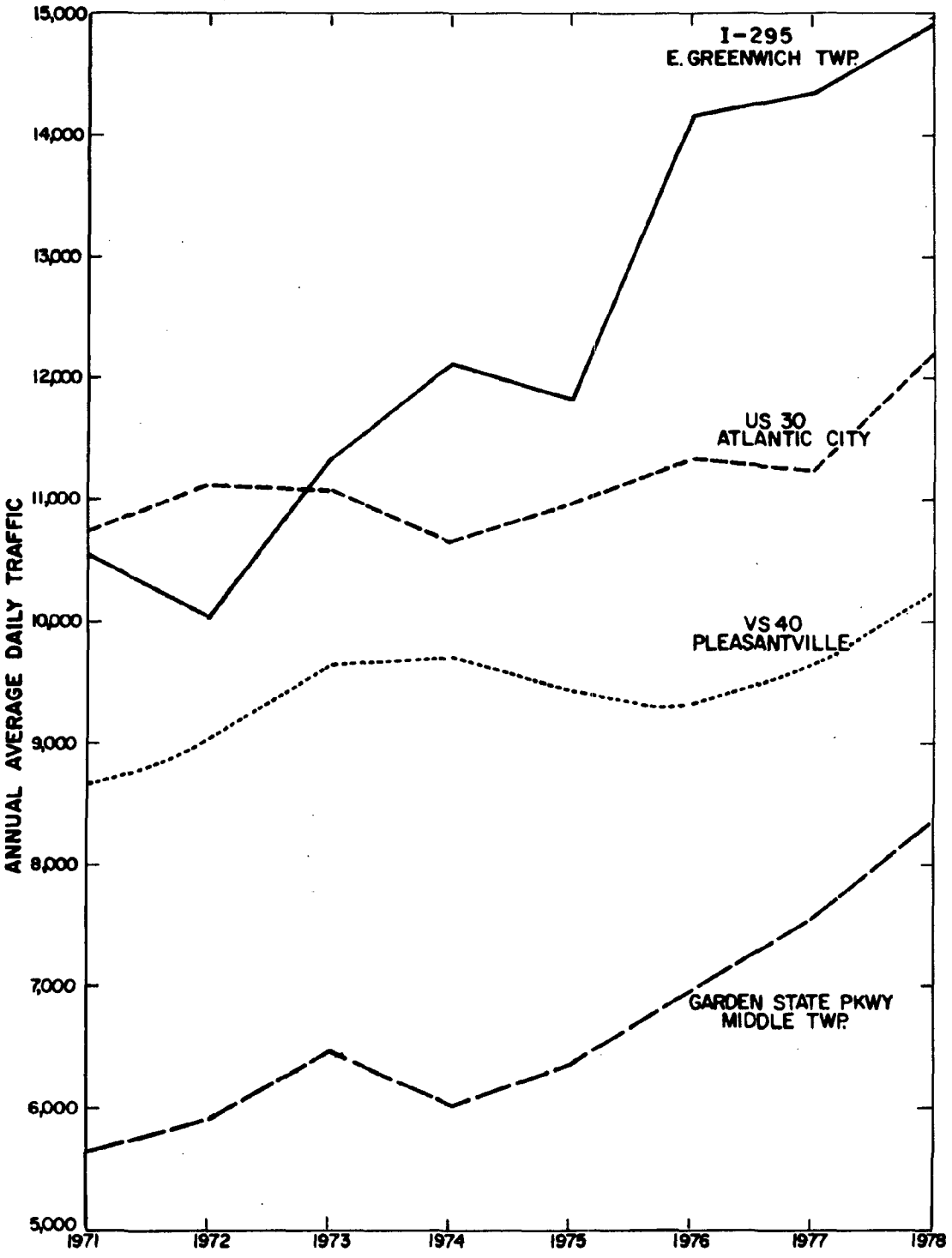
THE DELAWARE RIVER AND BAY AUTHORITY

STUDY OF CROSSING REQUIREMENTS AND PRESENT USES OF THE DELAWARE RIVER AND BAY

SELECTED PERMANENT RECORDER SITES IN NEW JERSEY AND DELAWARE

URS CORPORATION — NEW YORK, N.Y.

ARTHUR D. LITTLE INC — CAMBRIDGE, MASS.



AADT AT SELECTED PERMANENT RECORDER STATIONS IN NEW JERSEY

Exhibit II-6

The remaining site is located on the Garden State Parkway approximately 10 miles north of its southern terminus. The compound average annual growth rate at this location was 5.9% for the years 1971 through 1978. The increases in traffic at this location have been constant and relatively sharp, with the exception of the decline in 1974 as a result of the energy crisis. In particular, the rate of growth has exceeded 8% in each of the last three years, reflecting the growth in this area spurred by the attraction of Atlantic City and the development of tourism in southern New Jersey.

II.C.4 Delaware Highways

II.C.4.a Delaware Turnpike

The key section of I-95 in terms of its linkage to the Delaware Memorial Bridge is the Delaware Turnpike. Since its opening in November 1963, its toll-paying traffic has grown as shown in Table II-12.

In the 11-year period, 1964 through 1975, long-distance barrier traffic doubled, while local ramp traffic increased nearly ten-fold. During this period, suburban development in the Wilmington-Newark corridor "exploded," undoubtedly induced by the high-speed service provided by the Turnpike.

The elimination of local tolls on the northeasterly Turnpike ramps at Del. 896, Del. 273 and Del. 7 on September 30, 1976, also has been a significant factor influencing Turnpike traffic patterns in the last few years. While barrier traffic has shown a steady moderate growth in the range of two to six percent annually since the "energy crisis" in 1974, ramp traffic increased sharply during the last quarter of 1976 and throughout 1977, and still continues to outpace the growth in barrier traffic. In 1975, before the local tolls were eliminated, ramp traffic represented 48% of the total Turnpike traffic; by 1978, this proportion increased to 58%.

The 5.5% drop in barrier traffic in 1979 was the result of the late Spring and Summer fuel shortage and the escalating fuel prices which ensued.

On the basis of the above traffic estimates and counts made by the Delaware DOT on the low-volume southwesterly Turnpike ramps, the following traffic profile was prepared for the Turnpike for its fiscal year ended June 30, 1979.

Table II-12. Delaware Turnpike Historical Traffic Growth

Year	Barrier (Thru)(A) AADT	Barrier (Thru)(A) Growth	Ramps (Local)(B) AADT	Ramps (Local)(B) Growth	Total AADT	Percent Ramps
1964(C)	16,262	-	3,027	-	12,289	15.7%
1965	19,054	17.2%	4,011	32.5%	23,065	17.4
1966	20,050	5.2	5,451	35.9	25,501	21.4
1967	21,786	8.7	7,516	37.9	29,302	25.7
1968	23,843	9.4	11,033	46.8	34,876	31.6
1969	27,173	14.0	14,498	31.4	41,671	34.8
1970(D)	29,275	7.7	16,659	14.9	45,934	36.3
1971	30,453	4.0	20,963	25.8	51,416	40.8
1972	32,438	6.5	24,906	18.8	57,344	43.4
1973	33,614	3.6	27,178	9.1	60,792	44.7
1974(E)	29,766	(11.4)	27,601	1.6	57,367	48.1
1975	31,459	5.7	29,383	6.5	60,842	48.3
1976(F)	32,798	4.3	33,660	14.6	66,458	50.6
1977	34,892	2.3	43,297	28.6	77,009	56.2
1978	34,892	3.5	48,169	11.3	83,061	58.0
1979	32,970	(5.5)	NA	-	-	-

(A) Main-line toll barrier located between Del. 896 and the Maryland Line.
(B) Ramps carrying traffic to and from the east (north) on the Turnpike at Del. 896, Del. 273 and Del. 7 (Churchmans Road), combined traffic.
(C) First full year of operation.
(D) Ramp tolls reduced April 1, 1970.
(E) Barrier tolls increased January 1, 1974.
(F) Barrier tolls increased and ramp tolls eliminated September 30, 1976.

Source: Preliminary analysis by Delaware D.O.T., October 1978, updated through December 1979.

Interchange		1979 AADT	
Route	To & From	Ramps	Main Line
			34,670
Del. 896	West	1,250	
	East	24,800	
			58,220
Del. 273	West	2,440	
	East	14,110	
			69,890
Del. 7	West	2,320	
	East	9,090	
			76,660

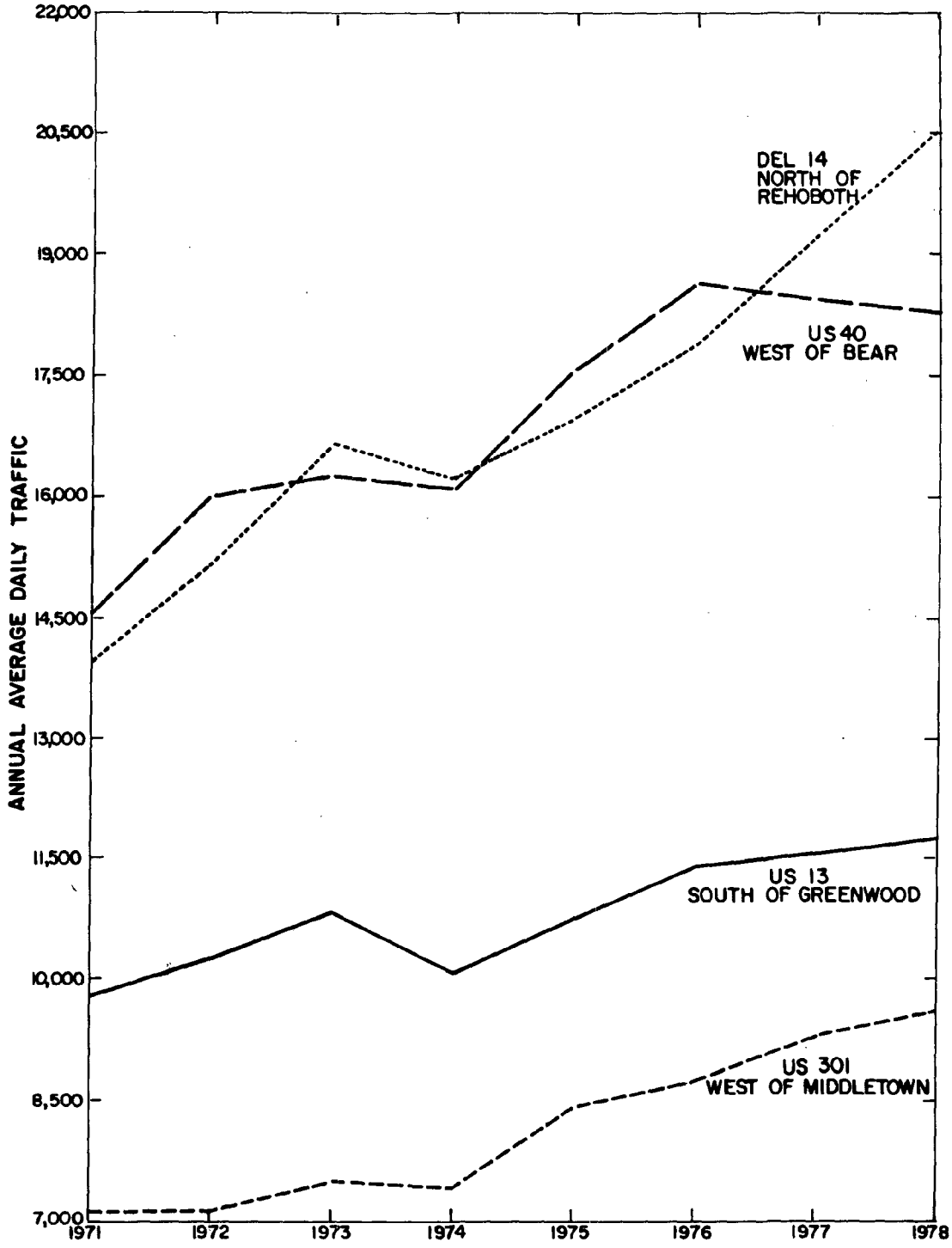
The above table, showing main-line traffic east of Del. 7 over twice the volume of the main line west of Del. 896 (at the toll barrier), reflects the large volumes of ramp traffic with local origins and destinations. The main-line section east of Del. 7 (just west of the Christina Marsh interchange), therefore, is the critical section in terms of the evaluation of the adequacy of the Turnpike, discussed further in Section II.D. On the basis of past trends, land use and population forecasts, traffic in this critical Turnpike section has been projected through 1985 in the following table. Also shown are the corresponding afternoon peak hour traffic estimates for the south-westbound roadway.

Delaware Turnpike Projection, Critical Section

Year	AADT 2-Way	Peak Hour Volume W/B
1979	76,660	4,210
1980	78,700	4,270
1981	80,800	4,330
1982	83,000	4,390
1983	85,300	4,450
1984	87,600	4,520
1985	90,000	4,580

II.C.4.b Other Delaware Highways

Another measure of historical growth trends in traffic can be seen by analyzing traffic counts obtained by the State of Delaware at specific permanent traffic recorders. Exhibit II-7 on the following page shows the Annual Average Daily Traffic (AADT) for the years 1971 through 1978 at four locations. These locations are noted on the map in Exhibit II-5. The general trend at the four stations has shown annual increases with the exception of the effect of the energy crisis in 1974.



AADT AT SELECTED PERMANENT RECORDER STATIONS IN DELAWARE

Exhibit II-7

The greatest increases occurred at the station located on Del. 14 north of Rehoboth, where the compound average annual growth rate for the period 1971-1978 was 5.7%. This reflects the increase of resort traffic in this area. The sharp seasonality in this area can be seen by monthly data at this site. Although the Annual Average Daily Traffic at this location was 20,500 in 1978, average daily traffic in July and August exceeded 35,500 and in an average day in January and February was less than 11,000.

The other location in southern Delaware is on US 13, south of Greenwood. Between 1971 and 1976, the annual rate of growth at this location ranged between five and six percent (with the exception of the impact of the energy crisis in 1974). In the last two years, the rate substantially decreased to 1.2 percent in 1977 and 2.3 percent in 1978.

The remaining two stations are in northern Delaware and are located on US 40 and US 301. The site on US 40 is west of Bear and is used for local traffic and as a bypass of the Turnpike. At this site the compound average annual growth rate over the eight years was 3.4 percent; however, there were modest decreases of 1.2 percent and 0.6 percent in the last two years. The other permanent recorder is on US 301 west of Middletown and serves local traffic and long-distance trips by-passing Baltimore and Washington, D.C. via the Delmarva Peninsula. Traffic at this location has been consistently increasing since the energy crisis of 1974. The rate of growth in 1977 was 5.7 percent and in 1978, 3.6 percent.

II.C.5 Maryland and Virginia Facilities

The Maryland Transportation Authority operates five crossings and the Maryland Turnpike (JFK Memorial Highway). Each of these facilities is used by a different segment of long-distance through traffic on the Delaware Memorial Bridge. Traffic between the northeast and points south of Baltimore use either the Maryland Turnpike or the Susquehanna River Bridge for the distance between the Delaware state line and the City of Baltimore and either the Baltimore Harbor Tunnel or Outer Harbor Bridge as a by-pass of the City of Baltimore. An alternative route between the northeast and Washington, D.C. is via US 301 and US 50 which includes the Chesapeake Bay Bridge. Traffic headed further south in Virginia has the option of by-passing Washington via US 301 and the Potomac River Bridge. Table II-13 on the following page summarizes the growth trend on each of these facilities for the years 1950 through 1978.

As can be seen from the table, both the Potomac River Bridge and the Susquehanna River Bridge lost traffic during the 1960's as a result of the completion of the Maryland Turnpike in 1963 and the diversion of traffic to that facility. A similar drop in traffic occurred at the Baltimore Harbor Tunnel after the March 1977 opening of the competing Outer Harbor Bridge, but total cross-Harbor traffic actually increased.

Table II-13. Growth Trends on Maryland Toll Facilities

Year	Baltimore Harbor Tunnel*	Outer Harbor Bridge**	Total Baltimore By-Pass	Chesapeake Bay Bridge	Potomac River Bridge	Susquehanna River Bridge	Maryland Turnpike (Barrier)***
	Annual Traffic Volume						
1950	-	-	-	1,919,000	965,000	5,493,010	-
1960	12,807,000	-	12,807,000	2,966,000	2,391,000	9,416,000	6,156,000****
1970	21,795,000	-	21,795,000	5,810,000	2,085,000	5,756,000	10,606,000
1978	22,460,000	5,755,000	28,215,000	9,833,000	2,992,000	5,584,000	-
	Compound Average Annual Percent Change						
1950-1960	-	-	-	4.5%	9.5%	5.5%	-
1960-1970	5.5%	-	5.5%	7.0	(-1.4)	(-4.8)	9.5%
1970-1978	0.4	-	3.3	6.8	4.6	(-0.4)	-

*Baltimore Harbor Tunnel opened to traffic 1957.
**Outer Harbor Bridge opened to traffic 1977.
***Maryland Turnpike opened to traffic 1963.
****1964.

With these exceptions, the general trend has been toward lower rates of growth during this decade than in the previous twenty years. This is in keeping with the reduction in the rate of growth for population in the State of Maryland, as shown on Table II-8.

In Virginia, the Chesapeake Bay Bridge Tunnel handles long distance through traffic travelling along the coast via the Cape May-Lewes Ferry and the Ocean Highway. The Bridge-Tunnel was opened to traffic in 1964. Total traffic using the facility in 1970 was 1,205,000 and increased at a compound average overall rate of 5.2 percent to 1,808,000 in 1978. For comparison, population in Virginia increased at a compound average annual rate of 1.4 percent between 1970 and 1975 and motor vehicle registration at 7.5 percent. The rate of growth on the Crossing was between the rate of growth of population and motor vehicle registration.

II.C.6 Intermodal Diversion Potential

The choice of an alternative mode of travel for motorists using the facilities of the Delaware River and Bay Authority depends on the length of the trip. For local traffic, there are no alternatives. Motorists using the Delaware Memorial Bridge cannot switch to mass transit since there are no local buses crossing the River in this area. The Ferry does not handle local passenger traffic due to the significant travel time and distance involved. For a trip of intermediate length, there are two major alternatives -- rail and bus, and a third, more costly but faster choice -- air. For long-distance trips the same three alternatives are available, but train and air are the more acceptable.

For trips of intermediate length, we have selected two major traffic movements in the northeast corridor to analyze: New York City to Washington, D.C. and New York City to Norfolk, Va. These two trips correspond to major movements in the two transportation corridors discussed above: I-95 and the Eastern Shore. In general, other trips between major population centers have characteristics similar to these movements. Table II-14 summarizes the quantifiable characteristics of travel by each mode for the two selected trips.

As the table shows, if a motorist drives at 50 miles per hour, the 225 mile trip between New York and Washington takes 4-1/2 hours, the same time as the regular Amtrak train or the bus, but an hour longer than the Metroliner. Therefore, the time difference among these alternatives, rail, bus, and auto is not great. Because of the high value of time savings to business travellers, air travel is preferred since the higher cost is acceptable to most persons travelling on business. (In the travel time via public transportation, there is no allowance for time between the actual origin and destination and the railroad or bus station or airport, since it is assumed that approximately the same time will have to be added on both ends of the trip via auto.)

Table II-14. Comparison of Characteristics of Private and Public Transportation for Selected Trips in the Northeast Corridor

	New York City to Norfolk, Va.		New York City to Washington, D.C.	
	Via Delaware Memorial Bridge	Via Cape May-Lewes Ferry		
Distance	335 miles	342 miles	225 miles	
PRIVATE TRANSPORTATION				
Approximate Travel Time	7 hours	8-1/2 hours	4-1/2 hours	
Costs: Tolls	$10.40	$20.40	$5.65	
Gasoline (A)	35.84	34.88	24.08	
Total	$46.24	$55.28	$29.73	
RAIL			Regular	Metroliner
Approximate time	10-1/2 hours		4-1/2 hrs	3-1/2 hrs.
Fare (one-way)			$23.00	$28.00
Number of scheduled trains per weekend day	1(B)		11	6
per weekday	1(B)		14	11
BUS				
Approximate time	8-1/2 hours		4-1/2 hours	
Fare (one-way)	$33.00		$17.00(C)	
Schedule	8 per day		hourly(D)	
AIR				
Approximate time	1 hour		1 hour	
Fare (one-way tourist)	$50.00		$44.00	
Schedule	6 per day(E)		hourly(F)	

(A) Estimated at 10.7¢ per mile.
(B) Through service not available; trip shown is by connection.
(C) One-half of round trip fare (One-way ticket is $20.50).
(D) Hourly during day; frequent service available at night.
(E) Direct flights.
(F) Data for hourly shuttle flights. There are additional scheduled flights.
(G) Cost shown includes toll on Cape May-Lewes Ferry for driver and one adult passenger.

Total passenger car tolls for a trip via the Holland Tunnel, New Jersey Turnpike, Delaware Memorial Bridge, Delaware Turnpike, Maryland Turnpike and Baltimore Harbor Tunnel is $5.65. The cost of gasoline and other mileage-related running costs for the 225-mile trip is $24.08 based on a rate of 10.7-cents per mile. Thus the total perceived or out-ofpocket cost for the trip of $29.73 is higher than either the $23.00 oneway fare via regular train or the $28.00 fare via Metroliner.

As far as scheduling is concerned, there are frequently scheduled departures for all three modes of public transportation. At the present time, the Federal Department of Transportation is recommending that Amtrak cut down on the number of routes it maintains. However, this trip will not be affected since there are no plans for curtailing service in the northeast corridor.

For the trip between New York City and Norfolk, Virginia, the travel time, distance and cost are shown via both the Delaware Memorial Bridge and the Cape May-Lewes Ferry. For both trips, the best route continues down the Delmarva Peninsula on US 13 and the Chesapeake Bay Bridge Tunnel. Although the mileage difference between the Bridge and Ferry routes is only 7 miles, the travel time on the Ferry route is 1-1/2 hours greater and the cost is $9.04 greater.

A comparison of the alternative modes shows that the advantages and disadvantages are similar to those for the trip between New York and Washington. The major difference is that scheduling for public transportation is not as frequent.

In summary, the competitive advantage of travel by auto for a trip of intermediate length is the monetary savings when more than one person is making the trip in one auto. It should be noted that this benefit may be reduced in the future if the cost of gasoline continues to increase.

For a long distance trip, the non-quantifiable characteristics are generally more important than those that can be measured. For example, the trip between Miami and New York City is 1,300 miles, an estimated driving time of more than 29 hours. The gasoline and toll cost is estimated to be $148.55, as shown in Table II-15; but additional costs for lodging and food depending upon the habits of the traveller would have to be taken into consideration.

The comparative figures for public transportation show that the time for auto, bus and rail are similar. Of course, air travel is significantly faster and if only one person is making the trip, it is less expensive. The costs shown for public transportation are basic rates; reduced fares are available depending upon certain conditions.

Because a trip of this length generally involves the investment of a significant period of time and money, the traveller plans an itinerary that is most suited to his specific requirements. The major future

Table II-15. Comparison of Characteristics of Private and Public Transportation for Trip between New York City and Miami

	New York City to Miami
Distance	1,300 miles
PRIVATE TRANSPORTATION	
Approximate driving time	29-1/3 hours
Cost: Tolls	$ 9.45
Gasoline * *	139.10
Total	$148.55
RAIL	
Travel Time	28 hours
Cost (Coach, one-way)	$92.00
BUS	
Travel Time	28 hours
Cost (one way)	$93.00
AIR	
Travel Time	2-1/2 hours
Cost (one-way)	$119.00

*Estimated at 10.7 per mile.

development that may induce travellers to change their mode of travel is a shortage of the availability of gasoline. Because the cost of gasoline now represents a significant portion of the overall cost of a long distance trip, prices would not have to increase drastically before additional motorists switch to another means of transportation.

In addition to the quantifiable characteristics of cost and time, there are major non-measurable factors influencing the choice of the mode of transportation for both intermediate and long distance trips. The following is a brief summary of the other advantages of both private and public transportation.

Advantages of Private Transportation

- Scheduling can be done at the convenience of the traveller
- Transportation is from door-to-door and a car will be available for local travel at the destination.

Advantages of Public Transportation

- The trip can be more relaxing for a passenger travelling alone; the person can read, work or do a similar activity instead of driving.
- During a peak period of inclement weather, the aggravation of driving can be avoided.
- There is no worry about the availability of gasoline.

II.C.7 Effect of Energy Conditions

As discussed in section II.C.1.a, the Delaware Memorial Bridge traffic has increased steadily since 1952 except in two years: a slight decline in 1957 with the opening of the Walt Whitman Bridge, and a more significant decrease in 1974 due to the opening of the Commodore Barry Bridge coupled with the Arab oil embargo. Since 1974, traffic volumes have been increasing at a lower rate of growth as a result of the escalation in the cost of living and particularly gasoline prices. The steady growth from the dip in 1974 to 1978 has been sufficient to bring the traffic level on the Delaware Memorial Bridge approximately up to the level which existed in 1973.

No additional crossings, which could divert traffic from the Delaware Memorial Bridge, are now planned. Future traffic, therefore, will be governed by the availability and price of gasoline, the growth of the area served by the Bridge, the traffic generation potential of such major attractions as Atlantic City, and the distribution of bridge traffic in terms of short-distance and long-distance trips.

With respect to gasoline costs, it can be expected that prices will increase steady as they have in recent years. These increases will be offset by the gradual shift to smaller, more fuel-efficient cars. A review of the trend to small cars in the United States indicates that sales of U.S.-made cars were only 26% small cars (sub-compact and compacts) in 1972, but in 1976 they reached 41%. Inclusion of imports boosted small car sales in the U.S. to about 44% in 1972 and 51% in 1976. Looking towards 1981, annual sales of U.S. made small cars are expected to be about 6 million, larger U.S. made cars 3.5 million, and imports 2 million. It is estimated that over 85% of imported cars are in the subcompact classification. Thus, small car sales are expected to be almost 70% of new car sales in the U.S. in the next few years through 1981.

In terms of the nationwide fuel supply and consumption by motor vehicles, the long-term conditions must be considered, not the present motor fuel "crisis," which will probably ease just as the 1974 "crisis" eased. The following are findings developed by the Office of Technology Assessment of the United States Congress in a February 1979 report entitled

Technology Assessment of Changes in the Future Use and Characteristics of the Automobile Transportation System.

1. Even though the number of automobiles and vehicle-miles traveled (VMT) continues to rise, fuel consumption will peak by the early 1980's and then begin to fall as smaller fuel-efficient cars make up an increasingly greater share of the fleet. Between 1985 and 2000, consumption is expected to stay approximately at the 1985 level as progressive gains in fuel efficiency are offset by the continuing rise of VMT.

2. The complete exhaustion of oil resources is not likely. As production by conventional methods declines and oil becomes more scarce, the price will rise and more expensive recovery methods and novel technologies will be used to produce additional oil.

3. Small, gradual increments in the price of gasoline would not make significant reductions in the use of fuel. Analysis of historical data shows that a 15-percent increase in the real price of gasoline would reduct VMT by only about 3 percent.

4. Several major technological developments are expected by 1985:

   - Down-sizing programs will reduce the average size and weight of the vehicle fleet. Waste space from styling and image requirements will be greatly reduced.

   - Materials substitution -- greater use of lightweight materials such as aluminum, plastics and high-strength low-alloy steels -- will reduce vehicle weight further.

   - Changes in vehicle layout, such as front wheel drive, will allow further size and weight reduction.

   - Additional improvements in fuel economy will be achieved by improvements in transmission and drive-train efficiency and by reduced power requirements for accessories. The application of electronic controls for fuel metering and ignition will help the engine maintain efficient performance and reduce the need for tune-ups.

   - Several new or refined engines may be widely offered, including diesels, several of which are now offered.

The growth of the area served by the bridge and the traffic generation potential of Atlantic City and other major attractions, such as the new

Christiana Mall located at the Route 7 (Del.) interchange on the Delaware Turnpike, will continue to provide the underlying basis for traffic growth on the Delaware Memorial Bridge.

As for the distribution of bridge traffic, Table II-16 is a summary of the origin-destination patterns from the most recent roadside-interview survey in 1969. Although the data are 10 years old and the overall traffic volumes have gone up, the percentages in terms of origin-destination patterns are probably fairly accurate, with the exception of the double river crossings to and from Philadelphia, which have probably been virtually eliminated with the completion of I-95 through and past Philadelphia. (In 1969, I-95 only extended as far north as Wilmington.)

Table II-16. Origin-Destination Patterns of Delaware Memorial Bridge Traffic

	Estimated 1969 AADT			
	New York New England	Southern N.J.	Phila. Area	Total
The South	73%	18%	9%	100%
Washington, D.C.	65	23	12	100
Eastern Shore of Maryland and Southern Delaware	36	49	15	100
Southern Maryland and Anne Arundel County	100	-	-	100
Northern Maryland and Western Pennsylvania	45	43	12	100
Northern Delaware and Eastern Pennsylvania	12	84*	44*	100
All Other	54	36	10	100
Total	42%	49%	9%	100%

*Considered short-distance trips. All others can be considered long-distance trips.

As noted in Table II-16, the trips marked with an asterisk can be considered short-distance trips; all others can be considered long-distance trips. The short distance trips represent 31 percent of the total. Assuming that all truck trips and most short-distance passenger car trips are relatively inelastic with respect to curtailment due to fuel availability and pricing, the following table shows the distribution of bridge traffic in terms of elasticity.

Degree of Elasticity	Estimated 1979 AADT			
	Psgr. Cars Light Trucks	Heavy Trucks	Total	Percent
Elastic	23,589	-	23,589	53.5%
Inelastic	12,536	7,953	20,489	46.5%
Total	36,125	7,953	44,078	100.0%

In the estimation of future growth rates for bridge traffic, consideration was given to the short-term and long-term availability and price of motor fuel, the underlying traffic growth potential of the area served by the bridge, and the fact that nearly half of the traffic crossing the bridge will not be affected much by fuel inconveniences, unless fuel becomes unavailable at any price. This is highly unlikely, since after the 1974 energy crisis traffic nationwide regained its upward trend.

With respect to the Cape May-Lewes Ferry, its future growth trends are likely to be somewhat higher than those of the bridge because of the impact of casino gambling in Atlantic City. Section II.D.1.b indicates that these growth rates will be moderate, however, reflecting the use of the ferry by long-distance recreational trips which are most susceptible to curtailment during periods of fuel shortages.

II.D ADEQUACY OF HIGHWAY SYSTEM

As stated in the introduction to this Chapter, one of the principal objectives of this regional study has been to analyze and present the highway transportation facilities which exist today in the area of the Delaware River and Bay between New Jersey and Delaware and to consider the need for possible additional crossings between the two states. In consideration of this objective, the overall adequacy of the existing highway system with respect to the type and degree of current usage, the aggregate burden placed on the facilities, and future travel demand and needs are addressed in this section. Previous analyses are also summarized in the process of evaluating the adequacy of the highway systems to serve present and future users.

The evaluation of the adequacy of the highway system considers two conditions: (1) adequacy of the system to carry and expedite traffic and (2) adequacy of the system to satisfy the future travel desire patterns and needs of the users. The first refers to capacity and levels of service and the second refers to the shape of the network, specifically the location of major links.

The principles and guidelines set forth in the Highway Capacity Manual prepared by the Highway Research Board in 1965, in terms of levels of service, were used in the evaluation of the adequacy of the highway systems to carry and expedite traffic. The following definitions of the

various levels of service were summarized from the Highway Capacity Manual.

- Level of Service "A" - reflects free-flow operation in which a vehicle is not affected by other vehicles in the traffic stream. (Speeds of 60 mph or greater are limited by nationwide 55 mph speed limit.)

- Level of Service "B" - is the higher speed range of stable flow. Free-flow operation has been reduced so that speed becomes primarily a function of traffic densities. (Speeds in the range of 55 to 60 mph are limited by nationwide 55 mph speed limit.)

- Level of Service "C" - is the middle speed range of stable flow. Traffic approaches the maximum volume that can be maintained for extended periods of time without undue delay. (Speeds in the 50 to 55 mph range.)

- Level of Service "D" - is the lower speed range of stable flow. Traffic operation approaches instability and becomes very susceptible to changing operating conditions. (Speeds in the 40 to 50 mph range.)

- Level of Service "E" - reflects unstable flow, with volumes approaching maximum capacity. Intermittent fluctuations in speed occur, actual stoppages become more frequent and their effects tend to be cumulative. (Speeds of about 35 mph.)

- Level of Service "F" - indicates a forced-flow condition. The highway acts as storage for vehicles backing up from a bottleneck. (Speeds from 0 to 30 mph.)

With respect to roadway capacities, Table II-17 shows traffic volumes, expressed in terms of equivalent passenger cars on level grades with 12-foot lanes and no roadside obstructions, are capable of being handled at the various levels of service along controlled access freeways or expressways and non-controlled access rural highways.

Although level of service "E" represents the ultimate capacity of a highway facility, traffic conditions at this level represent unstable flow and are considered unacceptable.

The motoring public should be afforded the highest practical level of service within the limits of funding, particularly when the payment of tolls is involved. Although a Level of Service "B" is a desirable condition to maintain on a toll facility, as a practical matter Level of Service "C" is acceptable for short periods during peak hours. Even a Level of Service "D" may be tolerated for short periods, and it is not until Level of Service "E" is attained that traffic growth is restricted and toll revenue affected.

Table II-17. Traffic Capacities at Various Levels of Service

Level of Service	One-Way Hourly Traffic Capacity					
	Freeway or Expressway			Non-Controlled Access		
	4-Lane	6-Lane	8-Lane	2-Lane(A)	4-Lane	6-Lane
A	1,400	2,400	3,400	400	1,200	1,800
B	2,000	3,500	5,000	900	900	3,000
C	2,750	4,350	6,000	1,400	3,000	4,500
D	3,300	4,900	6,600	1,700	3,600	5,400
E	4,000	6,000	8,000	2,000	4,000	6,000
F						

(A) Two-way volumes.

II.D.1 Delaware River and Bay Crossings

In evaluating the adequacy of the existing Delaware River and Bay crossings, they were considered separately and in combination, to the extent of the commonality of origin-destination patterns and the approach road network.

II.D.1.a Delaware Memorial Bridge

The Delaware Memorial Bridge originally consisted of one four-lane crossing of the Delaware. However, to meet increasing traffic volume, a twin parallel bridge was opened to traffic in 1968. This more than doubled the capacity of the bridge. With an eastbound roadway 51 feet wide and a westbound roadway 52 feet wide and a gradient of four percent, the bridges provide the levels of service at the indicated traffic volumes shown below:

	Maximum Traffic Volume	
	Eastbound Crossing	Westbound Crossing
At Level of Service A	1,600	1,710
At Level of Service B	2,440	2,520
At Level of Service C	2,800	2,900
At Level of Service D	3,075	3,175
At Level of Service E	3,900	4,030
At Level of Service F	over 3,900	over 4,030

Hourly traffic volume data for the summer of 1978 indicate that the bridge operates at Level of Service C during a few hours in the summer months. The peak flows when this condition occurs are on Sunday evenings indicating the relative importance of recreational traffic. However, during an average Sunday, peak flows are about 2,200 vehicles per hour or Level of Service B. Commuter hour peak flows, occurring on weekday mornings and evenings, indicate volumes of 1,400 and 1,600 respectively, both within the Level of Service A.

From the above, it can be concluded that at present there is no need for additional capacity at the Memorial Bridge.

As discussed in Section C, the rate of growth of traffic on the Memorial Bridge during the 1950's and 1960's falls between the rates of growth in the number of vehicles registered in the states of Delaware and New Jersey. However, during the first half of this decade, Bridge traffic grew at a lower rate and more closely resembled the population trend.

In light of the modest annual growth of Bridge traffic in recent years, the low population projections for the area served by the Bridge, and the recent lower rate of growth of motor vehicle registrations, the estimated increases in Bridge traffic for the years 1979 through 1983

have been conservatively estimated on the basis of a continuance of these downward trends. Recent concerns as to fuel costs and availability, of course, reinforce this approach. Traffic volumes are estimated to increase from 18,763,000 in 1979 to 19,035,000 in 1983, an increase of 1.4%.[1]

Considering a relatively high long term growth rate of between 1% and 2% to be appropriately conservative for transportation planning purposes, it is estimated that by the year 2000 traffic volumes may reach a total of 24,500,000 representing an AADT of 67,200 vehicles with peak hour volumes during summer peak days of between 3,900 and 4,000 vehicles per hour in each direction. This indicates that by that time, summer Sunday traffic would reach the Level of Service E. However, average peak hour flows occurring generally during weekends throughout the year would be about 3,000 vehicles per hour which would represent conditions at the Level of Service D. Commuters and weekday morning and evening peak volumes would still be between the Levels of Service B and C.

With the highway networks remaining as at present, the Delaware Memorial Bridge would be adequate to sustain estimated traffic growth through the year 2000, except for a few hours in the summer when capacity (operation at Level of Service E) would be reached. This condition would not be of such duration that it would deter a substantial amount of traffic from using the Bridge and would not result in an adverse impact on toll revenues.

In Section II.B of this report on "Proposed Highway Facilities" in New Jersey and Pennsylvania, mention was made of the long-term plans for completing I-95 in the Philadelphia area and in the area between Trenton and New Brunswick, New Jersey. Today, with these missing links, the I-95 corridor traffic between Delaware and the New York-New Jersey Metropolitan Area and points north uses the Delaware Memorial Bridge and the New Jersey Turnpike and I-295 on the east side of the Delaware River. In the future, if and when I-95 is completed, some traffic will divert from the Turnpike I-295 routing on the east side of the river to the I-95 routing via Philadelphia on the west side of the river, which will result in a diversion of traffic from the Delaware Memorial Bridge. The magnitude of these potential diversions is shown in Table II-18 using data from the 1969 Origin-Destination Survey on the Delaware Memorial Bridge. Although the data are 10 years old and the overall traffic volumes have gone up, the percentages in terms of origin-destination patterns are probably fairly accurate.

Roughly 50 percent of the traffic on the Delaware Memorial Bridge could conveniently divert to I-95 on the west side of the river once the missing I-95 links are completed in Philadelphia and New Jersey. As an

---

[1] Toll Rate Study, URS/Coverdale & Colpitts, May 1979.

Table II-18. Traffic Diversion Potential from the Delaware Memorial Bridge to I-95 via Philadelphia

	Passenger Cars and Light Trucks		Heavy Trucks		Total	
	Estimated 1969 AADT	Percent	Estimated 1969 AADT	Percent	Estimated 1969 AADT	Percent
Potential*	16,701	46%	5,729	72%	22,430	51%
Non-potential**	19,424	54	2,224	23	21,648	49
Total	36,125	100%	7,953	100%	44,078	100%

*Includes traffic with northerly trip ends in the New York-New Jersey Metropolitan Area, New York State and New England.

**Includes traffic with northerly trip ends in southern New Jersey, plus (at the time in 1969 before I-95 was open between Wilmington and Philadelphia International Airport), double river crossings via the Delaware Memorial and DRPA Bridges.

Table II-19. Toll Increments for Use of the Delaware Memorial Bridge and New Jersey Turnpike

Facility	Toll Via Turnpike* Cars	Via Turnpike* 5-Axle	Via I-295** Cars	Via I-295** 5-Axle
Delaware Memorial Bridge	$ .50	$1.75	$ .50	$1.75
New Jersey Turnpike	1.10	3.70	.40	1.40
Total	$1.60	$5.45	$ .90	$3.15

*New Jersey Turnpike all the way between Interchanges 1 and 10.

**I-295 between Delaware Memorial Bridge and Bordentown, and New Jersey between Interchanges 7 and 10.

indication of the degree of such diversions, two principal factors must be taken into account: (1) the loss in travel time due to rush-hour traffic conditions in Philadelphia, weighed against (2) the savings in toll via the I-95 routing.

The following table lists the relative distances and estimated travel times via the two routings:

Relative Distances and Travel Times via I-95 and New Jersey Turnpike*

Route	Distance (miles)	Time (minutes) Peak	Non-Peak
I-95	101	136	119
N.J. Turnpike	94	102	102
Savings via Tpk.	7	34	17

*Between junction of I-95 and I-295 in Delaware and junction of I-95-287 and New Jersey Turnpike.

There is no toll along I-95 via Philadelphia and the Scudders Falls Bridge over the Delaware River west of Trenton. On the routing via the east side of the river, tolls on the Delaware Memorial Bridge and New Jersey Turnpike (as far north as the I-95 junction at Interchange 10) are shown for passenger cars and five-axle trucks in Table II-19.

On the basis of the savings in travel time via the Delaware Memorial Bridge and the New Jersey Turnpike weighed against the additional toll for the use of these time-savings facilities, it is estimated that if and when I-95 is completed in Pennsylvania and New Jersey, 20 percent of the total traffic which would have been using the Delaware Memorial Bridge if I-95 were not completed, would divert from the Bridge to the I-95 routing via Philadelphia. Taking into account that 50 percent of the total bridge traffic is in the potential group for diversion (from Table II-18), it is estimated that the Delaware Memorial Bridge will experience a 10 percent drop in traffic when I-95 is completed. With the completion of I-95, it is likely that by the year 2000 additional capacity for Bay crossings in the area of the Memorial Bridge would not be needed and the Delaware Memorial Bridge would be adequate to carry and expedite traffic.

II.D.1.b Cape May-Lewes Ferry

Each ferry has a capacity of 100 vehicles. Average headways during July and August vary from one to two hours. During peak periods, the 1979 schedules represent a departure each hour which is equivalent to 200 vehicles per hour both ways. With 12 departures from each shore the ferries can carry a volume of about 2,000 vehicles per day. Actual peak volumes in 1978 were 1,500 vehicles per day.

With the addition of a fourth ferry, the scheduled departures from each shore could be increased to between 45- and 50-minute headways and the capacity to about 2,600 vehicles per day or about 260 vehicles at peak hours.

In estimating future traffic, historical traffic growth on the ferry, projected population increases for the area served by the ferry and the low growth in the number of automobile registrations in Delaware and New Jersey during the first half of this decade were taken into consideration just as they were for the Delaware Memorial Bridge. Additional factors influencing ferry operations are the planned expansion of the ferry schedule for the summer of 1979, the addition of a new ferry into service for the peak season of 1981 and the impact of casino gambling in Atlantic City. For these reasons, ferry traffic will increase in the future; however, the rate of growth is estimated to be moderate in light of the fact that the principal use of the ferry is for long-distance pleasure trips and these are the trips that are most likely to be curtailed somewhat if the price of gasoline increases drastically or an energy crisis persists.

The number of passengers and vehicles using the ferry under the existing toll schedule is estimated to increase from 229,000 vehicles and 676,000 passengers in 1979 to 281,000 and 770,000, respectively, in 1983. This is an increase of 22.7% in vehicles and 13.9% for passengers.[1]

As noted above (in the year 1978) casino gambling in Atlantic City resulted in a significant increase in ferry traffic. Economic Research Associates, in a report on the Impact of Casino Gambling on the Redevelopment Potential of the Uptown Renewal Site and the Economy of Atlantic City, estimated a growth in gambling visitors of 320% from 1982 to 1990 based on an increase in the number of casinos from 6 to 15 or 18. If with only one casino the increase at the Ferry was about 20%, much higher increases than those projected may be realized. For transportation planning purposes, a conservative growth of 8% per year is estimated through the middle of the 1990's. Thus, by the year 2000, a total of 2,200 vehicles may be using the Ferry crossing on an average day. This depends on the number of ferries in service and the schedules in effect.

The Cape May-Lewes Ferry serves both (1) local trans-bay trips between points in southern New Jersey and the Eastern Shore, which would be far more circuitous via the Delaware Memorial Bridge, and (2) mid-Atlantic regional trips between central New Jersey and points north and the Delaware-Maryland beaches, Norfolk and points south via the Ocean Highway (US 13 and US 17), which could use the Ferry as an alternative routing to the Bridge. Table II-20 illustrates, for several typical trips, approximate time, distance and toll comparisons between places or "decision points" on both sides of Delaware Bay, via the Cape May-Lewes Ferry and via the Delaware Memorial Bridge.

[1]Toll Rate Study, 1979.

For example, a relatively "captive" Ferry trip (i.e., for which the Bridge routing is far longer in time and distance), between the junction of US 9 and Del. 1 outside of Lewes (the decision point for Rehoboth Beach and Ocean City) and Cape May, is 148 miles shorter and 1 hour and 40 minutes quicker by Ferry. For these savings, the toll by way of the Ferry (in this comparison, for only the car and driver) is $7.50 more than the toll by way of the Bridge. In economic terms, using an automobile running cost of 10.7 cents per mile the cost of mileage-related items and a time value of $3.00 per hour, the additional Ferry toll is offset by the time and mileage savings.

	Via Bridge	Via Ferry	Ferry Savings
Auto running costs*	$18.19	$0.64**	$17.55
Time value	11.50	6.45	5.05
Toll	.50*	8.00	(7.50)
TOTAL	$30.19	$15.09	$15.10

*Reflective of January 1979 conditions

**16-mile Ferry crossing deducted from the 22-mile total distance.

On the other hand, the purely discretionary trip between the US 9-US 13 junction at Laurel, Delaware (the decision point for Salisbury and Norfolk) and the New Jersey Turnpike-Garden State Parkway junction at Woodbridge, New Jersey (the decision point for the New York-New Jersey Metropolitan Area, upstate New York, New England and Canada) is essentially the same distance via Bridge and Ferry, but is 1-1/2 hours longer by Ferry and $8.10 more costly in terms of tolls alone. Such a trip by Ferry, therefore, is made by choice as an alternative to the Bridge routing.

This economic evaluation of the two existing alternative routings is made in light of the objectives of this regional study to consider a possible third crossing in the area between the Bridge and the Ferry.

II.D.1.c Commodore Barry Bridge

The Commodore Barry Bridge, with its five lanes (the center lane of which is reversible) has a capacity of 6,750 vehicles per hour. Expressed in terms of AADT the bridge can carry about 75,000 vehicles per day. The 1978 AADT was 13,300 or about 18 percent of the stated capacity. Since its opening, the bridge has experienced a higher than average growth rate of 10.6%. Most new facilities experience a high rate of growth during the first few years of operation as a result of generated traffic. For future planning purposes, a more normal rate of growth between 3% and 5% per year is estimated. Under this assumption, the bridge would be carrying about 32,000 vehicles per day, still well within its estimated capacity.

Table II-20. Time and Distance Comparisons

Typical Places or Decision Points South	North (A)	Route (B)	Distance (miles)(C)	Time(D) (hrs.:min.)	Toll (E)
US 9 - Del. 1 (F)	Cape May	Bridge	170	3:50	$ .50
		Ferry	22	2:10	8.00
		Savings	148	1:40	(7.50)
	GSP - ACE (H)	Bridge(J)	156	3:10	1.50
		Ferry	59	2:50	8.50
		Savings	97	0:20	(7.00)
	NJTP - GSP (I)	Bridge	175	3:30	1.65
		Ferry	152	4:30	9.75
			23	(1:00)	(8.10)
US 9 - US 13 (G)	Cape May	Bridge	176	4:00	.50
		Ferry	50	2:50	8.00
			126	1:10	(7.50)
	GSP - ACE (H)	Bridge(J)	162	3:20	1.50
		Ferry	87	3:30	8.50
		Savings	75	(0:10)	(7.00)
	NJTP - GSP (I)	Bridge	181	3:40	1.65
		Ferry	180	5:10	9.75
		Savings	1	(1:30)	(8.10)

Notes:

(A) Abbreviations: GSP = Garden State Parkway; ACE = Atlantic City Expressway; and NJTP - New Jersey Turnpike.

(B) Via Delaware Memorial Bridge; via Cape May-Lewes Ferry; and savings which Ferry affords in comparison to the Bridge.

(C) Ferry routing includes 16-mile crossing of Delaware Bay.

(D) Ferry routing includes 70-minute crossing plus 20-minute wait, 15-minute loading and 15-minute disembarkation, or a total of 2 hours.

(E) For passenger car and, in the case of the Ferry, only the driver.

(F) Decision point for Rehoboth Beach and Ocean City.

(G) Decision point for Salisbury, Maryland; Norfolk, Virginia; and points south.

(H) Decision point for Atlantic City.

(I) Decision point for Metropolitan New York, upstate New York, New England and Canada.

(J) Via Atlantic City Expressway and I-295.

The Commodore Barry Bridge would be adequate to carry estimated future traffic through the year 2000 and beyond.

II.D.2 New Jersey Highways

The four main New Jersey highways evaluated for adequacy are the New Jersey Turnpike and I-295, along the north-south corridor leading to the Delaware Memorial Bridge; the Garden State Parkway, along the eastern shoreline leading to the Cape May-Lewes Ferry; and the Atlantic City Expressway, connecting the Philadelphia-Camden area with Atlantic City and also serving as a link between the Turnpike and the Parkway in Southern New Jersey.

The New Jersey Turnpike has served north-south long distance movements in the northeast corridor since its opening in 1951 -- the same year as the opening of the Delaware Memorial Bridge. The Turnpike is designated I-95 between Edison (Interchange 10) to its connection with the George Washington Bridge. Since the segment of I-95 parallel to the Turnpike between its southern terminus and Interchange 10 in Edison is not completed, the Turnpike has served as a link between the completed portions of I-95.

Traffic volumes along the Turnpike range from a high of 120,000 vehicles per day along its 12-lane dual-dual roadways through Newark to a lower volume of 20,000 vehicles per day along its southern four-lane divided section. The Turnpike operates at Levels of Service C and D along the northern sections approaching the Lincoln Tunnel and at Level of Service B along its southern section approaching the Delaware Memorial Bridge.

The average rate of growth of traffic on the Turnpike was 3.8% per year during the period 1970-78. At this rate, the southern section of the Turnpike will exceed the Level of Service D by the year 2000. However, with the ultimate completion of I-295 and I-95 in New Jersey (when and if it becomes necessary) and through Pennsylvania, it is estimated that there will be a redistribution of traffic along these three major north-south corridor highways (as described previously in Section II.D.1). The Turnpike would continue to be adequate to sustain an acceptable level of operation in the foreseeable future, especially along its southern section which leads to the Delaware Memorial Bridge.

Route I-295, which runs parallel to the New Jersey Turnpike, carried an annual average daily traffic of 24,000 vehicles in 1977 along its section south of the Camden-Gloucester area. The road under its present conditions operates at Level of Service B.

The other major north-south route connecting to one of the Delaware Bay Crossings is the Garden State Parkway. This facility carried from 38,000 to 45,000 vehicles per day along its northern section through Union and Essex Counties and about 4,000 vehicles per day along its southern section through Cape May County. The Parkway is operating at Levels of Service between D and E along its northern sections and at Level of

Service A along its southern section. However, the Parkway is a highly recreational facility and operation at Level of Service E prevails during peak summer hours along some sections in Cape May and other areas to the north. As shown in Table II-10, Section C, annual growth along the two southern across-the-road Parkway toll barriers was in the range of 6% to 7% per year on the average.

The New Jersey Highway Authority has consistently maintained a policy of providing for increased capacity along the Parkway as required and after the increase is proven financially feasible. As presented in Section II.B., the Authority is planning to widen the Parkway along some sections in Ocean, Manmouth, Union and Middlesex counties and is also planning to expand the toll collection facilities along its southern sections. Present plans are for grade separations to increase capacity along the southern section through Cape May County.

The Parkway is an essential link along the Ocean Highway between the North and South. Its importance to certain north-south movements is fully dependent on the Cape May-Lewes Ferry. A discussion of the adequacy of the Parkway to serve these movements is presented heretofore in Section II.D under the "Cape May-Lewes Ferry" heading.

The third major highway facility serving the Delaware Bay Region within the State of New Jersey is the Atlantic City Expressway. Although this facility is not directly connected to the Delaware Bay crossings, its location between the two north-south corridors is thus related with the adequacy of the highway system which serves the Bay Region. In 1978, the Expressway carried 14,500 vehicles per day along its western section and 14,000 vehicles per day through Pleasantville near Atlantic City. The facility was operating at the Level of Service B during the summer months along its western section and Level of Service A along its eastern section, except at toll plazas where Level of Service D prevailed. With the advant of casino gambling in Atlantic City there was a significant increase in traffic in 1978 and through the early part of 1979 (see Table II-11). Further development of casinos and related recreational facilities could attract additional traffic along the Expressway. Although not presently planned, it is likely that the New Jersey Expressway Authority will widen the Expressway from its present two lanes each way to three lanes in each direction before the year 2000 if developments in Atlantic City are realized as they are now envisioned by the Casino Gambling Commission.

Summarizing, the four main highway facilities in New Jersey leading to the Delaware Memorial Bridge and the Cape May-Lewes Ferry will be adequate to sustain normal traffic growth through the 1980's and to the year 2000 if presently planned construction and improvement projects are completed. Highly recreational traffic along the Parkway leading to the Cape May-Lewes Ferry may require additional construction not presently planned.

II.D.3 Other Delaware Highways

The four main Delaware highways evaluated for adequacy were the Delaware Turnpike or I-95 and US 40 in the Northeast Corridor and US 13 and US 301 on the Delaware Peninsula.

The key section of I-95 in terms of its linkage to the Delaware Memorial Bridge is the Delaware Turnpike. On the basis of (1) the traffic growth trends developed in Table II-12 of this Chapter, (2) the capacity figures listed in Table II-17, factored for trucks, and (3) the expectation that the Turnpike will be widened to eight lanes by the end of 1981, Table II-21 shows the level of service profile which was prepared to reflect estimated future peak-period operating conditions on the Turnpike.

Table II-21 indicates that with its widening between Del. 141 at the Christina Marsh Interchange and Del. 273, the Turnpike, for the most part, can be expected to operate at an acceptable level of service through the mid-1980's. Accordingly, the Turnpike will continue to serve as the principal feeder route to the Delaware Memorial Bridge without any traffic constraints during this period.

Table II-21. Delaware Turnpike Level of Service Profile*

Year	Md. Line to Del. 896	Del. 896 to Del. 273	Del. 273 to Del. 7	Del. 7 to Del. 141
1979	A	A	C	D
1980	A	A	C	E
1981	A	B	C	E
1982	A	B	C**	C**
1983	A	B	C**	C**
1984	A	B	C**	C**
1985	A	B	C**	C**

*Based on afternoon peak-period conditions on the westbound (southbound) main roadway.

**Based on widening to four lanes in each direction.

Although the section of I-95 between the Christina Marsh Interchange and the Pennsylvania line will only be operating at a tolerable level of service during peak hours despite the widening of the viaduct section leading into Wilmington, this should not have a constraining effect on the collection and dispersal of trans-river traffic, because parallel I-495, which will have ample capacity for some time to come, can take up the overburden.

US 40, which parallels I-95 from Delaware into Maryland, presently is operating between Levels of Service B and C except near the Maryland border where the Level of Service C is exceeded. These are acceptable conditions for a rural highway. US 40 can be expected to maintain an acceptable level of service well into the 1980's as long as the parallel I-95 route continues to be adequate also, which is estimated to be the case.

Traffic conditions on US 13 down through Smyrna and Dover are widely variable depending on location (urban versus rural) and season.

Volume to capacity ratios for both US 13 and US 301 as developed by the Highway Division of the Department of Transportation indicate that both facilities have exceeded the Level of Service C and operate between Levels D and E.

Assuming that (1) no major improvements are made to US 13, (2) no parallel arterials are built, with the exception of the four-laning of Del. 896, and (3) the growth trends developed in Section II.C.4.b are realized, traffic conditions on US 13 can be expected to deteriorate further by 1985 and conditions may become unacceptable.

Traffic conditions on US 301, on the other hand, are governed by: (1) the expectation that it will be widened in the near future, with some resultant diversion of traffic from the I-95 corridor via Baltimore to the US 301 corridor via Annapolis; (2) seasonal fluctuations that are not nearly as sharp as those experienced on US 13, and (3) the traffic growth trends developed in Section II.C.4.b. Although US 301 presently is routed between the Farnhurst Interchange and Summit Bridge via US 13 Del. 71 southbound/Del. 299 northbound, it has been assumed that if Del. 896 is improved as indicated above, US 301 would be routed via I-95 and Del. 896 to Summit Bridge. At present, the rural section of US 301 between Summit Bridge and Middletown is operating between the Levels of Service D and E; if widened to four lanes, by 1985 traffic conditions could be expected to improve to acceptable levels of service.

Summarizing, of the four main Delaware highways radiating from the Delaware Memorial Bridge, it appears that only US 13 will be adequate in the 1980's under current construction programs. Accordingly, during summer peak periods, some of the vehicles with southerly trip ends at the Delaware-Maryland beaches and northerly trip ends in New Jersey and points north, which presently use the Delaware Memorial Bridge, will probably then utilize the shorter, but more costly Cape May-Lewes Ferry to avoid congestion on US 13.

II.E NEED FOR ADDITIONAL CROSSING

Three major factors in the overall determination of the need for an additional crossing of the Delaware Bay are: (1) the need for added capacity of all existing crossings; (2) the need for an additional

crossing to better serve the desire lines and patterns of travel and thus provide a more efficient transportation system; and (3) the wish to stimulate additional development.

II.E.1 Additional Capacity

As described previously, the Delaware Memorial Bridge has adequate capacity to accommodate estimated traffic growth through the year 2000 with the existing highway network remaining essentially as at present. With the planned completion of I-95 through Pennsylvania and in New Jersey, there will be some traffic diversion from the Memorial Bridge to I-95, and this makes it even more likely that the bridge will have adequate capacity through the year 2000. Also, the Commodore Barry Bridge, which competes with the Delaware Memorial Bridge for cross-river and cross-Bay traffic, will be adequate to sustain estimated traffic volumes through the year 2000.

In assessing the adequacy of the Cape May-Lewes Ferry to handle anticipated traffic through the year 2000, it should be noted that the capacity depends entirely on the number of vessels and on the schedules. The number of ferries can be increased, and headways reduced significantly, so as to handle foreseeable traffic increases.

In conclusion, there is no apparent need at present or through roughly the year 2000 for an additional crossing of the Delaware Bay solely to provide additional traffic-carrying capacity.

II.E.2 Improvement of the Regional Transportation System

A 1973 traffic survey conducted by URS/Coverdale and Colpitts, Inc. for the Delaware Department of Transportation indicated that of a total of 47,000 trips along the US 40-Turnpike Corridor, about 10% were long-distance trips from New York and New England to and from the southeastern states, including Virginia. An earlier survey conducted by Coverdale and Colpitts in 1969 on the Delaware Memorial Bridge indicated that 11% of all passenger car trips and 24% of all truck trips on the Bridge were between the New York-New England region and the south, an equivalent of a total of about 6,000 trips in 1969. These long-distance trips are adequately served by the existing regional highway network.

However, the 1969 Coverdale and Colpitts Study, which addressed a new crossing of the Delaware Bay approximately halfway between the Delaware Memorial Bridge and the Cape May-Lewes Ferry, estimated that such a crossing would carry about 11,000 vehicles per day of which 10,800 would be diverted from the Memorial Bridge, about 100 from the Cape May-Lewes Ferry and 100 more would be induced or generated by the new facility. The trips diverted from the Ferry and from the Delaware Memorial Bridge were considered to find it more convenient to cross the Delaware Bay at a location approximately midpoint between the Ferry and the Memorial Bridge. Savings in distance travelled and in time would be realized by the 10,900 trips thus diverted.

Two-thirds of these trips were estimated to be long-distance New York-New England trips to and from the south. Other trips, primarily from Southern New Jersey and Baltimore, Washington and the Delmarva Peninsula, accounted for the balance. The 1973 traffic survey across the US 40-I-95 Corridor corroborated this estimate with a 4,500 trip total for these long-distance trips. Since 1973 there has been a slight decrease of about 2.5% in traffic across the Delaware Memorial Bridge. This indicates no significant change in the order-of-magnitude estimate of trips which could be attracted to an additional crossing.

In the 1969 study, it was concluded that, since most of the trips estimated to use a new crossing would be diverted from existing Delaware Bay Authority crossings, the trips would not represent an increase in toll revenue to the Authority and the feasibility of toll revenue bond financing for a new crossing was remote. Since there has been no major growth in traffic since that date, it is likely that the pattern of traffic flows and demand has not changed appreciably since that time.

In a more general vein, the regional transportation network has historically adjusted to connecting major population centers. Around the Bay Region, the major centers are (1) the Washington-Baltimore areas on the southwest corner of the region; (2) the Wilmington Area at the center; (3) the Philadelphia-Corridor area to the northeast; and (4) the New York Metropolitan Tri-State area beyond the northeast corner. Other lesser population centers extend along the coast on a strip development from the tip of the Delmarva Peninsula on the south, to central New Jersey shore northeast of the Bay, including Atlantic City at its northern section and Rehoboth Beach and Ocean City on the Peninsula. Other population centers extend along the spine of the Peninsula from Salisbury through Dover and around a small core in southern New Jersey composed of Bridgeton, Vineland and Millville.

These population centers clearly define the major desire lines of travel and existing regional and intra-regional corridors. The first and most heavily travelled of those corridors is the northwest to northeast corridor between Washington-Baltimore and the Philadelphia-Camden-Trenton metropolitan areas.

A second major desire line of travel is also between the Washington-Baltimore area and the New York Metropolitan area.

The Delaware Memorial Bridge lies directly in the geographical path of the two major desire lines of travel mentioned above. The Bridge replaced the Newcastle Ferry which originally was the key link between the northeast and south regions. Because of the convenience of that crossing and the existence of major highways connecting the metropolitan regions of Washington-Baltimore, Wilmington, Philadelphia-Camden-Trenton, and New York Tri-State areas, further strip development continued along this corridor, strengthening the importance of the transportation facilities serving the corridor, including the Memorial Bridge.

This corridor is presently the heaviest travelled in the Bay Region with a total of about 97,000 vehicles per day (1978) using US 40 and I-95 southwest of Wilmington, and about 80,000 northeast of Wilmington along I-95/495 continuing west of the Delaware River. East of the river I-295 and the New Jersey Turnpike carry about 41,000 vehicles per day.

A second major corridor, running east-west between Atlantic City and the Philadelphia-Camden area, carries about 59,000 vehicles per day along US 30, US 40/US 322 and the Atlantic City Expressway.

The Peninsula north-south corridor carries about 23,000 vehicles per day between the Wilmington area and Dover and then splits in two with a branch to Salisbury carrying about 13,000 vehicles per day and another with about 15,000 vehicles per day towards the seashore resorts of Rehoboth Beach and Ocean City.

The north-south shoreline corridor carries about 15,000 vehicles per day along US 9 and the Garden State Parkway between Cape May and Atlantic City.

The major flow corridors listed above connect all major population centers and are adequately served by the existing highway network. All major desire lines of travel are thus reasonably accommodated by the present high-capacity crossing of the Bay (Delaware Memorial Bridge) and the substantially lesser capacity ferry crossing.

There are some less significant desire lines which are not served. There is no convenient connection between the Dover area and the major resort and population center of Atlantic City. Also, there is no direct connection between the south Jersey core (Vineland, Bridgeton and Millville) and the Peninsula area of Dover. A similar situation occurs between southern New Jersey resort communities and the resort communities along the Delmarva Peninsula. Although these are connected by the Cape May-Lewes Ferry, the crossing time, the toll, and the average ferry waiting time do inhibit traffic interchanges.

However, these population centers are much smaller than those along the major traffic flow corridors and their traffic generation potential, particularly to possible trans-Bay destinations, is very limited.

In summary, travel patterns or major desire lines of travel have developed along and between historical areas of growth, development and population concentrations; the provision of high capacity transportation links along these corridors have further reinforced this development; and there is no need to provide additional traffic capacity or new links such as another Bay crossing to accommodate travel desires between major urban areas in and adjacent to the Region. There is some latent or unfulfilled travel desire between such areas as the Shore resorts of South Jersey and the Delmarva Peninsula which another crossing would address, but the traffic volume potential to another crossing because of

such latent travel demand is quite limited and is not comparable to the traffic levels needed to consider a major capital investment in a fixed crossing.

II.E.3 Stimulation of Area Development

Although the need for a new crossing of the Delaware Bay can be neither demonstrated nor supported on the basis of traffic usage or growth, limited existing crossing capacity, or the creation of a transportation network which better matches the overall travel demand or desire patterns in the region, it is possible in some instances to justify such a major transportation link on the basis of the economic development which would result.

An approach to follow to ascertain the types and amounts of broad economic development benefits that would be attributable to the construction of a new crossing is outlined in Section "A" of Chapter V. Also noted is a possible alignment and an order-of-magnitude construction cost as an indication of the general size of the necessary economic development benefits to be required to justify the public support of such a project.

III. MARINE TRANSPORTATION

III.A INTRODUCTION

Since colonial times, marine transportation in the Delaware River and Bay has played a significant role in both the social and economic development of Delaware, New Jersey and Pennsylvania. This chapter thus addresses marine topics of current interest in the Delaware Basin -- principal waterborne commodity movements, the numbers of types of vessels using port facilities, a general evaluation of these facilities in terms of utilization and future adequacy, and marine navigational factors in both the Bay and River -- and focuses on aspects of pertinence to the DRBA Region. The evolution of the regional transportation systems -- land and water -- has been described in Chapter I.

The ports of the Delaware River are "consumer ports" in that imports and receipts represent about 90% of total cargo activity. Because the Delaware River Basin contains one of the largest concentrations of petroleum processing facilities in the country -- the area supplies a substantial portion of the east coast's petroleum requirements -- crude oil and bulk petroleum products such as residual fuel are the most important imports in terms of tonnage and have been the determining factor in the long range tonnage growth in waterborne commerce. The increasing demand for crude petroleum coupled with the greater draft requirements of the newer tankers has necessitated a large scale lightering operation in lower Delaware Bay, one of the most important operational developments in recent years.

Other bulk commodities such as ores and nonmetallic minerals also have contributed to bulk cargo growth. Imports and exports of general cargo, while far less important on a total tonnage basis than the bulk commodities, have demonstrated a generally rising trend which is often obscured by year to year fluctuations in response to cyclical economic conditions. General cargo movements require considerably more port services per ton and yield more port revenue per ton than bulk cargoes, and therefore such cargoes are more significant than tonnage figures alone might indicate.

At the present, the future level of economic activity in the Delaware River and Bay region, and the resultant effect on maritime transportation, is dependent upon many "non-technical" factors. It is therefore difficult to quantify, even in the light of careful analysis of past history. In the past, maritime freight movements of crude petroleum and petroleum products have demonstrated strong and consistent growth, but without further increases in regional refining capacity it is entirely possible that this growth may not continue. The shift of petrochemical production to the Gulf region, political instability in producing countries, as well as conservation efforts in the United States could also restrain future growth in the Delaware Basin.

Government policy in support of increased coal utilization could, at least marginally, reduce petroleum demand, as could increasing dependence on other alternative energy sources. Balance of payments problems (largely induced by dependence on foreign oil) will also shape commercial activity. If the dollar declines in value relative to other major currencies, imports, at least in theory, should be reduced, and imports are significant to the Delaware River Ports. Finally, environmental considerations can be expected to constrain some commercial, industrial and residential development. Complex and interlocking factors such as these will influence developments in the Delaware River and Bay.

The Marine Transportation aspects of this Study have been organized in three topical sections. "Waterborne Commerce" gives a historical review of total activity in the Delaware River and Bay with additional emphasis on major import and export commodities and future trends. "Trends in Vessel Usage" describes the types and characteristics of commercial vessels, and includes comments on marine operational considerations. "Port Facilities" outlines the types of cargo handling facilities currently available and planned future developments. Based upon the information obtained and the analyses performed, a section of Chapter V presents an appraisal of the ability of the ports to handle future cargoes and discusses various port development concepts and potentials.

It should be noted that while the main thrust of this Report is directed toward the DRBA Region defined in Chapter I, activities in other ports and in the hinterland are significant and are discussed where necessary.

III.B WATERBORNE COMMERCE

This section presents statistical information regarding waterborne commerce. Two basic data sources have been used. The first is Waterborne Commerce of the United States published in annual editions by the Corps of Engineers. The specific volume of interest is "Part I, Waterways and Harbors, Atlantic Coast." This data source provided tonnage statistics in total and by commodity for annual imports and exports and coastwise and internal shipments and receipts. (Definitions of these terms are provided in Exhibit III-1 at the end of this Chapter.) A second data source was the International Waterborne Commerce Report, an annual report issued by the World Trade Division of the Delaware River Port Authority (DRPA). This latter source proved valuable in that bulk and general cargo commodity data were separately disclosed and countries of origin (or destination) were given for international cargoes. Both data sources were used as noted.

It should be mentioned at this point that initial analytical attention was generally focused on waterborne commerce along the entire Delaware Bay and River. The statistical series is entitled "Trenton to the Sea" in the Corps of Engineers data. The DRPA publication refers to "Ameriport - The Ports of Philadelphia" to describe the same area. This initial focus provides necessary background for the subsequent, more specific study of Wilmington and other ports of interest to this Study.

As an additional general statement, overall trends were first considered, such as "total imports" or "total exports" by area or by port. Further analyses were then performed to disclose the significant components included in and influencing overall trends. These analyses permitted a systematic, in-depth appraisal of different aspects of the Region's waterborne commerce.

III.B.1 Area and Port Activity, 1956-1977

In order to obtain a long-term historic overview of total activity in the Delaware River and Bay and in the specific ports of Wilmington, Camden and Philadelphia, total cargo movements in the area and in these ports were analyzed. "Total," expressed as short tons of 2000 pounds,[1] includes both imports and exports as well as coastwise and internal receipts and shipments. ("Local" or intraport activity is also included; except for Philadelphia, this category is usually not significant.)

Table III-1 gives total annual tonnages handled in the entire Delaware River and Bay ("Trenton to the Sea") and in the Ports of Wilmington, Camden and Philadelphia.[2] Data for the Port of Baltimore, which can be considered a competing port, are also provided. Indices of port activity were then computed based upon the average of total tonnage in the five-year period 1951-1956 being equal to 1.0; these indices are tabulated numerically in Table III-2 and shown graphically in Exhibit III-2 on the following pages.

For total River and Bay tonnage, the trend has been steadily upward, peaking in 1974 and declining in the recession year of 1975 before resuming a more restrained upward advance. The principal cause of this steady trend has been increasing oil imports, a factor which will be discussed in more detail subsequently. (Because of the concentration of refineries in the Delaware River and Bay area, the level of petroleum refining and its rate of increase is the single most important factor in tonnage activity).

The annual variations in the ports under consideration are more striking, Camden having exhibited the greatest cyclical behavior; although in recent years its performance has been characterized by steadier growth. Philadephia has shown a more consistent level of activity and a relatively modest rate of long term growth. (For most of the time period shown in Exhibit III-2, total activity at Philadelphia has been less than 20% greater than the average of the five base years, 1952 to 1956). Finally, Wilmington has displayed fewer and less extreme cyclical variations than Camden; activity at Wilmington peaked in the years 1972, 1973 and 1974 in large measure because of internal receipts of petroleum. At all three

---

[1] All "ton" or "tonnage" figures used in this Report are short tons unless specifically noted otherwise.

[2] Tabulations which are not directly included with the text are provided in Appendix B.

Table III-2. Indices of Cargo Activity
Selected Ports and Harbors, 1956-1977

Year	Wilmington Harbor	Delaware R. (Trenton to the Sea)	Delaware R. at Camden	Philadelphia Harbor	Baltimore Harbor
1952-1956 Average*	2,391	82,919	2,276	44,103	43,673
		Indices of Cargo Activity**			
1957	1.06	1.27	0.75	1.18	1.19
1958	1.22	1.20	0.64	1.06	0.95
1959	1.03	1.25	0.67	1.08	0.92
1960	0.93	1.20	0.77	1.01	0.99
1961	0.90	1.17	0.82	0.93	0.87
1962	0.99	1.27	0.87	1.11	0.98
1963	0.95	1.25	1.06	1.06	0.99
1964	0.93	1.31	1.15	1.07	1.10
1965	1.00	1.29	1.08	1.08	1.01
1966	0.99	1.37	0.96	1.12	1.00
1967	1.06	1.39	0.89	1.10	0.93
1968	1.06	1.40	0.84	1.12	0.97
1969	1.13	1.45	0.93	1.15	1.01
1970	1.15	1.50	1.12	1.18	1.17
1971	1.24	1.49	1.06	1.16	1.01
1972	1.51	1.53	1.25	1.10	1.05
1973	1.67	1.68	1.19	1.24	1.23
1974	1.63	1.73	1.35	1.36	1.37
1975	1.35	1.59	1.14	1.18	1.21
1976	1.11	1.61	1.03	1.15	1.20
1977	1.22	1.61	1.12	1.13	1.02

*Average of five years, 1952-1956 inclusive - thousands of tons. (Based on Data of Table III-1)

**Base of 1952-1956 = 1.0

Table III-1. Comparative Cargo Activity
Selected Ports and Harbors, 1952 to 1977

Year	Wilmington Harbor	Delaware R. (Trenton to the Sea)	Delaware R. at Camden	Philadelphia Harbor	Baltimore Harbor & Channels
		(Thousands of Tons)			
1952	2,238	70,844	2,424	38,321	40,718
1953	2,463	74,018	2,359	37,288	41,810
1954	2,439	80,239	2,091	40,299	38,434
1955	2,259	88,580	2,011	48,893	45,824
1956	2,556	100,912	2,497	55,713	51,580
1957	2,529	105,681	1,708	52,127	52,014
1958	2,912	99,844	1,446	46,664	41,703
1959	2,462	103,922	1,518	47,656	40,224
1960	2,231	99,845	1,746	44,475	43,420
1961	2,155	97,190	1,873	40,965	37,815
1962	2,363	105,701	1,978	49,124	42,588
1963	2,265	104,007	2,422	46,673	43,197
1964	2,223	108,988	2,608	47,042	48,220
1965	2,392	107,315	2,467	47,735	44,267
1966	2,362	113,443	2,178	49,506	43,877
1967	2,523	115,531	2,018	48,703	40,738
1968	2,537	115,999	1,910	49,290	42,459
1969	2,695	120,408	2,119	50,526	43,917
1970	2,760	123,975	2,546	52,224	51,084
1971	2,967	123,543	2,415	51,134	44,003
1972	3,602	127,207	2,854	48,357	45,799
1973	4,002	139,297	2,698	54,630	53,787
1974	3,889	143,674	3,066	59,920	59,891
1975	3,227	131,819	2,591	52,030	52,661
1976	2,653	133,696	2,350	50,604	52,437
1977	2,918	133,276	2,538	49,711	44,756

Source: Annual Issues, Waterborne Commerce of the United States

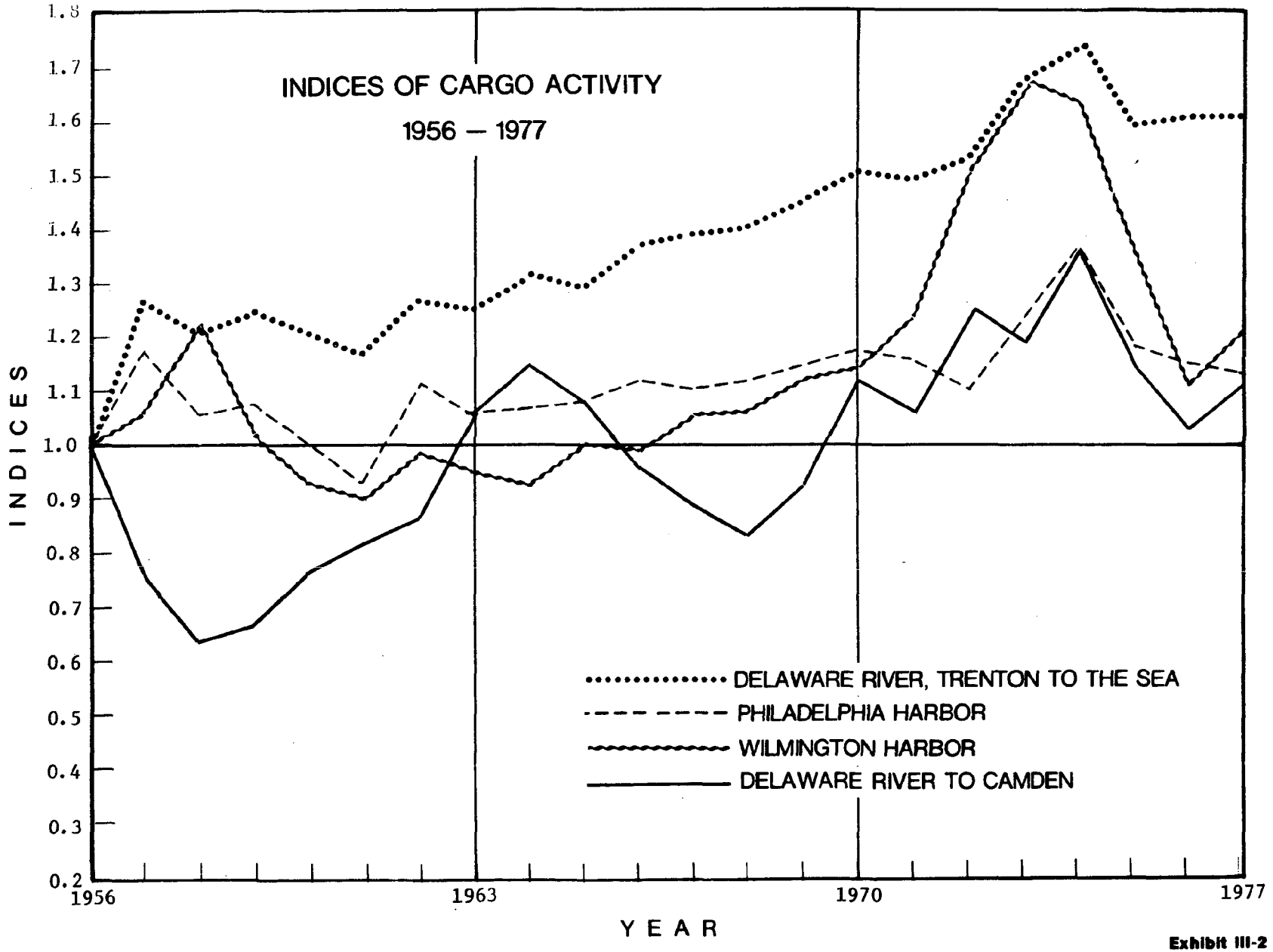


Exhibit III-2

ports, activity declined after 1974 because of a general recession in those years.

From these observations it is possible to conclude that over the long term, the major Delaware River Ports handling general and bulk cargoes, including petroleum, have exhibited low growth tendencies which have been overshadowed by year to year variations. Such port activity is, of course, influenced by intrinsic factors such as rate structure and available facilities and services. It will also be influenced, perhaps even more significantly, by prevailing economic factors such as the rate of economic growth, international trade, and currency fluctuations.

In order to determine whether the nearby east coast port of Baltimore performed differently than Philadelphia during the historic period under review, activity indices of these two ports were compared as shown in Exhibit III-3. While the Port of Philadelphia has displayed somewhat more consistent performance than Baltimore, both appear to be responding generally to the same economic factor. (Expressed in statistical terms, the co-efficient of correlation between the cargo activity data for these two ports is 0.839.)

A least-squares trend line was calculated for the Port of Wilmington for the period 1956-1977 and deviations from the trend were also determined. The series appears in tabular form in Table III-3 and is shown graphically in Exhibit III-4. The analysis showed that about 70% of actual total tonnages are within $\pm$ 13.3% of the calculated trend line. It is of interest that the trend analysis indicates an annual growth in total activity of 50,000 tons, but the normal annual variation in total tonnage is even greater than the figure. The "energy crises" of 1973 and 1979 and related abnormal levels, however, clearly indicate that trend line analyses, while useful, are not sufficient for forecasting likely future volumes. Specific cargo movements at Wilmington are discussed in a later section of this Chapter.

III.B.2 Imports

Imports are the most important component of total cargo activity in the Delaware River and Bay. (The ports under consideration are basically "consumer" ports.) In this section total historical imports will be discussed first, followed by imports by commodity class and identification of originating countries or areas. Finally, imports by specific ports will be addressed.

Table III-4, presented subsequently, shows total imports for the Delaware River Basin for the years 1962 to 1977. Imports are shown by the categories "general cargo" and "bulk," the value of the imports is provided, and average tonnage values have been calculated. The percentage of general cargo on both tonnage and value bases are also noted.

Between 1962 and 1977, annual bulk cargo imports for the Basin increased from a level of about 45 million tons to 70 million tons; the overall

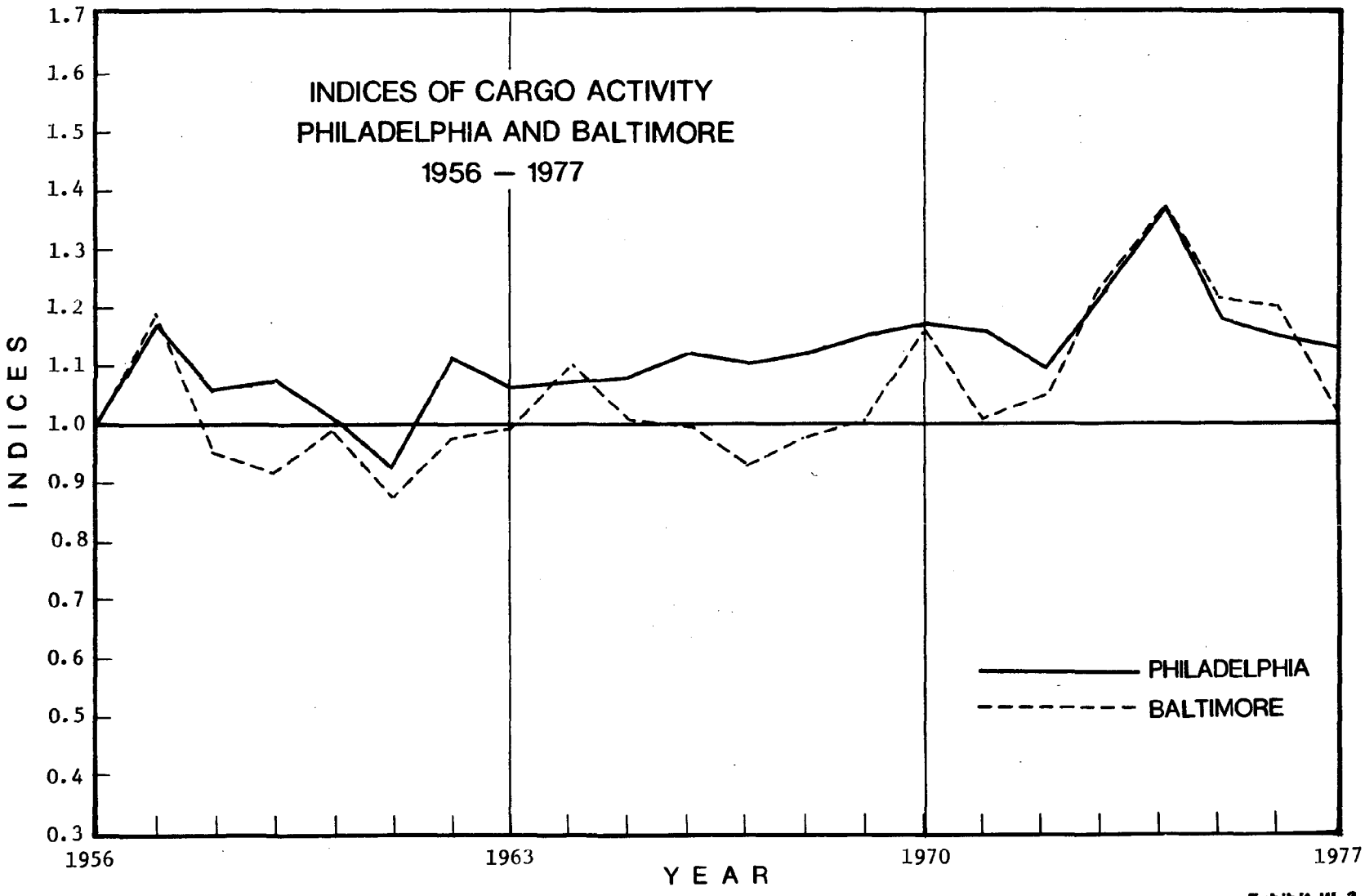


Exhibit III-3

Table III-3. Annual Tonnages - Actual and Trend
Wilmington Harbor, 1956 - 1977

Year	Actual Tonnage	Trend Tonnage	Trend÷ Actual
	(Millions of Tons)		
1956	2.391*	2.190	0.916
1957	2.529	2.242	0.887
1958	2.912	2.293	0.787
1959	2.462	2.345	0.952
1960	2.231	2.396	1.074
1961	2.155	2.447	1.136
1962	2.363	2.499	1.057
1963	2.265	2.550	1.126
1964	2.223	2.601	1.170
1965	2.392	2.653	1.109
1966	2.362	2.704	1.145
1967	2.523	2.756	1.092
1968	2.537	2.807	1.106
1969	2.695	2.858	1.060
1970	2.760	2.910	1.054
1971	2.967	2.961	0.998
1972	3.602	3.012	0.836
1973	4.002	3.064	0.766
1974	3.889	3.115	0.801
1975	3.227	3.167	0.981
1976	2.653	3.218	1.213
1977	2.918	3.269	1.120

*Average of five years, 1952-1956.

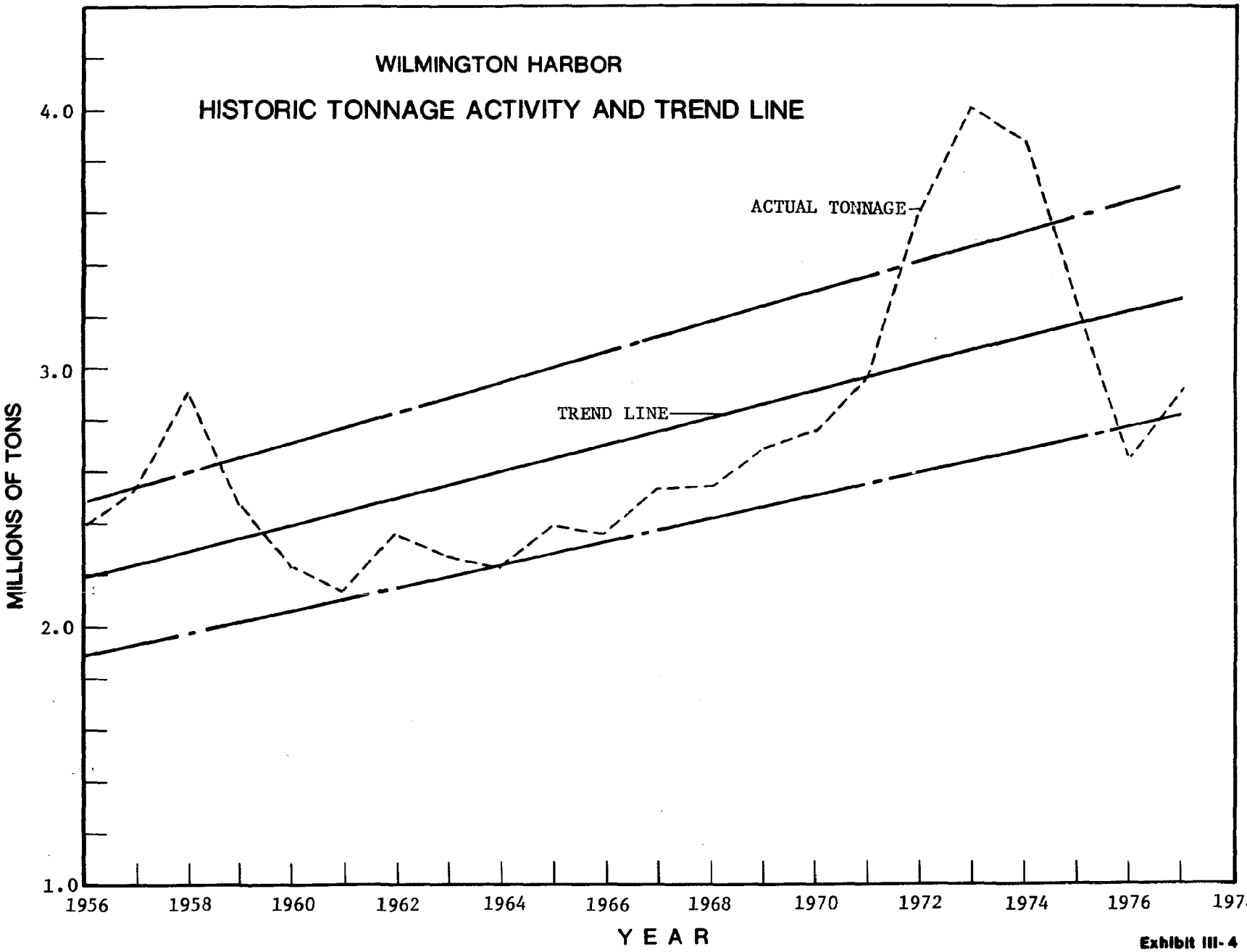


Exhibit III-4

Table III-4. Total Imports - Delaware River and Bay, 1962-1977

Year	Tonnage Imports (Thousands of Short Tons)			Tonnage Values (Thousands of Dollars)			Average Values (Dollars per Short Ton)			Percent General Cargo	
	Bulk	General Cargo	Total	Bulk	General Cargo	Total	Bulk	General Cargo	Total	Tonnage	Value
1962	44,301.4	2,138.0	46,439.4	-	-	$1,121,345.8	-	-	$ 24.15	4.6%	-
1963	42,388.1	2,311.8	44,699.9	-	-	1,189,090.7	-	-	26.60	5.2	-
1964	46,343.7	2,409.6	48,753.3	-	-	1,224,449.3	-	-	25.12	4.9	-
1965	47,808.3	2,941.2	50,749.5	-	-	1,322,833.2	-	-	26.07	5.8	-
1966	49,531.9	3,262.6	52,794.5	-	-	1,413,140.0	-	-	26.77	6.2	-
1967	43,083.3	2,955.1	46,038.4	-	-	1,354,869.1	-	-	29.43	6.4	-
1968	46,952.1	3,769.4	50,721.5	-	-	1,557,269.4	-	-	30.70	7.4	-
1969	51,357.3	3,122.8	54,480.1	-	-	1,545,790.1	-	-	28.37	5.7	-
1970	46,357.8	3,281.2	49,639.0	-	-	1,623,235.4	-	-	32.70	6.6	-
1971	47,564.1	3,824.3	51,388.4	-	-	1,801,430.2	-	-	35.06	7.4	-
1972	55,498.0	4,266.4	59,764.4	$1,008,994.7	$1,173,119.5	2,182,114.2	$18.18	$274.97	36.51	7.1	53.8%
1973	69,339.8	4,181.3	73,521.1	1,586,483.5	1,407,254.0	2,993,737.5	22.88	336.56	40.72	5.7	47.0
1974	70,293.5	3,578.5	73,872.0	4,511,174.9	1,827,349.9	6,338,524.9	64.18	510.65	85.80	4.8	28.8
1975	67,411.8	3,349.9	70,761.7	4,249,913.5	1,878,278.8	6,128,192.3	63.04	560.70	86.60	4.7	30.6
1976	66,733.9	3,311.6	70,045.5	4,763,465.0	1,961,293.5	6,724,758.5	71.38	592.25	96.01	4.7	29.2
1977	68,947.8	3,619.7	72,567.5	-	-	8,006,605.1	-	-	110.33	5.0	-

Source: DRPA, International Waterborne Commerce Report

average annual rate of increase, 1962 to 1977, was 3.0% per year; between 1971 and 1977, the average annual rate of increase was 6.4% per year. (As already noted, petroleum imports are the determining factor - Table III-5.) During this same period, general cargo imports increased from a level of about 2.5 million tons per year to 3.5 million tons per year. The highest general cargo tonnages were imported in 1972 and 1973. Over the period, general cargo imports have ranged from about 4.5% to 7.5% of total imports on the basis of tonnage. Prior to the oil price increases, general cargo imports were about 50% of total imports in value. More recently, the value of the general cargo has been about 30% of total imports. Between 1962 and 1977, the value of goods imported has increased at an average rate of 14.0%; between 1971 and 1977, because of price increases and greater tonnages, the value of imports increased at an average annual rate of 28.2%. The changes in total imports in both the tonnage and value are summarized below, constructed from the data of Table III-4.

Years	Annual Increase in Tons - %	Annual Increase in Value - %
1970-71	3.5%	11.0%
1971-72	16.3%	21.1%
1972-73	23.0%	37.2%
1973-74	0.5%	111.7%
1974-75	(-4.2%)	(-3.3)%
1975-76	(-1.0%)	9.7%
1976-77	3.6%	10.1%

Basically, the sharp increase in the value of imports is attributable to the petroleum price increases imposed by the OPEC countries. (Additional price increases subsequently occurred as trading nations either increased the prices of their goods or felt the effects of inflationary pressures.)

Table III-5 gives five major commodity groups of bulk cargo imports - petroleum, ores, crude materials, sugar and molasses, and coal and coke. Petroleum and ores together generally comprise about 95% of bulk imports. (The high level of ore imports in the early 1970's reflects fears of nationalization in Venezuela.) Crude minerals and sugar and molasses together amount to 3 to 4% of bulk imports.

While general cargo imports are relatively small in tonnage comparison with bulk imports and since 1972 have evidenced some decline they generally represent high unit values and are important with regard to future planning for port facilities. Table III-6 provides data on tonnage imports of general cargo by six major categories for the period 1972 to 1977. The percentage distribution by significant categories and products is also given for selected years. In total, the category "Manufactured Goods and Machinery" is the most significant and within that category, iron and steel products are most important. Imported food products account for 15 to 18% of total general cargo imports and, except for meats

Table III-5. Bulk Cargo Imports - Delaware River and Bay, 1972-1977

Classification	Year 1972	1973	1974	1975	1976	1977
			(Thousands of Short Tons)			
Commodity						
Petroleum	42,993.6	53,411.8	51,203.2	48,083.2	54,034.0	58,233.2
Ores	10,422.2	13,688.5	15,011.2	17,255.8	11,015.7	7,632.2
Crude Minerals, Gypsum	1,171.0	1,114.9	1,039.5	821.8	739.9	1,037.0
Sugar, Molasses	911.2	1,124.6	1,030.9	802.8	880.1	1,294.7
Coal and Coke	-	-	2,008.7	448.2	0.5	570.9
Other	-	-	-	-	63.7	179.8
Total	55,498.0	69,339.8	70,293.5	67,411.8	66,733.9	68,947.8
			Percent Distribution			
Commodity						
Petroleum	77.5%	77.0%	72.8%	71.3%	81.0%	84.5%
Ores	18.8	19.7	21.4	25.6	16.5	11.1
Crude Minerals, Gypsum	2.1	1.6	1.5	1.2	1.1	1.5
Sugar, Molasses	1.6	1.6	1.5	1.2	1.3	1.9
Coal and Coke	-	-	2.8	0.7	-	0.8
Other	-	-	-	-	0.1	0.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
			Thousands of Dollars			
Value	$1,008,994.7	$1,586,483.5	$4,511,174.9	$4,249,913.4	$4,763,465.1	-
			Average Unit Value - Dollars per Ton			
Average Value	$18.18	$22.88	$64.18	$63.04	71.38	-

Source: DRPA, International Waterborne Commerce Report

Table III-6. General Cargo Imports - Delaware River and Bay, 1972-1977

Classification	Year (Thousands of Short Tons)						Percent Distribution		
	1972	1973	1974	1975	1976	1977	1972	1974	1977
Mineral Fuels & Lubricants									
Coal	0.6	388.3	-	-	-	-	-	-	-
Gas, Natural & Mfd.	144.7	96.6	109.1	2.9	-	-	3.4	3.0	-
Other	1.4	4.2	2.0	0.2	4.3	18.9	-	0.1	0.5
Subtotal	146.7	489.1	111.1	3.1	4.3	18.9	3.4	3.1	0.5
Crude Materials									
Wood, Lumber Cork	603.1	552.3	380.3	234.7	362.3	408.9	14.1	10.6	11.3
Crude Fertilizers & Minerals	320.1	240.9	267.3	194.1	80.6	140.5	7.5	7.5	3.9
Other	114.9	88.6	130.7	90.9	70.9	84.0	2.7	3.7	2.3
Subtotal	1,038.1	881.8	778.3	519.7	513.8	633.4	24.3	21.8	17.5
Manufactured Goods & Machinery									
Wood & Cork manufactures	164.6	155.2	120.0	143.8	190.1	175.6	3.9	3.4	4.9
Non-metallic mineral manufactures	148.8	120.5	50.7	33.5	39.6	31.4	3.5	1.4	0.9
Paper and Paperboard	123.0	95.8	30.1	4.6	17.4	35.5	2.9	0.8	1.0
Nonferrous Metals	124.2	98.1	48.3	45.2	102.5	116.8	2.9	1.3	3.2
Iron and Steel	1,376.7	1,248.0	1,305.9	1,576.6	1,321.0	1,544.0	32.3	36.5	42.6
Transportation Equipment	25.2	22.5	39.6	78.7	61.0	101.7	0.6	1.1	2.8
Other	156.2	150.1	167.7	169.4	174.7	193.2	3.6	4.7	5.3
Subtotal	2,118.7	1,890.2	1,762.3	2,051.8	1,906.3	2,198.2	49.7	49.2	60.7
Foods, Beverages, Tobacco									
Meat and Meat Preparations	157.4	159.8	134.2	125.3	135.7	127.8	3.7	3.7	3.5
Fruits and Vegetables	154.2	156.1	171.0	166.1	188.2	186.2	3.6	4.8	5.1
Coffee, Cocoa, Tea, Spices	288.2	252.9	231.2	234.2	259.9	197.7	6.8	6.5	5.5
Other	79.2	130.9	133.5	89.9	87.6	91.3	1.8	3.7	2.5
Subtotal	679.0	699.7	669.9	615.5	671.4	603.0	15.9	18.7	16.6
Chemicals, Oils and Fats									
Chemical Elements & Compounds	191.5	116.7	108.1	86.8	149.9	107.0	4.5	3.0	3.0
Fertilizers, Mfd.	19.7	36.7	77.4	25.5	-	-	0.5	2.2	-
Other	24.0	26.0	38.1	20.8	31.4	20.3	0.6	1.1	0.6
Subtotal	235.2	179.4	223.6	133.1	181.3	127.3	5.6	6.3	3.6
Misc. Manufactures & Special Transactions	48.7	41.1	33.3	26.7	34.9	38.9	1.1	0.9	1.1
Total	4,266.4	4,181.3	3,578.5	3,349.9	3,311.6	3,619.7	100.0	100.0	100.0

Source: DRPA, International Waterborne Commerce Report

and meat preparations, represent tropical or semi-tropical produce such as coffee, bananas and cocoa which are not produced in the United States. Finally under the heading of "Crude Materials," lumber is the most important imported product.

Table III-7 summarizes total imports by commodity classifications for the six year period 1972 to 1977. The first two groupings, mineral fuels and crude materials, correspond closely with the bulk commodities previously described except for sugar which is included in the food grouping. Again, it may be noted that manufactured goods and machinery with foods, beverages and tobacco, generally account for 5 to 6% of total import tonnage. In 1972, before the substantial oil price increases, these two categories represented slightly more than 50% of total imports in value and include high value items such as automobiles. In more recent years, the relative significance of the more sophisticated imports has decreased because of increases in oil prices.

At the same time, it can be observed that the inflationary effect of oil price increases has spread to the other import categories. Between 1972 and 1977, the average value per ton of the group "Manufactured Goods and Machinery" increased at an average annual rate of 19.3%; the corresponding percentage for "foods, beverages and tobacco" is 9.3%.

The Delaware River and Bay area receives imported goods from about 140 countries. These countries have been grouped into 8 major regions. The major regions and the subdivisions within these regions are itemized below.

WESTERN HEMISPHERE

Canada

Mexico and Central America - Mexico, Guatemala, Belice, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama

Carribbean - Trinidad, Bahamas, Netherlands-Antilles, Jamaica, Haiti, Dominican Republic, Leeward and Windward Islands, Barbados, and French West Indies

South America - Colombia, Venezuela, Ecuador, Peru, Bolivia, Surinam, Guyana, French Guyana, Chile, Brazil, Paraguay, Uruguay and Argentina

EUROPE

Scandinavia - Iceland, Sweden, Norway, Finland and Denmark

Iberian Peninsula - Portugal, Spain and Azores

Western Europe - United Kingdom, Iceland, Netherlands, Belgium, France, West Germany, Austria, and Switzerland

Table III-7. Total Imports - Delaware and Bay Commodity Summary, 1972-1977

Classification	Year 1972	1973	1974	1975	1976	1977
			(Thousands of Tons)			
Mineral Fuels	43,140.3	53,900.8	53,323.0	48,534.5	54,038.8	58,843.8
Crude Materials	12,631.4	15,685.2	16,829.0	18,597.3	12,269.4	9,302.6
Manufactured Goods & Machinery	2,118.7	1,890.2	1,762.3	2,051.8	1,906.3	2,198.1
Foods, Beverages, Tobacco	1,590.2	1,824.4	1,700.8	1,418.3	1,551.4	1,897.8
Chemicals, Oils, Fats	235.1	179.4	223.6	133.1	244.9	286.3
Misc. Manufactures, Spec. Transactions	48.7	41.1	33.3	26.7	34.7	38.9
Total Tons	59,764.4	73,521.1	73,872.0	70,761.7	70,045.5	72,567.5
			Percent Distribution			
Mineral Fuels	72.2%	73.3%	72.2%	68.6%	77.1%	81.1%
Crude Materials	21.1	21.3	22.8	26.3	17.5	12.8
Manufactured Goods & Machinery	3.5	2.6	2.4	2.9	2.7	3.0
Foods, Beverages, Tobacco	2.7	2.5	2.3	2.0	2.2	2.6
Chemicals, Oils, Fats	0.4	0.2	0.3	0.2	0.4	0.4
Misc. Manufactures, Spec. Transactions	0.1	0.1	-	-	0.1	0.1
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
			Import Value - Thousands of Dollars			
Mineral Fuels	$ 755,154.9	$1,239,793.4	$3,962,491.5	$3,616,597.1	$4,336,625.2	$5,153,256.0
Crude Materials	204,529.5	260,107.7	282,236.7	342,876.0	282,102.3	263,693.9
Manufactured Goods & Machinery	549,097.0	587,301.6	902,032.8	1,141,024.3	1,046,521.7	1,379,425.5
Foods, Beverages, Tobacco	549,358.1	770,312.5	1,016,068.4	891,540.5	883,250.9	1,023,715.3
Chemicals, Oils, Fats	45,154.4	54,607.7	89,295.0	64,554.6	83,517.1	85,951.3
Misc. Manufactures, Spec. Transactions	78,820.3	81,614.6	86,400.5	71,599.8	92,741.3	100,563.1
Total	$2,182,114.2	$2,993,737.5	$6,338,524.9	$6,128,192.3	$6,724,758.5	$8,006,605.1
			Percent Distribution of Import Values			
Mineral Fuels	34.6%	41.4%	62.5%	59.0%	64.5%	64.3%
Crude Materials	9.4	8.7	4.5	5.6	4.2	3.3
Manufactured Goods & Machinery	25.2	19.6	14.2	18.6	15.6	17.2
Foods, Beverages, Tobacco	25.2	25.7	16.0	14.5	13.1	12.8
Chemicals, Oils, Fats	2.0	1.8	1.4	1.1	1.2	1.1
Misc. Manufactures, Spec. Transactions	3.6	2.7	1.4	1.2	1.4	1.3
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
			Average Values - Dollars/Ton			
Mineral Fuels	$ 17.50	$ 23.00	$ 74.31	$ 74.52	$ 80.25	$ 87.58
Crude Materials	16.19	16.58	16.77	18.44	22.99	28.35
Manufactured Goods & Machinery	259.17	310.71	511.85	556.11	548.98	627.55
Foods, Beverages, Tobacco	345.46	422.23	597.41	628.60	569.32	539.42
Chemicals, Oils, Fats	192.06	304.39	399.35	485.01	341.02	300.21
Misc. Manufactures, Spec. Transactions	1,618.49	1,955.76	2,594.61	2,691.64	2,672.66	2,585.17
Total	$ 36.51	$ 40.72	$ 85.80	$ 86.60	$ 96.01	$ 110.33

Source: DRPA, International Waterborne Commerce Report

Eastern Europe - East Germany, Czechoslovakia, Hungary, Poland, USSR, and Rumania

Mediterranean - Italy, Gibraltar, Malta, Yugoslavia and Greece

MIDDLE EAST

Turkey, Cyprus, Syria, Lebanon, Iraq, Israel and Jordan

ARABIAN PENINSULA & IRAN

Iran, Kuwait, Saudi Arabia, Qatar, United Arab Emirates, Yemen Arab Republic, Yemen, Oman and Bahrain

ASIA

Afghanistan, India, Pakistan, Nepal, Bangladesh, Ceylon (Sri Lanka), Burma, Thailand, Laos, Malaysia, Singapore and Indonesia

EAST ASIA

Philippines, Macao, China, Outer Mongolia, Republic of Korea, Hong Kong, Taiwan and Japan

OCEANIA

Australia, New Zealand, New Guinea, Western Samoa, French Pacific Islands, Other Pacific Islands

AFRICA

Morocco, Algeria, Tunisia, Libya, Egypt, Sudan, Canary Islands, Cameroon, Senegal, Mali, Guinea, Sierra Leone, Ivory Coast, Ghana, Niger, Togo, Nigeria, Gabon, Madeira, Chad, Upper Volta, Dahomey, Angola, Congo (Brazzaville), Portuguese West Africa, Liberia, Congo, Burundi, Rwanda, Uganda, Ethiopia, French Somaliland, Kenya, Tanzania, Mauritius, Mozambique, Malagasy Republic, French Indian Ocean Area, Republic of South Africa, Zambia, Swaziland and Malawi

Table III-8 provides details of imports in both tonnages and dollar values for the years 1972 to 1977 for Delaware River and Bay ports. The table below, abstracted from Table III-8, summarizes 1977 imports.

Imports - Delaware River and Bay Ports

	Tonnage Imports	Dollar Value	Percent Distribution Tonnage	Value
	(Thousands)		(Percent)	
Western Hemisphere	16,836	$1,456,151	23.2%	18.2%
Europe	4,284	1,031,429	5.9	12.9
Middle East	16	10,451	0.0	0.1
Arabian Peninsula, Iran	18,337	1,495,312	25.3	18.7
Asia	2,296	239,850	3.2	3.0
East Asia	1,492	673,109	2.1	8.4
Oceania	335	196,155	0.5	2.4
Africa	28,972	2,904,145	39.8	36.3
TOTALS	72,568	$8,006,602	100.0%	100.0%

In 1977, 72.5 million tons of imports were received in the Delaware River and Bay area; these imports were valued at slightly more than $8.0 billion. Petroleum imports predominate, accounting for about 58 million tons valued at approximately $5 billion. (Africa, the Arabian Peninsula and Iran, and the Western Hemisphere are important sources of petroleum imports.) Import trade in manufactured goods with Europe amounted to over $1.0 billion.

III.B.2.a Imports - Wilmington Harbor

Table III-9 shows imports at Wilmington Harbor by selected commodities for the six-year period, 1972-1977. The abbreviated tabulation below gives total imports at Wilmington (exclusive of crude oil and residual fuel) and the annual percentage change.

Total Imports - Wilmington

Year	Tonnage Imports*	Annual % Change
1972	980,144	-
1973	808,235	(-17.5)%
1974	872,288	+ 7.9%
1975	703,728	(-19.3)%
1976	689,383	(- 2.0)%
1977	948,083	+37.5%
Six-year Average	833,644	

*Exclusive of crude oil and residual fuel.

Source: Waterborne Commerce of the United States

Table III-8. Total Imports - Delaware River and Bay By Countries and Areas of Origin, 1972-1977

Country or Area	Year (Thousands of Tons)						Year (Thousands of Dollars)					
	1972	1973	1974	1975	1976	1977	1972	1973	1974	1975	1976	1977
Western Hemisphere												
Canada	5,050	4,965	4,984	4,246	3,580	4,400	$ 97,508	$106,205	$ 132,670	$ 90,512	$ 103,176	$ 133,301
Mexico and Central America	220	246	247	365	335	343	34,863	33,951	37,092	59,792	70,994	67,198
Caribbean												
Trinidad	2,818	2,021	2,718	1,703	1,834	2,172	42,634	42,717	191,504	128,186	148,833	196,166
Bahamas	715	1,096	205	182	177	407	11,484	20,162	17,443	14,591	14,208	34,789
Netherlands Antilles	563	1,358	1,454	628	1,143	655	8,518	37,297	99,830	45,890	83,841	53,216
Others	65	60	148	155	180	160	14,421	8,944	51,693	74,047	44,294	26,226
Subtotal, Caribbean	4,161	4,535	4,525	2,668	3,334	3,394	77,057	109,120	360,770	262,714	291,176	300,397
South America												
Venezuela	16,634	16,561	16,460	14,935	8,918	7,121	242,425	270,488	751,910	568,350	379,650	406,894
Brazil	745	1,910	2,391	2,327	1,944	738	107,583	129,071	265,695	247,212	280,254	343,703
Peru	1,081	1,058	1,057	970	614	437	53,475	47,625	47,632	56,100	59,154	50,957
Others	389	186	243	331	412	403	49,775	61,693	125,317	81,840	102,565	153,701
Subtotal, South America	18,849	19,715	20,151	18,563	11,888	8,699	453,258	508,877	1,188,544	953,502	821,623	955,255
Total, Western Hemisphere	28,280	29,461	29,907	25,842	19,137	16,836	662,686	758,153	1,719,076	1,366,520	1,286,969	1,456,151
Europe												
Scandinavia	186	232	210	345	669	652	32,814	23,092	56,141	59,045	60,602	88,631
Iberian Peninsula	313	290	317	102	55	71	25,861	30,436	49,128	22,258	22,560	29,606
Western Europe												
United Kingdom	154	241	383	167	146	1,099	51,013	61,511	95,187	81,759	67,374	159,688
West Germany	160	523	1,685	610	129	697	75,536	110,056	222,945	201,018	120,674	352,599
Netherlands	127	473	900	117	178	675	24,371	52,348	81,455	34,690	46,437	77,720
Others	461	464	519	274	128	336	90,114	128,512	186,002	102,172	90,003	124,598
Subtotal, Western Europe	902	1,701	3,487	1,168	581	2,757	241,034	352,427	585,589	419,639	324,488	714,605
Mediterranean												
Italy	1,218	783	764	577	208	476	50,152	54,738	125,887	270,431	157,695	157,581
Others	75	165	19	38	30	130	17,766	20,144	18,866	13,414	28,559	21,847
Subtotal, Mediterranean	1,293	948	783	615	238	606	67,918	74,882	144,753	283,845	186,254	179,428
Eastern Europe	159	236	252	563	125	198	11,926	23,261	31,591	45,804	17,819	19,159
Total Europe	2,853	3,407	5,049	2,793	1,668	4,284	$379,553	$504,098	$ 867,502	$ 830,591	$ 611,923	$1,031,429

Table III-8. Total Imports - Delaware River and Bay By Countries and Areas of Origin, 1972-1977 (Continued)

Country or Area	Year (Thousands of Tons)						Year (Thousands of Dollars)					
	1972	1973	1974	1975	1976	1977	1972	1973	1974	1975	1976	1977
Middle East	98	139	68	110	20	16	$ 14,187	$ 14,419	$ 14,855	$ 20,026	$ 17,581	$ 10,451
Arabian Peninsula & Iran												
Saudi Arabia	4,284	3,096	5,095	9,123	15,478	13,005	67,990	57,185	337,782	634,559	1,171,078	1,033,950
Iran	3,015	2,073	7,359	3,057	2,695	5,013	49,348	39,060	485,527	222,957	205,107	432,976
Others	3,194	4,362	1,565	1,745	45	319	50,267	83,100	119,528	115,035	3,547	28,386
Total, Arab. Pen. & Iran	10,493	9,531	14,019	13,925	18,218	18,337	168,105	179,345	942,837	972,551	1,379,732	1,495,312
Asia												
Indonesia	1	183	870	1,906	1,825	2,222	1,405	7,916	74,370	154,259	150,014	195,335
Others	130	103	86	344	141	74	33,512	28,036	29,668	69,828	36,360	44,515
Total, Asia	131	286	956	2,250	1,966	2,296	34,917	35,952	104,038	224,087	186,374	239,650
East Asia												
Japan	709	625	691	804	957	885	224,147	219,413	322,979	378,520	381,441	444,675
Korea	101	150	180	151	278	248	20,957	30,285	69,844	54,700	91,870	92,289
Others	418	735	475	250	199	359	109,176	166,574	206,574	132,821	102,519	136,145
Total, East Asia	1,228	1,510	1,346	1,205	1,434	1,492	354,280	416,272	599,397	566,041	575,830	673,109
Oceania												
Australia	263	284	138	266	297	277	124,140	164,337	132,424	154,960	181,307	123,816
Others	48	85	89	40	32	58	49,033	110,022	104,732	40,688	40,950	72,339
Total, Oceania	311	369	227	306	329	335	173,173	274,359	237,156	195,648	222,257	196,155
Africa												
Algeria	2,682	1,758	2,517	6,029	9,365	9,079	51,715	42,671	216,321	467,579	801,293	847,396
Libya	3,358	3,415	0	2,911	2,734	2,513	68,090	67,836	0	219,215	226,916	224,564
Nigeria	8,305	12,072	15,347	9,721	11,761	13,478	162,026	296,513	1,287,045	783,255	1,069,515	1,367,830
Gabon	0	0	721	1,170	651	1,843	16	13	61,550	87,187	51,316	151,475
Angola	509	1,727	1,666	2,876	292	696	9,755	35,947	132,482	210,457	22,688	59,741
Liberia	1,137	1,540	1,723	1,241	968	595	8,841	11,060	14,480	15,743	14,992	10,137
Republic of South Africa	133	38	68	52	133	341	21,611	18,294	27,682	19,518	21,773	41,905
Others	245	5,018	166	332	1,369	427	73,159	122,292	114,107	149,774	235,599	201,097
Total, Africa	16,369	22,052	22,208	24,332	27,273	28,972	395,213	594,626	1,853,667	1,952,728	2,444,092	2,904,145
Other	-	6,798	-	-	-	-	-	216,512	-	-	-	-
Grand Total	59,763	73,553	73,730	70,763	70,045	72,568	$2,182,114	$2,993,736	$6,333,528	$6,128,192	$6,724,758	$8,006,602

Source: DFPA, International Waterborne Commerce Report

Table III-9. Wilmington Harbor Imports of Selected Commodities, 1972-1977

Commodity Number	Description	Year (Tons)						Percent Distribution	
		1972	1973	1974	1975	1976	1977	1972	1977
0132	Bananas and Plantains	69,397	88,685	120,295	101,004	111,676	101,346	5.3%	8.1%
1011	Iron Ore and Concentrates	58,719	-	39,164	-	-	51,131	4.5	4.1
1091	Non-ferrous Ores and Concentrates	58,943	47,208	16,500	25,964	30,973	62,758	4.5	5.0
	Subtotal, Ores & Concentrates	117,662	47,208	55,664	25,964	30,973	113,889	9.0	9.1
1311	Crude Petroleum	169,227	193,545	191,676	378,580	39,800	83,219	13.0	6.7
2915	Residual Fuel Oil	154,857	452,936	120,576	84,072	342,661	216,304	11.8	17.3
	Subtotal, Petroleum & Fuel Oil	324,084	646,481	312,252	462,652	382,461	299,523	24.8	24.0
1411	Limestone	191,035	151,719	181,945	174,215	167,499	246,057	14.7	19.7
1499	Non-metallic minerals	47,565	76,205	94,084	49,567	-	4,920	3.6	0.4
	Subtotal, Limestone and Minerals	238,600	227,924	276,029	223,782	167,499	250,977	18.3	20.1
2011	Meat, Fresh, Chilled, Frozen	53,753	36,283	22,584	15,850	17,090	20,639	4.1	1.7
2421	Lumber	213,739	187,740	177,702	108,010	156,185	158,927	16.4	12.7
2819	Basic Chemicals and Products, Nec.	43,317	12,020	5,587	261	814	-	3.3	-
2879	Fertilizers and Materials, Nec.	-	-	-	-	-	55,893	-	4.5
	Subtotal, Chemicals & Fertilizers	43,317	12,020	5,587	261	814	55,893	3.3	4.5
3315	Iron, Steel Shapes, Exc. Sheets	34,620	17,789	44,233	36,500	15,593	17,193	2.7	1.4
3316	Iron, Steel Plates, Sheets	74,862	53,272	71,455	59,958	70,466	75,788	5.7	6.1
	Subtotal, Iron and Steel	109,482	71,061	115,688	96,458	86,059	92,981	8.4	7.5
3711	Motor Vehicles, Parts, Equipment	-	-	13,723	51,280	37,796	69,172	-	5.5
	Subtotal, above	1,170,034	1,317,402	1,099,524	1,085,261	990,553	1,163,347	89.6	93.2
	Others Not Itemized	134,194	137,314	85,016	81,119	81,291	84,259	10.4	6.8
	Total	1,304,228	1,454,716	1,184,540	1,166,380	1,071,844	1,247,606	100.0%	100.0%
	Total, Excluding Petroleum & Fuel Oil	980,144	808,235	872,288	703,728	689,383	948,083		

Source: Waterborne Commerce of the United States

During the past six years, imports have displayed substantial and erratic annual variations, although it may be noted that port activity in general at all ports declined significantly in the recession year of 1975. By 1977, Wilmington had almost recovered tonnage to the level of 1972.

Imports of crude petroleum and residual fuel have also shown substantial annual variations. The following table is based on the data of Table III-9 and gives annual tonnage changes in the importation of crude petroleum and residual fuel for the years 1972 to 1977.

Oil Imports - Port of Wilmington

Year	Tonnage Oil Imports*	Annual % Change
1972	324,084	-
1973	646,481	99.5%
1974	312,252	(-51.7)%
1975	462,652	48.2%
1976	382,461	(-17.3)%
1977	299,523	(-21.7)%

*Crude Petroleum (Comm. No. 13111) and Residual Fuel Oil (Comm. No. 2915)

Source: Waterborne Commerce of the United States

Tonnage imports at Wilmington by commodity for the years 1972 to 1977 are shown in Table III-9. Bananas, virtually a monopoly of Wilmington Harbor, in the Delaware Basin have remained above 100,000 tons per year for the last four years and contribute significantly to total import tonnage. Iron ore and concentrates are significant in some years (Philadelphia is the major port for the receipt of iron ore; Wilmington's imports of this commodity amounted to less than 2% of the tonnage at Philadelphia in 1977.) Non-ferrous ores and concentrates contribute significant, if variable tonnage each year. The categories "Limestone" and "Non-metallic Minerals" together represent about 20% of annual import tonnage at Wilmington. Frozen meat is a significant import item in terms of value, although tonnage quantities have been low in the most recent years of the analysis. At present, only Wilmington and Philadelphia receive frozen meats. Lumber is an import commodity at both Wilmington and Camden; a subsequent analysis shows the distribution of lumber imports among the ports of Wilmington, Camden and Philadelphia. Iron and steel shapes, plates and sheets account for 7-8% of import tonnages at Wilmington; as is the case with lumber, an additional comparative analysis compares the performance of the three ports with respect to iron and steel imports. Finally, a relatively new import item -- motor vehicles -- has assumed importance at Wilmington. The increasing tonnage of "Motor Vehicles, Parts Equipment" reflects importation of Volkswagen and Fiat automobiles.

As noted, some of the commodities previously discussed are imported in significant tonnage quantities at Philadelphia and Camden as well as at Wilmington. From 1972 to 1977, a six-year period, some 4,980,968 tons of limestone and non-metallic minerals (Commodities 1411 and 1499) were imported at the three ports. Average annual quantities for this period were: Camden-300,000 tons, Philadelphia-285,000 tons and Wilmington-231,000 tons. Total tonnages and market share by year are given in the table below.

Limestone and Non-metallic Minerals*

Year	Tonnage Imports**	Percent Distribution			
		Philadelphia	Wilmington	Camden	Total
1972	983,769	32.2%	24.2%	43.6%	100.0%
1973	992,957	44.4	23.0	32.6	100.0
1974	910,394	34.1	30.3	35.6	100.0
1975	643,305	39.3	34.8	25.9	100.0
1976	546,771	34.0	30.6	35.4	100.0
1977	813,772	24.9	30.8	44.3	100.0
Period		34.9%	28.3%	36.8%	100.0%

*Commodities 1411 and 1499.

**At Philadelphia, Wilmington and Camden.

Source: Waterborne Commerce of the U.S.

In recent years, Wilmington has assumed a leading role in the importation of automobiles because of contractual arrangements with Fiat and Volkswagen. Since 1974, most of the motor vehicles imported in the Delaware River and Bay area have passed through Wilmington Harbor, as indicated in the tabulation below.

Motor Vehicles, Parts and Equipment*

Year	Tonnage Imports**	Percent Distribution			
		Philadelphia	Wilmington	Camden	Total
1972	5,776	98.3%	-	1.7%	100.0%
1973	11,101	99.1	-	0.9	100.0
1974	27,188	44.0	50.5%	5.5	100.0
1975	65,460	18.5	78.3	3.2	100.0
1976	48,533	21.5	77.9	0.6	100.0
1977	87,538	17.5%	79.1%	3.4%	100.0%

*Commodity No. 3711.

**At Philadelphia, Wilmington and Camden.

Source: Waterborne Commerce of the U.S.

A similar comparison was prepared for the iron and steel products (sheets, and shapes - Commodities 3315 and 3316). In the six years from 1972 to 1977, a total of 6,863,466 tons of these products were imported at the three ports; average annual tonnages were: Philadelphia-856,000, Camden-192,000 and Wilmington-95,000. Total tonnages and market shares in percentages for the three ports, by year, are shown in the table below.

Iron and Steel Shapes, Plates and Sheets*

Year	Tonnage Imports**	Percent Distribution			
		Philadelphia	Wilmington	Camden	Total
1972	1,122,061	77.9%	9.8%	12.3%	100.0%
1973	1,051,492	75.5	6.8	17.7	100.0
1974	1,105,973	73.6	10.5	15.9	100.0
1975	1,263,058	64.3	7.7	28.0	100.0
1976	1,065,832	78.7	8.1	13.2	100.0
1977	1,255,050	80.0%	7.4%	12.6%	100.0%

*Commodities No. 3315 and 3316

**At Philadelphia, Wilmington and Camden.

Source: Waterborne Commerce of the U.S.

It can be noted that Camden's share of the market in these commodities increased sharply in 1975 at the expense of Philadelphia. This increase is attributable to a longshoreman's strike at Philadelphia which resulted in diversion of cargo across the river to Camden.

Lumber is a commodity of significance to Wilmington. At the three ports, during the 1972-1977 period, some 2,471,327 tons were imported. Annual tonnage averages at the three ports were: Camden-175,000, Wilmington-167,000 and Philadelphia-70,000. Market shares for the three ports for the period are given in the following table.

Lumber*

Year	Tonnage Imports**	Percent Distribution			
		Philadelphia	Wilmington	Camden	Total
1972	576,796	28.0%	37.1%	34.9%	100.0%
1973	541,791	30.1	34.7	35.2	100.0
1974***	369,427	17.7	48.1	34.2	100.0
1975***	229,245	3.8	47.1	49.1	100.0
1976***	355,400	2.3	43.9	53.8	100.0
1977***	398,670	2.6%	39.9%	57.5%	100.0%

*Commodity No. 2421.

**At Philadelphia, Wilmington and Camden

***Lumber not promoted at Philadelphia

Source: Waterborne Commerce of the U.S.

Two factors of importance may be noted from the foregoing tabulation. First, for the analysis period, total importation of lumber has declined, so there is less lumber to be divided among the three ports. Secondly, the decision of management at Philadelphia to de-emphasize or discourage lumber has resulted in diversion of the cargo to Camden and Wilmington. (From 1975 on, Camden has acquired an increasing share of the market.) The situation with regard to lumber indicates the mutual interdependence of the three ports.

A final comparison of competing port activity was made for the commodity frozen meats (Meat, fresh, chilled, frozen-Commodity No. 2011.) As in the case of lumber, tonnage imports of frozen meat have declined in recent years from the levels of 1972 and 1973. Camden is presently not a factor in the importation of frozen meat. Total tonnage imports of frozen meat and market shares for the 1972-1977 period are shown in the tabulation which follows.

Meat, Fresh, Chilled, Frozen*

Year	Tonnage Imports**	Percent Distribution			
		Philadelphia	Wilmington	Camden	Total
1972	133,646	59.8%	40.2%	-	100.0%
1973	128,304	70.4	28.3	1.3%	100.0
1974	107,293	79.0	21.0	-	100.0
1975	105,001	84.9	15.1	-	100.0
1976	107,550	84.1	15.9	-	100.0
1977	109,911	79.5%	20.5%	-	100.0%

*Commodity No. 2011

**At Philadelphia, Wilmington and Camden

Source: Waterborne Commerce of the U.S.

During this period, Wilmington's position appears to have eroded substantially below the percentage participation achieved in the early years. It is emphasized that Camden does not as yet participate in the importation of this commodity.

III.B.3 Exports

While exports both in tonnage and total value have been overshadowed by imports of the Delaware River and Bay, a measure of their continuing importance can be derived from their total value in 1977, about $2.0 billion. In this section, total historical exports will be considered, then exports by commodity class will be followed by a discussion of the countries, or areas of destination. Finally, exports by specific port will be discussed.

Table III-10 shows total exports from the Delaware River and Bay area for the years 1962 to 1977. Tonnages of both bulk and general cargoes

Table III-10. Total Exports - Delaware River and Bay, 1962-1977

Year	Tonnage Exports (Thousands of Short Tons)			Tonnage Values (Thousands of Dollars)			Average Values (Dollars per Short Ton)			Percent General Cargo	
	Bulk	General Cargo	Total	Bulk	General Cargo	Total	Bulk	General Cargo	Total	Tonnage	Value
1962	2,324.6	1,555.6	3,880.2	-	-	$ 384,160.7	-	-	$ 99.01	40.1%	-
1963	3,823.8	1,861.8	5,685.6	-	-	463,627.5	-	-	81.54	32.7	-
1964	2,094.9	2,163.2	4,258.1	-	-	509,732.1	-	-	119.71	50.8	-
1965	1,844.1	1,479.7	3,323.8	-	-	485,196.1	-	-	145.98	44.5	-
1966	1,490.1	1,479.0	2,969.1	-	-	476,573.6	-	-	160.51	49.8	-
1967	1,413.4	1,724.0	3,137.4	-	-	545,904.9	-	-	174.00	54.9	-
1968	1,504.8	1,572.7	3,077.5	-	-	553,873.1	-	-	179.98	51.1	-
1969	1,171.1	1,885.7	3,056.8	-	-	520,853.1	-	-	170.39	61.7	-
1970	2,303.7	2,115.0	4,418.7	-	-	723,417.1	-	-	163.72	47.9	-
1971	1,507.7	1,784.5	3,292.2	-	-	664,622.4	-	-	201.88	54.2	-
1972	2,376.3	1,829.5	4,205.8	$103,808.9	$ 582,767.5	686,576.4	$ 43.69	$318.54	163.25	43.5	84.9%
1973	3,570.7	2,255.1	5,825.8	269,449.0	804,547.3	1,073,996.3	75.46	356.77	184.35	38.7	74.9
1974	4,622.1	2,348.8	6,970.9	450,515.4	1,439,106.8	1,889,622.2	97.47	612.70	271.07	33.7	76.2
1975	3,922.9	1,941.2	5,864.1	432,345.4	1,901,544.9	2,333,890.3	110.21	979.57	398.00	33.1	81.5
1976	3,830.9	2,053.0	5,883.9	373,300.0	2,027,266.7	2,400,566.7	97.44	987.47	407.99	34.9	84.4
1977	2,685.6	1,520.6	4,206.2	-	-	2,018,928.7	-	-	479.99	36.2	-

Source: DRPA, International Waterborne Commerce Report

are indicated, as well as the value of the exports.

Bulk exports, on a trend-line basis for the period 1962 to 1977, have increased at the rate of about 120,000 tons per year. Similarly, on a trend-line basis, general cargo exports have increased at the rate of 20,000 tons per year. As is the case with other port activities, year to year fluctuations generally overshadow the long-term trend. The following tabulation , based on the data of Table III-10, shows the annual percentage variations in both bulk cargoes and general cargoes for the period under consideration.

Percent Change from Previous Year - Bulk and General Cargo Exports

Year	Bulk	General	Total
1963	65.5%	19.7%	46.5%
1964	(-45.2)	16.2	(-25.1)
1965	(-12.0)	(-31.6)	(-21.9)
1966	(-11.1)	-	(-10.7)
1967	(- 5.1)	16.6	5.7
1968	6.5	(- 8.8)	(- 1.9)
1969	(-22.2)	19.9	(- 0.7)
1970	96.7	12.2	44.6
1971	(-34.6)	(-15.6)	(-25.5)
1972	57.6	2.5	27.8
1973	50.3	23.3	38.5
1974	29.4	4.2	19.7
1975	(-15.1)	(-17.4)	(-15.9)
1976	(- 2.3)	5.8	0.3
1977	(-29.9)%	(-25.9)%	(-28.5)%

Table III-11 shows bulk cargo exports for the period 1972 to 1977. It can be seen that grain and soybeans together (farm products) are the most important tonnage export and accounted for 50% to 60% of all bulk cargo exports during the period. Coal exports are also significant, but the high level of coal exports in 1974 was largely offset by a comparable tonnage imported (Table III-5).

While recognizing the present and potential importance of coals, it is apparent that farm products are the basic element in maintaining high levels of bulk export tonnage from the Delaware River and Bay area.

The exports of general cargo from the Delaware River and Bay area are given in Table III-12. Over the six-year period, 1972-1977, the commodity grouping "Manufactured Goods and Machinery" represented 5,209,000 export tons, an average of about 868,000 tons per year; a second commodity group, "Crude Materials," accounted for an additional 3,397,000 export tons, an average of about 566,000 tons per year. These two

Table III-11. Bulk Cargo Exports, Delaware River and Bay, 1972-1977

Classification	Year 1972	1973	1974	1975	1976	1977
			(Thousands of Short Tons)			
Commodity						
Grain	1,119.7	2,396.0	2,135.5	2,121.1	2,292.0	1,283.6
Soybeans	244.7	353.1	406.1	336.5	250.7	369.3
Coal and Coke	649.0	766.5	2,015.8	1,346.6	1,056.0	890.6
Petroleum	313.7	54.6	63.9	118.1	232.0	141.3
Ores	49.3	0.5	0.8	0.6	0.2	0.7
Total	2,376.4	3,570.7	4,622.1	3,922.9	3,830.9	2,685.5
			Percent Distribution			
Commodity						
Grain	47.1%	67.1%	46.2%	54.1%	59.8%	47.8%
Soybeans	10.3	9.9	8.8	8.6	6.5	13.8
Coal and Coke	27.3	21.5	43.6	34.3	27.6	33.2
Petroleum	13.2	1.5	1.4	3.0	6.1	5.2
Ores	2.1	-	-	-	-	-
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
			Thousands of Dollars			
Value	$103,808.9	$269,449.0	$450,515.5	$432,345.4	$373,300.0	-
			Average Unit Value - Dollars per Ton			
Average Value	$43.68	$75.50	$97.47	$110.21	$97.44	-

Source: DRPA, International Waterborne Commerce Report

Table III-12. General Cargo Exports - Delaware River and Bay, 1972-1977

Classification	Year (Thousands of Short Tons)						Percent Distribution			
	1972	1973	1974	1975	1976	1977	1972	1974	1975	1977
Mineral Fuels & Lubricants										
Petroleum Products	254.9	231.8	207.4	184.1	180.5	152.3	13.9%	8.8%	9.5%	10.0%
Other	0.2	-	0.2	0.1	0.2	0.1	-	-	-	-
Subtotal	255.1	231.8	207.6	184.2	180.7	152.4	13.9	8.8	9.5	10.0
Crude Materials										
Crude Fertilizers & Minerals	81.3	55.2	77.4	32.0	58.1	3.6	4.4	3.3	1.6	0.2
Pulp, Waste Paper	3.7	10.3	11.7	7.4	18.1	13.7	0.2	0.5	0.4	0.9
Ores and Scrap Metal	264.4	646.2	372.7	595.0	542.1	442.2	14.5	15.9	30.7	29.1
Other	20.8	28.6	31.5	31.1	25.7	24.5	1.1	1.3	1.6	1.6
Subtotal	370.2	740.3	493.3	665.5	644.0	484.0	20.2	21.0	34.3	31.8
Manufactured Goods & Machinery										
Non-metal Mineral Manufactures	34.2	41.8	52.8	41.2	58.1	58.5	1.9	2.2	2.1	3.9
Iron and Steel Products	699.6	580.9	775.1	161.1	287.0	122.2	38.2	33.0	8.3	8.0
Machinery (incl. electrical)	48.7	59.0	105.6	120.0	109.8	96.1	2.7	4.5	6.2	6.3
Transportation Equipment	51.1	48.2	173.4	382.6	345.4	266.3	2.8	7.4	19.7	17.5
Other	49.1	80.3	117.7	88.1	89.2	66.1	2.7	5.0	4.5	4.3
Subtotal	882.7	810.2	1,224.6	793.0	889.5	609.2	48.3	52.1	40.8	40.0
Foods, Beverages, Tobacco	42.3	83.1	75.0	30.2	49.0	47.1	2.3	3.2	1.6	3.1
Chemicals, Oils and Fats										
Animal Oils & Fats	47.6	37.2	35.4	31.3	21.7	20.0	2.6	1.5	1.6	1.3
Chemical Elements & Compounds	91.7	192.3	150.7	123.9	133.1	78.4	5.0	6.4	6.4	5.2
Synthetic Resins & Plastics	47.2	52.2	56.9	38.0	52.2	42.1	2.6	2.4	2.0	2.8
Misc. Chemical Products	46.7	43.5	62.9	39.8	42.7	41.1	2.6	2.7	2.0	2.7
Other	37.0	56.6	33.4	27.2	31.2	37.8	2.0	1.4	1.4	2.5
Subtotal	270.2	381.8	339.3	260.2	280.9	219.4	14.8	14.4	13.4	14.5
Misc. Manufactures & Spec. Transactions	9.0	7.9	9.0	8.0	8.9	8.5	0.5	0.4	0.4	0.6
Total	1,829.5	2,255.1	2,348.8	1,941.1	2,053.0	1,520.6	100.0%	100.0%	100.0%	100.0%

Source: DRPA, International Waterborne Commerce Report

groupings totalled 72% of all export tonnage of general cargo during this period. Within the "Crude Materials" category, scrap metal is the most significant single-item; transportation equipment-motor vehicles-and iron and steel products are the most important items in "Manufactured Goods and Machinery." Chemicals and chemical products have also contributed significantly to export tonnage, as have petroleum products to a somewhat lesser extent.

A summary by commodity groupings for both bulk and general cargoes is provided in Table III-13. Manufactured goods and machinery, which in 1977 represented only 14.5% of exports by tonnage accounted for 67.1% of total export value. On the other hand, while mineral fuels (oil and coal) were 28.2% of tonnage exports in 1977, they represented only some 4.8% of total export value in that year.

Table III-14 was prepared to show the major countries and regions to which cargoes were exported from the Delaware River and Bay area during the six-year period ending in 1977. Tonnage exports to the different regions of the world are shown below both in actual amounts and as a percent of total.

Exports*

Region	Tons**	Percent	Value	Percent
Western Hemisphere	817	19.4%	$ 490.7	24.3%
Europe	2,348	55.9	475.6	23.6
Middle East	110	2.6	71.6	3.5
Arabia and Iran	206	4.9	493.3	24.4
Asia	56	1.3	60.0	3.0
East Asia	476	11.3	191.2	9.5
Oceania	65	1.5	120.6	6.0
Africa	129	3.1	115.9	5.7
TOTAL	4,207	100.0%	$2,018.9	100.0%

*Thousands of Tons
**Millions of Dollars

As a general comment, high-value manufactured goods such as motor vehicles are exported to the wealthier oil exporting countries. As can be seen in the foregoing table, while tonnage exports to Arabia and Iran amounted to only 4.9% of total, in terms of value the percentage was 24.4. For Europe, the tonnage percentage was 55.9; the value percent was 23.6. (Among other commodities, Europe imports large quantities of wheat.) Other regions vary between these two extremes. There are, of course, variations within regions. Venezuela, for example, imports high value equipment, although the average value for the Western Hemisphere is only slightly above the overall world average.

Table III-13. Total Exports - Delaware River and Bay Commodity Summary, 1972-1977

Classification	Year 1972	1973	1974	1975	1976	1977
			(Thousands of Tons)			
Mineral Fuels	1,217.8	1,052.8	2,287.2	1,648.9	1,468.7	1,184.3
Crude Materials	664.1	1,094.0	900.3	1,002.6	894.9	854.0
Manufactured Goods & Machinery	882.7	810.2	1,224.6	793.1	889.5	609.2
Foods, Beverages, Tobacco	1,162.0	2,479.1	2,210.6	2,151.2	2,341.1	1,330.8
Chemicals, Oils, Fats	270.2	381.8	339.2	260.2	280.9	219.4
Misc. Manufactures, Special Transactions	9.0	7.9	9.0	8.0	8.9	8.5
Total Tons	4,205.8	5,825.8	6,970.9	5,864.0	5,884.0	4,206.2
			Percent Distribution			
Mineral Fuels	29.0%	18.1%	32.8%	28.1%	25.0%	28.2%
Crude Materials	15.8	18.8	12.9	17.1	15.2	20.3
Manufactured Goods & Machinery	21.0	13.9	17.6	13.5	15.1	14.5
Foods, Beverages, Tobacco	27.6	42.5	31.7	36.7	39.8	31.6
Chemicals, Oils, Fats	6.4	6.6	4.9	4.4	4.8	5.2
Misc. Manufactures, Special Transactions	0.2	0.1	0.1	0.1	0.1	0.2
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
			Export Value - Thousands of Dollars			
Mineral Fuels	$ 41,051.1	$ 38,098.6	$ 141,983.6	$ 121,383.6	$ 114,941.7	$ 97,018.9
Crude Materials	57,978.9	140,058.0	181,400.4	166,031.5	140,737.9	145,863.2
Manufactured Goods & Machinery	372,032.3	471,377.7	926,107.7	1,486,083.1	1,575,767.4	1,355,573.9
Foods, Beverages, Tobacco	79,700.5	215,957.4	345,287.1	310,648.2	283,663.0	157,375.4
Chemicals, Oils, Fats	118,693.5	186,218.8	263,629.9	213,605.1	245,743.3	220,658.8
Misc. Manufactures, Special Transactions	17,120.1	22,285.8	31,213.6	36,138.8	39,713.3	42,438.5
Total	$686,576.4	$1,073,996.3	$1,889,622.3	$2,333,890.3	$2,400,566.6	$2,018,928.7
			Percent Distribution of Export Values			
Mineral Fuels	6.0%	3.5%	7.5%	5.2%	4.8%	4.8%
Crude Materials	8.4	13.0	9.6	7.1	5.9	7.2
Manufactured Goods & Machinery	54.2	43.9	49.0	63.7	65.6	67.1
Foods, Beverages, Tobacco	11.6	20.1	18.3	13.3	11.8	7.8
Chemicals, Oils, Fats	17.3	17.3	14.0	9.2	10.2	10.9
Misc. Manufactures, Special Transactions	2.5	2.1	1.6	1.5	1.7	2.1
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
			Average Values - Dollars/Ton			
Mineral Fuels	$ 33.71	$ 36.19	$ 62.08	$ 73.61	$ 78.26	$ 81.92
Crude Materials	87.30	128.02	201.49	165.60	157.27	170.80
Manufactured Goods & Machinery	421.47	581.80	756.25	1,873.77	1,771.52	222.54
Foods, Beverages, Tobacco	68.59	87.11	156.20	144.41	121.17	118.26
Chemicals, Oils, Fats	439.28	487.74	777.21	820.93	874.84	1,005.74
Misc. Manufactures, Special Transactions	1,902.23	2,820.99	3,468.18	4,517.35	4,462.17	4,992.76
Total	$ 163.25	$ 184.35	$ 271.07	$ 392.00	$ 407.98	$ 479.99

Source: DRPA

Table III-14. Total Exports - Delaware River and Bay By Countries and Areas of Destination, 1972-1977

Country/Area	Year (Thousands of Tons)						Year (Thousands of Dollars)					
	1972	1973	1974	1975	1976	1977	1972	1973	1974	1975	1976	1977
Western Hemisphere												
Canada	355	379	355	372	456	423	4,986	6,714	44,430	60,489	34,990	23,194
Mexico and Central America	25	41	38	20	22	22	15,647	17,.51	24,941	19,184	17,832	20,965
Caribbean												
Trinidad	3	2	2	2	2	3	1,482	1,243	1,870	1,956	2,141	2,939
Bahamas	57	0	0	0	0	0	1,003	155	0	4	0	323
Netherlands Antilles	4	4	5	4	3	6	1,892	2,356	3,406	2,939	2,668	4,829
Others	32	7	12	6	4	6	5,569	5,935	9,709	8,859	8,527	9,226
Subtotal, Caribbean	96	13	19	12	9	15	9,946	9,699	14,985	13,758	13,336	17,317
South America												
Venezuela	229	182	230	193	235	144	66,741	68,073	154,720	257,342	257,948	230,104
Brazil	108	198	320	86	95	60	36,150	65,873	136,957	87,890	127,468	92,352
Peru	24	58	167	84	39	67	13,862	16,424	29,576	25,711	20,291	13,065
Others	152	122	213	73	69	86	64,725		95,014	98,375	73,793	93,735
Subtotal, South America	513	560	930	498	438	357	181,478	194,230	416,267	469,318	479,500	429,256
Total, Western Hemisphere	989	993	1,342	902	925	817	212,057	227,744	500,623	562,749	545,658	490,732
Europe												
Scandinavia	114	76	29	158	55	75	23,844	11,383	21,329	32,896	20,641	19,771
Iberian Peninsula	515	845	1,208	1,132	861	670	40,270	83,316	165,554	138,954	105,468	72,775
Western Europe												
United Kingdom	464	744	638	443	598	247	47,962	90,224	136,763	94,927	120,310	74,562
West Germany	313	540	377	126	63	206	37,562	78,095	64,719	44,817	46,449	53,545
Netherlands	372	549	451	486	384	271	35,006	67,393	75,295	70,362	65,834	56,210
Others	374	261	323	281	572	203	50,349	74,301	93,258	85,856	138,797	92,811
Subtotal, Western Europe	1,523	2,094	1,789	1,336	1,617	927	170,879	310,013	370,035	295,962	371,390	277,128
Mediterranean												
Italy	153	306	255	335	453	375	17,490	32,194	94,673	45,306	60,788	64,430
Others	249	92	61	69	44	53	17,714	15,297	22,137	16,887	18,578	10,245
Subtotal, Mediterranean	402	398	316	404	497	428	35,204	47,491	116,810	62,193	79,366	74,675
Eastern Europe	65	334	172	400	700	248	4,756	31,588	28,115	66,515	81,910	31,291
Total, Europe	2,619	3,747	3,514	3,430	3,730	2,348	274,953	493,791	701,843	596,520	658,775	475,640

Table III-14. Total Exports - Delaware River and Bay By Countries and Areas of Destination, 1972-1977 (Continued)

Country/Area	Year (Thousands of Tons)						Year (Thousands of Dollars)					
	1972	1973	1974	1975	1976	1977	1972	1973	1974	1975	1976	1977
Middle East	63	44	83	113	155	110	12,032	14,106	26,268	70,228	86,490	71,576
Arabian Peninsula & Iran												
Saudi Arabia	29	18	32	89	144	123	8,733	9,647	40,120	168,380	349,597	270,403
Iran	28	32	33	87	56	5	13,095	15,915	33,203	221,776	64,495	12,488
Others	7	6	13	81	68	78	6,005	5,876	24,349	165,265	158,106	210,396
Subtotal, Arab. Pen. & Iran	64	56	78	257	268	206	27,833	34,438	97,672	555,921	572,198	493,287
Asia												
Indonesia	4	9	7	7	14	12	1,201	4,062	11,796	5,055	21,914	21,291
Others	107	96	108	130	87	44	24,508	28,911	50,222	45,489	36,374	38,738
Subtotal, Asia	111	105	115	137	101	56	25,709	32,973	62,018	50,544	58,288	60,029
East Asia												
Japan	147	323	1,055	304	244	235	28,679	69,405	149,320	97,026	86,091	68,524
Korea	42	21	19	68	99	154	4,430	5,108	23,838	17,620	44,229	54,111
Others	53	239	347	237	61	87	20,374	64,479	100,602	104,330	72,919	68,591
Total, East Asia	242	583	1,421	609	404	476	53,483	138,992	273,760	218,976	203,239	191,226
Oceania												
Australia	31	82	104	45	61	54	27,195	69,321	102,667	75,825	101,856	103,914
Others	7	16	19	12	15	11	6,649	10,019	18,463	12,377	15,244	16,674
Total, Oceania	38	98	123	57	76	65	33,844	79,340	121,130	88,202	117,100	120,588
Africa												
Algeria	0	18	61	31	14	0	129	2,069	15,045	7,419	8,737	140
Libya	0	1	0	0	1	1	443	5,071	103	1,252	1,312	1,111
Nigeria	2	3	12	11	22	16	1,853	1,425	3,606	14,117	61,214	17,848
Gabon	0	0	0	0	0	0	55	112	103	211	211	0
Angola	6	2	7	0	0	1	2,395	2,366	1,492	122	0	609
Liberia	1	1	1	3	3	3	618	506	788	1,559	1,786	5,150
Republic of South Africa	22	33	48	34	21	18	19,679	26,415	51,543	75,128	41,338	28,503
Others	45	140	135	280	164	90	21,503	24,681	33,623	90,345		62,490
Total Africa	76	198	264	359	225	129	46,675	62,645	106,303	190,753	158,820	115,851
Others		0						0				
Grand Total	4,202	5,824	6,940	5,864	5,884	4,207	686,586	1,074,029	1,889,617	2,333,893	2,400,568	2,018,929

III.B.3.a Exports - Wilmington Harbor

Tonnage exports from Wilmington Harbor are given in Table III-15 for the years 1972 to 1977. Summarized below, from Table III-15, are total exports exclusive of crude petroleum transfers.

Total Exports

Year	Tons	Percent Change
1972	29,616	-
1973	17,904	(-39.5)%
1974	43,333	142.0%
1975	77,255	78.3%
1976	138,249	79.0%
1977	114,780	(-17.0)%

During the 1972-1977 period, as shown above, exports increased substantially at Wilmington. The single most important factor in these increased exports has been the export of motor vehicles; the vehicle export tonnages are compared with total tonnage exports (exclusive of crude petroleum) in the following abbreviated table.

Vehicle Vs. Total Exports

Year	Total Exports (Tons)	Vehicle Exports (Tons)	Vehicle Exports (Percent)
1972	29,616	-	-
1973	17,904	4	
1974	43,333	10,638	24.5%
1975	77,255	21,527	27.9
1976	138,249	71,552	51.8
1977	114,780	78,806	68.7
4-Year Totals	373,617	182,523	48.9%

Source: Waterborne Commerce of U.S.

During the last four years almost half the total tonnage exports from Wilmington have been motor vehicles. In view of the importance of this item, exports from Wilmington were compared with those from Camden and Philadelphia and the "market shares" of the three ports were computed. The results of this comparison are given in the table which follows.

Table III-15. Wilmington Harbor Exports of Selected Commodities, 1972-1977

Commodity Number	Description	Year					
		1972	1973	1974	1975	1976	1977
		(Tons)					
1121	Coal and Lignite	-	-	-	-	16,384	-
1311	Crude Petroleum	-	-	-	-	187,740	85,050
1492	Sulphur, Dry	-	-	-	-	16,117	-
2819	Basic Chemicals & Prod. Nec.	4,681	11,811	9,831	3,039	9,971	9,071
2891	Miscellaneous Chemical Products	1,350	-	-	-	7,994	-
3313	Coke, Petroleum Asphalts, Solvents	18,532	-	21,953	51,709	14,999	23,801
3411	Fabricated Metal Products	-	4,022	1	3	23	-
3711	Motor Vehicles, Parts, Equipment	-	4	10,638	21,527	71,552	78,806
	Subtotal	24,563	15,837	42,423	76,278	324,780	196,728
	Other	5,053	2,067	910	977	1,209	3,102
	Total	29,616	17,904	43,333	77,255	325,989	199,830
	Percent Itemized	82.9%	88.5%	97.9%	98.7%	99.6%	98.4%

Source: Waterborne Commerce of the United States

Motor Vehicles, Parts, Equipment*

Year	Tonnage Export**	Percent Distribution			
		Philadelphia	Wilmington	Camden	Total
1972	44,450	99.6%	-	0.4%	100.0%
1973	46,401	99.7	-	0.3	100.0
1974	170,621	88.1	6.2%	5.7	100.0
1975	376,299	64.8	5.7	29.5	100.0
1976	334,579	45.2	21.4	33.4	100.0
1977	256,214	38.1%	30.8%	31.1%	100.0%

*Commodity No. 3711

**At Philadelphia, Wilmington, Camden

Source: Waterborne Commerce of U.S.

Wilmington's percent participation in the export of motor vehicles has increased steadily. In the last four years (1974 to 1977), Wilmington's vehicle exports have accounted for 16% of total exports from the three ports.

The commodity classification "Coke, Petroleum Asphalts, Solvents" has been an important and relatively consistent export for Wilmington. Philadelphia is the major exporter as shown in the table below.

Coke, Petroluem, Asphalts, Solvents

Year	Tonnage Exports	Percent Distribution			
		Philadelphia	Wilmington	Camden	Total
1972	142,746	86.9%	13.0%	0.1%	100.0%
1973	183,890	99.8	-	0.2	100.0
1974	118,662	81.3	18.5	0.2	100.0
1975	207,558	74.6	24.9	0.5	100.0
1976	244,534	93.4	6.1	0.5	100.0
1977	352,433	93.2%	6.8%	-	100.0%

Source: Waterborne Commerce of the U.S.

As in the case with imports, Wilmington exports cargoes in competition with both Philadelphia and Camden, the level of tonnage handled will depend on competitive actions at the other ports as well as the facilities and other incentives offered at Wilmington.

III.B.4 Coastwise and Internal Commerce

Coastwise and internal receipts and shipments represent important components of total activity at the ports and harbors of the Delaware River and Bay area. The terms "coastwise receipts and shipments" apply to domestic traffic between United States ports, including Puerto Rico. "Internal receipts and shipments" refer to movements within an internal body of water, in this case the Delaware River and Bay.

It is readily evident that petroleum and petroleum products -- residual fuel, distillate fuel and other refined products such as gasoline -- are the principal products distributed by water. For the total Delaware River and Bay ("Trenton-to-the-Sea"), coastwise shipments have been summarized in Table III-16 for the years 1972 through 1977. This table shows, for the year 1977, that three petroleum products, gasoline and distillate and residual fuel oil, totalled 73.3% of total tonnage; crude petroleum contributed an additional 8.2%. (In recent years, direct importation of crude petroleum has become much more important than coastwise receipts.)

Basic chemicals, caustic soda and sulphuric acid are among the important non-petroleum commodities moving in coastwise commerce. In general, coastwise traffic consists of petroleum products and other bulk commodities which have a high weight to value ratio and can be shipped most economically by water.

Internal shipments follow the same pattern as coastwise movements with some significant differences. Movements of crude petroleum are much more important in internal traffic than in coastwise shipments. The tonnages shown in Table III-17 represent the barge lightering operations from lower Delaware Bay to destinations upstream. (This lightering operation will be discussed in detail in another section of this Report.) Very low value materials such as sand, gravel, and crushed rock are also more important in "internal" tonnage than in coastwise traffic; similarly coal, sulphuric acid, residual fuel, and scrap are more significant in internal than coastwise movements.

Basically, internal cargo movements serve to distribute bulk commodities within the Delaware River and Bay area. In addition to the lightering of crude petroleum and the movement of petroleum products, basic industrial chemicals, construction materials, and scrap are shipped from point of production within the area to points of consumption or consolidation in the River and Bay.

At Wilmington Harbor, coastwise receipts and shipments have played only a minor role in total tonnage handled. Table III-18 gives a summary of foreign, domestic and internal commerce at Wilmington for the period 1965 to 1977. During this period, internal receipts have generally been the single most important tonnage category, although in 1976 and 1977, this preeminence has been lost to imports. (The decline in internal receipts reflects decreases in petroleum products and crude oil received

Table III-16. Trenton-to-the-Sea Coastwise Cargo Movements, 1972-1977

Commodity Number	Description	Year (Thousands of Tons)						Percentage of Total		
		1972	1973	1974	1975	1976	1977	1972	1975	1977
1121	Coal & Lignite	8	77	1	-	-	-	0.0%	0.0%	0.0%
1311	Crude Petroleum	11,507	6,529	6,068	3,612	2,398	2,207	32.6	13.7	8.2
1493	Sulphur, Liquid	210	211	247	81	81	77	0.6	0.3	0.3
2061	Sugar	-	19	35	62	85	12	0.0	0.2	0.0
2421	Lumber	108	49	44	35	8	7	0.3	0.1	0.0
2810	Sodium Hydroxide	200	185	191	185	542	222	0.6	0.7	0.8
2811	Crude Tar, Oil, Gas Products	189	181	110	105	107	132	0.5	0.4	0.5
2813	Alcohols	129	167	114	85	89	94	0.4	0.3	0.4
2817	Benzene and Toluene	236	86	213	212	281	153	0.7	0.8	0.6
2818	Sulphuric Acid	133	152	103	59	69	50	0.4	0.2	0.2
2819	Basic Chemicals and Prod., Nec.	471	525	637	565	643	573	1.3	2.1	2.1
2911	Gasoline	6,981	7,675	8,609	7,738	8,529	7,883	19.8	29.4	29.4
2912	Jet Fuel	258	392	349	264	511	405	0.7	1.0	1.5
2913	Kerosene	119	325	281	152	288	237	0.3	0.6	0.9
2914	Distillate Fuel Oil	6,377	7,122	5,783	5,953	5,084	6,116	18.1	22.6	22.8
2915	Residual Fuel Oil	5,147	3,856	5,302	4,854	7,011	5,652	14.6	18.4	21.1
2916	Lubricating Oils and Greases	906	1,209	1,079	1,054	964	900	2.6	4.0	3.4
2917	Naphtha, Petroleum Solvents	283	170	127	175	579	511	0.8	0.7	1.9
2918	Asphalt, Tar and Pitches	1,018	757	665	443	801	841	2.9	1.7	3.1
2991	Petroleum and Coal Prod., Nec.	269	174	105	148	176	108	0.8	0.6	0.4
3314	Iron and Steel Primary Forms	99	94	77	16	-	3	0.3	0.0	0.0
3319	Iron and Steel Products, Nec.	1	6	4	82	90	2	0.0	0.3	0.0
4011	Iron and Steel Scrap	-	1	56	9	1	7	0.0	0.0	0.0
4112	Commodities, Nec.	5	175	253	100	156	161	0.0	0.4	0.6
	Subtotal	34,654	30,137	30,453	25,989	28,493	26,353	98.2	98.6	98.3
	All Others	659	551	875	345	87	456	1.8	1.4	1.7
	Total	35,313	30,688	31,328	26,334	28,580	26,809	100.0%	100.0%	100.0%
	% Itemized	98.1%	98.2%	97.2%	98.7%	99.7%	98.3%			

Source: Waterborne Commerce of the United States

Table III-17. "Trenton-to-the Sea" Internal Cargo Movements, 1972-1977

Commodity Number	Description	Year					
		1972	1973	1974	1975	1976	1977
		(Thousands of Short Tons)					
1121	Coal and Lignite	1,220.7	1,736.0	1,707.8	1,524.6	948.8	842.9
1311 *	Crude Petroleum	4,955.3	6,796.1	9,068.5	9,993.0	9,846.7	11,044.5
1442	Sand, Gravel, Crushed Rock	2,314.7	2,175.1	1,694.7	1,553.3	726.4	654.3
2611	Pulp	133.9	151.5	134.9	139.4	135.1	104.4
2810	Sodium Hydroxide	125.8	177.5	141.8	68.1	48.0	26.1
2813	Alcohols	68.3	38.5	1.0	-	-	-
2817	Benzene and Toluene	148.0	179.4	99.2	76.1	155.2	136.5
2818	Sulphuric Acid	679.0	673.2	755.0	416.1	372.1	469.3
2819	Basic Chemicals and Prod., Nec.	38.3	140.3	90.4	167.9	396.8	195.9
2911 *	Gasoline	3,753.9	2,976.6	3,029.7	2,329.1	2,376.0	1,946.2
2912 *	Jet Fuel	856.8	871.4	859.5	565.6	486.0	532.5
2913 *	Kerosene	235.8	249.1	200.5	154.4	206.7	241.6
2914 *	Distillate Fuel Oil	3,503.4	3,872.6	4,814.7	4,120.8	3,341.8	3,445.3
2915 *	Residual Fuel Oil	8,709.5	7,709.3	7,263.4	6,441.5	8,634.5	8,579.5
2916 *	Lubricating Oils and Greases	78.3	117.1	134.9	63.2	136.6	173.6
2918 *	Asphalt, Tar, Pitches	320.2	371.9	343.6	237.0	282.8	296.7
2991 *	Petroleum and Coal Prod. Nec.	154.2	220.3	225.7	177.1	87.9	107.4
3312	Slag	-	-	-	-	-	60.8
4029	Waste and Scrap, Nec.	442.9	500.4	605.0	603.7	675.7	518.9
4112	Commodities, Nec.	7.1	81.8	98.5	100.1	141.8	79.1
	Subtotal	27,746.1	29,038.1	31,268.8	28,731.0	28,998.9	29,455.5
	All Other	138.0	181.1	163.4	130.6	186.4	237.5
	Total	27,884.1	29,219.2	31,432.2	28,861.6	29,185.3	29,693.0
	Percent Itemized	99.5%	99.4%	99.5%	99.5%	99.4%	99.2%
	*Petroleum & Products - Tons	22,567.4	23,184.4	25,940.5	24,081.7	25,399.0	26,367.3
	% of Total	80.9%	79.3%	82.5%	83.4%	87.0%	88.8%

Source: Waterborne Commerce of the United States

Table III-18. Wilmington Harbor Foreign and Domestic Cargo Movements, 1961, 1965,to 1977

Year	Total	Foreign		Domestic				Local	Percent Distribution				
		Imports	Exports	Coastwise		Internal			Foreign	Coastwise	Internal	Other	Total
				Receipts	Shipments	Receipts	Shipments						
			(Tons)										
1961	2,154,997	281,226	29,089	173,881	185	1,554,997	115,639	-	14.4%	8.1%	77.5%	-	100.0%
1962													
1963													
1964													
1965	2,391,716	676,934	16,478	34,176	52	1,550,567	113,393	116	29.0	1.4	69.6	-	100.0
1966	2,346,203	628,706	22,170	40,508	215	1,564,567	90,037	-	27.7	1.8	70.5	-	100.0
1967	2,523,297	603,200	5,947	26,975	76	1,843,449	43,650	-	24.1	1.1	74.8	-	100.0
1968	2,536,738	753,690	5,925	40,211	122	1,670,998	65,792	-	29.9	1.6	68.5	-	100.0
1969	2,695,491	684,032	10,588	75,739	30	1,889,876	34,956	-	25.8	2.8	71.4	-	100.0
1970	2,760,568	706,270	13,789	44,519	3,028	1,930,825	62,137	-	26.1	1.7	72.2	-	100.0
1971	2,967,223	815,218	55,212	16,750	666	2,033,953	45,424	-	29.3	0.6	70.1	-	100.0
1972	3,602,395	1,304,228	29,616	49,628	-	2,206,427	12,496	-	37.0	1.4	61.6	-	100.0
1973	4,001,816	1,454,716	17,904	69,997	-	2,441,189	18,010	-	36.8	1.8	61.4	-	100.0
1974	3,888,848	1,184,540	43,333	60,433	-	2,564,357	32,449	3,736	31.6	1.6	66.7	0.1%	100.0
1975	3,226,559	1,166,380	77,255	126,101	-	1,836,430	20,393	-	38.5	3.9	57.6	-	100.0
1976	2,653,259	1,071,844	325,989	244,623	-	1,008,496	2,307	-	52.7	9.2	38.1	-	100.0
1977	2,917,774	1,247,606	199,830	371,018	250	1,078,024	21,045	-	49.6%	12.7%	37.7%	-	100.0%

Source: Waterborne Commerce of the United States

at Wilmington.) Generally, internal receipts at Wilmington follow the same patterns as those displayed at the other ports of the Delaware River and Bay.

III.B.5 Future Trends

This section discusses significant future trends which will affect commerce in the Delaware River and Bay. After reviewing the prospects of containerization and trends in the commodity flows, the specific outlook for both Wilmington Harbor and the lightering operation in lower Delaware Bay will be examined.

III.B.5.a Containerization

The widespread and expanding use of containers with the associated changes in facilities and equipment to accommodate them is an established trend throughout the shipping and related transportation industries. Major advantages of container systems over conventional breakbulk general cargo handling methods are:

- More efficient cargo handling and vessel loading which permits decreased port times and higher vessel productivity.
- Faster door-to-door transit or delivery times for shipments due to improved handling, faster vessels, and coordinated inland transportation and documentation.
- Reduced pilferage and cargo damage due to water leakage, poor handling or stowage, lack of climate controls, and other hazards.

Specific factors affecting container usage at a particular port include: the volume of cargo destined to or originating in, overseas ports on a single trade route; the availability of regular containership service; the availability of container facilities at overseas cargo destinations or origins; the cost, speed and overall service quality of inland transportation connections; the balance of container imports and exports so that large volumes of empty containers will not have to be handled; the unit value of cargo offered and shipping rate levels; and the susceptibility of the commodities being moved to various types of damage.

Philadelphia began handling containers in substantial numbers in 1972; data on container movements for the most recent four-year period (furnished by the World Trade Division of the DRPA) are given in the table below for the Packer Avenue Terminal and the Tioga Marine Terminal.

Total Container Movements, Packer and Tioga Terminals, Philadelphia*

Year	Packer	Tioga	Total	Annual % Change
1975	56,469	29,679	86,148	-
1976	64,066	36,821	100,887	+17.1%
1977	42,535	45,906	88,441	(-12.3)%
1978	61,597	64,896	126,493	+43.0%

*In TEU's (20-foot equivalent units); both export and import.

During the last four years, Philadelphia's container movements have averaged 100,000 TEU's per year. Using a general measure of 11 metric tons per container (12.125 short tons per container), it is possible to calculate the approximate container tonnages handled and compare them with foreign general cargo tonnages in total (see below).

	Tons*			Containers	
Year	Import	Export	Total	Tons[1]	% of Total
1975	3,350.0	1951.1	5301.1	104.45	19.7%
1976	3,311.6	2053.0	5364.6	1222.3	28.8
1977	3,619.7	1520.6	5140.3	1072.3	20.9%
1978	-	-	-	1533.7	-

*Thousands of short tons.

If future container traffic is to increase in the Delaware River and Bay, the local ports must attract cargo now using other ports and/or achieve a greater share or new container tonnage than in the past. While there appears to be considerable "potential" for such additional tonnage, significant marketing efforts will have to be made to achieve increased container throughput.

III.B.5.b Commodity Flows

In many respects, future growth in waterborne commerce can be forecast as an extension of the historic performance of traditional commodities. Although present study objectives and scope do not require specific projections, we have examined overall growth trends with particular emphasis on general cargo movements and have reviewed the work of other consultants who have made such projections. One such report, Port Facilities Study, City of Philadelphia, was prepared by Tippetts-Abbett-McCarthy-Stratton (TAMS) and dated May 25, 1978. This report contained a forecast of general cargo movements through the Ports of Philadelphia, which is shown on the following page (Table III-19). Our review is in basic agreement with the general cargo import and export forecasts of TAMS, shown graphically on Exhibit III-5. (This projection does not

Table III-19. Forecast General Cargo Through Ports of Philadelphia; 1978, 1983, 1990

(000's Short Tons)

	1975 (Existing)	1978	1983	1990
Imports				
Primary Metals (excl. Cokes, etc.)	1,859	2,050	2,350	2,700
Food Products (excl. Sugar and Molasses)	251	335	502	706
Lumber and Wood	340	400	450	500
Farm Products	337	385	400	415
All Others	272	292	330	392
Subtotal	3,059	3,462	4,032	4,713
Exports				
Scrap Metals	592	600	600	600
Transportation Equipment	361	250	275	300
Primary Metals (excl. Cokes, etc.)	187	190	200	215
Chemicals and Allied Products	181	221	296	415
All Others	426	496	630	855
Subtotal	1,747	1,757	2,001	2,385
Total Imports Plus Exports	4,806	5,219	6,033	7,098
Domestic				
Scrap Metals	565	--	--	--
Chemicals and Allied Products	373	--	--	--
All Others	1,109	--	--	--
Subtotal	2,047	2,047	2,047	2,047
GRAND TOTAL	6,853	7,266	8,080	9,145

Source: Tippets-Abbett-McCarthy-Stratton

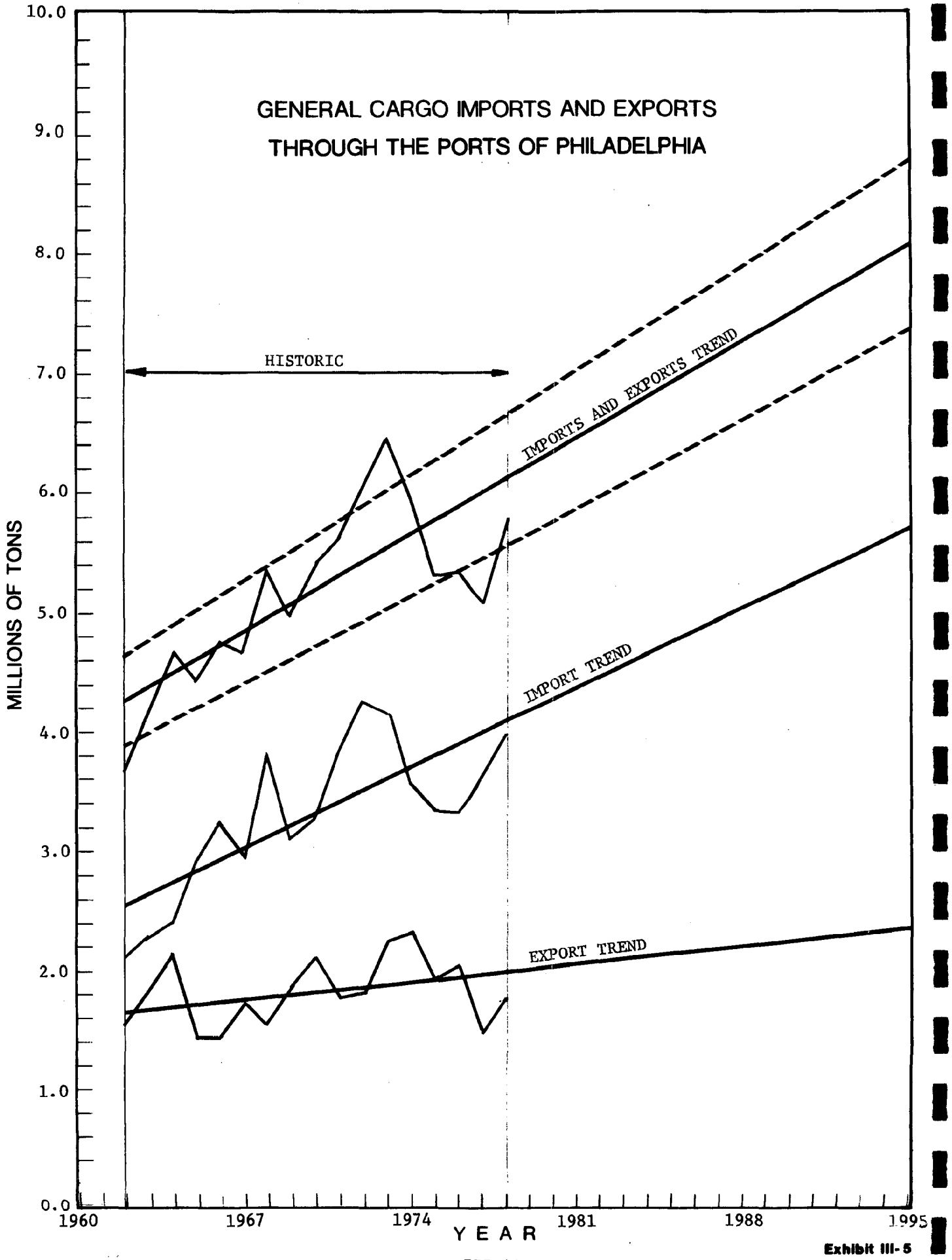


Exhibit III-5

include the two million tons of domestic general cargo included in the TAMS forecast.) Thus, a reasonable expectation is that the Ports of Philadelphia will handle six to eight million tons of general cargo in 1990. Regarding individual commodities, the TAMS forecast is reasonable although it is generally acknowledged in all forecasting that the level of accuracy of components is usually less than the total. A similar forecast of bulk cargo, exclusive of petroleum, was also prepared by TAMS. This forecast, reproduced as Table III-20 below, also appears to be realistic in light of past experience and is suitable for planning purposes.

Table III-20. Forecast of Bulk Cargo Commerce Through the Ports of Philadelphia: 1978, 1983, 1990

	(000's Short Tons)			
	1975	1978	1983	1990
Imports				
Metallic Ores	10,350	6,180	7,165	8,810
Cokes, etc.	291	313	354	420
Sugar & Molasses	786	850	950	1,050
Non-metallic Minerals	655	760	950	1,365
All Others	63	70	90	120
Sub-total	12,145	8,173	9,529	11,765
Exports				
Grains	2,400	2,600	3,000	4,000
Coal	1,200	1,300	1,400	1,500
Cokes, etc.	208	235	285	374
All Others	95	111	145	191
Sub-total	3,903	4,246	4,830	6,065
Total Imports + Exports	16,048	12,419	14,359	17,830
Domestic				
Non-metallic Minerals	1,039			
Coal	479			
All Others	106			
Sub-total	1,624	1,624	1,624	1,624
GRAND TOTAL	17,672	14,043	15,983	19,454

Source: Tippetts-Abbett-McCarthy-Stratton

III.B.5.c Wilmington Harbor

A subsequent section of this Chapter (III.D. "Port Facilities") describes the present facilities at Wilmington. This section outlines future developments at Wilmington as forecast by the Development Planning Division of Frederic R. Harris and contained in a three-volume report prepared for the Department of Planning and Development, City of Wilmington, under title of Port of Wilmington Delaware, Investment Strategy.[1]

[1]Draft Final Report, May 1979.

The Harris report recommends the earliest possible procurement of a multi-purpose crane and related civil works as Phase I of a port development program for Wilmington. A second step, after the implementation of Phase I would, as recommended, be a master plan study leading to selection of a port expansion program. Two alternatives were considered of which the $12 million "bulk cargo development plan is currently recommended." Table III-21, Table 6-2 of the Harris report, is reproduced to show the capital costs of the projected investments.

Table III-21. Estimated Capital Costs for New Port Services* Port of Wilmington, Delaware (in 1979 Dollars)

Phase 1 - Replace Bulk Crane with Combination Bulk/Container Crane

Cargo Handling Equipment	$4,100,000
Civil Works	
Relocate autos, lumber, roads, fences, etc. as required	150,000
Paving and drainage	150,000
Conveyor and revisions	250,000
Truck scale and gate revisions	150,000
Additional shed requirements	350,000
Engineering Services	260,000
	$5,410,000

*The Phase I development is equivalent to Alternate I.

Phase 2 - Port Expansion. Add new Berth and Facilities

	Alternative II	Alternative III
Cargo Handling Equipment	$7,500,000	$ 5,400,000
Civil Works	9,700,000	6,000,000
Engineering Services	800,000	600,000
Total	$18,000,000	$12,000,000

Source: Port of Wilmington, Delaware Investment Strategy, Volume III - Draft Final Report, Frederic R. Harris, Inc.

The Harris forecast envisions substantial container activity at Wilmington with the addition of the new combination crane. Tonnage throughput taken from Table 3.3 of the Harris report is shown below. (The first year of new crane operation is forecast as 1981; the notes are from the Harris report.)

Year	Bulk Tonnage*	Container Tonnage**
1981	733,000	455,000
1982	741,000	482,000
1983	748,000	511,000
1984	755,000	542,000
1985	763,000	574,000
1986	770,000	609,000
1987	778,000	645,000
1988	786,000	684,000
1989	794,000	725,000
1990	802,000	769,000

*"Based on 1% growth rate/year from 1980 estimated with bulk tonnage of 726,000 tons."

**"Assumes 70% of 1978 Least-Cost Potential of tons in first year of operation (1981), then 6% growth rate/year."

Source: Table 3.3 of Harris Report.

With the new crane, the Port of Wilmington is expected to be able to handle the forecast tonnage.

III.B.5.d Lower Delaware Bay

With the increasing size of tankers, the forty-foot channel depth of the Delaware River has prevented the larger vessels from delivering cargo directly to terminals and oil refineries along the River. To accommodate this situation, extensive lightering operations have developed in the deepwater anchorage in lower Delaware Bay. This operation consists of the partial unloading of tankers into smaller craft in the Bay off Big Stone Beach so that the tankers can then meet channel draft limitations and proceed to the refineries upriver. The smaller craft, lighters, also transport their loads to the refineries. The following tabulation shows total tonnages handled in the lightering operation.

Lower Delaware Bay, Delaware

Year	Total Tons	Imports	Internal Shipments	Other*
1968	2,565,643	496,604	1,780,550	288,489
1969	2,649,091	350,178	1,886,581	412,332
1970	2,845,298	919,194	1,549,460	376,644
1971	3,196,381	842,246	2,050,018	304,117
1972	9,451,732	4,101,595	4,955,813	394,324
1973	11,726,303	5,510,179	5,860,604	355,520
1974	12,903,735	3,683,177	8,665,719	554,839
1975	15,031,984	4,450,145	9,734,044	847,795
1976	15,729,033	4,428,938	10,575,765	724,330
1977	18,299,866	6,322,872	11,624,403	352,591

*Includes Exports, Coastwise Receipts & Shipments, Internal Receipts and Local Movements, if any. These categories are generally much less significant than "Imports" and "Internal Shipments."

Source: Waterborne Commerce of the U.S.

"Imports" have been described as the tonnage of petroleum which remains on the tanker after lightering; the "internal shipments" are the lightered tonnage. Some additional perspective on tonnage activity in the lightering operation of the Lower Delaware Bay can be gained by converting the tonnage statistics to barrels per calendar day. (There are approximately 6.8 42-gallon barrels of 36° API Crude per short ton.) These figures are listed below.

Year	Total Activity* (Barrels/CD)	Barrels/Year (Millions)
1968	48,000	17.4
1969	49,000	18.0
1970	53,000	19.3
1971	60,000	21.7
1972	176,000	64.3
1973	218,000	79.7
1974	240,000	87.7
1975	280,000	102.2
1976	293,000	107.0
1977	341,000	124.4

*Figures rounded to nearest thousand.

Basically, a deepwater oil transfer operation has developed in the lower Delaware Bay. This operation has grown consistently year by year over the analysis period without interruption. The ultimate level of this activity will depend on refinery capacity in the area.

III.C TRENDS IN VESSEL USAGE

In recent years, two general trends in vessel usage can be discerned. First, particularly for tankers, but also for other types of vessels, the average vessel size has been increasing to obtain economies of scale; secondly, specialized cargo vessels have been developed to more efficiently handle specific types of cargoes and commodities or to serve major trade routes. These two often complementary trends have caused technical problems for ports and harbors; the increased vessel size requires deeper channels and greater depths alongside piers and wharves, and the specialized cargo vessels demand suitable handling facilities in the ports.

III.C.1 Vessel Types

In the Delaware River and Bay, it is possible to discern some definite trends. For the period 1969-1978, overall vessel arrivals have declined rather steadily, a decline that is not a result of reduced commerce. The principal vessel category responsible for the overall decrease in arrivals is breakbulk (non-containerized general cargo). In 1969, there were 2,387 breakbulk vessels arrivals, but in 1978 these arrivals amounted to 1,135. This substantial decrease can be attributed, at least in large measure, to the initiation of containership service in 1972. Bulk cargo vessel arrivals were high in the three year period 1973 to 1975 because of ore shipments. Oil tanker arrivals have decreased in number, but the average size of the tankers has more than offset the decline in units. In the most recent four year period, auto transporters have increased dramatically -- one in 1975, 74 in 1976, 117 in 1977 and 197 in 1978. In recent years, RO/RO (Roll on-Roll off) and LASH (Lighter Aboard Ship) vessels have appeared in the Delaware River and Bay; but, their numbers have been insignificant relative to the other categories. A graphical presentation showing these trends -- based on information obtained from the Philadelphia Maritime Exchange -- appears as Exhibit III-6.

In order to obtain a numerical indication of the growth in vessel size, the following tabulation was prepared from the data of the Philadelphia Maritime Exchange. In this tabulation average net registered tonnage for selected vehicle categories is shown for the years 1969 through 1978. Vessel size and cargo capacity -- as indicated by net registered tonnage -- have increased significntly for all vessel categories, with tankers and containerships demonstrating the greatest increases.

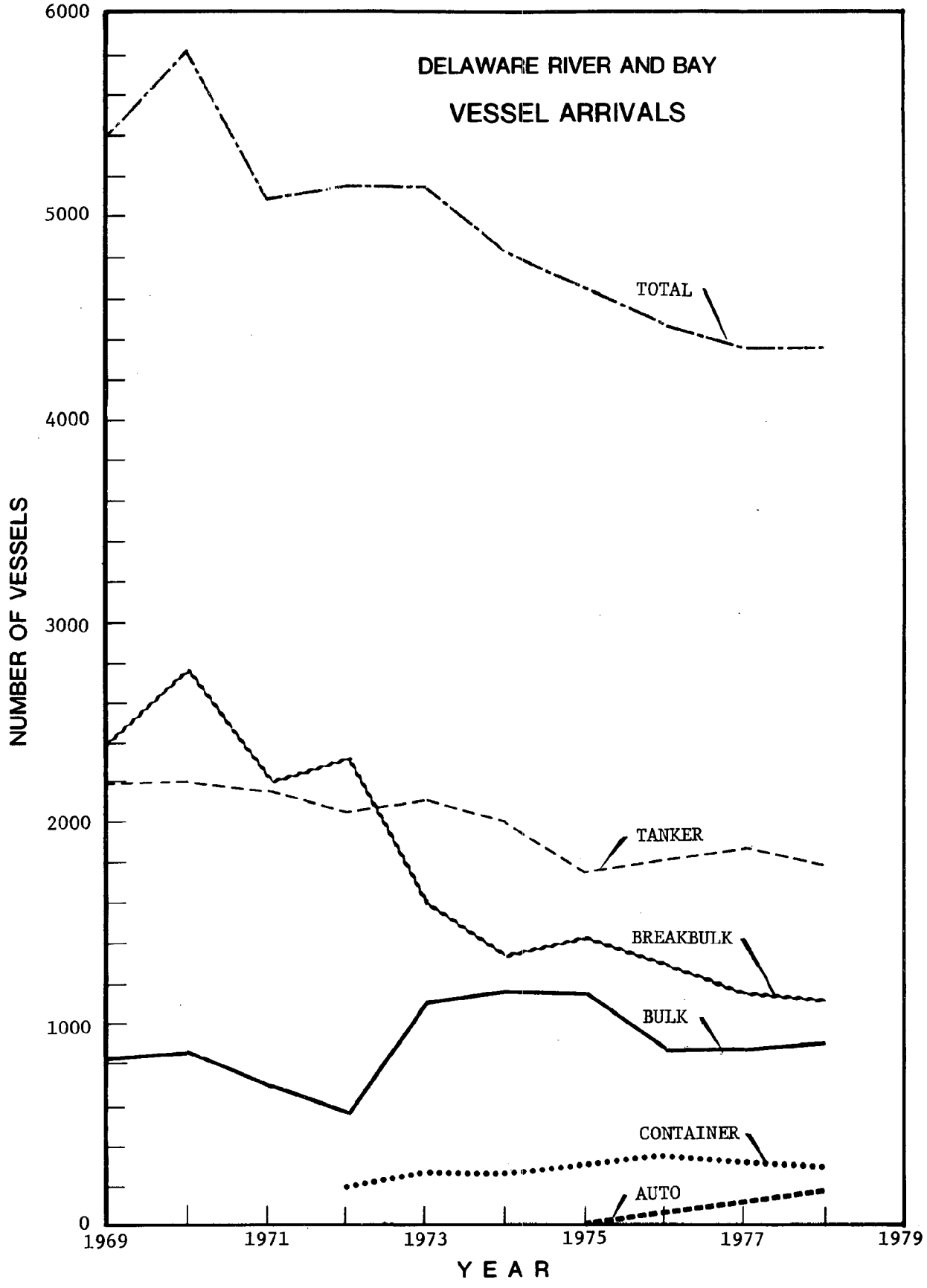


Exhibit III-6

Average Net Registered Tonnage

Year	Breakbulk	Container*	Bulk	Tanker	All Groups**
1969	4701	--	6632	12265	8085
1970	4161	--	8750	14097	8764
1971	4133	--	11152	12592	8694
1972	5056	8169	8347	15210	9583
1973	4783	7951	8786	15470	10248
1974	4878	10169	9575	16135	11047
1975	5257	11436	10437	17200	11462
1976	5479	11207	10152	18487	12261
1977	5557	10995	10640	18605	12719
1978	5921	13569	10171	20453	13464
1969/1978 % Inc.	26.0%	66.1%	53.4%	66.8%	66.5%

*Period 1972-1978.
**Includes categories not itemized in the tabulation.

III.C.2 Inbound Vessels - Wilmington Harbor

In general, the average size of vessels as measured by draft requirements has been increasing at Wilmington. The trend is most noticeable in the case of tankers as shown in the following table, which is based on data in Waterborne Commerce of the U.S.

Inbound Tankers - Wilmington Harbor

Year	Draft in Feet				
	18' and Less	19' to 24'	25' to 30'	31' plus	Total
	(Number in Vessels)				
1970	68	1	8	4	81
1971	115	2	10	2	129
1972	109	3	4	2	118
1973	105	2	4	4	115
1974	89	1	5	3	98
1975	96	1	3	8	108
1976	11	3	5	21	40
1977	3	6	7	26	42

Over this period, the number of tanker arrivals has declined sharply and in the last two years of the analysis period most arrivals have been larger vessels. A similar tabulation shows trends in draft requirements for passenger and dry cargo vessels. Again, the basic data has been taken from Waterborne Commerce of the U.S. These data indicate a definite shift from the shallower draft vessels; unlike the tanker trends, it appears that the shift has been to medium draft vessels rather than to deeper draft ships.

Inbound Passenger and Dry Cargo Vessels - Wilmington Harbor

Year	Draft in Feet			
	18' and Less	19' to 30'	31' plus	Total
	(Number of Vessels)			
1970	75	159	14	248
1971	67	132	31	230
1972	53	189	26	268
1973	23	200	29	252
1974	32	201	18	251
1975	13	204	12	229
1976	15	185	21	221
1977	16	208	19	243

III.C.3 Future Vessel Trends

Increasing vessel size has been a well established trend over the past ten years. In the future the following trends are anticipated.

Tankers: Future construction of crude oil bulk carriers will emphasize two size groups. By the year 2000, the larger size may be characterized by 700,000 DWT and 85 foot draft designed to unload at offshore terminals. The smaller tanker types would range between 69,900 DWT and 80,000 DWT with drafts of 38 to 42 feet. The latter ships would be particularly common on shorter trade routes such as from Venezuela and the Carribbean to Delaware Bay. They also are expected to find increasing employment in the Mid-East trade due to the reopening and probable deepening of the Suez Canal. The present lighterage operation in Delaware Bay is expected to continue to service tankers largely between the foregoing tonnage ranges and of sizes up to about 150,000 tons, particularly since no offshore terminal is presently foreseen for the Delaware Bay Area.

Dry Bulk: The most important development in dry bulk carriers is increase in size. However, there are characteristics of the bulk trade market which tend to restrict the size of bulk carriers such as wide variations in trade routes, commodities and cargo volumes; vessels need to remain small enough to be suitable for different types of service. In addition, the vessel is captive to the port and land transshipment arrangements of the bulk cargo industrial consumer. Two significant innovations may become important, the development of large shallow draft bulk carriers and the increased use of self-unloading shipboard equipment to achieve greater productivity.

Neobulk: Neobulk shipping provides a service which fills the gap between liner and tramp services with respect to general cargo commodities which can be handled efficiently in large shipment sizes, often with specialized equipment. Ship service may be as frequent as liner service but

rates are closer to those offered by tramps. The chief economic advantages of neobulk carriers are the elimination of special preparations required for mixed cargoes and the use of large hatches and heavy specialized lifting gear to speed cargo handling. As world population and commerce continue to grow, more commodities will be carried in sufficient quantity to be handled as neobulk cargo. Characteristics of neobulk shipping are slow to medium service speeds, flexible scheduling and cargoes of medium value and lot size.

Commodities which are now carried as neobulk on certain trade routes are lumber, newsprint, iron and steel products, cars, trucks, tractors, sugar and fruit. Neobulk carriers are usually specially designed to carry a particular commodity.

Conventional General Cargo: Despite the large projected increase of world commerce, the number and size of general cargo vessels carrying breakbulk cargo may increase very slightly and the portion of the total trade carried may decline. As the commodity volume increases, it goes to neobulk shipping and as its value increases, it goes to containerized shipping. Breakbulk vessels will continue to carry heavy weight, awkward commodities which require a heavy lift and will service these trade routes where a low value, low volume market exists. Breakbulk carriers may service the ports of South America and Africa although RO-RO ships will penetrate into this market. To maintain flexibility in the diverse breakbulk market, conventional cargo ship dimensions will be limited to a 700-foot length, 90-foot beam and 30-35-foot draft.

The handling of cargo in port constitutes a major element in total system operating costs so the largest technological advance will be to increase the cargo handling rate. This has led to the development of capital intensive ships such as container ships, roll on-roll off and barge carrying which are discussed later. Because of the nature of the cargo handled, the productivity increase for conventional cargo vessels will be much less than for other general cargo ships.

Containership: Containerships typically carry medium to high value cargo which is easily unitized. Containers have increased the annual production capability or cargo handling capacity of vessels and related systems by a factor of 10 over the conventional general cargo ship. This increase can be attributed to an increase in speed, ship capacity, and cargo handling rate. At the present time a speed of 33 knots and a capacity of 3,000 containers have been achieved. The maximum future projected horsepower is 200,000 SHP which would permit a speed of about 37-40 knots depending on ship size. It is doubtful this amount of power would be installed by 1985 unless fuel cost increased so much that nuclear power became an attractive alternative to fossil fuel. Container ship beams and length will show some future increase so by 1985 ships carrying 4,000 containers will be operating. The draft will not increase significantly. As larger and faster container ships come into operation, they will operate on the highest volume trade routes with the most modern cargo handling facilities. These vessels will call only at

central distribution ports, perhaps just one at each end of the trade route and cargo will be shipped by a feeder system to other ports. Large marshalling areas will be required to effectively handle the increase in cargo throughput. Second generation container ships which are currently operating will be servicing the smaller, lower commodity volume ports so modernization of container facilities at these ports will also be required.

The cost of handling containers to and from the ship and movements inland account for 80% of the total system costs. One way to reduce handling cost is to reduce the pool/slot ratio (total number of containers in the pool or set of containers used by a particular ship divided by spaces available on the ship). A lower ratio means a lower number of containers to be acquired and maintained. A 2% reduction in freight rate is possible with a 17% decrease in the pool/slot ratio. This is achieved principally by reducing the port turn around time which in turn is dependent on the cargo handling rate. Increasing the handling rate from 50-75 containers/hour would reduce the freight rate another 5%. Container handling equipment may be improved by using multiple cranes and by moving several containers for each lift.

Roll On-Roll Off: RO-RO ships carry cargo which is rolled on and off the ship, frequently under its own power. Some ships also reserve space for containers or bulk cargo which is lifted off to increase flexibility of operation. RO-RO service offers many distinct advantages over other services particularly for regions such as the Middle East with heavily congested ports or South America and Africa which have limited cargo handling facilities and unskilled shoreside labor. The shipper is provided with fast service directly to the destination. Cargo carried on RO-RO vessels is of high value and easily unitized.

The most significant technological advances in RO-RO vessel design will be to increase the utilization of available cubic capacity and improvements in unloading arrangements. The size of the ships will be limited by two factors. Most RO-RO vessels operate in short trade routes, in congested port areas with limited facilities. Secondly, short term overtonnage is expected to exist by 1980 because 38% of the projected fleet is now on order and by 1975 the tonnage ceiling was already reached on the North Sea and Mediterranean. Ports in the Middle Eastern countries are developing faster than previous projections indicated.

The market for RO-RO service from the North East U.S. to Florida appears to be particularly promising because the service schedule nearly matches that for truck and rail but the freight rates are much lower. Only a 1% penetration into the truck/rail service would permit break-even on operation of the RO-RO service. In addition there would be reduced congestion of highways and reduced air pollution and energy consumption.

Barge Carrier: Barge carrying ships generally load/unload their barges either by lifting them over the stern (LASH) or by using a stern elevator (SEABEE). Barge carrying ships typically provide feeder service between "express" ports and have the advantage of quickly dropping off barges at

these ports while keeping the capital intensive carrier ship in operation. Barges can then be moved by tug via inland or intra-coastal waterway. Since air cargo and containerships are expected to capture the higher value cargo commodities, more shipowners are going to LASH and SEABEE vessels to handle lower value bulk commodities which can be unitized.

To accommodate barge carriers, ports must provide marshalling areas for barges. The original intent of the LASH concept was that ships be able to operate in small ports transferring the barges to a tug outside the harbor, if necessary. Like RO-RO ships, many barge carrying ships also carry containers so they now need to utilize docks to unload.

Tub-Barge: Tug-barge units offer a service similar to the barge carrying ships in that they carry commodities of low value and the capital intensive tug unit is not subject to delays from unloading/loading the barge unit. They carry cargoes of larger lot sizes than the LASH ships on trade routes where neobulk carriers are not required.

In the past most integrated tug-barge units have operated on inland waterway and coastal trade routes. An important recent development is a large increase in tug-barge deadweight and the operation of such combination vessels on trans-ocean routes. Changes in port facilities of the DRBA region will be required to meet future needs of ship owners and operators, new types of facilities and technical advances provided by competing ports and requirements of the various types of ships calling at the ports. Based upon the study analyses and reviews, however, it appears that planned improvements and development of the port and terminal facilities in the Delaware River and Bay Area should be adequate to satisfy these future needs.

III.C.4 Navigational Considerations

The high capital and operating costs of modern vessels require their optimum utilization if economic viability is to be realized. Such requirements place emphasis on the need not only for fast turn-around time in port, but also on the assurance of ready and safe access to ports through adequate channels and fairways marked with appropriate buoyage and other navigational aids.

The main ship channel between the Philadelphia and Trenton area and the sea provides principal access to the major ports of Wilmington, Philadelphia and Camden and to the numerous marine terminals operated by private industry in the area. The Federally established project depth of this channel is 40', which is adequate for most current ocean going vessels, with the notable exception of larger tankers. These can enter the tanker anchorage off Big Stone Beach with drafts up to 55 feet, but must reduce such drafts to about 38 feet by lightering before proceeding up the main channel to refinery berths.

Such lightering of bulk petroleum is not unusual and is regularly conducted in many other areas where channel or harbor approaches are of

insufficient depth to accommodate the larger tankers at their full load draft. A typical example may be found in New York Harbor, when deep draft tankers transfer part of their cargoes to barges in the Gravesend Bay area with both the barges and lightened vessels then proceeding upriver to refineries in the Bayonne, New Jersey Area. In the Gulf of Mexico VLCC's partially offload to specially configured tankers for delivery to refineries in the Houston, Texas area; in the Caribbean crude petroleum destined for the Hess Oil Refinery on the island of St. Croix is transferred from VLCC's anchored offshore to large tank lighters; on the West Coast oil from the North Slope fields moving south in large tankers is transferred at the Pacific Ocean approaches to the Panama Canal to smaller tankers capable of transiting the Canal for delivery to East Coast ports; and in the English Channel, VLCC's with oil destined for Milford Haven partially discharge into smaller vessels before proceeding to berth.

From available information it does not appear likely that the channel will be deepened beyond 40' in the foreseeable future. Physical constraints such as the presence of underlying aquifers and a limestone base that could seriously impede dredging, together with higher costs, environmental aspects and permitting all are limited factors to prospects of any extensive deepening of this channel. Other improvements, however, are planned by the U.S. Army Corps of Engineers which has responsibility for maintenance of navigational waterways. These include:

- Deepening of the Mantua Creek Anchorage from 37 feet to a project depth of 40 feet. This anchorage is located near the entrance to the Schuykill River and is frequented by general cargo vessels. This improvement is authorized but is not funded.

- Development of a turning basin at the Tioga Terminal in Philadelphia with an authorized project depth of 36 feet.

- Restoration of the access channel to the Delaware Breakwater to its 15 foot project depth. A Congressional study resolution has not yet been funded.

- Dredging of the Chesapeake and Delaware Canal to the original construction depth of 35 feet. This project, which was implemented following the resolution of problems regarding disposition of dredge spoils is expected to be completed within two years.

The main navigational channels in the Delaware River and Bay are characterized by generally long straight legs uncomplicated by severe turns or bends. Buoyage, lights and beacons are in accordance with standards for U.S. deepwater ports and are provided and maintained by the U.S. Coast Guard. The Coast Guard also engages in ice clearance operations and has installed some ice buoys in an endeavor to insure reliable channel

markers under severe winter conditions (ice buoys, of the thin profile span type, are designed to be overrun by ice flows and emerge on station, while standard buoys, with frame structures are prone to being dragged off station as well as to damage by ice).

Consideration has been given to the installation of a vessel traffic system (VTS) in the Delaware River and/or Bay. Such systems, operated by the Coast Guard, are designed to reduce collisions through radar surveillance and strict monitoring of vessel movements from a central shore based station. Generally their costs are justified only in areas of high density vessel traffic, such as in the San Francisco Bay area, where a VTS has been in successful operation for several years.

While the Coast Guard has undertaken to provide a full range of navigation aids within its budgetary limits, there is concern on the part of operators, pilots and others that further improvements are needed. Included are buoys, range lights and structures and the installation of transponders for improved radar identification of specific markers.

III.D PORT FACILITIES

In the Delaware River and Bay region, port facilities have been developed to handle a wide range of general cargo and both liquid and solid bulk shipments. The public general cargo ports are at Wilmington, Camden and Philadelphia and these ports are also equipped both to receive and ship liquid and bulk commodities. Because of extensive petroleum refining and chemical and steel manufacturing in the region, there are additional piers, wharves and storage facilities dedicated to specific bulk commodities for private industrial organizations. While these latter facilities are usually not considered in assessing port requirements, they are necessary to the commercial activity in the area and its continuing development.

At the present, the major container handling operations in the region are at Packer and Tioga Terminals in Philadelphia. (Containers are also handled at Northern Shipping Co. in Philadelphia.) It is expected that container operations will be initiated at Wilmington in the near future. Containerized handling began rather late in the Delaware River and Bay region (such operations commenced in Philadelphia in 1972) and the region lags behind other comparable East Coast ports such as Charleston, Baltimore and Hampton Roads. (Containerization has been discussed in Section III.B.5.a.)

General cargo shipments, depending on the type and value of the particular commodity, require different types of intermediate storage. Some low value commodities, as well as high value items such as motor vehicles, require considerable acreage of open storage. Warehouse space must be provided for other commodities and temperature-controlled storage areas must be available for frozen meats and produce.

Ideally, the port should have a balanced mixture of equipment and facilities to handle efficiently the cargoes offered.

This section of the Report describes the port facilities in the Delaware River and Bay region with particular emphasis on the Port of Wilmington and the River and Bay to the south. In view of the interdependence of ports in the area, present and planned facilities at Camden and Philadelphia also will be reviewed.

III.D.1 Wilmington

The port of Wilmington is located immediately to the north of the Delaware Memorial Bridge, approximately four hours by ship from the sea buoy at the entrance to the Delaware River and Bay. The Port does not have regular, scheduled vessel or liner service, but substantial movement of spot cargoes results in frequent vessel calls. Ships range in size from small refrigerated ships of about 220 feet in length to lumber and dry bulk carriers of 700 feet in length or more. Principal cargoes include lumber, iron and steel products, bananas, motor vehicles, gypsum and petroleum coke. There is a tanker berth at Wilmington operated jointly by the Delaware Terminal Company, Inc. and the Sico Company for the shipment and receipt of petroleum products. Total storage tank capacity amounts to over one million barrels. As a measure of activity at the tanker berth, the following tonnages were handled in 1974, a peak year, and the most recent year 1977.

	1974	1977
	(Short Tons)	
Crude Petroleum	984,991	168,269
Gasoline	509,284	295,877
Kerosene	27,255	19,134
Distillate Fuel Oil	591,620	574,530
Residual Fuel Oil	470,777	747,119
Totals	2,583,927	1,804,929

Source: Waterborne Commerce of the U.S.

In the two years cited, the tanker berth handled between 12 and 18 million barrels of petroleum and products.

In addition to the tanker berth, the Port of Wilmington has seven other berths, one of which is a 515-foot floating roll-on berth consisting of three permanently moored steel barges which are aligned in marginal wharf configuration with shore access via ramps. The remaining six marginal berths have a total length of 3000 feet; the depth alongside is 35-feet at mean low water.

The six marginal berths are served by two transit sheds totalling 47,000 square feet, and four warehouse areas designated A, B, C, D which provide 340,000 square feet of dry storage area and over 1,000,000 cubic feet of convertible space which is available for refrigerated and frozen storage. In addition to the warehouse space there are 90 acres of paved and unpaved open storage with an additional area for the storage of gypsum rock at the Georgia Pacific plant. (Much of the open storage area is used for the import storage of Fiat automobiles.)

Materials handling equipment includes a bulk unloading tower and a 75-ton receiving hopper; a conveyor system for the storage of gypsum rock; two diesel-electric revolving cranes; and one 140-ton diesel mobile crane. Supplementing the heavier equipment are about thirty fork-lift trucks.

The Port of Wilmington is served by Conrail and the C&O and B&O railways, and, via Terminal Avenue, connects with Interstate Highway 95, 295 and 495. In general, the port may be considered adequate in terms of facilities, buildings, upland area and equipment to handle its existing commerce. Over the last five years, some $12 million has been spent on refurnishing, improving and modernizing warehouses and wharves. Included in these improvements have been the installation of the floating berth, new roofs, new siding and warehousedoors and new wharf surfaces and foundations. Overall, the facility has been well developed to handle existing demand.

Berth utilization is approximately 35 percent, a good average working utilization for facilities serving ocean-going vessels. A general appraisal indicates that current throughput of one million tons (dry bulk and general cargo) is well below the capacity of existing facilities. This throughput could probably be increased by as much as 50 percent before berth congestion and delays could be expected.

Present plans call for the installation of a multi-purpose crane, the provision of additional warehouse space, and the development of a container storage area. These new improvements are expected to cost about $5.4 million and increase port capacity to about 1.8 million tons per year. The container capability will add to the Ports' attractiveness, but container handling is not expected to be a major port activity.[1]

Other port development possibilities in the area include a future coal facility on property adjacent to the Port. The status of this project is unclear at this time.

Exhibit III-7 on the following pages gives the description of facilities at the Port of Wilmington included in Port Series No. 8 (Revised 1978), prepared by the Board of Engineers for Rivers and Harbors.

[1]Future plans at Wilmington are outlined in Section III.B.5.c.

Exhibit III-7. Piers, Wharves, Docks and Storage Warehouses - Wilmington, Delaware

Piers, Wharves and Docks

NAME	Port of Wilmington, Marine Terminal, Tanker Berth.	Port of Wilmington, Marine Terminal, Floating Berth.	Port of Wilmington, Marine Terminal Wharf, Berths 1-6.
LOCATION ON WATERFRONT	South side of entrance to Christina River.	Right bank, Christina River, approximately 750 feet above entrance.	Right bank, Christina River, approximately 3,000 feet above entrance.
OWNED BY	*United States Government.*	*City of Wilmington.*	*City of Wilmington.*
OPERATED BY	Delaware Terminal Co., Inc., and The Sico Co.	City of Wilmington, Department of Commerce.	City of Wilmington, Department of Commerce, and Wilmington Launch Service, Inc.
PURPOSE FOR WHICH USED	Receipt of petroleum products.	Receipt and shipment of general cargo and automobiles in foreign and domestic trades.	Receipt and shipment of general cargo and automobiles in foreign and domestic trades; receipt and/or shipment of bananas, woodpulp, lumber, chemicals, gypsum rock, and miscellaneous liquid and dry bulk materials; mooring company-owned tugs.
TYPE OF CONSTRUCTION	Concrete-filled, steel pipe pile, concrete-decked, offshore platform with two 30- by 20-foot, similar breasting dolphins in line with face, fronted by rubber-cushioned, timber fender system; row of 13 steel sheet pile, cellular, and 2 steel pile, (Continued under Remarks)	Offshore wharf: Three permanently moored steel barges with two 250- by 35-foot, pontoon approaches, each with 50- by 15-foot, hinged, timber-decked steel ramp at inner end.	Upper and lower sections: Part timber and part concrete-filled, steel pipe pile, concrete-decked wharf; Center section: 800-foot, concrete retaining wall with asphalt-surfaced solid fill on part timber and part concrete, relieving platform, supported partly by timber and partly by steel piles.

DESCRIPTION	Face	Lower side	Upper side	Face	Lower side	Upper side	Face	Upper side
Dimensions (Feet)	50	40	34	515	35	35	3,060	180
Depth Alongside at MLW Do.	34	-	-	35	-	-	35	-
Usable Berthing Space Do.	1,000 w/dolphs.	-	-	515	-	-	3,060	-
Width of Apron Do.	Open.			Open.			27 and open.	-
Height of Deck Above MLW Do.	12			-			12	
Load Capacity per Sq.Ft. (Lbs.)	-			-			-	
Lighted or Unlighted	Lighted.			Lighted.			Lighted.	

TRANSIT SHEDS			
	None.	None.	One-steel frame, brick walls; concrete floor. Shed No. 1	One-steel frame, part concrete, metal-covered, & glass block* Shed No. 2
Number and Type of Construction				
Length and Width (Feet)			400 by 20	420 by 80 (See Remarks)
Height Inside Do.			17	20
Floor Area for Cargo (Sq.Ft.)			24,000	22,400 (See Remarks)
Load Capacity per Sq.Ft. (Lbs.)			500	500
Cargo Doors (Feet)		Shipside:	Eighteen, 18 by 16.	Twenty-one, 18 by 18.
		Others:	One, 12 by 12.	Thirteen, 12 by 12.

*walls; concrete floor.

MECHANICAL HANDLING FACILITIES	Two 12- and one 8-inch, swivel-jointed, unloading arms.	Twenty-seven 2- to 7-ton, gasoline and LP-gas, fork lift trucks.	One diesel-electric, traveling, bulk-unloading tower with 100-foot, hinged-cantilevered boom equipped with 9½-cubic yard, clamshell bucket, and 75-ton, receiving hopper; unloading rate 350 to 500 tons per hour. Bulk material, other than gypsum rock, is loaded directly into rail cars or trucks from the hopper; gypsum rock is stockpiled via a 22-inch, elevated, electric, belt-conveyor system extending along rear of face, and to Georgia-Pacific Corp., Gypsum Division plant. One 100- and one 20-ton, diesel-electric, revolving, full-portal, gantry cranes with 80- and 60-foot booms, respectively. One 140-ton, diesel, mobile crane with 80-foot boom. Cranes have use of one 52-inch, electric magnet and six clamshell buckets ranging in capacity from 1 3/4- to 14-cubic yards. Use of fork lift trucks described under Ref. No. 11.
RAILWAY CONNECTIONS	None.	Three surface tracks at rear of face join additional terminal trackage, connect with Consolidated Rail Corp., Chesapeake and Ohio Railway, and Baltimore and Ohio Railroad.	Two surface tracks on lower and upper sections of apron, join 8 miles of additional trackage at terminal in rear; connect with Consolidated Rail Corp., Chesapeake and Ohio Railway, and Baltimore and Ohio Railroad.
HIGHWAY CONNECTIONS	Via driveway, asphalt, varied widths, from Christina and Terminal Avenues, asphalt, 24 and 40 feet wide, respectively; Terminal Avenue connects with Interstate Highways Nos. 95, 295, and 495.		
WATER SUPPLY (Available to Vessels)	None.	Through 2½-inch connections.	Through 2½-inch connections.
ELECTRIC CURRENT (Available to Vessels)	None.	A.C., 110 volts, single-phase, 60-cycle; A.C., 220 volts, 3-phase, 60-cycle; D.C., 250 and 350 volts.	Same as Ref. No. 11.
FIRE PROTECTION (Other than City)	Chemical carts and hand extinguishers.	One 75,000-gallon water tower, three 1,000-g.p.m. pumps, hose, and watchmen.	Same as Ref. No. 11.
REMARKS	concrete-capped, mooring dolphins at rear of face, connected by a 4-foot, timber and steel catwalk which continues 1,100 feet to shore. One 30-, two 12-, and one 10-inch, submerged lines extend from wharf to the following storage tanks: Delaware Terminal Co.: 2 heated, steel, storage tanks, total capacity 500,000 barrels; and 3 unheated, steel storage tanks, total capacity 219,000 barrels. The Sico Co.: 24 steel storage tanks, total capacity, 357,150 barrels.	-	One 12-inch pipeline extends from wharf to 2 steel storage tanks at rear, operated by ICI United States, Inc., total capacity 3,000,000 gallons. Approximately 80 acres of paved and 10 acres of unpaved, open storage area at rear; additional open storage area for approximately 300,000 tons of gypsum rock is located at Georgia-Pacific Corp. plant in rear. Rear section of Transit Shed No. 2, designated Warehouses A and B (S.W. Ref. No. 1), and Warehouses C and D (S.W. Ref. Nos. 2 and 3, respectively), are also located at terminal in rear.

Exhibit III-7. Piers, Wharves, Docks and Storage Warehouses - Wilmington, Delaware (Continued)

Storage Warehouses

OPERATOR AND ADDRESS	The Port of Wilmington Marine Terminal P. O. Box No. 1191 Wilmington, DE 19899		The Port of Wilmington Marine Terminal P. O. Box No. 1191 Wilmington, DE 19899		The Port of Wilmington Marine Terminal P. O. Box No. 1191 Wilmington, DE 19899	
BUILDING DESIGNATION/S	Warehouses A and B.		Warehouse C.		Warehouse D.	
LOCATION	At foot of Christina Avenue (P.W.D. Ref. No. 12).		At foot of Christina Avenue (P.W.D. Ref. No. 12).		At foot of Christina Avenue (P.W.D. Ref. No. 12).	
KIND OF STORAGE	Dry and cold.		Dry.		Dry.	
COMMODITIES USUALLY STORED	General merchandise and perishable food commodities.		General merchandise.		General merchandise.	
DESCRIPTION Type of Construction	Two buildings - steel frame, brick walls; concrete floor.		Steel frame, part concrete, part metal-covered and part glass block walls; concrete floor.		Steel frame, part concrete, part metal-covered walls; concrete floor.	
Number of Floors	One, each.		One.		One.	
Clear Height for Storage (Feet):						
First Floor	17, dry storage; 12, cold storage.		20		40	
Other Floors	-		-		-	
Load Capacity (Lbs/Sq Ft.):						
First Floor	500		500		500	
Other Floors	-		-		-	
AREAS FOR PUBLIC STORAGE:	DRY STORAGE	COLD STORAGE	DRY STORAGE	COLD STORAGE	DRY STORAGE	COLD STORAGE
General Storage (Sq.Ft.)	60,000		136,000		144,000	
U.S. Customs Bonded (Sq.Ft.)		See Remarks.				
Cooler Space (Cu.Ft.)						
Freezer Space (Cu.Ft.)						
Convertible Space (Cu.Ft.)		1,300,000				
RAILWAY CONNECTIONS	Four platform-level tracks between warehouses, total capacity 36 cars, join additional trackage serving terminal; connect with Consolidated Rail Corp., Chesapeake and Ohio Railway, and Baltimore and Ohio Railroad.		One 330-foot surface track along east side, and one 350-foot, platform-level track along south side, total capacity 13 cars, join additional trackage serving terminal; connect with the 3 tracks described under Ref. No. 1.		One 250-foot, carfloor-level track along east side, one 250- and one 360-foot, platform-level tracks along south side, and one 360-foot, platform-level track along north side, join additional trackage (Continued under Remarks.)	
TRUCKLOADING STATIONS	Approximately 42, each.		Seven.		Approximately 70, total.	
HANDLING EQUIPMENT	Twenty-seven, 2- to 7-ton, LP-gas, fork lift trucks.		Use of equipment described under Ref. No. 1.		Use of equipment described under Ref. No. 1.	
FIRE PROTECTION	Sprinkler system, one 75,000-gallon water tower, hose, hand extinguishers, and watchmen.		Same as Ref. No. 1.		Same as Ref. No. 1.	
REMARKS	Freon refrigeration system, temperature range -10°F. to 0°F. in freezer and 35°F. to 40°F. in cooler. Cold storage space is all U.S. Customs Bonded.		-		serving terminal; connect with the 3 tracks described under Ref. No. 1.	

Source: U.S. Corps of Engineers, "Port Series No. 8"

III.D.2 Other Facilities, Wilmington-to-the-Sea

The major commercial facilities south of Wilmington on the Delaware River are those of Getty Oil Company at Delaware City (opposite Pea Patch Island), the liquid caustic receiving and shipping operation of Diamond Shamrock Corporation, and, on the eastern or New Jersey side of the River, the wharves of DuPont's Chambers works. As a measure of the tonnage activity at these commercial facilities, the following table shows total tonnage handled for the year 1977 (data from Waterborne Commerce of the United States).

	Total Tonnage - 1977
New Castle, Del. and Vicinity	10,994,355 (Principally Getty)
Penns Grove, Carney's Point, N.J.	454,451 (Principally DuPont)
TOTAL	11,448,806

Additional facilities include two timber pile piers operated by Delaware Bay Launch service, Inc. and Delaware Bay Ship Chandlers, Inc. at Slaughter Beach in Sussex County. This mooring serves launches which transfer pilots, crew, and ships' stores from vessels at anchor. Two facilities, one on Pea Patch Island opposite Delaware City and the other in Delaware City, are under construction to serve excursion vessels operating between the two points and are owned by the State of Delaware. There is also a public wharf in Delaware City. About one half mile north of the twin spans of the Delaware Memorial Bridge on the Delaware side of the River there is Conrail's Pigeon Point Transfer Bridge for the transfer of rail cars to and from car floats. These car floats operate to DuPont's Transfer Bridge on the New Jersey side of the River. At the entrance to the Bay on the New Jersey side are the Terminal facilities of the Cape May/Lewes Ferry. On the Delaware side the ferry terminal is located at Lewes behind the Delaware Breakwater.

III.D.3 Philadelphia

Philadelphia is the major port in the Delaware River and Bay region and has the most extensive facilities for cargo handling. Philadelphia appears to be a port in transition from the older, traditional cargo handling methods -- a large number of finger piers serving small vessels by labor-intensive techniques -- to fewer marginal wharf configurations with modern automated handling methods. Some of the older finger piers have been allowed to deteriorate without repair or replacement -- a form of passive disinvestment -- and others have been converted in a creative, imaginative manner to alternative public uses. The attractive Penn's Landing project is in the center of the commercial waterfront and is an effective reminder of the Port's maritime heritage. Immediately south of Penn's Landing is Pier 305 (operated by Pier 30 Associates) which provides eight indoor tennis courts in a single deck shed.

General cargo facilities in the Port of Philadelphia extend from the confluence of the Schuylkill and Delaware Rivers at Gerard Point north to the berths of the Northern Shipping Company, about 1.3 miles above the Tacony-Palmyra Bridge. Of particular interest are the Packer Avenue and Tioga Avenue Marine Terminals and the Northern Shipping Marine Terminal. The Packer Avenue Marine Terminal, a Philadelphia Port Corporation property[1] leased to Lavino Shipping Company, is located immediately adjacent to and south of the Walt Whitman Bridge. This terminal covers 104 acres and has a marginal wharf 3,100 feet long. Container crane rails along the wharf have been extended to 1,923 feet to handle increasing container trade in longer containerships. At Packer Avenue, the world's first container/heavy-lift crane with a lifting capacity of 375 tons has been installed. This crane will increase port flexibility in handling these types of cargo. In addition to this new crane, there are two container cranes with all purpose capability, three truck cranes (up to 200 tons capacity) and a 75-ton mobile Le Tourneau crane. Storage facilities include three transit sheds totalling 270,000 square feet, two warehouses (200,000 square feet) and a refrigerated warehouse of 1,500,000 cubic feet. Packer Avenue also has an 817 foot roll on-roll off berth. Approximately 64 acres of paved, open storage are available at the terminal.

The Tioga I Marine Terminal is also a Philadelphia Port Corporation property[1] and is operated by ITO Corporation. It is located about one mile below the Betsy Ross Bridge. The marginal wharf face is 3,172 feet long, the roll on-roll off berth is 725 feet long and there is a lower slip berth 610 feet long. The Tioga I Marine Terminal also has two 45-ton container cranes, a 300,000 square foot transit shed and ninety-five acres of asphalt-paved open container storage. (In addition to breakbulk and containerized cargo, this facility is used to receive fuel oil and ship tar for the Philadelphia Gas Works.)

The Tioga II Marine Terminal is immediately south of Tioga I and is operated by ITO Corporation's Sea-Land Service, Inc. and DRT Industries Inc. Berth 1 (Sea-Land) was built for container service and has ten acres of open storage in the rear. Berth 2 has pipeline facilities for receiving and shipping petroleum products and other bulk liquids.

The Northern Shipping Company Terminal is located about 1.4 miles above the Tacony-Palmyra Bridge, and has nine berths for the receipt and shipment of general cargo and some bulk materials. This facility has approximately 120 acres of open storage, a transit shed area of 180,000 square feet, and is equipped with diesel, electric and mobile cranes.

While many of the finger piers are expected to retain their utility in future years, the wharves described represent the facilities most likely to play an increasing role in the future of the Port of Philadelphia.

---

[1]Owned by the City of Philadelphia, administered by Philadelphia Port Corporation.

As part of its planning process, and as previously noted, the City of Philadelphia authorized a port facilities study to be performed by the consulting firm of Tippetts-Abbett-McCarthy-Stratton (TAMS). Associated with TAMS in the preparation of the report was the Regional Science Research Institute of Philadelphia. The Final Report, Port Facilities Study of Philadelphia, was submitted on July 25, 1978. The following conclusions quoted from that report are pertinent to the present study.

- There is adequate break-bulk handling capacity in the City to meet forecasted 1990 requirements. The principal development need in the port is additional container handling capacity, totalling 1.4 million tons annually, by 1990.

- This can be provided most economically through further development of the City's existing two container terminals, and this recommended expansion program will satisfy demand for container cargo through the year 1990.

- During the course of their study TAMS also evaluated the need for, and the actions the City should take, with regard to bulk handling facilities, which includes facilities for the handling of grains, coal and ores. At the present time, they concluded that no major actions are called for by the City.

III.D.4 Camden

As of April 30, 1979 the South Jersey Port Corporation owned and operated or leased three major marine terminals at Camden. They are the Beckett Street Terminal and the Broadway Terminal which are located in the City and County of Camden, and the Holt Terminals which is located in Gloucester City. All three facilities have good highway and rail access. The Beckett Street Terminal (formerly Camden Marine Terminals), founded in 1931, was owned and operated by the South Jersey Port Commission, a State agency, which was dissolved in 1968 with the passage of the Act establishing the South Jersey Port Corporation, its succeeding State Agency. Title to facilities of the Commission was transferred to the South Jersey Port Corporation (SJPC) pursuant to the Act, with the State assuming the financial obligations of the Commission.

The purposes for the establishment of the South Jersey Port Corporation was to increase the economic development of the region and to initiate those improvements necessary to enable the Port to become viable.

The principal properties of the Beckett Street Terminal consist of approximately 58 acres of which 34 acres are used for open storage. At present the terminal is operated as a three-berth pier. Buildings on the property include two transit sheds and three warehouse sheds. The terminal is equipped with normal marine and materials handling facilities. While the terminal is quite old, it appears to have had sufficient maintenance over the years so that it is generally in good condition.

In 1970 expansion was undertaken with the purchase of the 175-acre north yard of the New York Shipbuilding Corporation and renamed Broadway Terminal. On July 1972 SJPC entered into a lease with International Operating Company of America, Inc. (ITO) to provide port services as an agent for SJPC. The graving dock was converted into two new piers. Fifteen acres of upland area were graded, drained and paved and a transit shed was built.

East of Broadway, in Gloucester City approximately 19 acres has been leased to Holt Terminals. This is all of the Gloucester City land owned by SJPC.

In addition, the City of Camden has expressed interest in the development of the Petty's Island back channel. A Congressional study resolution has been passed, but the study is not funded.

In 1968, initial cargo tonnage was 541,989 tons and the increasing trend has continued with cargo handled in 1978 totaling 1,450,000 tons.

Plywood, lumber, scrap, dry bulk, vehicles and general cargo, are the major commodities handled by the port.

The South Jersey Port Corporation has made considerable progress during its brief existence. The need for expansion at Beckett Street is pressing as the facilities at this location already have exceeded the maximum throughput capacity. It now plans to move forward with a program of expansion to be financed through an $11.83 million bond issue. The proposed expansion would substantially enhance SJPC opportunity for continued growth by providing facilities needed to attract and accommodate this growth.

Another agency concerned with waterfront activities is the Camden Municipal Port Authority (CMPA). This organization was created by the City of Camden by an ordinance adopted in February 1978 to promote and implement the development of waterfront facilities in the Camden area (so long as such facilities are not in competition with the South Jersey Port Corporation). The CMPA currently does not operate any marine facilities. It is, however, active in the construction of a refrigerated-freezer warehouse on property leased from the SJPC.

A further discussion of the maritime aspects of this study will be found in Chapter V, Sections "B" and "C." Section "B" covers Cargo Port Development, including the adequacy of present facilities, future improvement needs and agencies with jurisdiction. Section "C" is concerned with Deep Water (VLCC) Port Development and covers present conditions, attitudes regarding deep water facilities, and agencies with jurisdiction.

TERMS FOR KIND OF TRAFFIC

The terms applied to the kinds of traffic as found in these publications are explained as follows:

Pertaining to Ports

Imports and exports. - These terms apply to traffic between the United States and foreign ports, including the Canal Zone. Traffic of U.S. Great Lakes ports with Canada is supplemented by the term "Canadian" to differentiate it from overseas traffic.

Coastwise receipts and shipments. - These terms apply to domestic traffic receiving a carriage over the ocean, or the Gulf of Mexico, e.g., New Orleans to Baltimore, New York to Puerto Rico, San Francisco to Hawaii, or Puerto Rico to Hawaii. Traffic between Great Lakes ports and seacoast ports, when having a carriage over the ocean, is also termed "coastwise." The Chesapeake Bay and Puget Sound are internal bodies of water; therefore, traffic confined to these areas is "internal" rather than "coastwise."

Lakewise receipts and shipments. - These terms apply to traffic between United States ports on the Great Lakes System. The Great Lakes System is treated as a separate system rather than as a part of the inland system.

Internal receipts and shipments. - These terms apply to traffic between ports or landings wherein the entire movement takes place on inland waterways. Also termed internal are movements involving carriage on both inland water ways and waters of the Great Lakes; inland movements that cross short stretches of open waters which link inland systems; marine products, sand and gravel taken directly from beds of the oceans, the Gulf of Mexico and important arms thereof; and movements between offshore installations and inland waterways.

Local. - Movements of freight within the confines of a port whether the port has only one or several arms or channels, except car-ferry and general ferry, are termed "local." The term is also applied to marine products, sand, and gravel taken directly from the Great Lakes.

Intraterritory receipts and shipments. - These terms apply to traffic between ports in Puerto Rico and the Virgin Islands, U.S.A., which are consideredas a single unit.

Pertaining to Rivers, Federal and Private Canals, Connecting Channels, and Intracoastal Waterways

The terms "imports," "exports," "coastwise receipts," "coastwise shipments," "internal receipts," and "internal shipments" are used as at ports.

Upbound and downbound. - These terms are applied to movements within the confines of a river, intracoastal waterway, canal, or a segment of one of these channels as described in the "Section included" for each channel.

Inbound and outbound. - Traffic moving from one waterway into another is termed "outbound" in the case of the shipping waterway and "inbound" with respect to the receiving waterway.

Through traffic. - Traffic moving through a waterway to and from points on other waterways is termed "through traffic."

General Terms

Freight reported under the terms "car ferry" or "general ferry" is not directly included in the port or channel tonnage, but is separately stated and tabulated.

IV. INSTITUTIONS, PLANNING AND REGULATIONS

Preceding chapters review the history of the Bay, economic trends which have affected development of the Bay and its resources, uses of land along its shore, characteristics of current or planned ports, and trends in transportation. Government agencies have had a significant effect on these development trends. Federal dollars for interstate highways spurred auto and truck traffic and the demand for facilities to cross the Bay. Ports along the Delaware estuary have been built and modernized by public and private operators. The U.S. Army, Corps of Engineers, keeps the Delaware River channel open to shipping through near constant dredging.

The role of public institutions in the development of Delaware Bay is rapidly expanding. Regulatory agencies now articulate and enforce the new public concern for environmental quality. Public agencies have been created both to spur and to restrain growth and development. Innovative uses of the Bay may not offer the immediate profits which would attract the private entrepreneur, and numerous proposals have been advanced to spur these innovations with public initiatives. Because public institutions will play such an important role in determining the future course of Bay development, this chapter is devoted to an analysis of the institutions and their policies.

Section A summarizes governmental activities, including the most significant programs encouraging or controlling development of the River and Bay. In Section B, the most important regulatory agencies are examined in depth. The discussion of each agency includes information on:

- statutory authority
- agency jurisdiction (geographic and substantive)
- current organization
- controls or permits administered by the agency
- coordination with the activities of other agencies
- criteria for project approval
- critical problems for a project developer

Section C examines the governmental or quasi-public agencies actually chartered to build or operate port or transport projects in the Delaware River and Bay. For each agency, the text reviews agency charter and source of authority, geographic jurisdiction, and current operations and planned developments.

An abstract analysis of policies and jurisdications of different agencies would be a dry and often misleading work. A better understanding can be achieved by studying ways in which different agencies would react to a specific project in the Bay. Section D identifies a range of projects which have been suggested for the Bay in recent years and analyzes the expected interaction of different institutions in developing or controlling these projects. For each project, the analysis examines:

- the agencies which could assert jurisdiction to operate the project
- the relationship between the project and land use and planning goals articulated by the States and federal government
- permits required for development of the project
- conflict with current policies of permitting agencies
- expected bureaucratic overlap and disagreement
- changes which would be necessary for the project to proceed

This analysis leads to the identification of potential or needed improvements in the institutional structure. In some cases, a project is infeasible because it violates clearly stated policies of one or both States and the federal government. However, any recommendation for change in these policies is beyond the scope of this report. Therefore, Section E, Improving Institutional Coordination, identifies ways in which the charters, regulations, or operating procedures of different agencies might be improved to facilitate developments which are consistent with existing State and federal policies.

IV.A THE INSTITUTIONAL SETTING FOR PROGRAMS IN THE BAY AREA

IV.A.1 Port and Waterway Facility Programs

IV.A.1.a Ports

Four port agencies are chartered to operate ports in the Bay area. The Delaware River Port Authority created by New Jersey and Pennsylvania covers the counties on the New Jersey shore of the Bay but operates no port facilities anywhere in its jurisdiction. The Sourth Jersey Port Corporation created by the State of New Jersey includes Salem, Cumberland, and Cape May Counties in its jurisdiction but currently operates facilities only in the Port of Camden. The Port of Wilmington, operated by the City of Wilmington, provides the only publicly-owned port facilities within the study area. The Delaware River and Bay Authority, created by

Delaware and New Jersey, is empowered to operate transportation and terminal facilities in the Bay area but has not done so to date.

IV.A.1.b Dredging

The U.S. Army, Corps of Engineers, is responsible for the planning and maintenance of channels and navigation improvements in the Delaware River and Bay. It currently maintains a 40-foot channel from the ocean to the Ports of Camden and Philadelphia. It also maintains the 35-foot access channel to the Port of Wilmington on the Christina River. Numerous smaller access channels for ports along the Bay are designated as Corps of Engineers projects, thus permitting the Corps to maintain the stated depths, but none is funded at this time.

Disposal of over 4 million cubic yards of spoil produced each year by dredging of the existing Delaware River Ship Channel is a major political and environmental problem. One large area is now being used as the site for four nuclear power reactors in Salem County, New Jersey. The Corps must acquire new spoil disposal sites to meet needs after the exhaustion of current sites in 15 to 20 years. In Salem County, the existing commitment of river-front land to spoil disposal is an active planning issue. The Corps' Philadelphia District is currently conducting a dredged spoils disposal study. Environmental constraints also appear to prevent further deepening of the Delaware River Channel north of Wilmington. Cutting of a deeper channel would threaten salt water pollution of the aquifers which provide drinking water for much of the population of southern New Jersey.

In addition to dredging, the Corps controls all private dredging and the placement of dredged spoils, piers, bulkheads, or other obstructions in all navigable waters and adjacent wetlands. Under Section 10 of the Rivers and Harbors Act and Section 404 of the Federal Water Pollution Control Act, the Corps regulates placement of dredged or fill material in U.S. waters and adjacent wetlands. The Corps reviews permit applications for effects upon navigability, environmental, economic, aesthetic, flood prevention, land use, recreation, water supply, water quality, and other factors. Federal environmental agencies--Fish & Wildlife Service (F&WS), the National Marine Fisheries Service (NMFS), and the Environmental Protection Agency (EPA)--perform an environmental review of permits pending before final decision by the Corps. Any project opposed by these agencies on environmental grounds will not be approved by the Corps without resolution of the dispute at successively higher levels of the federal government.

IV.A.1.c Marinas and Launching Ramps

The State of New Jersey through its Department of Environmental Protection currently operates four public marinas, including one on the Delaware Bay at Fortescue. The State of Delaware operates no public marinas, but it has acquired a site originally designated for marina

development at Indian River inlet, south of Cape Henlopen. Each State maintains small boat launching ramps at sites along the Bay shore. Expansion of publicly-owned marinas is not contemplated at this time, and funds for expansion of launching ramps are limited.

IV.A.1.d Deepwater Offshore Ports

Under the Deepwater Ports Act of 1974, the U.S. Coast Guard, Department of Transportation, has jurisdiction over oil ports or terminal facilities on the Continental Shelf outside the three-mile limit of State jurisdiction. To be approved, any project must meet a number of economic and environmental criteria. First preference in construction and operation of any deepwater port is to be given to an agency of a State government. Consent by adjoining States is required before a project can proceed. Numerous proposals for deepwater ports offshore or in lower Delaware Bay have been advanced in the last decade. Both New Jersey and Delaware oppose a port in the Bay, and New Jersey is now (October 1979) initiating a study with the Port of New York Authority of a single offshore port to supply refineries in New York Harbor and the Delaware Valley.

IV.A.1.e Commercial Fishing

Prospects for the commercial fishing industries have improved greatly with the establishment of the 200-mile limit for American fisheries. The reduction of pollution in the Delaware River has improved oyster crops and fish catches on the Bay and makes possible more intensive production through mariculture techniques already being tested by research institutions in Delaware and New Jersey. No single public agency promotes the fishing industries in the Bay or offshore. Bay fisheries are managed by State fish and shellfish agencies, while the catch in offshore fisheries is regulated by the Mid-Atlantic Fisheries Council. The Delmarva Advisory Council (an economic development agency) has recommended fisheries development on the Delmarva Peninsula, and legislation has been introduced in the New Jersey Legislature to provide support for the expansion of the fishing industry in that State. To date, no funding source has been designated by either State or the federal government to provide financial assistance for all aspects of fisheries development in the region.

IV.A.2 Environmental Protection Programs

IV.A.2.a Protecting the Air

The Delaware Bay area is downwind (under normal summer conditions) of major air pollution sources in the Baltimore-Washington Metropolitan Area. In addition, prevailing westerly winds carry air pollutants generated further west over this area. The Wilmington area, including New Castle County, is subject to a number of environmental controls designed to protect air quality. Information on the quality of the air in the lower Bay region is more sketchy, but there is evidence that air quality

may reach unacceptable levels during peak summer traffic periods on the Jersey Shore.

The State implementation plan submitted by New Jersey on December 29, 1975, in compliance with the requirements of the Federal Clean Air Act reported that the entire State of New Jersey had attained federal standards (both primary and secondary) for concentrations of sulfur dioxide and nitrogen dioxide. Standards for ozone concentration were generally not attained throughout the State. Carbon monoxide concentration requirements were also violated in at least 16 major business districts. Suspended particulate levels met the federal primary (health) standard, but exceed the secondary (welfare) standard in the industrial corridor on the west side of New York Bay and in the cities of Camden and Bridgeton.[1]

Because of the dominance of problems with ozone and carbon monoxide concentrations, the New Jersey implementation plan tries to reduce vehicle emissions and increases use of public transit. New Jersey already requires annual inspection of automotive pollution control devices and is considering a requirement that auto sales be restricted to vehicles with "California type" emission control systems. High traffic volumes along the ocean corridor do create air quality problems, and the State plan includes recommendations for improved public transit to beach resorts to reduce private vehicle usage. Improved public transit is emphasized particularly for the increasing number of visitors to Atlantic City casinos.

New controls on industrial emissions of volatile organics are included as part of the New Jersey strategy to reduce ozone concentrations. While this could affect the costs of the petroleum and petrochemical industries in the Delaware Valley, air pollution conditions in New Jersey do not impose extraordinary requirements on industries not found in other polluted industrial areas. The State is reluctant to require new industry in non-attainment areas to do more than meet national emission standards for fear of further loss in the State's industrial base. The State has been aggressive in urging EPA to take steps against upwind pollution sources (Washington, Baltimore, Philadelphia) which increase pollution concentrations in the air blowing across New Jersey.

Air quality in Delaware is also adversely affected by pollutants generated outside State borders. Photochemical oxidants (ozone) exceed federal standards where they are monitored, and Delaware is assumed, like most of the Northeast, to require measures to reduce these concentrations. Air quality data from Kent and Sussex Counties are limited, but the State Implementation Plan of 1978 assumed that no new actions were necessary to reduce concentrations of sulfur dioxide, carbon monoxide, or nitrogen dioxide. Because of problems with the location of monitoring devices,

[1] The Bridgeton problem is thought to be a localized effect resulting from a single plant.

parts of Wilmington and Newark were "unclassifiable" with respect to suspended particulates and might require further remedial actions.

Emphasis in the State Implementation Plan is placed on the need to reduce photochemical oxidants, particularly in New Castle County. Improved public transit, vehicle emission control inspection, and controls on industrial sources of volatile organics (including petrochemical plants and uses of volatile coatings) are elements of the recommended control strategy. Although the economic impact cannot be determined without considering a particular plant, these controls may increase the cost of petrochemical plants when compared with location in an area without a petrochemical oxidant problem. Since the ozone problem is widespread throughout the Northeast and occurs elsewhere--Metropolitan Philadelphia, for instance--such controls should have little effect on local siting decisions.

IV.A.2.b Protecting Water Quality

Under the Federal Water Pollution Control Act, the U.S. government maintains a nation-wide program of permits limiting the amount of pollutants which can be discharged from any point source into any waterway of the United States. In the State of Delaware, the administration of this program is delegated to the State government. In New Jersey, however, the State has not yet assumed administration of the National Pollution Discharge Elimination System (NPDES) program, so any pollution source in New Jersey requires permits separately issued by the federal government and the State government.

The ability of the Delaware River and Bay to dilute or accommodate pollutants is limited. The Delaware River Basin Commission, as the interstate agency responsible for management of water quality in the Delaware Basin, allocates pollution loads. All new treatment plants which discharge 50,000 gpd of treated wastes or more are reviewable by DRBC. Major facilities located on the River and Bay must meet standards set out in the DRBC water quality plan and in federal and State regulations. The water quality standards for segments of the River and Bay within the DRBA region are shown in the attached Table IV-1.

Evaluation of the effect of water pollution controls on future development is difficult. As can be seen, the River and Bay are expected to support natural fish populations and permit water-contact recreation below mile 59.5. Any new industry will be required to install the pollution control technology called for in National EPA guidelines for the particular industry. If the residual discharge after application of this technology would cause the water body to exceed the water quality objectives (or prevent reduction of pollution to these levels), the new plant may be required to install additional controls or it may be denied a discharge permit. Either action could kill the proposed development.

Table IV-1

Selected DRBC Water Quality Standards

River Segment	Protected Uses	Dissolved Oxygen (Min. 24 hr. Average)	Temperature	pH	Fecal Coliform (Maximum geometric average)
Pennsylvania-Delaware line (mi. 78.8) to Liston Point (mile 48.2)	Industrial water supply after treatment Maintenance of resident fish Passage of anadromous fish Maintenance of shellfish Recreation Navigation Wildlife	3.5 mg/l	86. F max. No more than 4. F above ambient Sept.-May 1.5 F	6.5-8.5	770 per 100 ml
Below mile 70.0	Propagation of resident fish	4.5 mg/l	above ambient June August		
Below mile 59.5	Recreation	6.0 mg/l			200 per 100 ml
Delaware Bay-Liston Point to Atlantic Ocean	Same uses as listed for first river segment	6.0 mg/l	85 F no more than 4 F above ambient Sept.-May; 1.5 F above ambient June-August	6.5-8.5	200 per 100 ml

Source: Delaware River Basin Commission

Whether or not additional industry can locate along the River and Bay depends on the amount and type of effluent released after treatment and the success of upriver polluters in controlling discharges so that the ambient water quality will not exceed the objective. While the petrochemical industry in the Delaware Valley has substantially reduced discharges to the River, major municipal polluters, such as the City of Philadelphia, are lagging behind in meeting clean-up requirements. The ability of the River above Liston Point to absorb the effluent from new industry will depend on the progress made upstream in controlling pollution. Any prospective development must be analyzed individually to determine the effect of residual pollution on water quality after application of control technologies.

Most of the Delaware Bay below Liston Point currently meets the water quality objectives--fish and shellfish are resident and do propagate. Any plant or new municipality with a treated discharge large enough to threaten these water quality goals in part of the Bay may be unable to obtain an NPDES permit. For most industrial facilities on the Bay, the effective limits to plant location are imposed by coastal siting and wetlands laws, not by water pollution control regulations.

IV.A.2.c Protecting All of the Environment

The National Environmental Policy Act requires an environmental impact statement for federal projects including those requiring permits that significantly affect the human environment. Any project affecting the waters or lands abutting the Bay would require two or more federal permits and would undoubtedly be subject to the requirements of the Act. Under regulations for environmental impact statements issued by the Council on Environmental Quality, the Corps of Engineers is most likely to be named the lead agency for Delaware Bay developments other than a bridge or offshore port, for which the U.S. Coast Guard would be named lead agency.

IV.A.2.c.1 Protecting the Bottom of the Bay

Each State has direct control over use of the underwater lands lying within State boundaries. This control is directly traceable to early English common law, which gave the States sovereign control over underwater tidal lands. Under this power, States are able to lease the bottom for oyster beds or other uses. In both Delaware and New Jersey, any project which will use or disrupt underwater lands requires the permission of the State.

IV.A.2.d Protecting Wetlands and Shorelines

Under the Federal Water Pollution Control Act, placement of dredged or fill materials in aquatic areas or wetlands requires a Corps permit because of the effect such alteration would have on water quality. In New Jersey and Delaware, the control over wetlands alteration or destruction is much more direct. Each State has passed a Wetlands Act which

directly regulates encroachment upon tidal wetlands. Without a permit issued by the State environmental agency, any filling, construction, or other alteration of wetlands is illegal. Each State has adopted a regulatory policy which places a very heavy burden of proof upon a developer to show that a development is totally dependent upon use of the particular wetland and that environmental effects will be minimal. In general, any project which could be built elsewhere will not be approved in a wetland. This policy is paralleled by the federal environmental agencies which comment on Corps of Engineers' permits for wetland alteration.[1] The Delaware River Basin Commission has adopted policy regulations on wetlands protection which are generally supportive of State legislation.

IV.A.2.e Protecting the Beaches

Both Delaware and New Jersey have programs for the restoration and preservation of beaches. These programs include planting of beach grass and other efforts to stabilize dunes, public-works programs to control beach erosion in storms, and efforts through planning to prevent developments which would threaten barrier beaches. Storm damage on the Atlantic Coast of both States and on the lower bay shore in Delaware has been accentuated by construction of second homes and other structures which breach the integrity of the barrier dunes.

Delaware's Beach Preservation Act of 1972 specifically controls private development along the beachfront. A building line is established by the Department of National Resources and Environmental Conservation (DNREC) along the landward toe of the primary dune. New buildings on the seaward side of this line are prohibited unless the plot was subdivided prior to the effective date of the Act and contains insufficient space to construct the building inland of the building line. Any structure such as a jetty, bulkhead, or groin which may affect beach erosion requires a permit from DNREC. Buildings crossing the line are permitted on small plots subdivided prior to the law only with the approval of DNREC.

Although some Atlantic Coast resorts have been badly damaged in past storms, Delaware has been reluctant to enter into the large scale beach protection public works program proposed by the Corps of Engineers. Initial cost is estimated at $32 million, but State analysts have concluded that the project may cost as much as $200 million to maintain over a 50-year lifetime. They prefer to control erosion through building limitations and low-cost programs such as planting of stabilizing grasses. A small experiment is underway in three Delaware Bay beaches to compare the effects of limited erosion control programs in these areas with the erosion of three other beaches not included in the experiment.

---

[1] The policies detailed are a part of the Corps' regulation and applied by the Corps in deciding on permit issuance or denial.

New Jersey does not have a direct statutory control such as the Beach Preservation Act in Delaware, but it does have a Shore Protection Program within the Division of Coastal Resources, Department of Environmental Protection. This office administers a $20-million, 5-year bond issue approved by New Jersey voters for shore protection in 1977. Property owners receiving assistance under the bond issue must provide public access to the protected beach. State policy articulated in the Coastal Zone Management Plan prohibits expanded or rebuilt development on barrier beaches unless the development is publicly funded or has no prudent or feasible non-beach location. This policy is similar to Delaware's, but enforcement will be indirect. The State will deny a CAFRA (coastal facility siting) permit or riparian permit to any project which proposes beachfront structures in violation of this policy. The control is incomplete, because individual private homes which do not cross the tide line with bulkheads, docks or other structures would not require either permit.

IV.A.2.f Protecting Wildlife

Large areas on either side of the Bay, particularly the wetlands in the middle Bay, are owned by the State and federal governments and operated as wildlife refuges. The federal agency which controls U.S. wildlife refuges (the Fish & Wildlife Service) is also one of the key environmental agencies in commenting on federal permits. In reviewing any development in the Bay, the agency can be expected to react negatively to a development which would threaten these wildlife preserves, which are a key link for migrating waterfowl on the Atlantic flyaway.

Much friction has been generated in recent years by the conflict between certain development projects and the requirements of the Endangered Species Act. The presence of endangered species in the Delaware Bay, notably the bald eagle found in the national wildlife refuges and certain species of sturgeon has been noted. Any significant development would have to be located to avoid the nesting, spawning, and feeding areas of these species.

IV.A.3 Land Use Planning

IV.A.3.a Coastal Zone Management

New Jersey and Delaware both have Coastal Zone Management Programs funded under the Coastal Zone Management Act (PL 92-583). In Delaware, the entire State has been designated as a coastal zone planning area. This decision was made by the State government because so much of the State is clearly in the coastal zone, and an independent State land use plan would largely overlap the coastal zone plan. New Jersey will have two separate coastal zone plans. One for the ocean and Bay north to Pennsville is completed. A second plan for the River north of Pennsville and for the industrialized area of the Raritan Bay and New York Harbor will be developed from a report on options for the developed coast published in 1979.

Each coastal zone plan emphasizes the need to preserve the Delaware Bay wetlands and the quality of the recreational opportunities at Atlantic beaches. In neither State does the Coastal Zone Management Plan become a control in itself; each uses its plan to guide development, relying upon wetlands permits, dredge and fill permits, riparian or subaqueous lands control, coastal facility siting permits, and local zoning to control development. The policies and priorities stated in the coastal zone plans should be reflected in the decisions made in these permit programs. Each plan seeks to concentrate development in pcpulated areas north of the Delaware Bridge and in inland population centers such as Vineland, Millville, Salem, and Dover. Destruction of wetlands or filling of shallow waters for industrial projects is contrary to the coastal zone plan in each State.

IV.A.3.b Controlling the Siting of Coastal Facilities

Each of the Delaware Bay States has passed legislation controlling development in the coastal zone. In Delaware, this law (Coastal Zone Act) applies to the entire coastline with certain exceptions for the Port of Wilmington. Because the Delaware State line extends to the eastern bank of the river within a 12-mile radius of New Castle, the Delaware Coastal Zone Act affects development in portions of Gloucester and Salem Counties in New Jersey. The New Jersey law (Coastal Area Facilities Review Act) exempts the Delaware Bay shoreline north of Pennsville.

Restrictions in the Delaware law are absolute. Bulk terminal facilities (except in the Port of Wilmington) and heavy industry are barred in the coastal zone. Additions to existing industrial facilities or new light industry in the coastal zone require a permit showing that the project is not inconsistent with the Act.

The New Jersey law is both more extensive and less restrictive. In addition to industrial developments, the Act requires permits for large non-industrial development, such as sub-divisions and major highway improvements. On the other hand, it does not absolutely bar heavy industry in the coastal zone, although the statutory purposes of the Act make it clear that the Legislature wished to discourage industrialization of the coastal zone. Coastal siting permits are required of any project in the coastal zone meeting the statutory criteria and are independent of wetlands, subaqueous land use, and dredge and fill permits.

IV.A.3.c Statewide Land Use Plans

These plans are not regulatory mechanisms per se but are intended to guide State policy in administering other regulatory programs and in distributing State funds for investment in public infrastructure (e.g., sewers and highways).

In Delaware, the Coastal Zone Management Plan is the State Land Use Plan. In addition to emphasizing preservation of the wetlands of the Bay in a natural state, this plan channels industrial development primarily to the north of the State, with limited industrial development allowed at Lewes and in the small urban centers in the south, such as Georgetown. The regulatory authorities discussed previously and the Coastal Zone State Land Use Plan are supplemented by three additional statutes. The Land Use Planning Act of 1978 is discussed below under local controls. Enforcement of the Erosion and Sediment Control Act is delegated to localities. The Natural Areas Preservation Systems Act specifies procedures for designating irreplaceable natural areas to be protected. Along the coast these areas are already defined and protected by existing State controls (wetlands, subaqueous lands, coastal facility siting).

The New Jersey State Development Guide Plan is a statewide document which explicitly states priorities for future development. This Plan clearly indicates the desire of the State to concentrate new industry in areas where population and public infrastructure already exist, rather than investing State funds in developing public services for industry and housing in undeveloped areas. The plan designates areas for growth and limited (low) growth. Along the Delaware Bay, only the northern region around the Delaware Memorial Bridge is designated as a growth area. The major cities in Cumberland, Salem, and Cape May Counties are also designated for growth, but the Plan specifically discourages growth in the agricultural areas surrounding these cities.

While providing for preservation of the Delaware Bay wetlands, the State Development Guide Plan also reflects New Jersey's recent concern with preservation of the Pine Barrens. Most encroachment upon the Pine Barrens has come from the north (Ocean County), and future pressure will undoubtedly be heaviest from the east, with development of resort gambling in Atlantic City. Governor Byrne's recent moratorium on Pinelands development and passage of the Pinelands Preservation Act by the New Jersey Legislature have indicated the State's intent to preserve the heart of the Pinelands in its natural state.

IV.A.3.d City and County

While State development plans provide overall guidelines for State regulatory and spending programs, they have no binding authority on local land use decisions. State statutes create municipal governments and grant them zoning authority over local land use.[1] These local

---

[1] In New Jersey, townships cover the entire area of the State, so zoning is essentially done at the local, not the county, level. In Delaware, county governments provide whatever planning or zoning controls which exist for land not incorporated into towns.

decisions are made by the county or town zoning commissions without any required approvals from State government. For most State permit programs, appropriate local zoning of a site is a pre-requisite to State approval. New Jersey has recently moved to require greater conformity between local planning and zoning decisions. It cannot override a local decision to approve a particular development for failure to comply with the priorities in the land use plan.

Localities may use zoning to encourage or discourage development. An interesting example of local attempts to use zoning to discourage development occurred in Rehoboth Beach, Delaware in 1976 when the electorate voted to annex to the town 60 square miles of Delaware territorial waters from Delaware Bay out to the three-mile limit. This initiative has not yet been tested in court and might not survive judicial scrutiny, but the attempt to annex this underwater land was clearly inspired by a local desire to prevent the location of an oil port anywhere in Delaware coastal waters.

In 1978, Delaware passed a Land Use Planning Act to improve State and local coordination in reviewing new developments. The law does provide for notice and comments to other local governments and State agencies affected by a major local planning or zoning decision. If a dispute arises over a proposed development, the law provides a procedure for resolving intergovernmental disagreements. Several major projects have already been reviewed under the new statute, and one project (a high rise in Sussex County) which did not follow the necessary notice procedures is being sued by the State for failure to adhere to the law.

The permutations and combinations of local controls affecting a specific type of development, in a specific town (or unincorporated area of a county), on a specific site are too numerous to detail in this analysis. Parameters controlled by local zoning laws, building codes, and licenses include:

- type of permissible use
- density of development
- height, setback, and land coverage ratios
- hazardous activities
- method of construction (building code)
- fire rating of structure
- location of flood plain
- access to sewage systems or permit for on-site disposal
- curb cuts and highway access
- fire rating of structure.

IV.A.3.e Regional Planning

The only general regional planning agency operating in the Bay area is the Wilmington Metropolitan Area Planning Council (Wilmapco), which covers Wilmington (New Castle County) and Salem County, New Jersey. South of this metropolitan area, all detailed planning is done on the county or local level. There is no formally-constituted agency for planning across the Bay for projects affecting Cape May, Cumberland, and Salem Counties as well as Kent and Susses Counties in Delaware.

IV.A.4 Other Significant Programs

IV.A.4.a Navigation Controls

The U.S. Coast Guard controls are important aspects of Bay development. Its control over navigation, including navigational aids, mooring areas, and use of Bay channels has an important impact upon commerce in the Bay area. The lightering area off Big Stone Beach is specifically recognized under Coast Guard regulations. The lightering area was increased from 3.2 to 5 square miles in 1974 in response to the five-fold increase since 1968 in the volume of oil lightered. A further increase to 13 square miles was proposed in 1978, but has not been issued as a final regulation. If the Coast Guard were to terminate permission for the lightering activity inside the Bay, oil companies would be required to import all oil in smaller tankers, unless a deepwater port could be developed offshore.

The Coast Guard also administers the authority assigned to the Department of Transportation to approve bridges over navigable waterways. Any crossing of the Delaware Bay, whether a bridge or a tunnel, or some combination, would require Coast Guard approval. Because of the large volume of traffic in the Bay, the Coast Guard would undoubtedly require a large span or tunnel crossing the ship channel.

IV.A.4.b Energy

The controls exercised by the federal government over offshore oil development could have an important effect on the future of the Bay area. The right to drill for oil offshore is controlled by the U.S. Bureau of Land Management and the U.S. Geological Survey, Department of the Interior. Oil companies bid on the right to explore the offshore lands controlled by the Bureau of Land Management, whose jurisdiction runs out to the edge of the Continental Shelf. Environmental constraints imposed on offshore oil leases can be an important factor in determining the course of oil and gas development.

Pipeline and terminal facilities developed to receive oil or gas produced in any offshore oil field would also require approvals from the U.S. Department of Energy. If a strike offshore were sufficiently large to justify a pipeline to Delaware Bay refineries, or if oil were piped onshore from a deepwater port, such pipelines would require federal

approval.* In addition, New Jersey has a Department of Energy with the power to coordinate and control the siting of most energy facilities within the State. The Delaware Energy Act of 1977 established an Energy Facility Siting Liaison Committee to assist in the resolution of siting disputes.

IV.B OPERATION OF MAJOR PROGRAMS, PLANNING, AND REGULATING ACTIVITIES IN THE DELAWARE RIVER AND BAY

IV.B.1 U.S. Army Corps of Engineers

IV.B.1.a Statutory Authority

The Corps of Engineers has traditionally been the primary federal agency responsible for construction and maintenance of public works on American waterways, including channels, locks, dams, levees, and other flood control and navigation projects. In addition to its responsibility for dredging channels in navigable waterways, the Corps was given authority under the Rivers and Harbors Act of 1899 to control the actions of private parties which would affect the navigable waters of the United States.

The purpose of the 1899 Act was to keep the navigable waters free of private encroachments and open to public navigation. Under Section 10 of the Act, a permit from the Corps is required for work and structures such as piers, bulkheads and breakwaters, as well as for dredging and filling. Any activity which affects the navigable capacity of a waterway requires a permit, even if it takes place outside the navigable channels.

District Engineers previously administered the permit program under §10 by establishing pier and bulkhead lines on navigable waterways. In general, any structure (pier, landfill, etc.) which did not cross the established line would receive a Corps permit. The only test applied to projects seeking Corps approval was the effect upon navigation. A project which did not restrict navigation was automatically approved.

In the late 1960's the Rivers and Harbors Act was revived as an instrument of federal policy to clean up the nation's waterways. Pollution discharges, including the discharge of dredge spoil, were defined as the dumping of refuse into a navigable waterway, thus requiring a permit from the Corps under the terms of the Rivers and Harbors Act. Environmental criteria were added to navigational considerations in reviewing permits for structures, dredging, and filling in navigable waterways.

---

*Including the Delaware River Basin Commission if the pipeline crossed the Delaware Bay or River or its tributaries.

Administrative and legal difficulties soon led to the replacement of the Rivers and Harbors Act as the prime federal mechanism for water pollution control. Passage in 1972 of the Federal Water Pollution Control Act (FWPCA) included §404, regulating dredge and fill operations in the waters of the United States. A permit is to be issued for such operations by the Corps through application of guidelines developed with EPA. The Administrator of EPA may prohibit the specification of any site as a dredge spoil disposal site whenever he determines that the discharge will have "an unacceptable adverse effect" on municipal water supplies, shellfish beds and fishery, wildlife, or recreational areas. Under §401 of the Act, any permit for the discharge of dredge spoil under §404 is subjected to certification by the State government that the proposal is not inconsistent with State water quality objectives.

The controls on dredge spoil disposal contained in §404 of the FWPCA are extended seaward by the Marine Protection Research and Sanctuaries Act of 1972 (the Ocean Dumping Act). The ocean dumping of dredged material requires a permit from the Corps of Engineers under §103 of the Act. Evaluation of a permit request is to be made by the Corps using the same criteria developed by EPA to guide the issuance of EPA permits under the Act for the ocean dumping of materials other than dredge spoil (such as sewage sludge or hazardous chemicals).

Creation of the §404 permit program under the FWPCA and the Ocean Dumping Act did not eliminate the requirement for a permit under §10 of the Rivers and Harbors Act for construction and dredging in navigable waters. The language of the FWPCA as amended in 1977 by referring to "the waters of the United States" clearly extends controls on placement of fill and dredge spoil to most waters and wetlands of the United States, except for a very limited exception for certain isolated lakes and inland wetlands not connected, directly or indirectly, to navigable waterways.

All of the Delaware River and By are subject to these controls:

- All piers, bulkheads, and other structures, and all dredge and fill activities require a permit under § 10 of the Rivers and Harbors Act.

- The discharge of dredge spoil or placement of fill in the Delaware Bay or any of its adjoining wetlands requires a permit under §404 of the Federal Water Pollution Control Act.

- Ocean dumping of dredge spoils removed from any project in the Delaware Bay requires a permit under §103 of the Ocean Dumping Act.

IV.B.1.b Jurisdiction and Current Organization

The Corps of Engineers is the only major federal agency handling environmental permits which has a single district office for the Delaware River and Bay area. The Philadelphia office processes all permit applications in the area of this study. However, the Corps office must coordinate comments from the following agencies on these permits:

- Environmental Protection Agency - Region II (New York) for projects on the New Jersey side; Region III (Philadelphia) for projects in Delaware and Pennsylvania.
- Fish and Wildlife Service - Annapolis, Maryland, field office for Delaware; Absecon, New Jersey, for New Jersey. Comments on endangered species come out of the Boston office.
- National Marine Fisheries Service - Oxford, Maryland, and Sandy Hook, New Jersey.
- State Governments of Delaware and New Jersey.
- Coast Guard (Governor's Island, New York) on the effect of proposed projects on the safety of navigation. The Coast Guard also specifies any markings or other navigational aids which must be included on structures permitted in navigable waters.

IV.B.1.c Current Organization

The District Office of the Corps currently provides a single application form, instructions, and environmental questionnaire for any project seeking a permit under §10 of the Rivers and Harbors Act, §404 of the Federal Water Pollution Control Act, or §103 of the Marine Protection Research and Sanctuaries Act. After the Corps determines that the application is complete, a public notice must be issued within 15 days. A 30-day public comment period is allowed, but the Corps usually allows all parties to comment up to the 75-day limit given to other federal agencies.

Applications to the Corps can usually proceed in parallel to application for necessary State permits. While some attempts have been made to unify permit reviews and public hearings with the Delaware wetlands permit program, the federal review is usually conducted separately from consideration of State permits. However, the Corps will not issue a permit until it has received notice that the necessary State permits have been issued. Pursuant to the Coastal Zone Management Act and §401 of the FWPCA, a federal permit cannot be issued if it is not consistent with State policy. Denial of a wetlands, subaqueous lands, or coastal siting permit is proof that the proposed project is inconsistent with State policy. In New Jersey, a water quality certificate under §404 is issued by the Division of Water Resources separately from the State permits

which the Corps also requires as pre-requisite (wetlands, coastal siting, subaqueous lands) to a §404 (FWPCA) and §10 (Rivers and Harbors Act) permit.

While State rejection of a project will prevent issuance of a Corps permit, opposition by the federal agencies does not necessarily preclude issuance of a permit. If another federal agency formally objects to a permit, the District Engineer initially responsible for permit issuance cannot issue the permit. A series of appeals beyond the District level is provided for the resolution of such interagency disputes. If the District Engineer finds that a project is in the public interest but is opposed by EPA, the F&WS, or the NMFS, he refers the case for resolution at successively higher levels of the bureaucracy. The issue can eventually reach the Secretary of the Army, the Secretary of Interior, or the Administrator of EPA. Such review procedures require great effort for the District Engineer and can receive only little attention from those at higher levels of authority. As a result, opposition by any federal environmental agency that cannot be resolved by negotiation or changes in the project effectively amounts to a veto, except in unusual circumstances where the development has strong political support at higher levels.[1]

To avoid confrontation during the permit process, the Corps encourages those who will need permits to discuss major projects early in the planning phase, before specific plans are drawn. The Corps will convene the responsible federal environmental agencies for this meeting so that the potential applicant may learn of the criteria which will be applied to the project. Also discussed at such a preliminary meeting are the questions which must be addressed if the project is of sufficient scope to require an environmental impact assessment under the National Environmental Policy Act.

Certain projects have minimal environmental impact, and have been allowed pursuant to permit regulations. These activities do not require any permit application. Included are:

- aids to navigation placed by the U.S. Coast Guard
- marine life harvesting devices such as crab and lobster pots
- repair of any currently serviceable structure constructed prior to the requirement for a §10 permit (no change in structure)
- structures in artificial canals, if the canals have previously been approved
- scientific surveys and instruments

[1] The Secretary of the Army is currently acting as the final arbiter of an interagency dispute over creation of a new oil refinery in lower Chesapeake Bay.

The regulations implementing Corps authority also provide for issuance of nation-wide permits to allow certain types of projects to proceed under limited conditions without the necessity of an individual permit review. Included in this permit class are dredge and fill and structural work ancillary to construction of a bridge approved by the Coast Guard, utility lines, bank stabilization work, repair of existing fills, and minor road crossing fills.

Any development process of any size occurring on the Bay or its fringing wetlands will undoubtedly require a full permit review by the Corps, the federal environmental agencies, and the State pursuant to the general policies for evaluating permit applications contained in 33CFR320.4. For many of the development projects discussed below, the Corps will be the lead federal agency in preparing an environmental impact statement.

IV.B.1.d Criteria for Project Approval

The language governing the approval of permits calls for a careful weighing of competing interests. Factors to be considered in determining whether or not a project is in the public interest include:

- conservation
- economics
- aesthetics
- general environmental concerns
- historic value
- fish and wildlife values
- flood damage prevention
- land use
- navigation
- recreation
- water supply
- water quality
- energy needs
- safety
- food production
- needs and welfare of the people

No project will be approved unless it is in the public interest. The regulations give priorities which the Corps will apply in evaluating the public interest. Particularly important is the review of alternative locations and methods to accomplish the objective of the structure or work. Each proposal must be analyzed in relation to the cumulative effect of existing and anticipated activities in the area.

Unnecessary alteration or destruction of wetlands is deemed contrary to the public interest by the regulations. The District Engineer cannot approve any project altering wetlands unless he concludes that benefits outweight the damage to the wetlands resource, and alteration of the wetlands is necessary to achieve the benefits, i.e., no alternative upland site or program could achieve the benefits.

The District Engineer is also instructed to give "great weight" to the views of the Fish and Wildlife Service and National Marine Fisheries Service on fish and wildlife considerations and views of the EPA on water quality. Any permit may be conditioned on measures to mitigate damages to fish and wildlife or to protect water quality.

IV.B.1.e Critical Problems for a Developer

For most projects in the Delaware Bay, other than a bridge or continuing source of air and water pollution, a permit from the Corps is the single most important federal approval. Administration of the two key permits --under §10 of the Rivers and Harbors Act and §404 of the FWPCA--has been integrated by the Corps. Because of the requirements for State certification under the Coastal Zone Management Act and §401 of the FWPCA, State approval is essential before any permit will be issued. While the Corps can nominally override an objection from the federal environmental agencies, these agencies can effectively tie up approval of a project (with rare exceptions), and a developer should be prepared to meet the conditions imposed by these agencies before he can build or dredge and fill in the waters and wetlands of the Bay.

IV.B.2 National Marine Fisheries Service (NMFS)

IV.B.2.a Statutory Authority

The NMFS performs two functions of importance to the Bay. It is the federal agency charged with research on ocean fishes, including estimates of the current stocks and maximum sustainable yield for most important food fishes. These estimates are used by the Regional Fisheries Management Councils in setting catch quotas and allocating unused stocks to foreign fishermen. This process, managed by the Mid-Atlantic Fisheries Council for fishing off Delaware and New Jersey, is crucial to the development of an expanded American fishing industry. Since the most desirable species of table fish for the American market are already fished to the limit, American fishermen must move into the species caught directly for foreign markets or develop new markets for underutilized species in order to expand significantly. The catch allocation, influenced by NMFS data and State Department pressures, will be an important influence on the future growth of fishing ports at the mouth of the Bay.

Of more immediate concern is the second role of the NMFS, commenting on federal permits, particularly Corps of Engineers permits. The Fish and Wildlife Coordination Act gives this role to the NMFS for all waters below the head of tide. Thus, the effects on the fish and shellfish of the Bay are evaluated by the NMFS, and their comments are given to the Corps. The NMFS is also responsible for implementation of the Endangered Species Act for all marine fishes and mammals.

IV.B.2.b Jurisdiction and Current Organization

Comments on Delaware Bay projects are handled by the Oxford, Maryland, laboratory and Sandy Hook, New Jersey offices of NMFS and sent to the District Engineer in Philadelphia. While the Oxford laboratory does research on crabs, oysters, and other bay species, fish of the open ocean are studied by the Woods Hole and Sandy Hook labs. Catch statistics for use in monitoring harvests and projecting yields are managed out of the NMFS laboratory in Gloucester, Massachusetts.

Despite the Fish and Wildlife Coordination Act, there is significant overlap between the environmental review agencies in the federal government. Theoretically, the only overlap should come with anadromous fish which migrate between tidal (NMFS) and non-tidal (F&WS) waters. However, salt water wetlands inundated by the tide are important bird habitats, so both the F&WS and NMFS are involved. EPA's mandate to review water quality effects extends to waters and wetlands within the purview of NMFS and the F&WS. As a result, all three agencies review the full range of effects on waters and wetlands in a tidal estuary like the Delaware Bay.

IV.B.2.c Controls or Permits in Effect/Relationship to Other Agencies

For projects in the Delaware Bay, the NMFS exerts its control through environmental review of permits issued by other agencies--not through permits of its own. While the service has a limited ability to do environmental impact research, the acquisition of any environmental data on a proposed project is the responsibility of the developer or sponsor. This is true whether or not the project requires an environmental impact statement. For certain small projects, NMFS may make environemtnal comments based upon past experience with similar projects. Otherwise, it provides available data to the developer and consults on the information which the permit applicant must develop before an NMFS recommendation will be provided to the Corps.

IV.B.2.d Criteria for Project Approval

Several endangered species of whale and turtle are occasional visitors at the mouth of the Delaware Bay, but foreseeable development projects would probably not be a threat to these species. Of more concern is the short-nosed sturgeon--a once profitable commercial species which is now designated as endangered. It survives in the Bay in small numbers. Young sturgeon have been found in cooling-water intakes at the nuclear power plant at Artificial Island. If the sturgeon spawning grounds are ever identified, the NMFS is likely to insist upon their protection from future development.

Any project which threatens the spawning and rearing grounds for a significant commercial species will be opposed by NMFS. The Delaware Bay marshes are an important link in the food chain leading to oysters, crabs, and commercial finfish, and any encroachment on the marshes is

opposed. NMFS normally opposes any project which affects significant beds of submerged vegetation or shellfish beds. This priority parallels 40CFR230.5 b (2(i), EPA guidelines for 404 permits, which states that disposal sites for dredged material shall not be designated in areas of concentrated shellfish production (see Exhibit IV-1).

The NMFS is normally opposed to any filling of subaqueous lands, even in industrialized sections of the river, if the land is being filled for purposes which are not dependent upon being on or adjacent to water or wetlands to serve its primary purpose. For this reason, the Service opposes the 200-acre fill on the Delaware River proposed by the Port of Wilmington. NMFS analysts are not opposed to expansion of the Port onto the riverfront but see no reason to fill land for storage space and warehouses which could be built on existing dry land. The necessary berths, NMFS analyst claims, could be obtained with a combination of pilings and floating piers without filling the underwater lands.

NMFS seeks to force the disposal of dredge spoil on uplands wherever possible and requires that any dredging project provide a guaranteed spoil disposal site. Where any encroachment on wetlands is permitted because an important activity must be located at the water's edge, the NMFS attempts to condition the permit on mitigating or compensating measures such as the restoration of previously degraded wetlands.

IV.B.2.e Critical Problems for a Developer

It is clear that the NMFS will normally oppose a permit for any project which threatens shellfish beds or spawning grounds or takes any wetland or subaqueous land for a purpose which is not entirely dependent on waterfront access. Any project should be designed and sited with these restrictions in mind. Marine structures should be floating or built on piles, so they disrupt the ebb and flow of the tide to a minimum extent. Significantly, NMFS analysts noted that Lewes might be a reasonable candidate for waterfront development because dredged material would be sand with minimal industrial contamination, and the dredge spoil could be disposed on upland sites or used in beach restoration projects and need not be disposed in wetlands.

IV.B.3 Fish and Wildlife Service (F&WS)

IV.B.3.a Statutory Authority

Responsibilities of the F&WS parallel those of the NMFS. The F&WS scrutinizes all activities which could affect birds, land mammals, or freshwater fish. Their concern extends to estuarine wetlands and species of fish which migrate across the tidal zone. The endangered species of most concern to the F&WS in the Bay region is the bald eagle. A few nests have been identified on the Bay in the past, and any major project which would create a risk for an active nest would undoubtedly be opposed, just as the Eastport, Maine, oil refinery has been blocked because of the threat to eagles nesting around Passamaquoddy Bay.

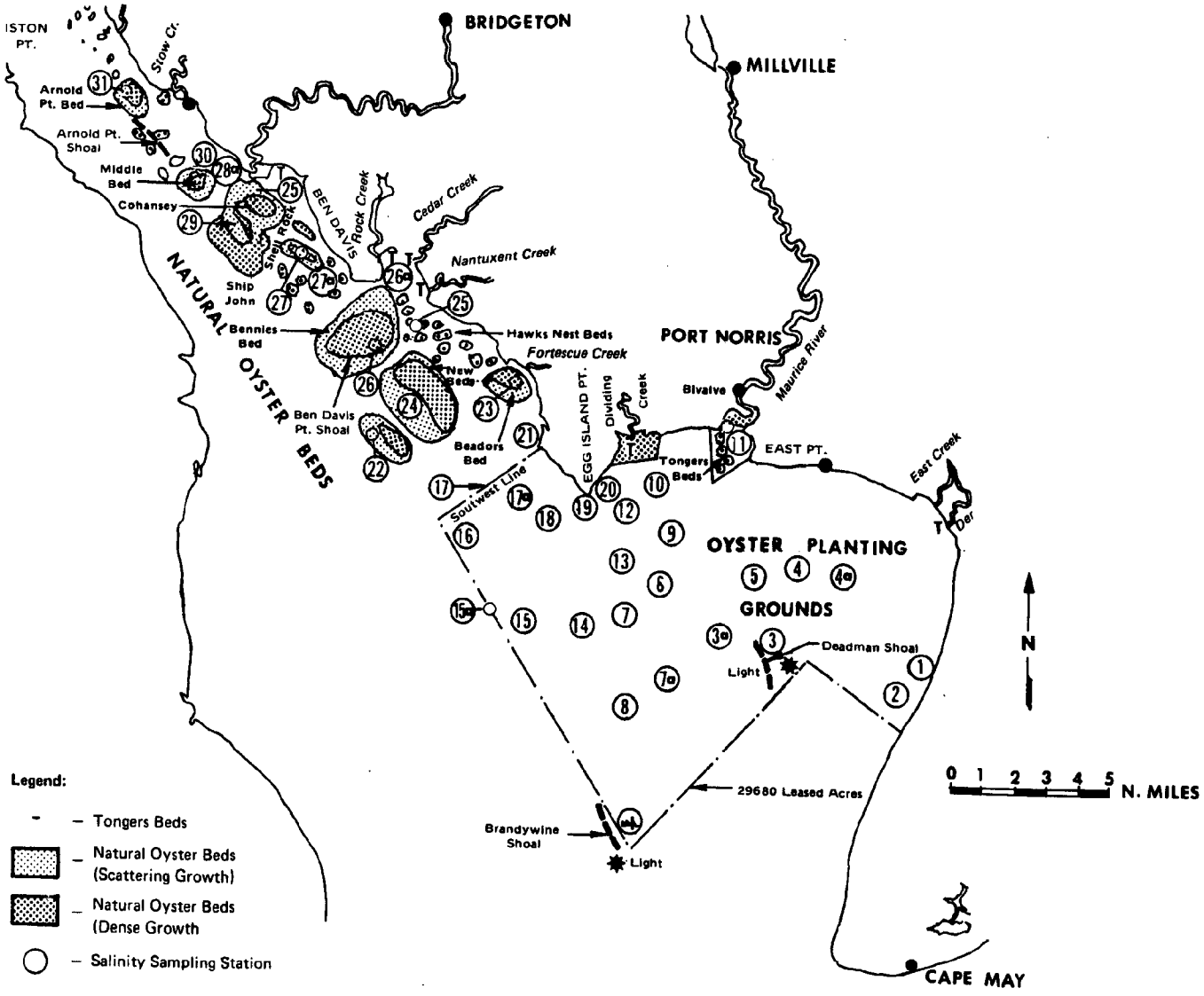


EXHIBIT IV–1
DELAWARE BAY
OYSTER BEDS ON NEW JERSEY SIDE

The F&WS is also designated as the prime agency for commenting on any action receiving federal funds or permits which would affect any of the lands managed by the Department of the Interior, including national parks, national monuments, and wildlife refuges.

IV.B.3.b Jurisdiction

The Ecological Service which handles all environmental comments within the F&WS has biologists stationed in Annapolis, Maryland, and Absecon, New Jersey.

IV.B.3.c Current Policies or Development

Extensive guidelines for the review of projects requiring Corps of Engineers' permits were published in the Federal Register by the Fish and Wildlife Service in December, 1975 (40 Federal Register #231). The goal of the F&WS is to "protect and preserve fish and wildlife resources, and protect public trust rights of use and enjoyment in and associated with navigable and other waters of the United States." The F&WS encourages developers to use every "possible means, method, and alternative (including non-development) to prevent harmful environmental impacts and degradation, and to restore habitat and increase opportunities for public use through proper development and land use control." Any structure approved should be water dependent and the least ecologically damaging alternative. Minimum disruption and reasonable mitigation and compensation measures are required.

Perhaps most important, the F&WS places the burden of proof on the permit applicant to demonstrate that the proposal is environmentally sound and in the public interest. In meeting this burden, the applicant for a permit must undertake any studies, sampling programs, or investigations necessary to meet his burden of proof. The F&WS guidelines emphasize the importance of early consultation between the agency and the developer. Reviewing biologists seek to have the developer explore a full range of options before committing to any project design. Biologists who review permit applications are concerned about the incremental effect of successive projects on both the productive wetlands and shallow waters and the quality of the recreational experience.

Comments on a proposed project are usually coordinated with State fish and game agencies. At this time, joint environmental analysis with affected State agencies is not a standard procedure, and State officials are not included in conferences with permit applicants in which the scope of an environmental impact statement is outlined or permit conditions are negotiated.

IV.B.3.d Critical Problems for the Developer

Despite the overlap which exists between the F&WS and the NMFS, the message for any development is clear:

- no destruction of wetlands or filling of shallow waters will be permitted without overwhelming proof of public benefit

- no structures or fill will be permitted for projects which do not depend on water access

- no filling or dredging will be permitted which endangers spawning grounds or shellfish beds

- no construction of marinas will be permitted in dredged dead-end basins or on channels which will require extensive maintenance dredging and disposal of spoil on wetlands or in Bay waters

IV.B.4 Environmental Protection Agency (EPA)

IV.B.4.a Statutory Authority

The Administrator of EPA exercises a statutory oversight function for dredge spoil disposal permits issued by the Corps of Engineers under §404 of the FWPCA. EPA also reviews water quality effects of all projects in navigable waters requiring a permit under §10 of the Rivers and Harbors Act.

EPA has overall responsibility for improvement in the nation's water quality under the FWPCA. This includes funding of the sewage systems and municipal treatment plants which are beginning to improve water quality in the Delaware River. The agency also sets effluent guidelines for all pollution discharges, municipal and industrial. When combined with water quality standards developed by the States, these regulations determine the amount of pollutants which can be discharged by a single source. The permit required for each discharge is issued and monitored by EPA under §402 of the FWPCA, unless a State is designated to perform this function.

Most states have water pollution control laws and permit programs which predated the passage of the FWPCA in 1972. Many have elected to administer the Federal (NPDES) discharge permit program to simplify the administrative process for dischargers in the State and to maximize the amount of State control available within EPA guidelines. Some States have chosen not to assume the extra burdens associated with the NPDES program and continue to administer separately a state discharge permit program while EPA issues NPDES permits.[1]

[1] At the time the report was written, the NPDES program had not yet been delegated to New Jersey, but the state intends to assume responsibility for the program in the future.

Any project which disrupts the bottom of the Bay or its wetlands will require a permit from the Corps, and EPA is one of the prime federal agencies commenting on the environmental effect of this permit. If the project will also produce a continuing discharge of pollutants into the Bay once in operation (for example, a fish processing plant), the operator must obtain an NPDES permit for this discharge.

IV.B.4.b Jurisdiction

EPA Region III (Philadelphia) handles the review of all projects requiring Corps permits on the Delaware side of the Bay. Certain NPDES permits for major installations, although written by Delaware, are subject to review by the EPA Region III office and cannot be issued if the Regional Administrator rejects any of the terms of the permit. Disputes between Delaware and EPA are relatively infrequent and have been resolved through State acceptance of the modifications required by Region III.

The EPA Region II Office covering New Jersey is in New York City. This office comments to the Philadelphia District Engineer on Corps permits. NPDES permits for continuing pollution discharges in New Jersey are issued from the Region II office.

The observer should note the number of federal offices which must be coordinated in an environmental impact statement for a major project. For a truly interstate project, such as another crossing of the Bay, two different regional offices for EPA and for the Fish and Wildlife Service must work together. Designation of lead agencies for the analysis could take some time in such a situation.

An additional agency to consider in reviewing governmental responsibility for water pollution control is the Delaware River Basin Commission (DRBC). This interstate compact agency (discussed in more detail below) is responsible for water quality planning in the Delaware River Basin. As part of this plan, it has adopted water quality standards for each segment of the Delaware and its tidal tributaries. Given the assimilative capacity of a stream, only limited quantities of pollutants can be dumped into each stream segment if water quality standards are not to be exceeded.

IV.B.4.c Current Policies on Development

Effluent requirements for an NPDES permit vary by type of source and are too diverse to review in this document. Any chemical or petroleum facility must develop a spill prevention, containment and control plan, in addition to reducing its regular discharge to acceptable levels. Spills of petroleum and hazardous chemicals are subject to fines under §311 g of the FWPCA. EPA policies applied to the review of Corps permits are essentially the same as those applied by the F&WS and NMFS. The degradation or destruction of aquatic resources by filling operations is considered the most severe environmental impact arising from a project requiring a permit under §404.

Any developer considering a project which will produce a continuing pollution discharge (industrial waste or sewage) must determine if he can dispose of his wastes with pre-treatment in a municipal sewage system. If a direct discharge to the waters of the River and Bay is indicated, the developer must determine EPA effluent guidelines for the discharge, water quality standards for the stream segment,[1] and the availability of a wasteload allocation sufficient for the necessary discharge.

IV.B.5 United States Coast Guard (Department of Transportation)

IV.b.5.a Statutory Authority

The U.S. Coast Guard serves many functions of importance to the future of the Delaware River and Bay. Coast Guard stations at Lewes and Cape May provide rescue services for mariners in the Bay. The Coast Guard builds and maintains all the aids to navigation which assist recreational and commercial traffic on the River and Bay. Under its powers to regulate navigation, the Coast Guard establishes traffic rules, including separation lanes for ocean shipping approaching the entrance to the Bay. Lightering activities off Big Stone Beach and the size of the lightering area are controlled by Coast Guard regulations. Ships entering American ports are now subject to some Coast Guard inspections, and U.S. registered vessels are subject to much more extensive controls on design, construction and operation. Coast Guard cutters enforce the new 200-mile limit protecting American fishermen. If an oil spill should occur, the Coast Guard would be responsible for supervising the clean-up efforts, perhaps using its mobile pollution strike force. Funds for any publicly supported clean-up would come from the contingency fund managed by the Coast Guard under §311k of the Federal Water Pollution Control Act.

Of particular interest to planners considering the future of the Delaware Bay area are two additional controls which the Coast Guard administers over bridges and offshore ports. The power to control bridges over navigable waters was transferred from the Corps of Engineers to the Department of Transportation in 1966. The Coast Guard now administers these controls. Plans for the bridge must be approved, and a bridge operator is required to change his plans so as not to "unreasonably" obstruct navigation. Tolls on the approved bridge are subject to approval of the U.S. Department of Transportation, unless the bridge is wholly within a State, or the tolls are prescribed by a contract with a State or municipality.

These controls (33USCA§491 et.seq.) make the Department of Transportation and its Coast Guard the lead agency in reviewing any new crossing of the

[1] See water quality standards for Zone 6, "Water Management Plan for the Delaware Basin." Waters must permit propagation of fish and shellfish.

Delaware River or Bay. The crossing must be designed to provide adequate horizontal and vertical clearance in existing channels to satisfy the Coast Guard that navigation is not endangered. Under the terms of the National Environmental Policy Act, the new crossing will require a full environmental impact statement, supervised by the Coast Guard. U.S. environmental agencies will be offered a chance to object to the harmful environmental effects of the construction and operation of the bridge and may be successful in persuading the Coast Guard to condition the bridge permit on specific siting or construction techniques. The environmental impact statement may lead to the conclusion that the potential public benefits from the crossing are outweighed by the environmental and navigational risks.[1]

Under the Deepwater Ports Act of 1974, the Coast Guard acquired responsibility for regulation of offshore ports located on the continental shelf outside State territorial waters--beyond three miles from the outer beaches. Congress passed the statute to regulate the location, ownership, construction and operation of deepwater ports. The Act carefully acknowledges the rights of States and communities to regulate growth, determine land use, and otherwise protect the environment. However, any deepwater port must obtain a Coast Guard permit, which amounts, in effect, to a franchise in a given area.

A deepwater port is defined as a fixed or floating manmade structure, other than a vessel, used or intended for use as a port or terminal for the loading, unloading and further handling of oil for transportation to any State. A licensed deepwater port cannot be used for transshipment of oil to other nations without the approval of the Secretary of Transportation.

The commercial implications of a deepwater port are considered in as great detail as the environmental consequences. The Attorney General and the Federal Trade Commission must determine that a deepwater port will not restrain trade. The impacts and benefits of a deepwater port must be compared with the impacts and benefits of ports within a State, proposed or existing. First preference in operating a deepwater port is given to an agency of State government or a multi-state agency. The Act specifically authorizes, in advance, interstate compacts to create deepwater ports. Second preference in operating a port is given to any person or corporation which is not affiliated with anyone engaged in producing, refining, or marketing petroleum. The last option for operation of a deepwater port would go to an oil company or consortium of oil companies.

To protect against the damages from an oil spill at a deepwater port, the Act imposes liability without fault of $150 per ton up to a maximum

---

[1] Vessels have collided with the Chesapeake Bay Bridge Tunnel and Lake Ponchatrain Bridge in recent years, causing serious damage and injury.

of $20 million for spills from vessels using a deepwater port. A clean-up fund of $100 million is established by the Act for spills occurring at deepwater ports. The fund is supported by a 2¢/barrel tax on oil transferred through a deepwater port.

Complaints that the Deepwater Ports Act would create an additional environmental review were met in drafting the Act with a statement that application for a Deepwater Ports license would be deemed an application for all necessary federal permits. The Coast Guard will coordinate distribution of the necessary information to other federal permit agencies. The Act does not pre-empt the power of coastal States to regulate shoreside facilities connected with the deepwater port. Adjacent States may charge the deepwater port operator a fee, subject to federal approval, to compensate for the economic cost attributable to the on-shore effects of the construction and operation of a deepwater port. The Governor of an adjacent coastal State can also veto a deepwater port under the terms of the Act.

IV.B.5.b Jurisdiction

All of the Delaware Bay and the Delaware River to Trenton lie within the Third Coast Guard District, which is based on Governor's Island in New York Harbor. Location of an offshore port, however, is an issue which will undoubtedly involve Coast Guard officials in Washington, D.C., because of the need to determine the service area in which the deepwater port would obtain an exclusive franchise. Would such a facility foreclose the possibility of a similar facility off New York Harbor or Norfolk, Virginia? What effects would the deepwater port have on existing onshore ports? What will the Attorney General and the Federal Trade Commission say about the anti-competitive effects of a deepwater port off the mouth of the Delaware Bay? These questions are difficult to answer, because deepwater ports have moved beyond the preliminary planning stages only in the Gulf of Mexico.[1]

A port built within Delaware Bay or anywhere inside a line three miles offshore of the Delaware - New Jersey coast and the line between the Delaware Capes is <u>not</u> subject to the Deepwater Ports Act, regardless of the depth alongside the terminal. Construction of such a facility would be regulated primarily by the Corps of Engineers, although the Coast Guard would prescribe navigation safety regulations for the facility and would regulate anchorage and lightering associated with the facility.[2]

---

[1] The Louisiana Offshore Oil Port (LOOP) has received a deepwater ports license and is under construction. A final environmental impact statement has been published for Seadock, Inc., off the Texas coast, but development is in doubt.

[2] In response to the Coast Guard's proposed expansion of the lightering area off Big Stone Beach, Federal Register, January 26, 1978, comments were received suggesting that the action was of sufficient consequence to require an environmental impact statement under the terms of the National Environmental Policy Act.

The project would be subject to all the coastal development controls in the State where it is located. Deepwater ports escape these coastal zone controls, but the States will regulate any onshore terminus of a pipeline from the deepwater port, and the Governor of an adjacent State can effectively veto a deepwater port which is contrary to State policy (for economic or environmental reasons).

IV.B.5.c Agency Operation and Policies

Projects of this magnitude--a cross-bay bridge or a deepwater port--are very infrequent occurrences. Much will depend upon the particular site, and the environmental impact statement. Both New Jersey and Delaware must be strongly committed to a project if it is to survive inevitable opposition. The Coast Guard is unlikely to approve a project which is not strongly favored by both States. A proposed deepwater port off of one State could be killed by veto of the Governor of the adjacent State. A strong coalition between the States must be mounted before seeking Coast Guard permits for a bridge or deepwater port.

IV.B.6 Delaware River Basin Commission

IV.B.6.a Statutory Authority

Following extensive litigation between the States of New York and Pennsylvaniz over water rights in the Delaware River watershed, all States with lands in the Delaware Basin joined with the U.S. governemnt in a Compact which created the Delaware River Basin Commission (DRBC). The Federal-interstate Compact between New York, New Jersey, Delaware, Pennsylvania, and the United States government was approved by Congress in 1961. Although the greatest stimulus for the Compact was the need to plan collectively for distribution of waters of the Delaware River to the member States, Section 3 of the Compact provides that the Commission shall "develop and effectuate plans, policies and projects relating to the water resources of the basin. It shall adopt and promote uniform and coordinated policies for water conservation, control, use and management in the basin." Under this authority, the Commission has developed a water code for the basin which sets water quality targets for 22 separate segments of the Delaware River system. In order to assure that these targets are met, a variety of projects which could affect the concentration of pollutants in the river are subject to review by the DRBC.

Projects requiring DRBC review include:

a. the construction of new water impoundments with a capacity exceeding 100 million gallons;

b. withdrawals from groundwater or surface water exceeding 100,000 gallons per month;

c. construction of a municipal sewage treatment plant exceeding 50,000 gallons per day in capacity;

d. direct industrial discharges to ground or surface water exceeding 50,000 gallons per day;

e. dredging of new channels on the main stem of the Delaware River and its tributaries;

f. a change in ground cover affecting groundwater infiltration over an area of 3 square miles or more;

g. liquid petroleum products pipelines operating at pressures over 150 pounds per square inch passing under, in, or across a stream in the Basin;

i. draining, filling or altering marsh or wetlands 25 acres or more in extent.

These reviews overlap Corps of Engineers, NPDES, or State permit reviews in many areas, although the threshold of concern for the DRBC is higher than thar for more federal or State permits. Federal agencies may forward projects requiring a DRBC approval directly to the Commission for review. Although the Commission works with environmental planning agencies in the member States, applications for approval by the DRBC must be made separately from applications for State permits. Commission approval is withheld until the necessary State permits have been issued.

In addition to its direct project approval responsibilities and role in commenting on federal environmental permits, the DRBC allocates wastewater discharge loads for each stream segment to the States which adjoin the stream. These allocations are based upon models of the River's capacity to assimilate pollutants without exceeding water quality targets. Thus, the DRBC indirectly affects the issuance of State water pollution permits by setting the water quality standards and distributing allowable wastewater loads.

IV.B.6.b Jurisdiction

The DRBC is responsible for water quality planning in all lands which drain into the Delaware River and Bay. The extent of this drainage basin and stream segments for purposes of water quality planning are

shown in Exhibit IV-2. All of the Bay below Liston Point is in one water quality planning zone. River segment 5 covers the main stem of the Delaware from Liston Point to the Delaware/Pennsylvania State line.

IV.B.6.c Agency Operation and Policies

The DRBC rarely leads the review of a project under the National Environmental Policy Act, preferring to defer to the Corps of Engineers or the Coast Guard in these matters. When a Commission approval is required, it can usually be issued within two months after the environmental impact statement is completed and the requisite State permits are issued. If the DRBC is required to prepare the environmental impact statement, lead time for the permit issuance runs from six months to two years from submission of complete data by the applicant.

Some potential conflict with State coastal plans is inherent in the Commission's position on the siting of power plants and facilities which discharge inorganic salts. The DRBC planners would prefer to see these facilities located on tidewater because of the reduced effect on freshwater quality. This might result in a preference for siting on the Bay shore designated for preservation under State plans. However, actual conflict is unlikely, because the DRBC, as a matter of policy, does not approve a project if the State where the facility is located opposes the project.

DRBC staff are concerned about the effects of channel dredging on the freshwater aquifers which underlie the River and Bay. Any deepening of the channel above Wilmington is not likely to receive DRBC approval. Even in the lower Bay, the DRBC would require extensive testing of the underlying aquifer before it would consider any dredging of a channel to supertanker depths.

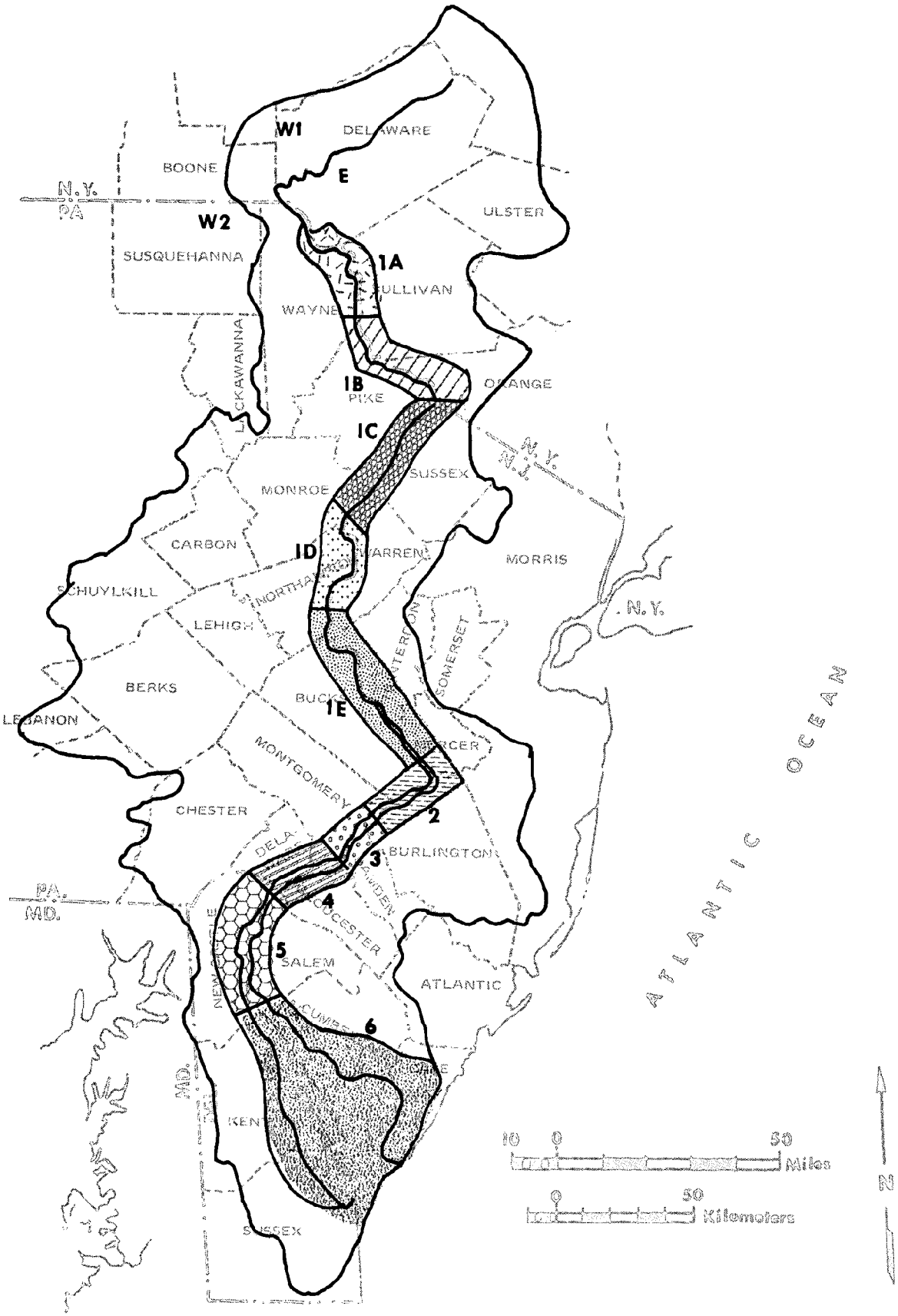
Control of tidal wetlands by the DRBC is not as extensive as that by the Corps of Engineers and State governments in the coastal areas.[1] The Commission generally supports the EPA and F&WS in protecting virgin wetlands, although projects in degraded wetlands located in developed areas might receive more favorable treatment in a DRBC analysis.

IV.B.7 Delaware Coastal Zone Act

IV.B.7.a Statutory Authority

In February, 1971, a task force on Marine and Coastal Affairs appointed by Governor Peterson recommended that industries incompatible with high environmental standards should be barred from the coastal zone of Delaware. Legislation based on this finding was introduced and passed

[1] Control over the filling of freshwater wetlands (25 acres or more) by the DRBC is greater than that in the laws of Delaware and New Jersey.



Source: Delaware River Basin Commission.

EXHIBIT IV–2

DELAWARE RIVER BASIN INTERSTATE ZONES

shortly after submission of the task force report, and Governor Peterson signed the Coastal Zone Act on June 28, 1971.

In its statutory purpose, the Act declares that it is intended to safeguard the use of the bays and coastal areas primarily for recreation and tourism, and to control the extent, location, and type of industrial development in Delaware's coastal waters. The Act seeks to "prohibit entirely the construction of new heavy industry in coastal areas, which industry is determined incompatible with the protection of the natural environment."

Offshore bulk transfer facilities are found to represent a significant danger of pollution to the coastal zone and generate pressure for industrial plants in the coastal zone. New heavy industry and bulk tranfer facilities are prohibited by the law. Other industrial activities may proceed if permits from the State are obtained. Prohibited heavy industries include those with a capacity to pollute "if mechanical malfunction or human error" occurs. Examples cited in the statute include oil refineries, pulp mills and chemical plants. Docking facilities for the exclusive use of a pre-existing industrial or manufacturing facility are permitted, despite the prohibition of bulk terminals. In 1979, the Act was amended to clearly exclude from the definition of prohibited heavy industry facilities of less than 20 acres which are used for the support of offshore research and exploration, including warehouses, storage areas, equipment repair shops, and similar support activities. Tank farms are still prohibited.

Continuing changes at existing non-conforming heavy industries created a problem in the administration of the Coastal Zone Act. To resolve the confusion, the State clarified the law by defining the expansion of existing users which would require a permit. Expansion or extension was defined to mean a change in existing "processes, facilities and building which significantly increases the production capacity, land use area or environmental impact." Repair and modernization projects which do not meet this definition of extension or expansion do not require a coastal zone permit. An applicant unclear about the status of a project may obtain an opinion from the Office of Management, Budget and Planning on whether a coastal zone permit is required.

IV.B.7.b Jurisdiction

The Coastal Zone Act is administered by the Environmental Policy Section of the Delaware State Office of Management, Budget and Planning (OMBD). One staff member is assigned to process coastal zone permits. The Delaware Coastal Zone Management Plan (under U.S. P.L. 92-583) is also drawn up by staff in the Environmental Policy Section of OMBP. Comment on the environmental impact of a proposed project is solicited from wetlands program, fish and shellfish, beach erosion and water pollution offices within the Department of Natural Resources and Environmental Conservation (DNREC).

The coastal zone covered by the Act runs from the limits of the State's territorial waters (the New Jersey State line or three-mile limit) inland to a line defined by the statute using State road maps. In general, the zone extends inland across wetlands to the first significant State highway and includes all significant beaches. The Port of Wilmington is excluded. The attached map (Exhibit IV-3) shows the geographic limits of the coastal zone. Prohibitions on bulk transfer facilities do not apply within the Port of Wilmington. Because the Delaware State line extends to the east bank of the Delaware River from some sections of New Castle County, waterfront projects on this section of the New Jersey shore are subject to review under the Delaware Act. This fact has caused considerable friction between States, and Salem County planners feel particularly aggrieved and disadvantaged by lack of cooperative interstate planning of New Jersey waterfront lands in Salem County.

An applicant aggrieved by denial of a coastal zone permit by the OMBP may appeal his case to a special Coastal Zone Industrial Control Board. This board has five appointees of the Governor. Members are balanced by party and county of residence. The Secretary of Natural Resources and Environmental Conservation, the Secretary of Community Affairs and Development, and the Chairman of the Planning Commission in each of Delaware's three counties also sit on the Board. The Board may overrule the original determination of the Director of OMBP, but it cannot approve a use prohibited under the Coastal Zone Act. The Board also approves regulations used in the administration of the Coastal Zone Program.

IV.B.7.c Program Operation

From June 1971 to December 1979, 115 projects were reviewed under the Coastal Zone Act. Ten permits for new manufacturing operations and 14 permits for expansion or extension of existing operations were granted. Seventy of the projects were determined to lie outside the authority of the Act and did not require a permit. One heavy industry project which reached the application stage was rejected. Nine applications for bulk transfer facilities were submitted. As of December 1, 1979, three were still under review.

Interest in the bulk transfer facilities prohibited by the Act continues, and the Attorney General of Delaware has offered the opinion that a deepwater oil port outside the State's territorial waters would not be illegal if the shore facilities (storage tanks, etc.) were located inland of the coastal zone. The pipeline crossing the coastal zone would not be a prohibited bulk transfer facility, although it would require permits for use of subaqueous lands or if it crossed wetlands or barrier beaches.

Granting of a coastal zone permit for an industrial use not banned by the statute involves the weighing of the economic benefits and environmental costs of the project. Benefits in terms of jobs and economic growth are projected by the applicant, and the State usually takes these benefits at face value because OMBP has no independent capacity for economic analysis of the application. The assessment of environmental losses is based upon

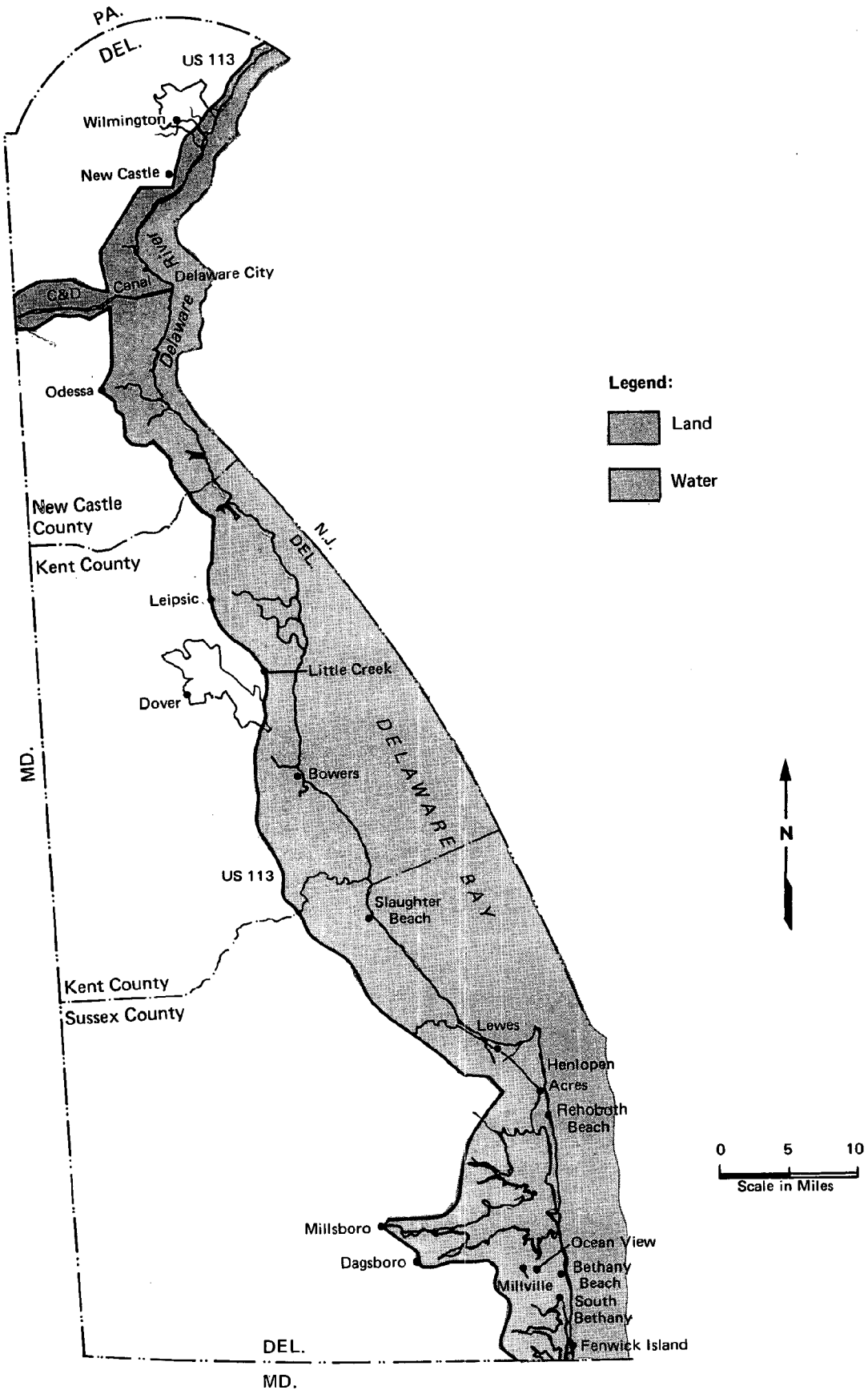


EXHIBIT IV–3
COASTAL ZONE OF DELAWARE

the comments of State environmental agencies and the experience of the planner assigned to coastal zone permits.

The principal objective of the Coastal Zone Act--prohibition of new heavy industry--has been achieved. Heavy industry may have been deterred from shorefront locations for reasons other than the strict controls implemented by the Act, but no heavy industry has been built on the shores of Delaware Bay since 1971. The Getty refinery at Delaware City, which predates passage of the bill, is the southernmost facility of the Delaware River petrochemical complex. Some clean, light industry, the kind desired by Governor Peterson's task force, has located in the coastal zone. The Maalox plant at Lewes is an example.

Although Coastal Zone Act administration is coordinated with coastal zone planning within the OMBP, the links to other State permits required in the coastal zone are more limited. Proof of appropriate local zoning is required before a coastal zone permit is approved. Environmental agencies are asked to comment on the permit applications. However, application forms and project review are still separate from DNREC permit reviews (wetlands, subaqueous lands, beach erosion) and Corps of Engineers permits.

IV.B.8 Coastal Area Facility Review Act (CAFRA) New Jersey

IV.B.8.a Statutory Authority

Passed in 1973, two years after the Delaware Act, the New Jersey Coastal Area Facilities Review Act represents a significantly different approach to the control of development along the coast. No facility is barred completely from the coastal zone, but a much wider range of facilities is subject to regulation, and the law is more specific in defining these regulated activities.

In the preamble to the bill, the New Jersey Legislature stated that it is "in the interest of the people of the state that all of the coastal area should be dedicated to those kinds of land use which promote public health, safety and welfare, protect public and private property, and are reasonably consistent and compatible with the natural laws governing the physical, chemical, and biological environment of the coastal area." The Legislature wished to "encourage development of compatible land uses in order to improve the overall economic position of the inhabitants of that area within the framework of a comprehensive design strategy which preserves the most ecologically sensitive and fragile area from inappropriate development and provides adequate environmental safeguards for the construction of any facility in the coastal area."

Any development included within the categories defined by the Act requires a permit from the Department of Environmental Protection. Developments covered by the Act include:[1]

---

[1]Summary list - statute is even more detailed.

- power generating stations;
- food (including fish) processing facilities;
- large waste incinerators;
- paper mills;
- major public works (roads, landfills, sewage treatment plants, airports);
- housing developments of 25 units or more (includes hotels and motels);
- organic chemical production;
- production of inorganic chemicals and salts;
- other chemical processes;
- storage and transfer facilities for oil and gas;
- metallurgical facilities (steel mills, aluminum smelters, etc.);
- marine terminal and cargo handling facilities.

Nuclear power plants are barred unless the Department finds that waste disposal will be safe and will comply with federal regulations. However, all plants currently planned for the Bay or ocean shore of New Jersey have received CAFRA permits.

The applicant for a CAFRA permit must submit an environmental impact statement which indicates the effect the project will have on the environment, unavoidable adverse effects, steps the applicant will take to minimize the adverse environmental effects of the project, and alternatives to the project with reasons for their acceptability or rejection.

A subsequent State court decision limits the alternatives to siting options, and does not require the developer to review fundamental policy changes beyond the developer's control.

To grant a CAFRA permit, the Commissioner of Environmental Protection must find that the project:

- has the requisite local zoning;
- conforms with air, water, and radiation emission standards and quality criteria;

- prevents pollutant discharges in excess of the dilution/recovery capability of the surrounding environment;

- produces the minimum feasible degeneration of underground aquifers;

- interferes with life processes of plants, animals, fish and humans to the minimum extent feasible;

- is located and constructed so that the project does not endanger human life or property or otherwise impair the public health, safety and welfare;

- will cause the minimum practicable degeneration of irreplaceable land types, historical or archaeological areas, and existing scenic and aesthetic attributes;

- will handle waste and litter properly to minimize adverse environmental effects and the threat to the public health.

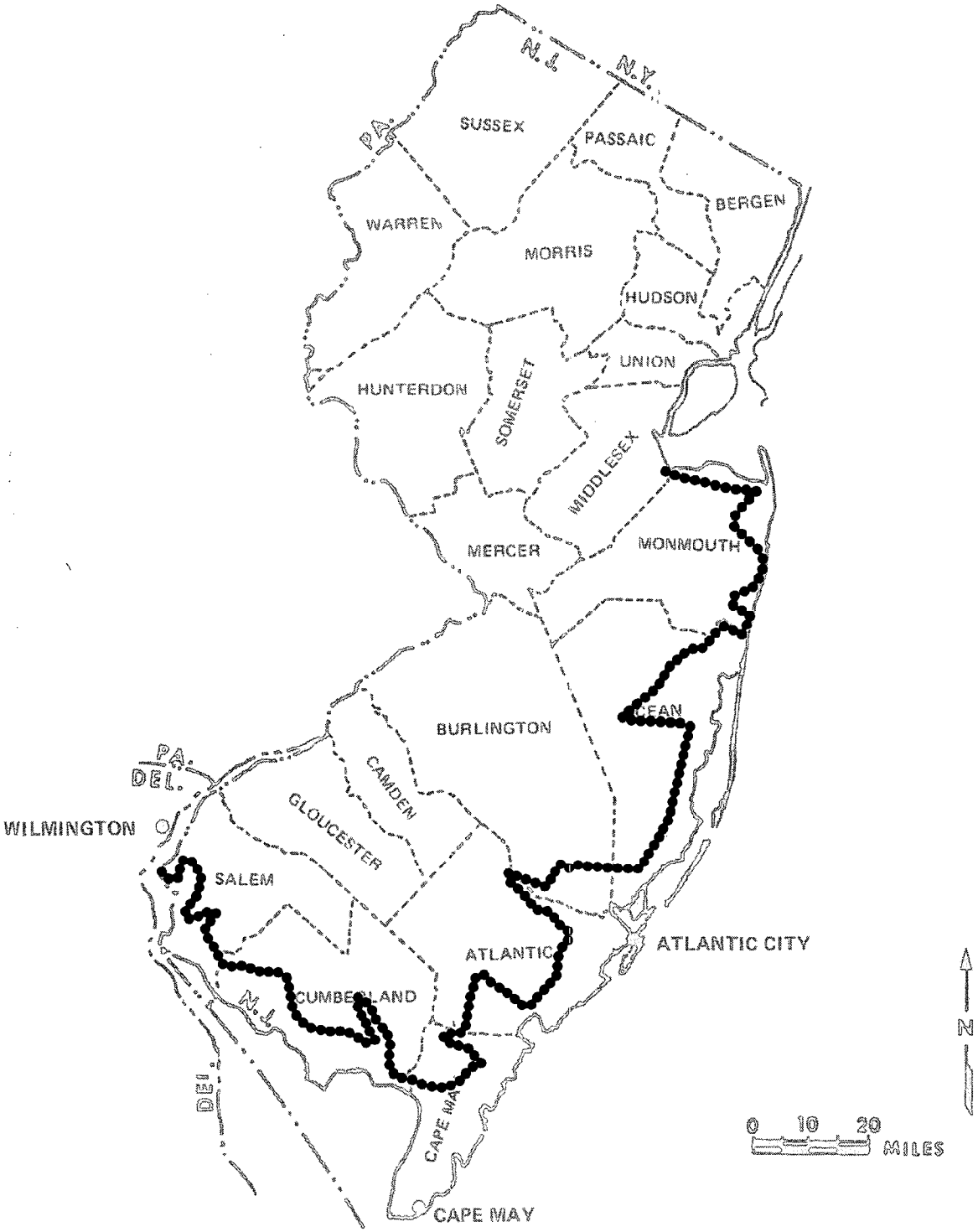
In addition to using these criteria, the Commissioner may also deny a CAFRA permit by referring to the intent of the Legislature stated in the Act. The legislation requires the Department of Environmental Protection to make an environmental inventory of the coastal area, including identification of existing facilities and land uses. This study is expected to estimate the ability of the coastal area to absorb man-made stress and lead to alternative management strategies and the delineation of areas appropriate for different types of development. The 1973 CAFRA Act gave four years for this study and the selection of environmental management strategies. Much of the required work is contained in the coastal zone plans created under the Coastal Zone Management Act, which is now being completed.

IV.B.8.b Jurisdiction

The New Jersey CAFRA Act specifically excludes the heavily developed areas of the State's waterfront from the requirement for a CAFRA permit. The boundary of the controlled coastal zone is shown in Exhibit IV-4. The Delaware River coast excluded from CAFRA control extends northward from Pennsville.

The CAFRA Act also attempts to streamline regulatory controls by exempting from the requirement for a CAFRA permit coastal wetlands controlled under the Wetlands Act. This exemption does little for a project covered by CAFRA which is to be sited partially in wetlands. This project would require both CAFRA and Wetlands permits.

The CAFRA Permit Program is managed by the Bureau of Coastal Project Review, Division of Coastal Resources, New Jersey Department of



Source: State of New Jersey, Department of Environmental Protection.

EXHIBIT IV–4
NEW JERSEY CAFRA INLAND BOUNDARY

Environmental Protection. This Bureau also has authority over Wetlands Act and riparian permits. A hearing is provided on the proposed application within 60 days of acceptance of a completed application. The permit decision is supposed to follow within 60 days of the public hearing. Pending CAFRA permit applications are listed in the weekly bulletin issued by the Department of Environmental Protection. On March 7, 1979, 14 applications were pending. The oldest had originally been filed in May 1978, but had been returned twice for additional information. All pending projects involved residential and commercial rather than industrial development.

An applicant aggrieved by denial of a CAFRA permit, or individuals or groups aggrieved by the award of a permit, may appeal the decision to the Coastal Area Review Board, composed of the Commissioners of Community Affairs, Environmental Protection, and Labor and Industry. This Board may rule on the basis of the existing record without granting a new hearing to the appellants. On May 7, 1979, 11 CAFRA projects had appeals pending.

Many projects requiring a CAFRA permit require additional permits for continuing pollution discharges and alteration of wetlands or submerged lands. The environmental review of large scale projects requiring multiple permits would be coordinated by the Office of Environmental and Historical Review, which reports to the Assistant Commissioner for Science and Research, Department of Environmental Protection.

IV.B.8.c Current Policy and Operations

Between the passage of the CAFRA Act in 1973 and May 3, 1979, a total of 222 CAFRA permit applications were reviewed. Only 22 projects had been denied, while another 27 were cancelled. Despite the relatively small denial rate, the law appears to have slowed the pace of development in sensitive coastal areas and increased the sensitivity of ecological decisions in the approvals. Residential and commercial projects which do not use up ecologically valuable areas and can be supported by existing infrastructure are usually approved. Permits have been granted for the first big casino projects in Atlantic City, although at least one approval was appealed by local environmental groups.

Examples of CAFRA decisions can be cited from a recent Department of Environmental Protection (DEP) publication. An 82-unit subdivision on undeveloped land in Cape May was denied a permit because it did not fill in existing development areas to reduce the need for additional infrastructure investment. The development was sited on agricultural land, and the State seeks to discourage the residential development of farm acreage. In another decision, DEP rejected a CAFRA permit application for 75 single-family homes on a 23-acre tract because the project would destroy an intermittent stream running through the land. The applicant was encouraged to redesign the project to consolidate the structures and protect the environmentally sensitive intermittent stream bed.

Since September 1978, CAFRA permit applicstions have been reviewed according to the location, use and resource policies contained in the Coastal Management Program - Bay and Ocean Shore Segment. Residential and commercial developments will likely be permitted within existing built-up coastal towns if they do not take wetlands or other sensitive areas. Major industrial developments and commercial and residential projects which produce further sprawl will be discouraged. Projects affecting wetlands, beaches, and underwater lands will be reviewed skeptically along the same lines used by federal environmental agencies --no project is likely to receive a CAFRA permit in these areas if there is any alternative upland site. New oil refineries are specifically excluded from the Bay area south of Pennsville by the Coastal Zone Management Plan, and new tank farms are to be located away from the coastal zone and populated areas. Review of energy facilities in the coastal zone is provided under the terms of an interagency agreement between the Department of Energy and the Department of Environmental Protection which seeks to harmonize the energy facilities siting authority held by the Department of Energy with the CAFRA Permit Program.

IV.B.9 New Jersey Wetlands Law

IV.B.9.a Statutory Authority

The New Jersey Wetlands Act became effective November 5, 1970, predating the Delaware Wetlands Act by approximately three years. Full enforcement of the provisions of the Act was delayed until 1972, when the DEP adopted the basic procedural rules for the program.

By passage of the Wetlands Act the New Jersey Legislature sought to preserve the "ecological balance of the area" (estuarine zone) and prevent its further deterioration and destruction by regulating the dredging, filling, removing, or otherwise altering or polluting of coastal wetlands. Any activity in a designated coastal wetland requires a permit from the DEP. Certain limited activities such as mosquito spraying and salt hay production do not require permits. In considering an application for altering wetlands, the DEP must consider the effect on public health and welfare, marine fisheries, shell fisheries, and the protection of life and property from flood, hurricane and other natural disasters. Any acitivity in a designated wetland (other than the brief list of exceptions in the statute) requires a permit. The Commissioner of DEP may also issue a general Wetlands order restricting or prohibiting dredging, filling, or other alteration of specified wetlands tracts.

In passing the Wetlands Act, the Legislature was sensitive to the charge that a strict Wetlands preservation program might constitute an unconstitutional taking of property from the owners of coastal marsh lands. For this reason, the statute contains a section which authorizes judicial relief if the court finds a Wetlands order or permit action to be an "unreasonable exercise of the police power." If the court makes such a finding, the order or permit action shall not apply. There is no intermediate appeals body created in the statute, and a wetlands owner

aggrieved by a permit decision by the Commissioner of DEP may appeal directly to the State Court. In important test cases, the New Jersey courts have upheld the Commissioner's power to impose rather broad development restrictions under the terms of the Act. In the leading case (Sands Point Harbor vs. Sullivan), the New Jersey Appeals Court found that the restrictions applied to the plaintiff's land did not constitute a "taking," because the only activities absolutely prohibited by the Wetlands order affecting the property were the dumping of solid waste, the discharge of sewage, and the storage and application of pesticides. In at least two other test cases, the New Jersey Courts have upheld development restrictions on wetlands as a valid exercise of the police power.

IV.B.9.b Jurisdiction

The New Jersey Wetlands Act applies only to coastal wetlands. The legislation is predicated on the finding that the "estuarine zone"--the area between the sea and the land--is one of the most vital and productive areas of the natural world. The Act covers all lands now or formerly connected to tidal waters, whose surface is at or below an elevation of one foot above extreme high water. The land must grow, or be capable of growing, some of 14 types of marsh plant listed in the statute.

The statute covers coastal marshlands on the Delaware River and Bay, as well as Atlantic coastal bays and rivers and the inland waterway. Property subject to the control of the Hackensack Meadowlands Development Commission is excluded from the jurisdication of the Act. All coastal marshlands north of Raritan Bay along the developed shore of New York Harbor are also excluded.

Administration of the Wetlands Program has been delegated by the Commissioner of Environmental Protection to the Bureau of Coastal Project Review, Division of Coastal Resources.[1] This section maintains detailed maps based on aerial photographs which show the exact location of all coastal wetlands subject to the requirements of the law.

IV.B.9.c Program Operation and Policies

In the first two months of 1979, the DEP issued decisions on seven wetlands permits, a level of activity far lower than that in the riparian permit program (see below) where 71 decisions were completed in the same period. There is little question that the combination of State and federal permits controlling encroachment on coastal wetlands has been effective in stopping shorefront residential community developers from altering wetlands. Builders have been deterred from proposing developments in coastal marshes, and this shift explains the relatively low

[1] A separate Bureau in the Division of Coastal Resources is responsible for the enforcement of permit conditions after issuance.

volume of permit activity in the Wetlands section. Because the Division of Coastal Resources manages CAFRA, wetlands and riparian projects, project review is coordinated, although separate permits are issued to comply with the terms of each law. For a major development, the CAFRA analysis would dominate, and a negative decision on issuance of the CAFRA permit would determine the result for wetlands or riparian permits.

New Jersey has a "90-day law" which requires issuance of a decision on wetland and other environmental permits within 90 days after required information has been submitted. This deadline is generally met. Wetlands permits are divided into two categories to further streamline filing of applications for minor projects.

Expertise in evaluating the effects of a proposed project comes from the staff in the Wetlands Office, as well as specialists in the Division of Shellfisheries and other units of DEP. The general policies applied to Wetlands permit decisions are very similar to those applied by the federal government under §404 of the FWPCA and are incorporated in the Coastal Zone Management Plan. Policies applying particularly to wetlands are as follows:

> "In general, development of all kinds is discouraged in wetlands, unless DEP can find that the proposed development meets the following four standards:
>
> (i) requires water access or is water-oriented as a central purpose of the basic function of the activity (for marshes on waterways);
>
> (ii) has no prudent or feasible alternative on a non-wetland site;
>
> (iii) will result in minimum feasible alteration or impairment of natural tidal circulation;
>
> (iv) will result in minimum feasible alteration or impairment of natural contour or the natural vegetation of the wetlands."

The ability of the State to enforce these development restrictions is now clear, and a developer must show that there are no alternative methods of achieving the proposed public benefits before a permit for alteration of wetlands will be issued.

IV.B.10 Delaware - Wetlands Act

IV.B.10.a Statutory Authority

Passage of the Delaware Wetlands Act occurred in 1973, two years after the Coastal Zone Act was passed. In the preamble, the Delaware Legislature determined that "the coastal areas of Delaware are the most critical

areas for the present and future quality of life in the State, and the preservation of coastal wetlands is crucial to the protection of the natural environment of the coastal area. It is declared to be the public policy of the State to preserve and protect the productive public and private wetlands to prevent their despoliation and destruction consistent with the historical rights of private ownership of land."

The statute reflects concern that the court might view some wetlands restrictions as a taking of private property, and the law allows two years for the State to acquire title or a conservation easement on wetlands if the court finds a regulatory ruling unduly restrictive. If the Secretary, Department of Natural Resources and Environmental Conservation initiates an attempt to acquire the wetlands or an easement within two years, an additional stay may be granted for negotiations. If no action is taken to acquire the land by the end of the two-year period, the developer who obtained the court ruling may begin construction of the project.

Certain minor non-destructive uses of wetlands are permitted by the statute--duck blinds, bird nesting boxes, the harvesting of salt hay. Any other project which would disrupt a wetland requires a permit from the DNREC. A permit applicant must show that he has proper local zoning. Staff at the DNREC then evaluate the application considering environmental factors, aesthetics, state, county and municipal plans for development and conservation, employment and tax effects. Court decisions have made it clear that the wetlands law does not permit Delaware to bar all development in certain marsh lands. Instead, the judgment must be based on an evaluation of competing environmental and economic interests.

IV.B.10.b Jurisdiction

The Delaware Wetlands statute applies development controls to all lands covered by the ebb and flow of the tide, or less than two feet above mean high water, which grow, or are capable of growing, some species of wetland plants.[1] Freash water bogs are covered by the law only if the land exceeds 400 acres in extent, is not currently used for agriculture, is covered by standing fresh water most of the time, contributes to ground water recharge, and would require artificial drainage for agricultural crops.

The law requires the DNREC to officially map and designate all wetland areas which meet the statutory definition and are protected by the law. Official maps are published by the State. The wetlands so designated are slightly less extensive than those covered by §404 of the FWPCA because Delaware has excluded previously filled wetlands and some fringe marshes along stream banks.

[1] The species are listed in the statute.

Persons aggrieved by DNREC decisions on Wetlands Permits may appeal to an Appeals Board created specifically by the Wetlands Act. The Appeals Board is composed of seven Delaware voters, at least two of whom must come from each of the State's three counties. The statute further provides for diversity in the Board's membership by requiring appointment of at least one farmer, one developer, one member engaged in recreational activities, and one member representating conservation interests. The Appeals Board must hold a public hearing on any appeal except for State-owned lands, and must issue a decision within 90 days if it is to reverse the determination of DNREC.

IV.B.10.c Current Policy and Operation

The Delaware Wetlands program is administered by one official in the DNREC, who also administers the State subaqueous lands program. Environmental evaluations of proposed wetlands alterations are received from other units of DNREC such as the Fish and Shellfish Division. The Wetlands program director reviews environmental impact statements required for the §404 (FWPCA) permit by the Corps of Engineers.

Estimated economic benefits from the proposed project are generally based upon the permit applicant's claim, because the DNREC has no independent staff for economic analysis. The regulations briefly summarize the biological productivity of coastal wetlands. These marshes produce nine tons of organic matter per acre each year, compared to 1 1/2 tons in a wheatfield. One thousand pounds of the phytoplankton that thrive in coastal marshes are necessary to produce one pound of a sport and food fish like the striped bass. Despite these assertions about wetland value, the program director reports that it is most difficult to compare the economic benefits of undisturbed marshland and proposed developments when reviewing a permit application.

A few alterations of designated wetlands are specifically prohibited in the regulations. These include:

- dredging of any channel through wetlands deeper than the existing or controlled depth of the connecting channel in a navigable waterway;
- dredging of dead end channels, unless such channels are equipped with an aerator or other means of meeting water quality standards;
- dreding of channels with a slope steeper than 1:3 (unless bulkheading is required);
- deposit of any spoils or other materials on wetlands, unless the project is approved by DNREC as part of an effort to restore or create wetlands;

- bulkheads higher than the surface of the natural land;
- use of wetlands for any activity unless it:
  - requires water access or water for the central purpose of the activity;
  - has no alternative on the adjoining non-wetland property of the owner.

This last restriction, the requirement for a water-dependent use, is similar to the restrictions imposed on permits for wetlands use by the U.S. and New Jersey.

To protect the environment, the DNREC may impose conditions on an approved permit and may require a security bond from the proposer, if project cost exceeds $10,000, to guarantee the fulfillment of permit conditions should the applicant fail to comply. Environmental conditions on permits guaranteed by such a bond might include aeration of channels, interconnection of channels and lagoons, and proper slopes on dredged cuts.

The Wetlands Permit Office has taken a number of steps to simplify the review of permit applications. Two types of applications are specified; the simpler form is reserved for projects involving less than one acre of land and excluding new structures. Joint public hearings on some major projects have been arranged with the Corps of Engineers. Under a cooperative arrangement with the beach erosion program at DNREC, a permit application involving alteration of beaches and wetlands will be reviewed by the program most significantly affected. The decision on this "lead" permit will determine the result for the parallel beach or wetland permit. Where a single project involves wetlands and subaqueous lands, the review is simplified because a single official is responsible for both programs. Coordination with review of the coastal zone siting permit is somewhat more limited, and the Office of Management, Budget and Planning usually waits for DNREC to decide on wetlands, beach erosion, and subaqueous land permits before deciding on a coastal zone siting permit.

The effectiveness of the Delaware Wetlands Program is hard to measure because of the interacting affects of the Delaware coastal facility siting program and the new environmental emphasis in the administration of federal permits (§10 of the Rivers and Harbors Act, §404 of the FWPCA). The rate at which wetlands have been destroyed along the Delaware shore has certainly decreased since these programs became effective in the early 1970's.

IV.B.11 Subaqueous Lands - Delaware

IV.B.11.a Statutory Authority

The lands beneath Delaware Bay, the Delaware River and tributary streams (if navigable) belong to the State governments, which also control underwater lands in a three-mile strip along the coast. Underwater lands to seaward of this strip are controlled by the federal government.

State ownership of underwater (subaqueous) lands is derived from English law, under which the King owned the tidewaters and the lands thereunder. Although Parliament placed restrictions on the King's control of the underwater lands, the Sovereign took title to the underwater lands in the newly discovered American colonies. This title passed to the States in the American Revolution, as the Supreme Court affirmed:

> "when the Revolution took place, the people of each state became themselves sovereign; and in that character hold the absolute right to all their navigable waters and the lands under them for their own common use, subject only to the rights since surrendered by the Constitution to the general government." [Martin V. Lesse of Waddell 41US367,410 (1842)]

The power of a State to develop or dispose of its underwater lands is limited by the federal government's power to control navigation and navigable waters.

Delaware law (7§6151) provides that the Governor and the Secretary of Natural Resources and Environmental Conservation shall have exclusive jurisdiction to:

> "convey a fee simple or lesser interest, to lease or grant permits or easements in or over any parts of the public lands of the state lying beneath the waters of the state (including the beach or shore to the mean high water level)."

No use of such lands may be undertaken except pursuant to a permit or grant. Even if another State agency seeks to use underwater lands, it is required to obtain approval from the DNREC under this provision. Leasing of underwater mineral rights and oyster beds are handled under separate provisions of law but are traceable to the same roots as in State ownership of underwater lands.[1] The authority even extends to

[1] In 1978, 13 leases totalling 7,960 acres had been granted for oyster cultivation.

private lands which are permanently flooded by the sea. Under the implementing regulations, land which is created by filling State subaqueous lands remains the property of the State, and the developer is only a leasee, unless the State chooses to sell the developer a fee simple title to the newly made land.

Delaware regulations clearly identify possible uses of public subaqueous lands and require prior approval by the DNREC for any project on these lands. Projects listed include:

- the erection of any structure (docks, bulkheads, bridges, etc.)
- the dredging or filling of such lands
- the excavation of any channel, lagoon, turning basin or ditch on public or private lands which will make connection with public subaqueous lands[1]
- the filling in of lands adjacent to public subaqueous lands[1]
- the laying of any pipeline, or telephone or electrical transmission line

IV.B.11.b Jurisdiction

Control of subaqueous lands in Delaware is administered by the official in the DNREC who also administers the wetlands program. He is, in effect, administering two different programs traceable to the State's title to underwater lands: a lease of public lands and a control of any alteration of underwater lands to protect the environment (including tidal waters).

Lease fees are not charged for structures (such as breakwaters) which are erected for the public benefit and protection. Structures erected on underwater lands for the private benefit and convenience of a land owner do pay a lease fee. All structures and alteration to subaqueous lands require a permit, even if the project is carried out by a State agency for a public purpose.

All of the underwater lands within the study area on the Delaware side of the River and Bay up to three miles into the Atlantic are within the jurisdiction of the Act. Private parties may own the bottoms of small non-navigable streams, but all lands beneath tidal and navigable waters belong to the State.

---

[1] This gives the State another control over alterations of coastal wetlands in addition to the Wetlands Act, although there has been some dispute about the legality of the claim.

No separate appeal is provided from decisions on the disposition of subaqueous lands. A dissatisfied party must go directly from the DNREC to the State courts. The State has argued that its refusal to sell a lease on underwater land is not reviewable by the courts in most circumstances, since the State as property owner may simply refuse any offer for the use of its land.

IV.B.11.c Current Policy and Operations

The Subaqueous Lands Act is clearly used by Delaware as a lever in preventing unwanted shorefront development and pollution of tidal waters. Projects must have a minimum detrimental effect on water quality, navigation, fish and wildlife, and public and riparian rights. The subaqueous lands regulations lay down specific steps to be taken in any dredging project to protect water quality. Decisions on leases and permits clearly reflect Delaware's desire to limit development of the Bay shoreline. However, a project approved under the Coast Zone and Wetlands Acts and consistent with the Coastal Zone Management Plan would likely receive a subaqueous lands lease or permit unless very unusual environmental effects are associated with the use of the underwater lands.

IV.B.12 Underwater Lands - New Jersey

IV.B.12.a Statutory Authority

New Jersey's title to lands beneath the Delaware Bay and its tributaries is also traceable to the English Kings, replaced as sovereign by the State governments during the American Revolution. Two separate but related controls arising from the title to underwater lands are exercised by the state. The granting of leases to private parties is approved by the Natural Resources Council.[1] Permit for any alteration or development of underwater lands (whether or not a lease is required) is the third coastal permit issued by the Division of Coastal Resources.

The tidal lands owned by New Jersey extend to the mean high water line. The New Jersey courts have held that the State cannot arbitrarily and absolutely bar a shorefront property owner from use of State-owned underwater lands and must show some environmental harm in denying a request for use of the lands. The Coastal Zone Management Plan now offers a detailed review of the acceptability of different projects on underwater lands.

IV.B.12.b Jurisdiction

On inland streams, disruption or alteration of underwater lands is controlled by a stream encroachment permit. Within the Delaware River and

[1] A twelve-member body appointed by the Governor with the advice and consent of the State Senate.

Bay area, all alterations of underwater lands are controlled by a "riparian" permit required for development of lands below tidal waters. Riparian permits are issued by the Bureau of Coastal Project Review, Division of Coastal Resources, Department of Environmental Protection. A separate staff in the Bureau of Tidelands prepared lease recommendations for the Natural Resource Council. An applicant can submit information once to obtain both a riparian permit and any necessary lease. Even if a lease is approved by the Natural Resources Council, a project can be blocked by the Commissioner of DEP if he refuses to approve the action of the Natural Resources Council. In a situation where an application already has a lease on the underwater land, only the riparian development permit would be required for a new project. No intermediate appeals board is provided by State law. Appeals from the DEP on riparian permits and the Natural Resources Council on leases are taken directly to the courts.

IV.B.12.c Current Operation and Policies

In the first two months of 1979, DEP took action on 79 requests for riparian development permits. Fifty-two more applications were awaiting decision. Most involved docks and bulkheads at commercial and residential property. Because of the New Jersey law requiring action on permits within 90 days after the applicant has submitted complete information, riparian permits are now being issued subject to issuance of a necessary lease by the Natural Resources Council, which is not bound by the 90-day limitiation.

Policies governing the issuance of riparian permits and recommendations to the Natural Resources Council are stated in the Coastal Zone Management Plan. The same general policies apply to the Atlantic shore and the Delaware Bay Shore below Pennsville.[1] Bulkheads and retaining walls are discouraged, unless they are necessary to protect life and property. Docks and piers are conditionally acceptable in areas intensively used for coastal recreation if the need cannot be satisfied by existing facilities. The docks should cause minimum feasible disruption of natural flow. Floating docks or pilings are preferred to solid construction. While maintenance dredging is accepted if adequate spoil disposal is provided, new dredging is discouraged unless a proven need exists, the area is adjacent to areas used for recreational and commercial boating, and the dredge area causes no significant disturbance to intertidal flats or subaqueous vegetation. Dredging to create new lagoons for residential development is prohibited.

Any proposed use of underwater land must be consistent with other coastal zone policies, particularly those protecting water quality and shellfish beds. Location policies encourage concentration, rather than sprawl, of

[1] Rules for a state-wide coastal management program are to be issued in 1980.

waterfront development. Administration of the riparian permit program reinforces the restriction imposed by the Wetlands and CAFRA Acts and the permits issued by the Corps of Engineers.

IV.B.13 Land Use Planning

IV.B.13.a Statutory Authority

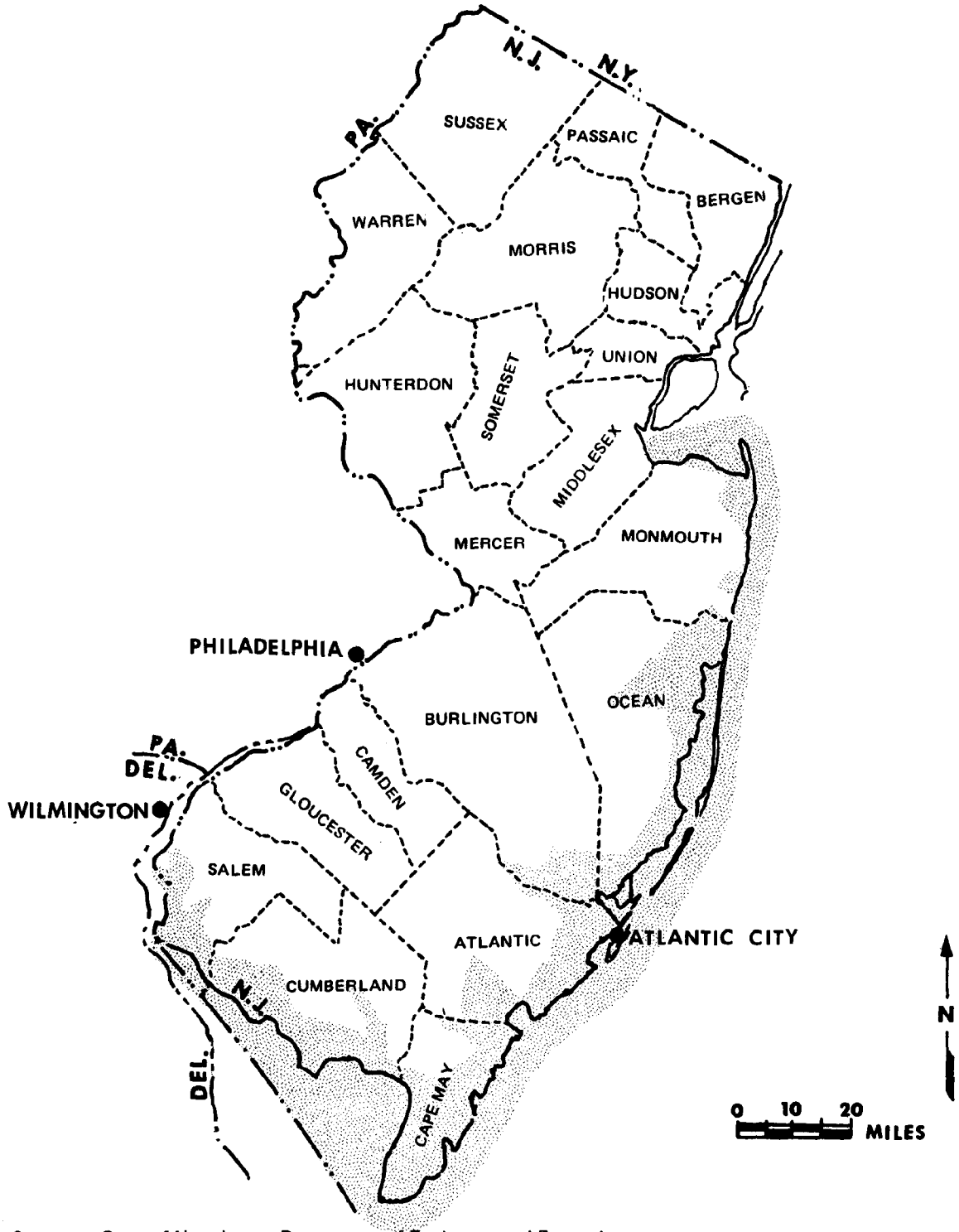
Land use plans at the State level in New Jersey and Delaware do not create new regulatory controls. They are an important influence on the way in which regulatory controls, including those described earlier in this section, are administered. Land use plans are drawn up under State statutes and under the authority of the federal Coastal Zone Management Act of 1972 (P.L. 92-583). In Delaware, the State government has decided to make the Coastal Zone Management Plan the land use plan for the entire State, because a substantial proportion of the State would be included in any Coastal Zone Management Plan.

In New Jersey, the State has published a Development Guide Plan for the entire State. This plan designates growth and limited growth areas, primarily to guide State infrastructure investments (sewer, highways, etc.). A separate Coastal Zone Management Plan has been prepared for the New Jersey shore. It is divided into two segments; one covering the Atlantic Coast and Delaware Bay, the area covered by the CAFRA Act, the other covering the upper Delaware River and New York Harbor. These plans establish priorities for coastal land use, define incompatible uses through environmental analysis and lay out rather detailed siting criteria which are reflected in the policies of the different coastal permit programs discussed above.

IV.B.13.b Jurisdiction

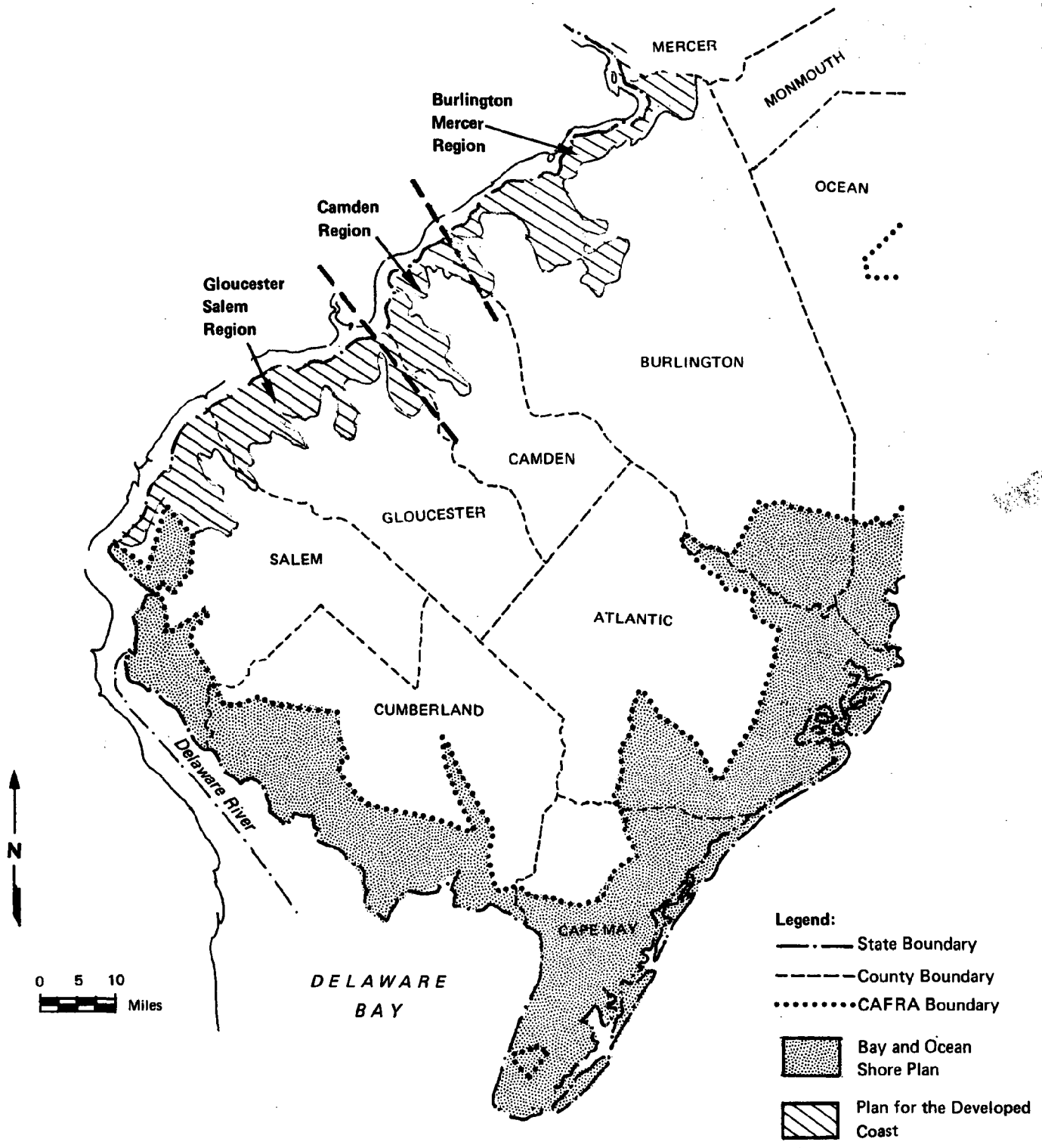
The Delaware Coastal Zone Management Plan was prepared by the State's OMBP. In New Jersey, the Coastal Zone Management Plan was developed by an office within the DEP's Division of Marine Services. This Division also administers the CAFRA, wetlands, beach erosion and riparian development permit programs. The boundary of the Bay and ocean shore segment of the plan is shown in Exhibit IV-5. The area along the Delaware River to be covered by the plan for the developed coast is shown in Exhibit IV-6.

Under the Coastal Zone Management Act, a State's coastal zone plan is subject to approval by the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. An environmental impcat statement on the plan is reviewed by NOAA prior to approving the plan. The plan could be rejected if the State does not have sufficient legal authority to implement the plan, if the plan fails to achieve the goals of the Act, or fails to provide for the national interest in siting facilities in the Coastal Zone. Once the plan is approved, all federal actions in the Coastal Zone, including federal licenses or financial assistance to development projects, must be consistent with the State's Coastal Zone Management Plan.



Source: State of New Jersey, Department of Environmental Protection.

EXHIBIT IV–5
NEW JERSEY BAY AND OCEAN SHORE SEGMENT –
COASTAL ZONE MANAGEMENT PLAN



Source: State of New Jersey, Department of Environmental Protection.

EXHIBIT IV–6
PROPOSED COASTAL ZONE MANAGEMENT PLAN BOUNDARY
DELAWARE RIVER AREA OF NEW JERSEY

(March 1979 - Subject to revision)

New Jersey's Development Guide Plan is prepared by the Division of State and Regional Planning, Department of Community Affairs. The current edition was published in September 1977. It is not as closely integrated into regulatory programs as is the Coastal Zone Plan. Local zoning decisions are not required to conform with the State plan. State investments in highways, sewers, and other public services are to be distributed according to the priorities set out in the plan. By withholding investments for expansion in limited growth areas, the State hopes to channel growth in the directions specified in the plan without state-wide land use controls.

The State Planning Office also reviews subdivision plans affecting more than 150 acres of land or proposing more than 500 dwelling units. State planners comment to the local zoning or planning board on the consistency of the proposed subdivision plan with the Development Guide Plan. Final approval or rejection lies with the local zoning board, but the State can refuse to provide the infrastructure investments necessary for a subdivision deemed inconsistent with the State plan.

An exception to the rule that New Jersey does not seek to impose general land use controls[1] is the Pine Barrens. This area of central New Jersey is designated for use as public open space in the Development Guide Plan. The area designated for preservation exceeds the land currently held by the State, local and federal governments. Governor Byrne's Pinelands Review Commission published a report on the planning and management of the Pinelands in October, 1978. The report reviews the threat to the Pine Barrens from uncontrolled development, and the unique ecology of this undeveloped land so close to New York, Philadelphia and Atlantic City.

State and federal funds are being committed to purchase large tracts of land in the Pine Barrens. As a result of fears that public acquisition cannot proceed fast enough to stop development in the Pine Barrens, Governor Byrne issued an executive order in February, 1979, declaring a moratorium on development in a 576-square-mile preservation area in the heart of the Barrens. A bill was introduced in the State Legislature at the same time to formally establish this preservation area and a larger 925-square-mile protection area which overlaps the coastal zone in southern New Jersey (see Exhibit IV-7). This Bill was approved by the State Legislature at the end of the 1979 session ans has been signed by the Governor.

Litigation testing the development controls in the new Pinelands law may well occur. Court decisions may produce some adjustment in the development control, but the trend is clearly established for the preservation

[1] Coastal permits apply only to particular projects (industry, large developments) or sites (wetlands).

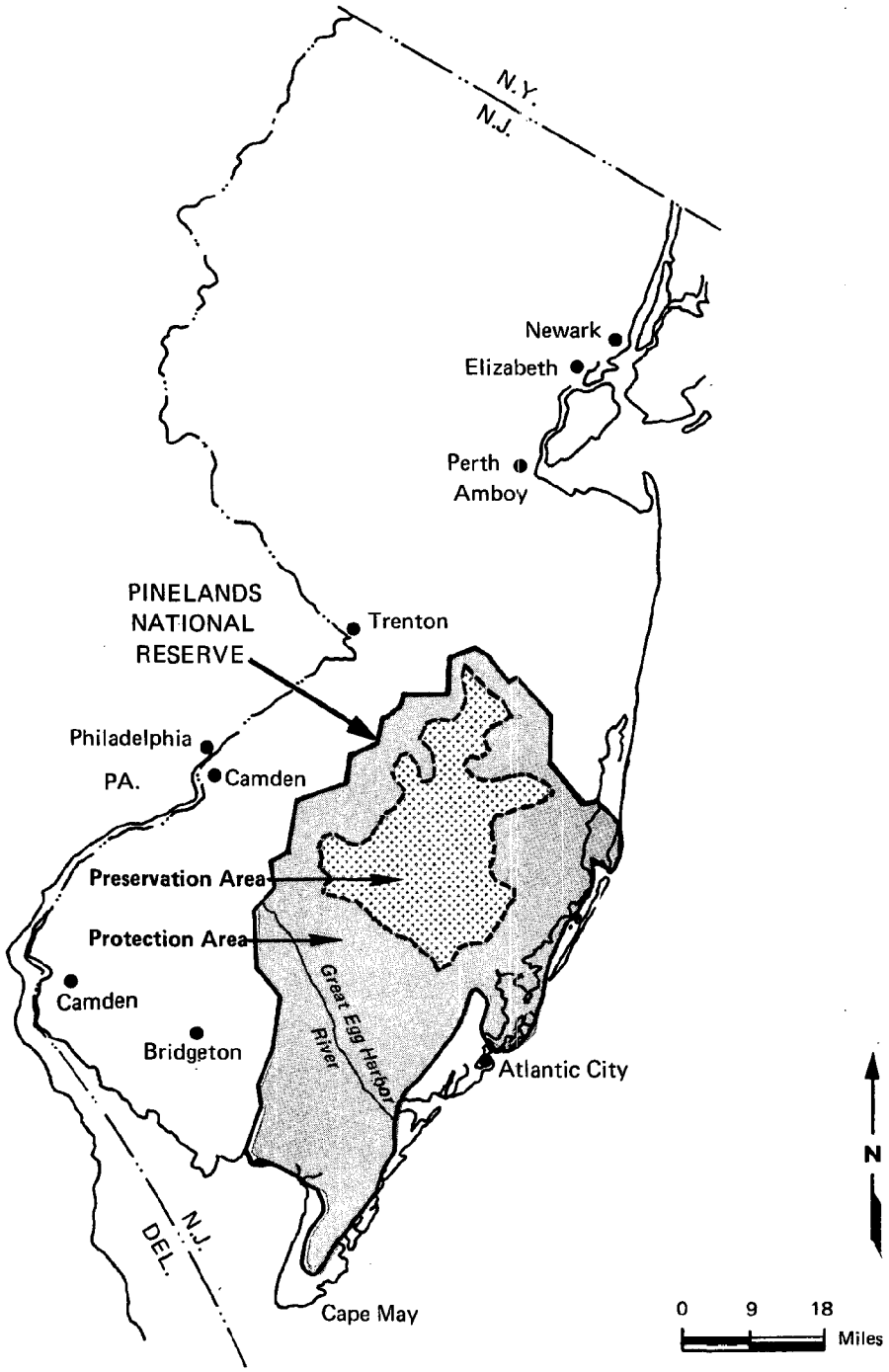


EXHIBIT IV–7

AREA OF DEVELOPMENT CONTROLS – NEW JERSEY PINELANDS

of an area in the Pine Barrens more extensive than current public holdings.

IV.B.13.c Current Operations and Policy

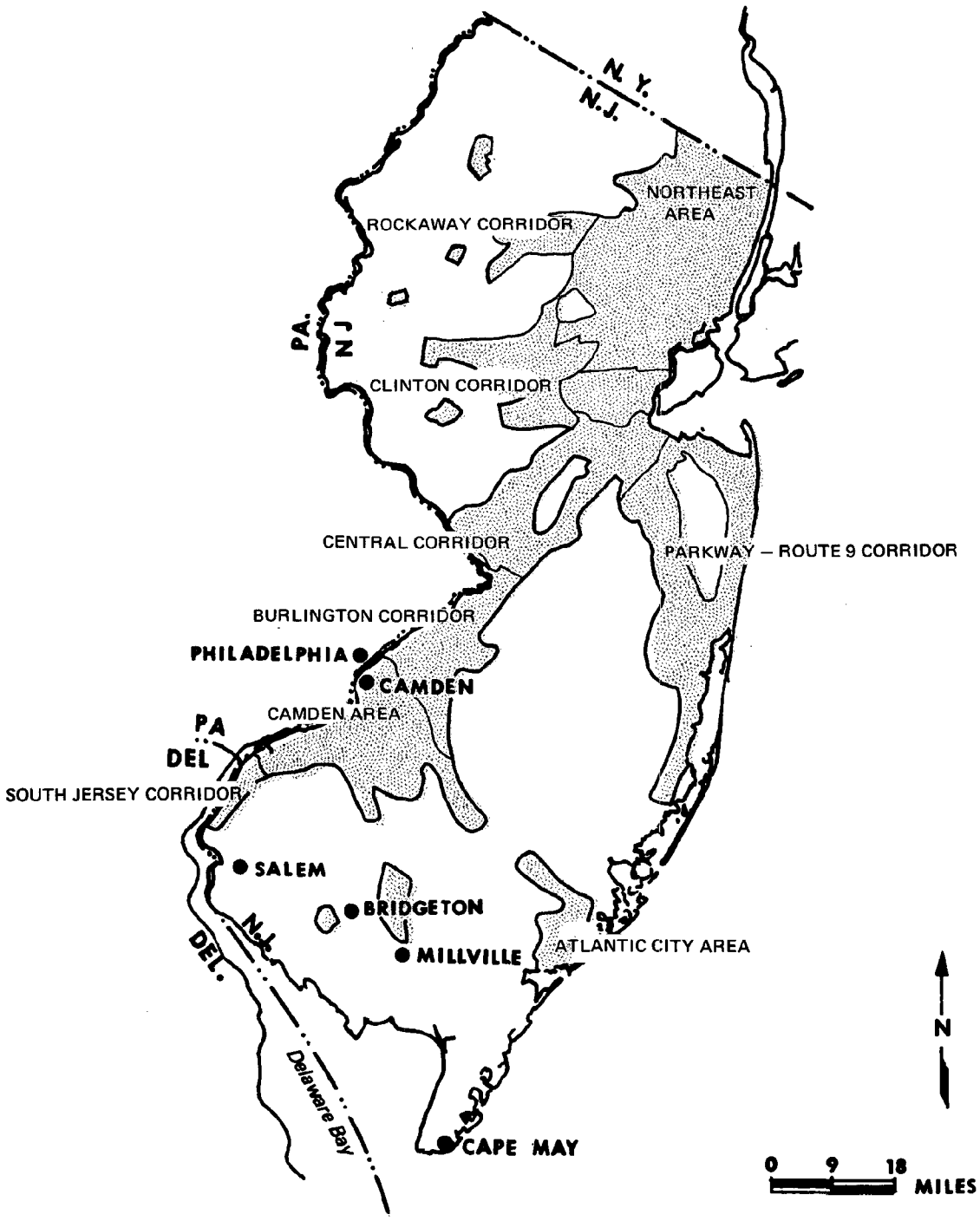
Coastal zone plans in both States contain similar priorities:

- concentration of industrial development in existing industrial areas (from the Memorial Bridge northward in the Delaware estuary);
- limitation of sprawling residential development along the coast;
- dedication of the Bay and ocean shoreline to recreation and conservation;
- preservation of wetlands, barrier beaches and areas of special environmental interest;
- protection of shellfish beds, spawning grounds, and other fish and wildlife habitats.

Specific siting policies are discussed in more detail under each coastal permit program.

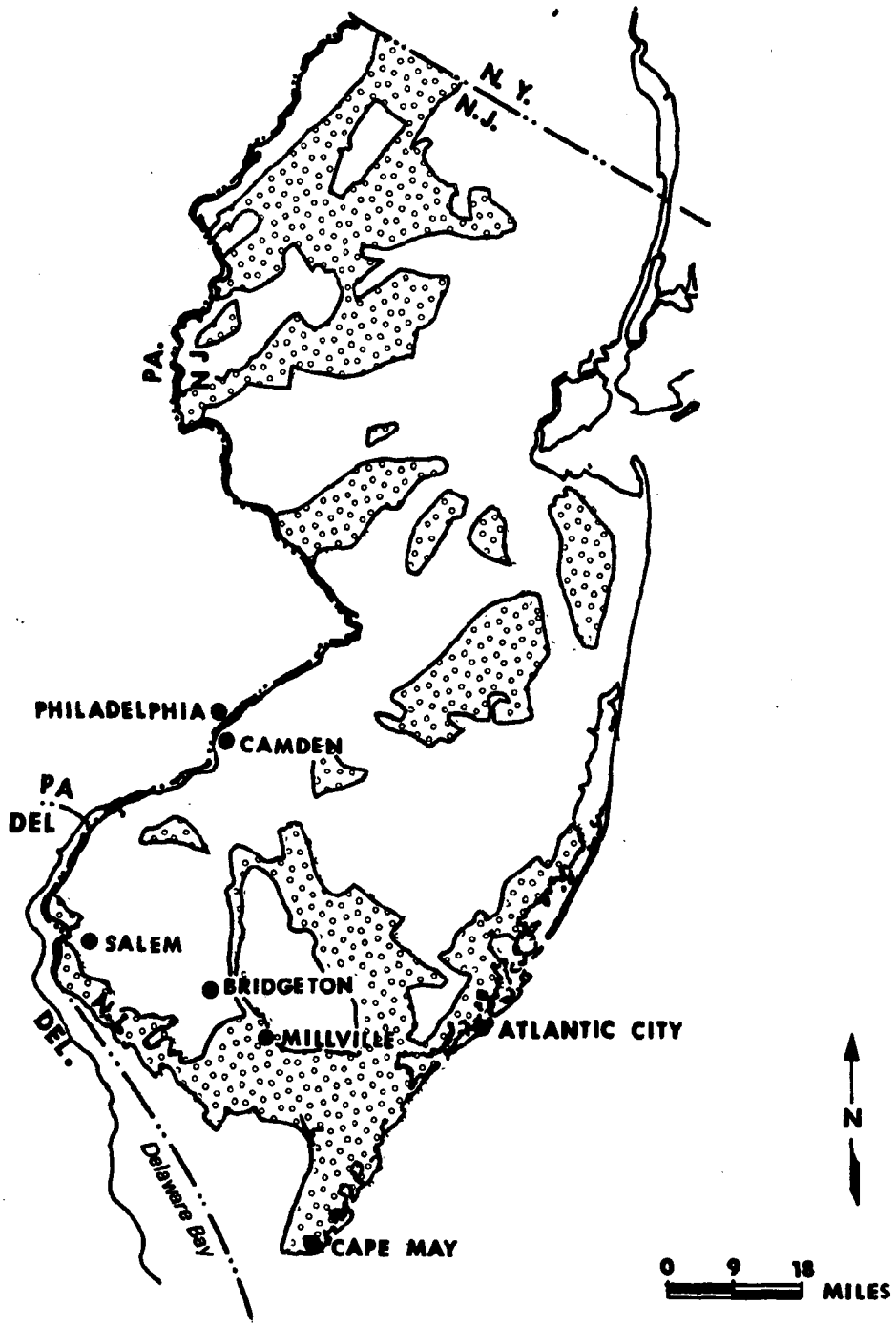
The goals of the New Jersey Development Guide Plan are stated more broadly to include maintaining the quality of the environment, preserving the open space necessary for an expanding population, and providing space and services for an expanding economy and population. Space and services for an expanding population, the plan concludes, can be provided most efficiently by concentrating growth in already developed areas. Public capital investment per person or unit of output is reduced because services such as water, sewers, and highways already exist in these areas. Surplus labor is available in many urban areas. Scarce energy resources are conserved if development is concentrated, and concentration of development preserves agricultural land for food production and open space for recreation.

Working from these premises, the plan designated growth or development areas in regions which are already developed (see Exhibit IV-8). Limited growth areas, agricultural lands, and public open space are designated in other areas of the state (see Exhibit IV-9, IV-10). As a result, most of the study region is not designated for growth. The nearest growth centers are the Delaware Valley industrial complex above the Memorial Bridge, the cities of Salem, Bridgeton, and Millville-Vineland (with a total of 33,808 acres suitable for development), and the Atlantic City area. The industrial zone at Cape May Airport will be an exception to the limited growth designation for the rest of Cape May County.



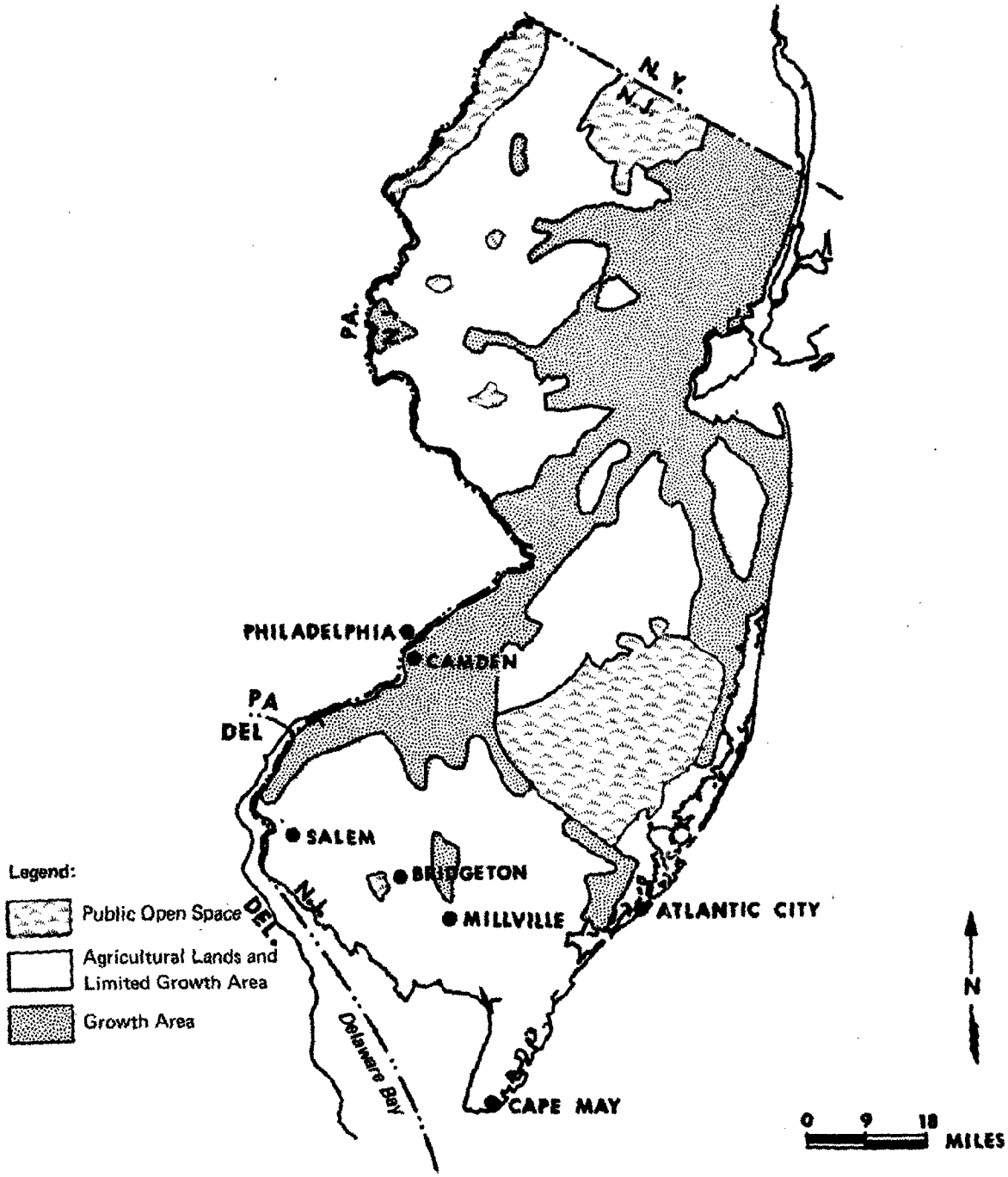
Source: New Jersey State Development Guide Plan.

EXHIBIT IV–8
DESIGNATED NEW JERSEY GROWTH AREAS



Source: New Jersey State Development Guide Plan.

EXHIBIT IV–9
DESIGNATED LIMITED GROWTH AREAS
NEW JERSEY



Source: New Jersey State Development Guide Plan.

EXHIBIT IV–10
PROPOSED LAND USE
NEW JERSEY

Economic projections must take the Development Guide Plan into account. The public infrastructure investments guided by the plan can be a powerful stimulus to growth. Refusal by the State to make such investments in limited growth areas can seriously hamper private development. Some sites may be sufficiently attractive that a residential or industrial developer will fund all the necessary public services for a project. Pressure will undoubtedly continue for the recreational use of prime shorefront land. However, the combination of coastal zone controls and the priorities stated in the Development Guide Plan make it unlikely that rapid growth will occur along the New Jersey shore of Delaware Bay.

IV.C PUBLIC AUTHORITIES UNDERTAKING PORT OR TRANSPORT PROJECTS IN THE DELAWARE BAY AREA

IV.C.1 Delaware River Port Authority (DRPA)

IV.C.1.a Charter and Source of Authority

The DRPA was created by an interstate compact between Pennsylvania and New Jersey, replacing a predecessor, the Delaware River Joint Commission. Because it is an interstate compact, the DRPA charter required approval of the U.S. Congress under Article 1 §10 of the Constitution. The drafters of the Constitution sought to limit the consolidation of States into more powerful entities which could challenge the federal government. As a result, each interstate compact for joint port, transport, water resources or other development requires Congressional approval.

The DRPA is authorized to:

- operate the bridges built by the predecessor toll bridge commission;
- build and operate new bridges or tunnels across the Delaware River between New Jersey and Pennsylvania;
- operate railroad or other transit facilities across DRPA bridges;
- construct or acquire real property and improvements for port purposes;
- promote the Delaware River as a port, and study port operations;
- construct and operate mass transit facilities between New Jersey and Philadelphia.

The DRPA is authorized to cooperate with other governmental agencies in carrying out these purposes. Each Governor retains a veto over any action by the Authority.

IV.C.1.b Jurisdiction

The charter authorizes the DRPA to operate in a port district which includes seven counties in New Jersey (Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, and Salem) and two counties in Pennsylvania (Delaware and Philadelphia). The extent of the port district is shown in Exhibit IV-11. The DRPA's jurisdiction potentially extends from Trenton down the Delaware River and Bay around Cape May and north beyond Atlantic City to Manasquan. On the Philadelphia side of the river, the port district runs from the northern city line of Philadelphia to the Delaware State border.

IV.C.1.c Operations

The DRPA does not actually operate any ports, despite its name and the objectives in its charter. State legislation to permit actual operation of port facilities by the DRPA was defeated in 1967 and 1968. Publicly-owned port facilities within the DRPA jurisdiction remain in the hands of the Philadelphia Port Corporation and South Jersey Port Corporation; some local legislators were apparently unwilling to surrender these facilities to a multi-state authority.

The World Trade Division of the DRPA actively promotes the use of all Delaware Valley Ports (collectively christened Ameriport). Offices were maintained (in 1977) in Bogota, Tokyo, Hong Kong, Brussels, Teheran, New York and Chicago. The DRPA rates it success in terms of the share of the North Atlantic market served by Ameriport - 34% in 1977.

The DRPA now owns and operates four bridges across the river; three at Philadelphia and one (Commodore Barry) at Chester. The newest of these bridges, the Betsy Ross, was opened in 1976.

A wholly owned subsidiary, the Port Authority Transit Corporation (PATCO), now operates the Lindenwold rapid (rail) transit line, which the DRPA built between South Jersey and center City Philadelphia. The DRPA points with pride to the fact that 11 million passengers paid 89% of the operating costs of the line in 1977.

The DRPA annual report for 1977 noted that the pace of development for the Authority would be slower with the completion of the Commodore Barry and Betsy Ross Bridges and the Lindenwold High Speed Line. Nevertheless, the Planning Division completed a Mass Transit study for the Philadelphia-Camden area in 1977. Financial consent to DRPA rail transit extension in southern New Jersey was obtained from the Governors of New Jersey and Pennsylvania.

Emphasis and effort at DRPA is placed on transit improvements. The Authority has no present plans to acquire or construct port facilities.

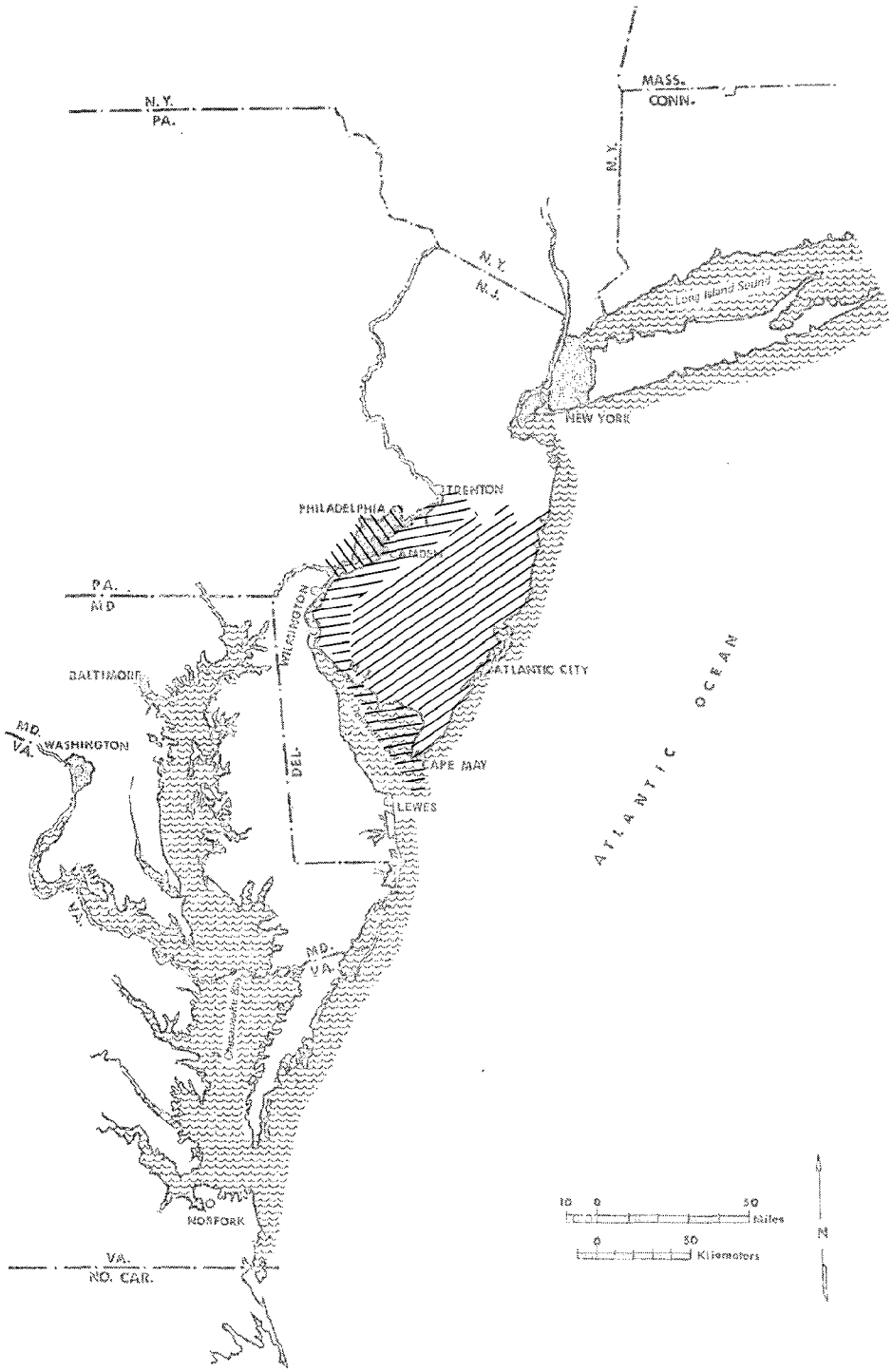


EXHIBIT IV–11

DELAWARE RIVER PORT AUTHORITY – SERVICE AREA

IV.C.2 South Jersey Port Corporation

IV.C.2.a Charter and Source of Authority

This agency is a public corporation created by act of the New Jersey Legislature, effective in 1968. The authorizing legislation designated the new Corporation as the sole agency for port development in South Jersey, replacing the predecessor South Jersey Port Commission. Operation of the Camden Marine Terminal (Beckett Street) was declared to be an appropriate State responsibility.

Unlike the Delaware River Port Authority, the South Jersey Port Corporation is a single-purpose agency empowered to acquire, construct, and operate marine terminals, including railroad connections, buildings and other facilities "necessary or convenient to the accommodation of steamships or other vessels and their cargo or passengers."

The Corporation has an independent seven-member board but is administratively located within the State's Department of Labor and Industry. The Governor can veto any action of the Corporation so long as he acts within ten days of a Board vote.

Language in the authorizing statute permits the Corporation to "enter into contracts and agreements with the Delaware River Port Authority or any other regional agency concerned with marine purposes providing for joint participation by the parties in any undertaking for marine terminal purposes." Subject to agreement with bondholders, the Corporation is authorized to lend, lease, convey, merge, or consolidate its operations with another regional agency concerned with marine terminal purposes. However, any such consolidation or transfer would require the approval of both houses of the New Jersey Legislature in a concurrent resolution. To date, the Corporation has not merged or disposed of any of its facilities.

IV.C.2.b Jurisdiction

The area covered by the South Jersey Port Corporation charter is shown in Exhibit IV-12. Included are Mercer, Burlington, Camden, Gloucester, Salem, Cumberland, and Cape May Counties. This jurisdiction is smaller than the DRPA Port District, lacking Atlantic and Ocean Counties to the east, but including Mercer County to the north, upriver from the DRPA Port District. The dominance of upriver interests is expressed in the composition of the Corporation board. Two members must come from Camden County, with three members from Burlington and Mercer Counties. Cape May, Salem and Cumberland Counties share one member. The seventh member is appointed from Gloucester County.

IV.C.2.c Operations

Current operations are limited to two facilities in the City of Camden. In addition to the Beckett Street terminal acquired from its predecessors,

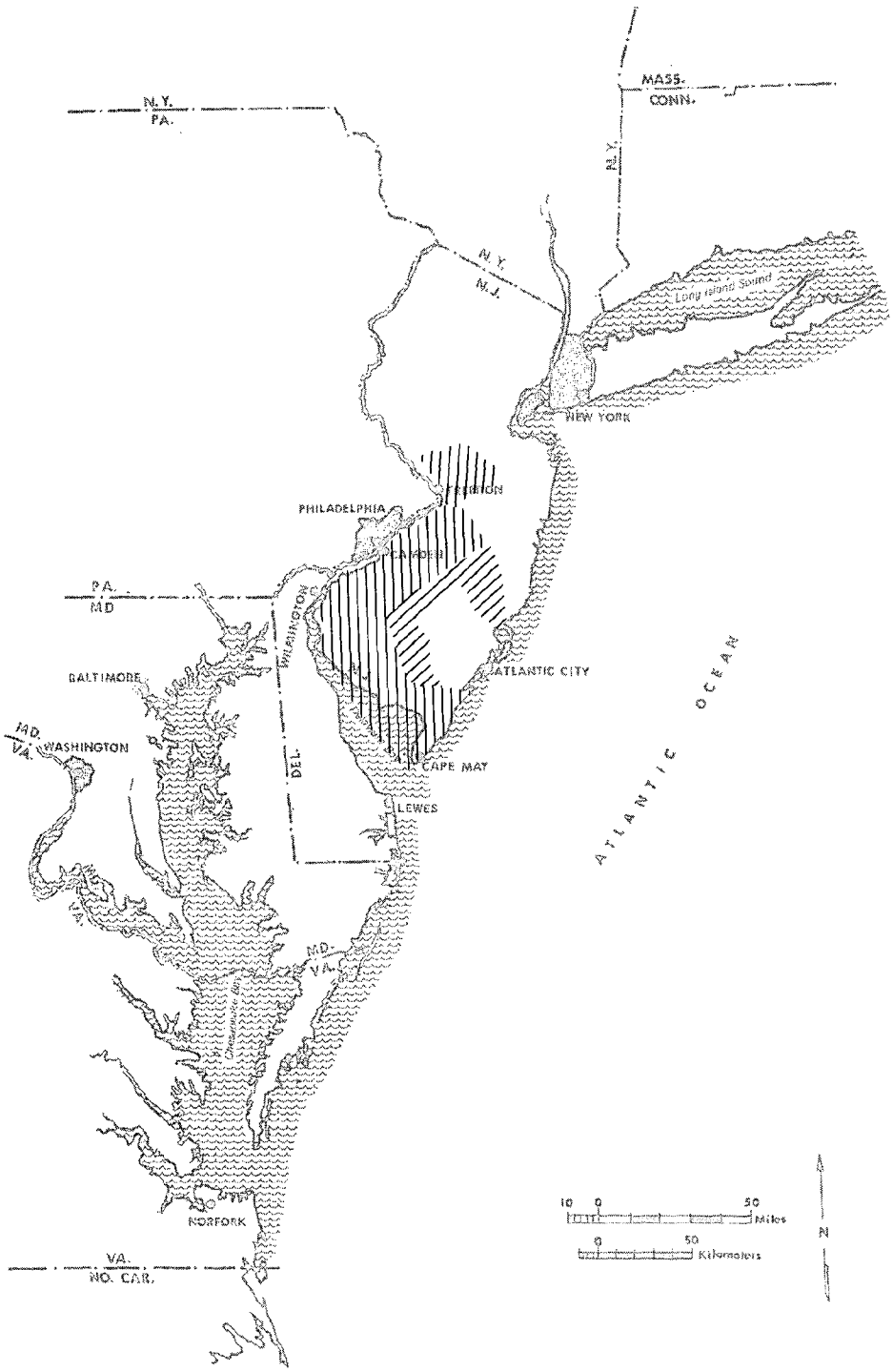


EXHIBIT IV–12
SOUTH JERSEY PORT AUTHORITY – SERVICE AREA

the Corporation purchased the old New York Shipbuilding property in 1970. This property has been developed into the Broadway Terminal, which houses marine-oriented industrial tenants. Ten berths are located at the two terminals. The Corporation acquired 17 acres of land adjacent to the Beckett Street terminal in 1975 for a 740-foot wharf expansion. The Beckett Street terminal is operated directly by the Corporation. At the Broadway terminal, the Corporation leases space to terminal operators and steamship lines.

At the present time, the Corporation has no apparent intention of expanding its operations to sites outside the Port of Camden. Payments to City and County governments in lieu of taxes are authorized by the enabling legislation and subsidized by the State of New Jersey. The State provided the full amount of $721,000 in these payments in 1977. In addition to subsidizing payments in lieu of taxes and assuming the debts of the old South Jersey Port Commission, the State of New Jersey also subsidizes the debt service on the Corporation's bonds, even though these are technically revenue bonds. The subsidy commitment is, in effect, a State guarantee of the Corporation's bonds. This subsidy required to restore the debt service reserve was $544,000 in 1977. Between 1972 and 1977, the State contributed $2,496,804 to the debt service reserve fund, effectively underwriting an equivalent loss when operating costs and debt service are subtracted from revenues.

IV.C.3 Philadelphia Port Corporation

IV.C.3.a Charter and Source of Authority

The Philadelphia Port Corporation is a non-profit corporation closely tied to the government of the City of Philadelphia. It was created in 1965 for the purpose of administering the port facilities owned by the City of Philadelphia and to plan, construct, extend, and improve the facilities of the Philadelphia waterfront. The Board of Directors of the Corporation (33 members) are drawn from City (9) and State (2) governments, the Philadelphia Chamber of Commerce (9), and the general public (13). Two Directors are appointed by the Delaware River Port Authority. The original mandate for the Philadelphia Port Corporation provided for transfer of its facilities to the Delaware River Port Authority at some future time with the consent of the Governor of Pennsylvania, the Mayor and City Council of Philadelphia and the President of the Chamber of Commerce. This option has not yet been exercised.

Rapid containerization of the general cargo trade in the North Atlantic provided the impetus for creation of the Corporation. Philadelphia officials feared that the piers owned by the City could not be modernized fast enough to accommodate the rapidly expanding container trade.

IV.C.3.b Jurisdiction

The Philadelphia Port Corporation operates solely in the City and County of Philadelphia.

IV.C.3.c Operations

Two marine terminals--Tioga and Packer Avenue--are the core of Corporation operations. Each is operated by a private terminal operator holding a lease with the Corporation. Smaller Corporation facilities for handling general cargo, coal, and oil are located along the City's waterfront. Abandoned city piers are being used as warehouses, and the Corporation converted an old railroad yard as back-up space for finger piers that would otherwise be outmoded. Reuse of piers for new purposes has been permitted by the Corporation, e.g., Pier 30 houses a tennis facility. The 1978 annual report of the Corporation calls attention to the new urban waterfront at Penn's Landing, with its historic ships and floating restaurant.

Philadelphia now has a foreign trade zone in its port. In 1978, the Corporation announced the first operation in the foreign trade zone, a French manufacturer who will process imported molasses into yeast for molasses. Although the Corporation pays rent to the City of Philadelphia, both the City and the State of Pennsylvania pay operating subisides to the Corporation. Each contributed $1,000,000 per year in fiscal 1977 and 1978. By a 1966 vote, the Port Corporation Board resolved to withdraw the annual request for appropriated subsidies at the time the Corporation achieved a continuing annual surplus from operations. From 1965 through June 30, 1978, the City of Philadelphia and the State provided $20,000,000 in subsidies to the Corporation.

Another agency concerned with waterfront activities is the Camden Municipal Port Authority (CMPA). This organization, created by the City of Camden by ordinance adopted in February, 1978, to promote and implement development of waterfront facilities in the Camden area, currently does not operate any marine facilities. It is, however, active in the construction of a refrigerated-freezer warehouse on property leased from the SJPC.

IV.C.4 Wilmington Port

IV.C.4.a Charter and Source of Authority

The Wilmington Port is a municipal facility, owned and operated by the City. Originally built in the 1920's with assistance from DuPont Company engineers, the Port was operated by a Board of Harbor Commissioners until 1967. Since that time the Port has been an operating division of City government. Cost of operation, including debt service on bonds issued by the City for Port improvements, has been met from operating revenues in recent years. The Port has returned a small surplus to the City treasury, although it does not pay taxes or a contribution in lieu of taxes, and pension obligations for port employees are met from the general budget.

IV.C.4.b Jursidiction

The Port of Wilmington operates a single facility on the south bank of the Christina River at its confluence with the Delaware River. The Port could acquire and operate other terminals within the city limits, as city ordinances give the Port jurisdiction over all port operations in Wilmington. It has not exercised any regulatory control over the private terminal operators in the area.

Present plans for enlargement and modernization are limited to the area adjacent to the current site. The Port has proposed to fill behind a new bulkhead line on the Delaware River and move primary berths from the Christina River to the new Delaware River frontage. The Port Director has made preliminary application for the dredge and fill permit necessary for this expansion. The permit request has met substantial opposition from the National Marine Fisheries Service and the Fish and Wildlife Service, who are requesting compensating environmental improvements. At the same time, the Commerce Department is attempting to assemble a package of State, federal (Economic Development Administration) and City funds to purchase a new container handling crane.

IV.C.4.c Operations

The Port of Wilmington is not strictly a loading and unloading operation. Space has been leased for the storage of imported automobiles offloaded in Wilmington. A manufacturer converts imported gypsum to wallboard in a factory on land leased from the Port. Delivered tonnage has been significantly expanded in recent years by a private bulk oil terminal on land leased from the Port. Additional unused or underutilized space is available on Port property.

In 1974, a special study commission reported to Delaware Governor Tribitt that the current institutional arrangements for the Port of Wilmington were unsatisfactory. The Port contributed to regional commerce, particularly the wider New Castle County area. However, Port costs were assumed entirely by the City. As a relatively small city, Wilmington was unwilling to issue the general obligation bonds necessary for Port improvements. Deterioration of wharves at the Port was attributed to dependence on Wilmington for financial support. The special study commission recommended that responsibility for the Port be assumed by a Port Corporation (the South Jersey Port Corporation was cited as a model). This Corporation could then finance Port imporvements through revenue bonds. Its board would represent the wider region and, if necessary, operating subsidies could be collected from governments in the broader region benefitting from Port development.

The recommendations of Governor Tribbitt's study commission have not been implemented. The City still operates the Port through the Commerce Department. New management has improved maintenance of Port facilities. However, the Port is still dependent upon City financing for improvements. Industrial revenue bonds have not been used, and the installation of a

new container crane will be dependent upon the City's ability to raise federal grants and local tax money to supplement the Delaware commitment of $1.25 million.

IV.C.5 Delaware River and Bay Authority (DRBA)

IV.C.5.a Charter and Source of Authority

On September 20, 1962, the U.S. Congress gave its consent to the Compact between Delaware and New Jersey creating the Delaware River and Bay Authority. The two States pledged to each other their faithful cooperation in the effectuation of the Compact and "the planning, development, financing, construction, operation and improvement of all projects entrusted to the Authority." The Authority was designated to function as an agency of the governments of the two States for the following general public purposes:

- operation of crossings between the States of Delaware and New Jersey across the Delaware River and Bay, together with approaches or connections required to make adequate and efficient connections between such crossings and any public highway;

- operation of any transportation or terminal facility (within those areas of both States which border on or are adjacent to the Delaware River or Bay) which is required for the sound economic development of the area; and

- the performance of such other functions as may be hereafter entrusted to the Authority by concurrent legislation expressly in implementation thereof.

These powers were expressly limited by the requirement that any project, "other than a crossing," requires approval by concurrent legislation in each State. Any action of the Authority is subject to veto by the Governor of either State, but projects other than crossings require the express consent of both Legislatures.

Formation of the Delaware River and Bay Authority followed a long history of litigation and negotiation between the two States. Disputes over boundaries and fishing rights in the upper bay and river were resolved by the Supreme Court in 1934. The Court declared that the Delaware State boundary extended to the low water mark on the eastern side of the Delaware River at all points within a 12-mile radius of the town of New Castle.

As traffic increased on the New Castle-Pennsville ferry in the 1930's and 1940's, Delaware looked for a way to construct a fixed crossing. A private company made a proposal in 1936, but the State soon assumed responsibility for planning. A joint venture with New Jersey could not be negotiated, and the first span of the bridge was built by the

Delaware State Highway Department with revenue bonds floated by the State of Delaware. Both towers stand on Delaware territory at the bottom of the river. New Jersey granted Delaware permission to construct the eastern approaches of the bridge on New Jersey soil, but did not join in the financing. However, the New Jersey Turnpike, built at the same time as the bridge, was planned to connect with the new span. The Delaware Memorial Bridge opened to traffic on August 16, 1951.

Traffic continued to build rapidly through the 1950's. Under the terms of the approvals obtained from the United States for the crossing,[1] tolls on the bridge would be ended when the bonds were paid off. Delaware did not want to assume responsibility for bridge maintenance costs with State tax dollars. Perhaps more important, traffic growth indicated that another span would be necessary. Delaware did not want to commit its limited highway resources to the construction of a second span when only a fraction of the users were Delaware citizens (estimated at 10%). Cooperation was sought from the State of New Jersey. Quick agreement on a cooperative effort was not possible, in part because New Jersey sought to eliminate tolls on the bridge as soon as the bonds were paid off.

Formal negotiations between the two State highway departments began in 1956. When they failed to produce results, the Governors of each State designated conferees to negotiate an agreement between the States on problems of mutual interest governing the Delaware River and Bay. The conferees met first in December, 1958; issues for discussion included the need for additional crossings, including a Cape May-Lewes ferry, the need for continuing tolls on the existing bridge, and "the feasibility and practicability of a bi-state agency to administer the area's needs."[2]

Drafts of an interstate compact were prepared and negotiated through 1959 and presented to the Governors of both States by the conferees on October 29, 1959. Following approval by the two State Legislatures and the U.S. Congress, the Delaware River and Bay Authority was formed and assumed responsibility for operation of the existing span of the Delaware Memorial Bridge and planning for the second span.

IV.C.5.b Jurisdiction

The DRBA is authorized to operate crossings of the Delaware River and Bay at any location south of the boundary line between the State of Delaware and the Commonwealth of Pennsylvania as extended across the river to the New Jersey shore. Transportation and terminal facilities may be operated

---

[1] Obtained from Congress and the Department of Defense. The function is now vested in the Department of Transportation.

[2] Governor Caleb Boggs in his opening remarks to the conferees.

in the areas of both States which "border on or are adjacent to" the Delaware River or Bay south of the Pennsylvania/Delaware line. Thus, the DRBA's jurisdiction may be said to encompass the River and Bay and adjacent shores between the Delaware/Pennsylvania line and Cape Henlopen and Cape May. This area arguably extends to the limits of State territorial waters immediately seaward of the line between Cape May and Cape Henlopen.

IV.C.5.c Operations

The operation of the spans of the Delaware Memorial Bridge is now a financially sound and stable operation, with a revenue of $12.1 million in 1977 generated by over 18,000,000 cars and trucks. The operation of a ferry between Cape May and Lewes, started in 1964, was very much a part of the agreement reached by the compact negotiators, and was predicated on the use of some bridge revenues to offset costs. The original ferries, retired from service across the mouth of the Chesapeake Bay by the bridge-tunnel, have since been replaced by newer, shallow draft boats. The Authority has improved terminal facilities at Cape May and Lewes, including construction of a breakwater. Negotiations are in progress for acquisition of a five-acre parcel of land immediately adjacent to the Lewes terminal for possible future expansion of parking or terminal facilities. Ferry revenues now cover operating costs, although capital investment in boats and facilities is still covered by excess bridge revenues.

The Cape May-Lewes Ferry and the Delaware Memorial Bridge are the only operations of the Authority at this time. The DRBA has never undertaken a project under its second public purpose, the operation of "transportation or terminal facilities." The definition of such facilities in the charter is broad and extends to any structure or facility "adapted for public use ... in connection with the transportation of persons or property, including railroads, motor vehicles, watercraft, airports and aircraft, docks, wharves, piers, slips, basins, storage places, sheds, warehouses, and every means of vehicle transportation now or hereafter in use for the transportation of persons and property or the storage, handling or loading of property, as well as appurtenances, and equipment related thereto."

Although the Authority has yet to build or operate any transportation or terminal facilities, the intent of the charter has been hotly debated in recent years. A proposal for the State of Delaware to build or independently franchise a deepwater oil terminal off the Delaware Capes was met with opposition by the Authority. In a lengthy legal memo, counsel to the DRBA argued that the New Jersey-Delaware Compact gave the DRBA the sole authority to develop any such superport. The logic may be paraphrased as follows:

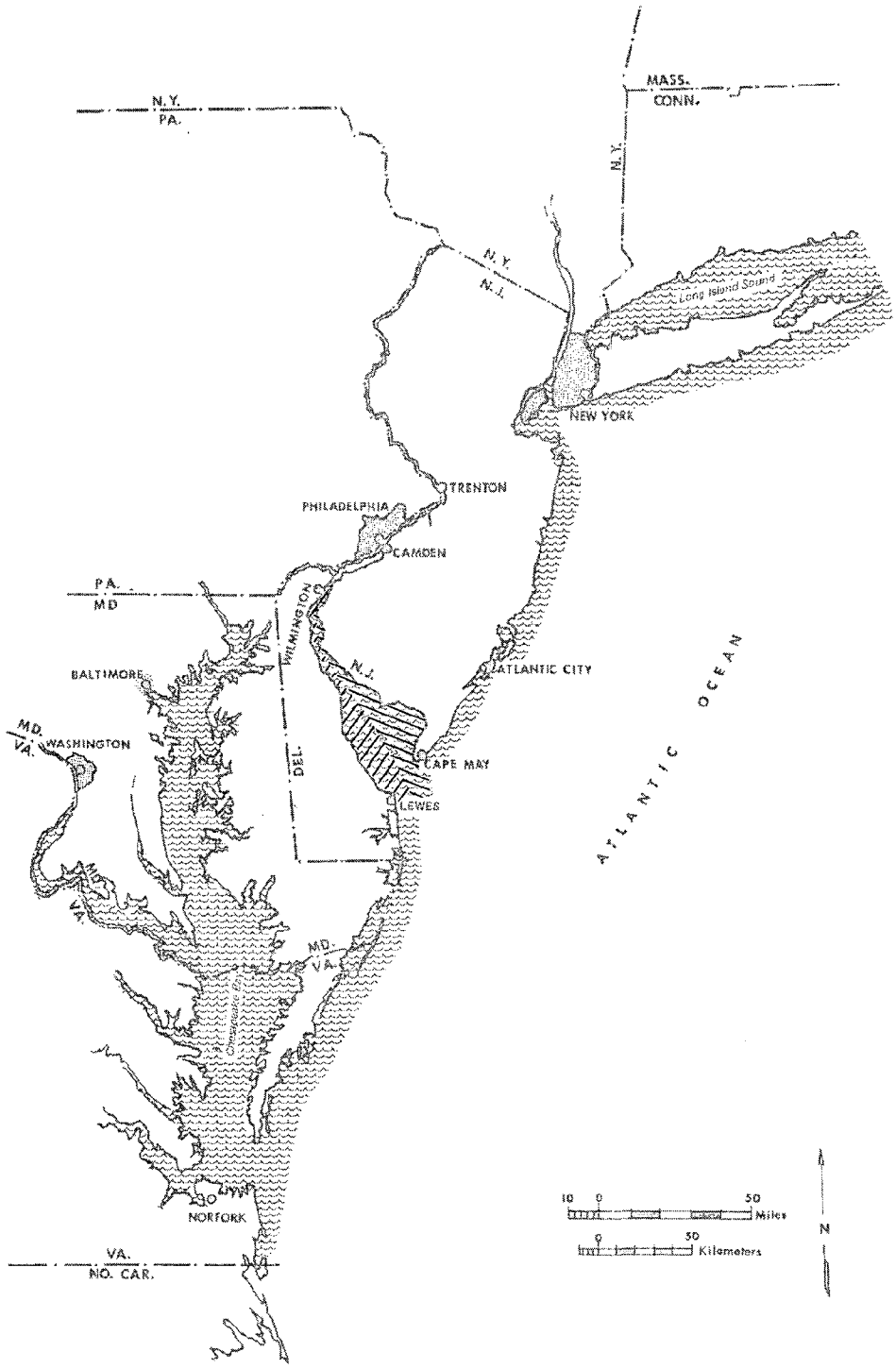


EXHIBIT IV–13
DELAWARE RIVER AND BAY AUTHORITY – SERVICE AREA

1. An offshore port beyond the Delaware Capes is a port facility for the Delaware Bay.

2. The DRBA has been designated by each State in the compact as an agency of the State for purposes of the compact.

3. Transportation and terminal facilities intended for public use are one of the State purposes for which the DRBA was created.

4. The DRBA is therefore an agency of the State of Delaware for the operation of terminal facilities for the Delaware Bay.

5. Delaware and New Jersey pledged faithful cooperation in implementing projects entrusted to the Authority.

6. A deepwater oil port off the Delaware Capes is a terminal intended for public use within the DRBA charter.

7. Therefore, Delaware is obligated by its commitment in the DRBA Compact to use the DRBA as the appropriate state agency for development and planning any offshore port.

In support of this argument, counsel for the Authority cited a 1970 opinion of the Attorney General of the State of Delaware which found that a port constructed on an artificial island in Delaware Bay would be a task for the Delaware River and Bay Authority.

> "The State of Delaware alone may not plan and construct facilities that fall within the purposes and purview of the Delaware-New Jersey Compact..."

The argument is also supported in the report of the conferees who negotiated the DRBA Compact, which states:

> "The Conferees have envisioned a single agency whose underlying objects would encompass the full breadth and scope of their inter-related aspects. It is their thought that this agency should be the only bi-state authority of the States of Delaware and New Jersey which will serve as the conduit or medium through which the two states may at all times act with respect to all matters of common interest to them.... The Conferees are of the view that the two states should avoid endless multiplication of separate agencies to deal with single problems as they arise."

Supporters of the independent Delaware proposal argued that Delaware had not surrendered its right to independently develop port facilities, particularly a superport not contemplated by the authors of the DRBA compact, and located beyond the Delaware Capes. Restrained by bond covenants and the requirement that both State Legislatures consent to a transportation or terminal development, the Authority has not initiated planning for any port facility.

In a recent conversation, the former secretary of the Delaware Conferees indicated that the Authority was definitely intended to serve as the forum for planning any major terminal development on the Bay. Competition and independent maneuvering by the two States over the bridge issue convinced many of the Conferees that an interstate agency should serve as a forum for resolution of differences over development projects in the River and Bay. These remarks[1] support the contention that the Delaware River and Bay Authority was granted an exclusive charter by each State to undertake any development of transportation and terminal facilities intended for public use on the River and Bay. While the existence of the Port of Wilmington might seem inconsistent with this mandate, the facility is owned by the municipality, and thus not a State undertaking. As such, its existence separate from the Delaware River and Bay Authority was tacitly accepted by the Compact language. Extensive direct attempts by the State of Delaware (including assumption of control), to extensively upgrade the Port of Wilmington might be met with the same arguments directed at the superport proposal. Indirect subsidies to the municipal port operation would appear to be consistent with the tacit acceptance of continued independent Port of Wilmington operation in the DRBA charter.

IV.C.5.d Financial Resources of the Delaware River and Bay Authority

Toll schedules at facilities of the Authority are required by the Trust Agreement to be established at an appropriate level to obtain the toll revenues necessary to pay off the bonded debt incurred for facility construction and to maintain the facilities in an acceptable operating condition. Specific items of cost to be covered by toll revenues, as noted in the Trust Agreement, include routine and special maintenance, operations, interest payments, principal amortization, reserve requirements, and coverage requirements. It is the intent of the Trust Agreement and other directives binding upon the Authority that its financial and operational practices follow prudent business principles and procedures.

Operating and maintenance expenses of the Authority have risen in recent years, as have costs incurred by other public and private agencies, and tolls were increased in late 1979. The basic rationale for determining appropriate toll increases and new schedules remains, according to the

[1] Judge James Latchum, U.S. District Court, District of Delaware and formerly Secretary of the Delaware conferees, in a private interview.

Trust Agreement, the establishment of rates sufficient to cover debt service and operating costs.

This approach to the establishment of toll schedules and levels is not followed by many agencies operating toll facilities. This is particularly true when the owning or operating agency has been given other responsibilities and mandates for involvement in activities which are not financially solvent. Examples of this situation include the Triborough Bridge and Tunnel Authority in New York City, which has tolls set very substantially in excess of the levels required to pay off its bonds. Surpluses generated are regularly turned over to the agency responsible for operating the New York City subway system. Another example, also in New york, is that of the Port Authority of New York and New Jersey. Many of its activities, ranging from mass transit sytems to port facilities and office buildings, are not self-sustaining, and revenues of toll bridges and tunnels are used to finance those activities. Authorities and agencies throughout the United States engage in similar transfers of funds from solvent toll facility operations to less financially viable activities which require support and may provide broad public benefits.

In cases where toll levels are not established solely to generate revenues to cover debt service and operating costs associated with the toll facility, toll schedules at higher levels may reflect user costs via competitive facilities and alternative routes. Schedules and experience elsewhere on similar facilities also influence what can be considered an acceptable toll level. In such cases the level of the toll schedules adopted is based in part on an assessment of the nature and magnitude of the public benefits which might be obtained by diverting of toll revenues to other purposes.

In the event that government officials at various levels and other concerned parties should consider it appropriate to use Authority toll revenues as a source of funds for purposes other than the operation of existing crossings and the associated debt amortization, then two questions must be addressed. First, what is the general magnitude of the funds which could be made available from earnings of the present facilities of the Authority and be applied to such other purposes as were thought to be in the public interest and worthy of Authority financial support? Second, what procedures would have to be followed to comply with existing bondholder agreements and still make available some funds for purposes other than those presently existing?

IV.C.5.e Additional Potential Authority Bonding Capacity

To develop a preliminary estimate of the additional financing capacity of the Authority (over and above its present obligations), two "possible" future toll schedules for the Delaware Memorial Bridge were analyzed. These "possible" toll schedules are characterized by rates that are significantly higher than both existing tolls and revised tolls recently implemented by the Authority. However, these possible rates are not

appreciably out of line from those currently in effect on similar facilities elsewhere.

Table IV-2 presents traffic and toll schedule data for the Delaware Memorial Bridge and nine other major crossings in the eastern United States. For the Bridge operated by the Delaware River and Bay Authority, four toll schedules are shown: the existing rates, an increased rate put into effect by the Authority in September, 1979 (based upon URS/ Coverdale & Colpitts' report of May, 1979), and the two schedules developed for this analysis titled Schedule "A" and Schedule "B." Each of the crossings included in the table had a total annual volume of more than 10,000,000 vehicles in fiscal year 1978, with two exceptions. The facilities with lower volumes are the Chesapeake Bay Bridge, which had a volume approaching 10,000,000, and the Commodore Barry Bridge, which is shown because it is the Delaware Memorial Bridge's chief competitor.

As can be seen from the table, the existing rates for all classes of vehicles on the Delaware Memorial Bridge are lower than those currently in effect on eight of the nine comparable facilities. Under the new toll schedule, the cash passenger car toll is increased to $0.60, equal to the level of the rates on the DRPA crossings, and the commuter rate is increased to $0.30. Under the Schedule "A" and Schedule "B" toll rates, the cash passenger car tolls are assumed to increase to $0.75 and $1.00 respectively. Tolls for commuters are increased commensurately. These rates are not inconsistent with those on five of the other facilities included in the table.

At present, rates for heavy commercial vehicles using the Delaware Memorial Bridge are low in comparison to the rates on other facilities. They are also low compared to the cash passenger car toll on the Bridge. Under the new toll schedule, these discrepancies are partially rectified since the increase in truck rates is greater than the increase in passenger car rates. However, the higher rates shown for the possible toll schedules would not be out of line with those charged on other facilities. A rate of $0.75 per axles assumed in the Schedule "A" toll rates is in effect on the DRPA facilities. A rate of $1.00 per axle assumed in the Schedule "B" toll rates is commensurate with the $1.00 cash passenger car toll.

In order to compare annual toll revenue levels under the existing, revised and possible toll schedules, estimated loss of traffic attributable to the toll increases was based on competitive factors and on the impacts of past toll increases on similar facilities. Estimated toll revenues were calculated for representative near-term years based on likely traffic growth trends. Table IV-3 presents estimates of additional annual toll revenues resulting from the implementation of higher toll schedules than the one now in force at the Delaware Memorial Bridge.

Table IV-2 Comparison of Tolls on Delaware Memorial Bridge with Tolls on Other Similar Facilities

	Annual Volume FY 1978	Percent of Total Traffic			Tolls		
		Psgr. Cars & Light Comm. Veh.		Heavy Comm. Vehicles	Psgr. Cars & Light Comm. Veh.		Heavy Comm. Veh.
		Cash	Commuter		Cash	Commuter	Rate per Axle
Delaware Memorial Bridge	18,584,000	70.9%	10.3%	18.8%			
Existing Tolls					$ .50	$ .20	$.33 to $.375
Revised Tolls*					.60	.30	.50
Schedule "A" (Possible)					.75	.40	.75
Schedule "B" (Possible)					1.00	.50	1.00
Newburgh-Beacon Bridge**	10,269,000	69.4	15.3	15.3	.25	.15	.25 to .33
Delaware River Port Auth.					.60	.40	.75
Commodore Barry Bridge	4,857,000	68.0	22.3	9.7			
Walt Whitman Bridge	32,572,000	63.5	30.5	6.0			
Ben Franklin Bridge	39,562,000	67.6	27.2	5.2			
George Washington Bridge**	39,562,000				.75	.50	
Baltimore Harbor Tunnel	22,460,000	71.7	15.7	12.6	.75	.35	.50
Tappan Zee Bridge	13,488			3.7	.75	.25	***
Verrazano Narrows Bridge	43,449,000				1.00		1.00
Chesapeake Bay Bridge	9,833,000	75.3	14.3	10.3	1.25	.60	.90

*Effective 9/1/79

**Tolls collected in one direction only. Toll shown is one-way rate.

***Classification not based on number of axles.

Table IV-3. Estimated Additional Annual Toll Revenues*

Toll Schedule	Additional Amount ($ Millions)	Increase over Revised Toll Schedule ($ Millions)
Revised	3.2	--
Schedule "A"	6.5	3.3
Schedule "B"	8.8	5.6

*Average values for 1979-1983 period.

As indicated, the revised toll schedule implemented in September, 1979, will produce an average of approximately $3.2 million annually in additional toll revenues over the next several years. These funds will be required to cover increased expenses of the Authority as presently envisioned. As further shown in the table, were the possible Schedule "A" or Schedule "B" to be implemented shortly thereafter, additional revenues estimated at $3.3 million or $5.6 million annually over those realizable under the revised schedule could be obtained.

For this analysis, increased tolls were not considered for the Cape May-Lewes Ferry, since the revised tolls are probably a maximum at this time. Further, they account for only a limited portion of the Authority's total revenues, and an increase would not result in significant additional revenues.

In order to prepare "order-of-magnitude" estimates of the Authority's additional bonding capacity which could result from the implementation of the possible toll schedules, the following basic assumptions were made:

1. The bonds will be issued on January 1, 1985, at a 6.5% interest rate and will be repaid over a 30-year period.

2. The revised toll schedule will be in effect before 1985. Therefore, for this analysis the additional net revenues available for supporting additional bonds are considered to be the annual differences between the anticipated revenues under the revised toll schedule and the "possible" toll schedules.

3. The Authority will be required to covenant that additional annual net revenues will be sufficient to cover 110% of required interest and amortization requirements. This coverage requirement is low but is based upon the assumption that concerned government agencies will provide some form of substantial support to the bond issue so that this reduced coverage can be obtained. Since all

prospective activities of the Authority would be in the public interest and must have the concurrence of New Jersey and Delaware as well as other governmental units, this assumption is appropriate.

Based upon the foregoing, it is estimated that the additional bonding capacity of the DRBA which could be derived by further toll increases and utilized for other purposes than the debt amortization and operation of existing crossings is approximately $40 million if Schedule "A" or a similar one is implemented and approximately $70 million if the higher Schedule "B" or a comparable schedule is established at the Delaware Memorial Bridge. The total amount which could be bonded for a new project could be higher if the project generated operating revenues sufficient to guarantee payment on debts in excess of these amounts.

IV.C.5.f Legal Requirements Regarding the Use of Authority Funds for New Purposes

The January 1, 1964, Trust Agreement securing the balance outstanding of the $103 million revenue bonds issued by the Authority in 1964 permits the issuance of additional bonds on a parity with the outstanding bonds for the purpose of paying all or any part of the cost of any bridge or any tunnel or any bridge and tunnel project across the Delaware River or Bay between the two States or any addition or improvement to, or any enlargement or replacement of, any part of the present bridge project, the present ferry project or any bridge or any tunnel or any bridge and tunnel project. The Trust Agreement does not permit the issuance of additional parity bonds for purposes other than a crossing. However, net revenues of the present projects in excess of debt service and reserve requirements may be deposited to the credit of the General Fund which, under the provisions of the Trust Agreement, may be used for certain other purposes. These purposes include paying for the cost of constructing transportation and terminal facilities which the Authority may be authorized to own and operate; they may also be pledged to pay the interest and amortization on any obligations of the Authority issued to pay such cost.

The pledge of the revenues of the Authority to these obligations would be subordinated to its pledge of revenues to its outstanding revenue bonds or to any additional parity bonds that might be issued.

If the Authority desired to issue bonds for transportation and terminal facilities on a parity with its other bonds, it would be necessary to refund the outstanding revenue bonds.

IV.D INSTITUTIONAL ANALYSIS OF HYPOTHETICAL PROJECTS

Eight types of projects are analyzed below. Each has been proposed or discussed by one or more parties in recent years as a potential use of the Bay and its resources. Most have both supporters and opponents among

officials on both sides of the Bay interviewed in the course of this study. The projects are:

- fixed crossing of the Bay
- expansion of conventional port facilities
- deepwater port development
- development of fishing ports
- marina development (recreational boating)
- other shoreline development
- dredge spoil disposal
- aquaculture

At the beginning of each analysis is a brief description of the type of development project to be considered. Possible illustrative locations may be suggested, but this does not constitute a recommendation for a specific project or site. Specifics are provided solely so the reader may get a better understanding of the regulatory or institutional issues which would surround such a development. The specificity of definition does not imply any commitment of interest by the Delaware River and Bay Authority, nor does it constitute a recommendation from the consultants.

Following a project description, the analysis is divided as follows:

- agencies which could assert jurisdiction to operate the project;
- relationship between the project and land use planning goals of the federal and State governments;
- permits required for project development;
- conflict between the project and the policies of permitting agencies;
- bureaucratic overlap and possible conflict;
- changes in policy which would be necessary for the project to proceed.

IV.D.1 Fixed Crossing

IV.D.1.a Project Description

If an additional crossing were to be proposed across the Delaware Bay, it would most likely be a bridge connecting with the Garden State Parkway and Routes 9, 1, and 14 in Delaware. This bridge would replace the existing Cape May-Lewes Ferry. The structure would be a trestle (not a causeway) across all existing water areas, with a high-rise span or a tunnel at the ship channel wide enough to accommodate two large ships passing in the channel. It is assumed that newly constructed approaches to the bridge would disrupt some wetlands and beaches on either side of the Bay.

IV.D.1.b Jurisdiction to Operate

The Delaware River and Bay Authority is the only public agency chartered to build crossings of the River and Bay below the Pennsylvania State line and would clearly be the agency to build an additional crossing.

IV.D.1.c Relationship to Land Use Planning Goals

Any mid-Bay or lower-Bay crossing which produced substantial pressure for development of the wetlands or agricultural land on either side of the Bay would be contrary to current State land use planning goals. A crossing at the mouth of the Bay would undoubtedly increase development pressure on the Atlantic coastal beaches, already heavily developed. While some development at the Cape May airport and in Lewes is considered desirable by State governments, a substantial increase in development pressures along the South Jersey coast would exacerbate the currently intense demand for public services resulting from casino gambling in Atlantic City and would be contrary to the current designation of most of Cape May County as a low-growth area in the New Jersey plan.

IV.D.1.d Permits Required

Any bridge or tunnel would require the full range of environmental permits. On each side of the Bay, the bridge would require State permits for use of wetlands, use of State-owned subaqueous lands, and quite probably a beach erosion permit on the Delaware side. The bridge itself would not require a coastal zone permit in Delaware, but such a permit would be required for the necessary approach roads in Cape May County. A permit from the Coast Guard would be required for the bridge itself and would specify the steps necessary to protect navigation in the Delaware Bay ship channel. The project is of sufficient scope that it would require an environmental impact statement under the National Environmental Policy Act. The lead agency for such a review would probably be the Coast Guard.

While the bridge would not constitute a point source of air or water pollution once completed, any service facilities for the bridge would require either a point source permit for pollution or a permit to tap into

municipal sewage systems. The bridge would undoubtedly be subject to a critical review under the New Jersey State Air Pollution Control Plan because of the contribution from increased traffic to the high levels of ozone experienced during peak summer periods along the Jersey shore.

IV.D.1.e Conflict with Policies of Permitting Agencies

To the extent that the bridge and associated road encourage increased development pressure in the coastal communities on either side of the Bay, the project would conflict with plans for low to moderate growth and the preservation of remaining wetlands along the Atlantic shore. Access roads would have to be routed so as to minimize any disruption of wetlands. The Coast Guard would undoubtedly require a central span of sufficient length to permit unobstructed passage of shipping in the channel. Federal dredge and fill permits and State permits for use of subaqueous lands would probably be approved if the other environmental aspects of the bridge were acceptable to State and federal governments. Nevertheless, federal agencies would undoubtedly require that the bridge be built in such a way as to minimize the disruption of bottom sediments.

The bridge would also need to be routed so as to avoid any substantial oyster beds or spawning areas. It does not appear that there are any endangered species which would be threatened directly by the construction of a bridge at the mouth of the Bay.

IV.D.1.f Overlapping Authorities

Determination of the acceptability of the bridge to the federal government would depend upon the environmental impact statement which would be required. The Coast Guard, Corps of Engineers, and environmental agencies commenting on the permit issued by each of these agencies, would attempt to coordinate their reaction to the bridge proposal. A parallel negotiation with State environmental authorities on either side of the Bay would be necessary to determine State imposed siting criteria or limitations on bridge development. In New Jersey, independent comment upon federal dredge and fill permits by Water Resources staff could further complicate planning efforts. However, New Jersey does have a special DEP office to coordinate environmental review of massive projects such as a bridge crossing, and this agency would be the focus in New Jersey of efforts to obtain a comprehensive analysis of the bridge.

IV.D.1.g Changes Necessary to Implement the Project

The attitude of the New Jersey State government, as expressed in the Development Guide Plan and coastal resources development policy, would have to change if any proposal for a crossing of the lower Bay were to be supported at policy-making levels. Designation of most of Cumberland and Cape May Counties as a limited growth area is inconsistent with a massive investment in a crossing of the lower Bay. No other environmental or land use policy explicitly excludes a crossing, but a very strong case for the need for a bridge would have to be made to override concerns about

the disruption of wetlands, beaches, or underwater lands in the Bay, and the concern for an increase in the danger of shipping accidents due to constriction of traffic by the crossing.

IV.D.2 Expansion of Conventional Port Facilities

IV.D.2.a Project Description

Construction of improved cargo handling capacity at ports already handling deepwater commerce has often been proposed. At the Port of Wilmington this might include reorientation of the wharves from the Christina to the Delaware River. It would involve dredge and fill operations but not the destruction of virgin wetlands. The development would occur in a populated area with existing infrastructure and labor supply.

A second type of port development could be possible at Cape May or Lewes for moderate draft ships (15-20 feet) of the offshore oil or fishing industries. The fishing port option is discussed more fully below. The Lewes port addition would be subject to most of the institutional constraints discussed with respect to a Wilmington Port Project, as well as to environmental constraints due to dredging impacts. Environmental conflicts would depend on the size and siting of any project, as well as the population growth projected to follow such a development.

IV.D.2.b Jurisdiction to Operate

While four public agencies are chartered to operate ports or transportation and terminal facilities in the Bay area--the Delaware River Port Authority, the South Jersey Port Corporation, the Delaware River and Bay Authority, and the Port of Wilmington--only the Port of Wilmington is currently operating any facility on or near to the Bay. Delaware is not a member of the Delaware River Port Authority or the South Jersey Port Corporation. New Jersey is a partner in both the Delaware River Port Authority and the Delaware River and Bay Authority, and the State created the South Jersey Port Corporation by statute.

IV.D.2.c Relationship to Land Use Planning Goals

Expansion of the Port of Wilmington or creation of additional port facilities north of the Delaware Memorial Bridge is consistent with the plans of both New Jersey and Delaware if the project is an expansion of existing facilities. Both States wish to encourage industrial growth north of the Bridge. A small port development in Cape May or Lewes would also be consistent with State land use planning goals.

IV.D.2.d Permits Required

Any expansion of existing port facilities would require the usual package of marine permits. This would incude a wetlands permit, if any saltwater marshes are to be affected, and a subaqueous lands permit from the State in whose waters the port is built. Appropriate local zoning of the land would also be required.

In New Jersey, any port development south of Pennsville would require a coastal facility siting permit. Docking facilities in the Port of Wilmington are exempt from the Delaware State Coastal Facility Siting Law, but expanded dockside operations in Lewes would require a coastal facility siting permit. Improvements in existing piers or channels would not require such a permit. Permits from the Corps of Engineers would be required for the bulkheads, piers, and any dredging necessary to add to existing port facilities.

IV.D.2.e Conflict with Policies of Permitting Agencies

In general, the government of either State would be expected to be receptive to an expansion of existing ports which does not greatly change the scale of these ports. The greatest potential conflict would come in the actual siting and method of construction. Federal environmental agencies commenting upon permits issued by the Corps could be expected to request a port developer to take compensatory measures, even in an industrialized area, to improve wetlands and marine environment. A heavy burden of proof would be placed upon the port developer to justify the need for any filling of shallow waters, and the filling of wetlands not already degraded would not likely be approved. In general, permitting agencies would prefer to see ports built on piles or floating structures connected to existing dry land, rather than on fill in shallow water or marshland.

IV.D.2.f Overlapping Authorities

Since the Port of Wilmington is the only operating public port on the lower River and Bay, there need not be any direct conflict with other agencies in expanding this port. However, the Port of Wilmington competes, at least in part, with the Port of Philadelphia (run by the Philadelphia Port Corporation) and the Port of Camden (run by the south Jersey Port Corporation). Since both of these port corporations are subsidized by their respective State governments, these governments may oppose any major transfer of funds from the Delaware River and Bay Authority or other interstate agencies to subsidize expansion of the Port of Wilmington. If such a subsidy were to occur, it should probably occur in the context of a larger regional port plan which would permit specialization of the Ports of Camden, Philadelphia, and Wilmington and reduce fears of direct competition. At the moment, none of the agencies chartered for port development is exercising this coordinating function for the entire Delaware River and Bay.

IV.D.2.g Changes Necessary to Implement the Project

There is nothing in the policy of Delaware or the federal government to discourage expansion of the Port of Wilmington. Recent evidence suggests, however, that federal environmental agencies might impose certain requirements for port construction which are contrary to the original plans of the Port of Wilmington. Closer conformity of environmental and land use planning policies might simplify expansion of the existing Port.

In Cape May or Lewes, small scale port expansion would be consistent with State and federal policies, but actual approvals would depend upon the site of the project and the amount of environmental disruption involved.

IV.D.3 Deepwater Port Development

IV.D.3.a Project Description

Two hypothetical options for a deepwater port are reviewed in the following discussion:

- A monobuoy unloading facility located beyond State territorial waters outside the Delaware Capes, with a pipeline connection to a tank farm onshore (behind the immediate coast) with a connecting pipeline to upriver refineries.

- An artificial island built on Lower Middle Shoal abutting the ship channel in the lower Bay, inside the Capes. Such a project might include storage tanks for LNG and/or crude oil, but does not include dry cargo or industrial facilities.[1] Pipelines would take the oil to existing refineries further up the River, and the terminals would not be expected to generate major new employment after construction is completed.

Either project would be expected to end the lightering of oil off Big Stone Beach. No crude oil would be transported upriver by tanker, but existing channel depths would be maintained for dry bulk and general cargo ships.

IV.D.3.b Jurisdiction to Operate

A deepwater port on the New Jersey side of Delaware Bay would appear to be within the charters of the South Jersey Port Corporation, Delaware River Port Authority, and Delaware River and Bay Authority. However, most of the deep water in the bay is located on the Delaware side, where the Delaware River and Bay Authority is the only multi-state agency chartered for port development. The Delaware River and Bay Authority has previously expressed the legal opinion that its charter makes it the sole agency for port development on both the New Jersey and Delaware sides of the Bay. There is some evidence that this exclusive responsibility was the intent of the drafters of the DRBA Compact, although the

---

[1] Inclusion of dry cargo, container handling, and industrial facilities on an artificial port island has been proposed in a paper by the College of Marine Studies, University of Delaware. The more limited concept of a port island for oil/LNG delivery is examined here.

Delaware River Port Authority and the South Jersey Port Corporation are clearly empowered to act as port agencies for the counties of southern New Jersey (Salem, Cumberland, and Cape May).

The jurisdictions of the South Jersey Port Corporation and Delaware River Port Authority run around Cape May and northward on the Atlantic Coast, within State territorial waters. Thus, these institutions are candidate public agencies for the operation of a deepwater port outside New Jersey territorial waters. The Delaware River and Bay Authority has argued that its jurisdiction extends outward to the three-mile limit of State territorial waters, and that it is also the appropriate agency for construction of an offshore port beyond State territorial waters off the Delaware Capes. Some interest has been expressed in the State of Delaware in a privately sponsored offshore oil port. The State of New Jersey has expressed no opinion as yet on the agency to take the lead if a deepwater port is built but has requested the Port of New York and New Jersey Authority to undertake a study of an offshore port which would receive all imported crude oil for the Delaware River and New York Harbor refineries.

Under the Deepwater Ports Act of 1974, an agency of the State (including a bi-state compact agency such as DRBA) has the first right of refusal in creating a deepwater port.

IV.D.3.c Relationship to Land Use Planning Goals

A deepwater port is not entirely inconsistent with coastal zone and land use plans in Delaware and New Jersey. A deepwater port within the Bay would be contrary to Delaware law and is not currently favored by New Jersey policy. An offshore port feeding the Delaware River refineries might be acceptable, but the shore-side facilities would have to be planned to minimize the effect on coastal communities. New Jersey may prefer to have any oil pipeline come ashore near Atlantic City, where it would proceed up the Atlantic City Expressway corridor to an inland tank farm, avoiding the environmentally sensitive Pinelands Preservation Area. In Delaware, some State officials have indicated that the State might permit a pipeline coming ashore from a terminal in the open sea off Cape Henlopen, but the community of Rehoboth is actively opposed, and Lewes has not strongly endorsed such a proposal.

IV.D.3.d Permit Required

Constructed in the Bay, a deepwater port would require the same permits listed for expansion of a conventional port. If located outside of State territorial waters beyond the mouth of the Bay, the port would also require a permit from the U.S. Coast Guard under the terms of the Deepwater Ports Act. In addition, a pipeline serving the Delaware River refineries would require approval of the Department of Energy.

IV.D.3.e Conflict with Policies of Permitting Agencies

A deepwater port in the Bay is barred by Delaware's Coastal Zone Act and is inconsistent with the goals of the coastal zone management plan in New Jersey. If a port was to be built, both States would reportedly prefer to see it located outside the Bay. This reflects the prevailing view that an oil spill within the Bay would be an ecological disaster for the beaches and wetlands, while a port well offshore would minimize the risk of grounding and collision, and any spills would be swept to sea by prevailing offshore winds.

Shore-side facilities for an offshore large tanker port would be subject to the same environmental concerns discussed under conventional ports. Both States could be expected to require any tank farm to be located inshore of the immediate coastal zone and to require that such a facility be built on dry land, not on marshland. The State of Delaware has offered a tentative opinion that a pipeline crossing the coastal zone from an offshore facility to an inland terminal would not be prohibited under the State Coastal Zone Act, which bars new bulk terminals in the coastal zone.

IV.D.3.f Overlapping Authorities

If a deepwater port is to be built in the Delaware Bay area, the overlap between port authorities would have to be resolved. Delaware and New Jersey would have to determine whether each State reserved the right to independently develop public ports when the Delaware River and Bay Authority was created. Since the approval of either State will be necessary under the Deepwater Ports Act for a port located off the Delaware Capes and constructed by the other State, a strong argument could be made for the construction of such facility through a bi-state authority.

IV.D.3.g Changes Necessary to Implement the Project

Any deepwater port in the Delaware Bay replacing the current lightering operation off Big Stone Beach would require amendment of the Delaware Coastal Facilities Siting Act and a change in the coastal zone management plan in New Jersey. Inasmuch as the lightering area is not a facility, it cannot be considered a "port" in terms of either the siting Act or the plan. Furthermore, it cannot be construed as a "port" in terms of other regulatory programs, such as for wetlands, underwater lands, bottom lands, and dredge and fill operations. If it were expanded with fixed facilities, it would no doubt become a "port." For a port to be constructed off the Delaware seacoast, a change in the opposition from residents of coastal resort communities would be necessary.

IV.D.4 Fishing Port Development

IV.D.4.a Project Description

In recent years, there have been proposals for development at Lewes and/or Cape May of the channels, docks, unloading facilities, and cold storage needed for expanded fisheries production. The project might include a processing plant for frozen fish products. The facility would accommodate more fishing craft of deeper draft than presently use the ports, dependent upon expanded exports or processed fish production. The site is assumed to require minor alterations in the shoreline but no extensive filling of existing wetlands.

IV.D.4.b Jurisdiction to Operate

Any one of the port authorities (Delaware River Port Authority, Delaware River and Bay Authority, South Jersey Port Corporation) which are chartered to operate ports in the Bay might potentially operate a fishing port in Cape May. The DRBA might also operate a fishing port in Lewes. Under the Fisheries Conservation and Management Act of 1976, the federal government manages fisheries within the 200-mile limit through a series of regional Fisheries Management Councils. Foreign fleets may only take that part of a fish harvest not captured by American boats. Mortgage insurance up to 87.5% of value is available for the purchase of new American fishing boats. However, the federal government does not have a program to develop shoreside facilities for fishing boats. Neither State has yet created a specific fisheries authority for the development of commercial fishing operations, although New Jersey has proposed some forms of subsidy for the expansion of shore facilities for commercial fishing.

IV.D.4.c Relationship to Land Use Planning Goals

Expansion of the fishing industry in Lewes and Cape May is consistent with current State land use and coastal zone management plans. The specific site and scope of the project would determine the acceptability under existing environmental policies.

IV.D.4.d Permits Required

The package of marine permits discussed under conventional ports would be required for a fishing port development which includes fish processing operations. These permits are:

- state coastal zone permit
- wetlands permits (if any wetlands are affected)
- riparian (New Jersey) and subaqueous lands (Delaware) permits

- dredge and fill permits from the Corps of Engineers (Chapter 10 of the Rivers and Harbors Act and Section 404 of the Federal Water Pollution Control Act)

Any change in existing operations would have to be consistent with local zoning, but both harbors do have waterfront zoned for commercial purposes. If a fish processing plant were to be built at the port, the processor could be required to obtain a NPDES permit for the discharge of wastes or a permit for an industrial connection to the municipal sewerage system. In Delaware, the permit would be issued by the State. In New Jersey, the fish processor would be required to obtain the NPDES permit from the U.S. EPA and a separate permit from the New Jersey DEP.

IV.D.4.e Conflict with Policies of Permitting Agencies

There is no inevitable conflict with the policies of either State in developing or expanding a fishing port in Cape May or Lewes. Specific problems would revolve around the site and scope of the project, particularly the discharge of any fish wastes into restricted waters, the effect of the necessary dredging upon benthic organisms, migrating fish, and shellfish, and the destruction of any wetlands which might occur as a result of fishing port development.

IV.D.4.f Overlapping Authorities

Neither State has a specific agency for the development of fisheries support. Port authorities might consider themselves having this responsibility, consistent with their charters for the operation of "port" or "terminal and transportation" facilities, so long as State governments accept this initiative.

IV.D.4.g Changes Necessary to Implement the Project

Outside of environmental limitations on specific sites, it appears that there are no bureaucratic barriers to the creation or expansion of fishing ports. The major problems are the exploitation of the appropriate new fish markets and the raising of the necessary capital for the expansion.

IV.D.5 Marina Development

IV.D.5.a Project Description

Marina proposals have been made in the past and are likely to continue in the future. As a hypothetical project we have selected creation of a new marina with 300 slips or more with draft to 10 feet and accommodating boats from 20-100 feet in length with additional dry storage and launching capacity. The facility could be built anywhere in the lower Bay but would be sited so it did not claim existing wetlands. The marina would be built inside breakwaters in existing open water north of

Cape May or at Breakwater Harbor in Lewes adjacent to the existing ferry terminal. A new marina might also be part of an artificial island created from dredge spoil in a shallow area of the bay. Only limited additional dredging would be necessary for such projects.

While development of smaller marinas along the shallow creeks in the central Bay is a possibility, more conflict with wetlands laws and more extensive dredging would be required to provide access for larger boats.

IV.D.5.b Jurisdiction to Operate

New Jersey operates four public marinas through the Division of Parks and Forestry, Department of Environmental Protection. These facilities, including the marina leased to a private operator at Fortescue on the Delaware Bay, were constructed by the State or acquired from municipalities. The State has no plans to expand these facilities or construct new marinas.

Delaware has no public marinas, although Delaware's DNREC does provide shoreline launching ramps. A Commission on Marine tourism appointed by the Governor has been studying waterfront facilities this year. One of their objectives is to increase access to State waters without an increase in the number of boat trailers clogging highways on summer weekends.

If a marina is defined as a transportation and terminal facility, then marina development fits within the charter of the Delaware River and Bay Authority. Although theoretically a form of port, it is unlikely that the South Jersey Port Corporation or the Delaware River Port Authority would assert jurisdiction to develop marinas in the Delaware Bay.

IV.D.5.c Relationship to Land Use Planning Goals

Development of additional marinas or expansion of existing marinas would be consistent with the dedication of the Atlantic coastal area primarily to recreational use. Development of marinas of any size in the mid-Bay marshlands would be inconsistent with the current environmental and land use policies, although small marinas on creeks already dredged and containing boat handling facilities could be consistent with the low growth designation of these areas. The most important restrictions on marina development deal with the specific site of the project, not with the general desirability of promoting public access to the Bay and Atlantic coastal waterways.

IV.D.5.d Permits Required

Any marina would require the package of marine permits listed in the discussion of port facilities. Land where a marina is located would have to be properly zoned under local planning ordinances to obtain the necessary permits. State funds for significant expansion of sewer or highway links to a new marina would be unlikely. In Delaware, a marina

could be developed without a coastal zone permit, but a marina of any size might be defined as a marine terminal and could require a coastal facility siting permit under New Jersey law. If combined with significant new roadways or housing and hotel developments in excess of 25 units, a marina would definitely require a coastal facility siting permit in New Jersey.

IV.D.5.e Conflict with Policies of Permitting Agencies

Any marina which disrupts existing wetlands would be opposed by both federal and State environmental agencies. Similar resistance would be encountered if the marina were to require any extensive initial dredging or constant maintenance dredging. This means that a large marina located in any of the shallow creeks on either side of the central Bay would likely be resisted. Federal environmental officials have indicated that they flatly oppose any marina created in dredged wetlands with dead-end basins or similar characteristics which prevent proper tidal flushing. A marina would be most acceptable if located in open water (perhaps protected by breakwaters, if such breakwaters did not threaten beach erosion) with adequate tidal flushing, and with minimum disruption of subaqueous lands or marshlands during construction.

IV.D.5.f Overlapping Authorities

The problem here is not one of overlap, but of clear designation of any agency to develop marinas, if either State believes that marina development is an appropriate public task. State of New Jersey officials have indicated that boating represents a relatively high income activity whose needs should be met by private capital. While it is true that existing marina rates suggest that a market may exist sufficient to reimburse the cost of investment in new facilities, the uncertainties involved in obtaining an environmentally acceptable site and necessary permits have apparently discouraged new private investment. Designation of a public authority to plan for a marina development which is actually carried out with private capital could be an appropriate solution.

IV.D.5.g Changes Necessary to Implement the Project

As discussed in the concluding section of this chapter, there is a need for marina development to be facilitated, and such projects are more likely to be designed in an environmentally acceptable manner if a public or quasi-public agency assumes planning and preliminary development responsibilities. Unification of various coastal/marine permits could also permit the private entrepreneur to negotiate more efficiently for an environmentally acceptable marina site in the lower Bay.

IV.D.6 Other Shoreline Development

IV.D.6.a Project Description

Development of access to water, including beaches, promenades, fishing facilities and historical points of interest could be integrated with

marina or fishing port development. It could occur anywhere in the Bay area except existing wetlands. At Lewes, a waterfront historical park could be established adjacent to the ferry terminal. Included in the expanded facilities would be the his rical lightship currently owned by the Lewes Historical Society and a museum dep ting the long and colorful history of the Delaware Bay pilots who are stationed at Lewes. Pier facilities would be provided for charter fishing and excursion boats, perhaps with a finger pier extending far enough into the bay to permit fishing and observation of traffic in the ship channel.

The great wetland wildlife refuges of the Bay do not attract the public interest which they might. Improvements (perimeter roads, ecological exhibits) might be provided to encourage more area citizens to learn about the ecology of the Bay. While mass access is not compatible with refuge purposes, improved pathways and shallow water access for guided tours might also be provided.

IV.D.6.b Jurisdiction

State parks and wildlife refuges are located on both sides of the Bay. There are no national parks in the Bay area, but the federal government operates extensive wildlife refuges here through the Fish and Wildlife Service. Some monies from the U.S. Bureau of Outdoor Recreation have been used only for land acquisition and the development of very limited public access to the areas acquired.

IV.D.6.c Relationship to Land Use Planning Goals

The network of wildlife refuges in the center of the Bay is an integral part of the approach to preservation of this area taken in State land use and environmental plans. Public beaches such as at Cape Henlopen State Park are part of the attraction for tourists offered in the Atlantic coastal segment. Some further development of recreational opportunities is not inconsistent with the general designation for low to moderate growth and the emphasis on tourism and recreation. Coastal zone plans in each State focus heavily on assuring public access to beaches and the waters of the ocean and Bay.

IV.D.6.d Permits Required

Construction of an artificial island, fishing piers, or similar enhancements to underutilized beaches on the Bay, such as those north of Cape May, would require various marine permits depending upon the actual project. Wetlands, subaqueous lands, and Corps of Engineers permits would probably be required for most such plans. In Delaware, a beach erosion permit would be required for any structure crossing the dune line.

IV.D.6.e Conflict with Policies of Permitting Agencies

No inevitable conflict in expanding recreational opportunities is apparent, unless the expected load of visitors would place undue burden upon existing public services, highways, or threaten wetlands and spawning grounds through land fill or decreased water quality.

IV.D.6.f Overlapping Authorities

Some conflict between Fish and Game agencies managing wildlife refuges and more intensive development of abutting shoreline areas for tourist use could be expected. However, the largest barriers to any enhancement of existing beach resources are the lack of available public land and the lack of capital.

IV.D.6.g Changes Necessary to Implement the Project

States would have to indicate if they wish to see any further development of specific sites with specific kinds of investments such as fishing piers, artificial islands, or similar improvements. If any capital intensive project is desired, then the States would have to designate a public agency with financial authority to perform such work.

IV.D.7 Dredge Spoil Disposal

IV.D.7.a Project Description

Provision of an environmentally sound area for the disposal of dredge spoil produced in the maintenance of the Delaware Bay shipping channel has also been considered. Creative use of the spoil might be included in development of the other port, waterfront, shoreline and recreational options. The Port of Wilmington is proposing the use of dredge spoil to construct a pier-front on the Delaware River which would ultimately replace existing facilities on the Christina River and enable the Corps of Engineers to stop dredging the Christina River channel to a 35-foot depth.

The nature channel in the Delaware River, prior to dredging, permitted a maximum draft of only 17 feet to Philadelphia. Dredging to maintain the current channel of 40 feet from the ocean to Philadelphia produces an estimated 4.0 to 4.3 million cubic yards of dredge spoil each year. Between 1836 and 1968, the Federal government dredged an estimated 863 million cubic yards from the Delaware River to maintain or improve navigability.

A large portion of the dredging required to maintain the 40-foot channel to Philadelphia occurs in a relatively small number of locations. The Marcus Hook range produces the largest single dredging requirements. The other segments of the channel requiring extensive maintenance dredging are Mantua Creek, Bellevue, Cherry Island, Deepwater Point, and New Castle.

Dredging costs rise sharply if spoil must be transported over long distances for disposal. The Corps of Engineers has recently relied on the use of a few major disposal sites on dry land or in diked areas near the major dredging operations. The two largest spoil sites in current use are at Pedricktown and Kiloohook. The Corps has been unable to obtain any major additional spoil disposal sites in the last decade because of environmental opposition to the filling of wetlands and in-water disposal and the high price of dry land sites which might also be suitable for industrial development. Disposal capacity in the sites currently in use has been increased by raising the height of the containment dikes, and existing sites are thought to be adequate, with added height, for another 15 to 20 years of maintenance of the 40-foot channel. After that, other solutions will be necessary or more lands pre-empted for spoils disposal and--perhaps--creative site developments.

IV.D.7.b Jurisdiction to Operation

The Corps is responsible for obtaining dredge spoil disposal sites for all spoil produced during Corps operations to maintain the ship channel below Philadelphia and other approved projects. Major disposal sites for maintenance of the main channel are currently owned or controlled by the Corps, but future arrangements might allow for use by the Corps of a site already owned by an agency, such as the Port of Wilmington, which would plan subsequent use of the land.

Any individual or State agency wishing to dredge must prove to the Corps that it has control of an environmentally acceptable disposal site for initial and maintenance dredging. Acquisition of the disposal site is a prerequisite for approval of a dredging permit by the Corps. Any disposal site where continued spoil deposition would harm shellfish and other aquatic organisms or significantly degrade water quality is not likely to be approved. The shortage of acceptable disposal sites suggests the importance of coordinating any dredging projects with nearby development efforts which might use the spoil.

IV.D.7.c Relation to Land Use Planning Goals

Deposition of spoil in areas designated for environmental preservation, particularly the mid-Bay marshlands, is clearly contrary to State policy. Some of the disposal sites currently used by the Corps were reclaimed from wetlands, but the capacity of existing areas is limited and similar sites for later use are not likely to be released by other federal agencies holding land along the River and Bay. Currently the cost of transporting spoil long distances to the open sea is considered prohibitive. Large spoil disposal beds in the tourist areas on the Atlantic Coast are unlikely to be acceptable either to tourist, fishing, or shellfishing interests. This places a great premium on creative use of disposal sites. One possibility might be an artificial recrational island built behind dikes in some of the shallow water of the Bay. Another possibility might be use of the spoil for industrial development on subaqueous lands or degraded wetlands in the upper segment of the river and Bay.

IV.D.7.d Permits Required

Spoil disposal requires a Corps permit, and federal and State environmental officials closely scrutinize the spoil disposal plan to determine its affect on shellfish, fish, and water quality goals for subaqueous waters, as well as the effect on aquifers. A State subaqueous lands or wetlands permit will also be required, except for upland disposal sites.

IV.D.7.e Conflict with Policies of Permitting Agencies

As noted in the case of the Wilmington Port expansion plan, federal environmental agencies are opposed to any new filling of subaqueous land or wetlands, particularly if the ultimate purpose can be achieved without filling. Burden is placed upon any party proposing dredging and spoil disposal to minimize environmental damage and to prove conclusively that his project is inevitably water-related and cannot be accomplished on existing dry land.

IV.D.7.f Overlapping Authorities

The Corps is clearly the primary authority, with the commenting environmental agencies at the State and federal level establishing the limits on allowable spoil disposal. No agency is clearly chartered to harmonize the need for spoil disposal with development projects such as the expansion of the Port of Wilmington.

IV.D.7.g Changes Necessary to Implement the Project

Some form of environmental zoning to permit greater environmental encroachment in the up-river zone designated for industrial development might provide greater opportunities for creative use of dredge spoil. The greatest need for maintenance dredging occurs in the industrialized portions of the river above New Castle, so location of spoil disposal/development projects in this area would also minimize disposal costs. If an artificial island or other project on filled land appears feasible, the two States would have to consider which agency with financing capability would be designated to take responsibility for creation of this facility from dredge spoil. A contribution from the Corps of Engineers or the private dredger disposing of these spoils might be a partial source of funding for the development project.

IV.D.8 Aquaculture

IV.D.8.a Project Description

Financial and technical assistance in bringing to commercial self-sufficiency the techniques for growing shellfish or fish under controlled conditions in the waters of the Bay has also been considered. Such a project might include venture capital, shore facilities, and allocation of appropriate sites to avoid conflicts with the natural

ecology. It could include provision of technical advice through the existing research programs at the University of Delaware (Marine Science complex at Lewes) and Rutgers University (Port Norris facilities). Shallow waters on both sides of the Bay could provide ideal sites for this type of development.

IV.D.8.b Jurisdiction to Operate

Both Rutgers University and the University of Delaware, College of Marine Studies--are active in aquaculture research. The College of Marine Studies maintains a substantial research facility at Lewes. Rutgers has a smaller research operation at Port Norris.

Each State has traditionally regulated the catch of shellfish in Bay waters. This is done through the Division of Shell Fisheries in New Jersey's DEP and through the DNREC in Delaware. These agencies have controlled the take of oysters from Bay beds by establishing open seasons, catch limits, and other regulations. New Jersey has required return of a proportion of oyster shells to the beds so that new generations of oysters will have a place to "set." While the growing on certain leased beds may be considered a form of aquaculture, supervising agencies have generally functioned in the same manner as a fish and game department setting regulations for the catch of wild creatures.

IV.D.8.c Relationship to Land Use Planning Goals

With proper environmental safeguards, almost any form of aquaculture in shallow waters in the central and lower Bay would appear to be consistent with current State land use policies. Problems could be expected only if the operation were so extensive as to damage the nature ecology or require the filling of land for shoreside support.

IV.D.8.d Permits Required

Under §318 of the Federal Water Pollution Control Act, aquaculture projects are subject to the requirements of the NPDES program, which would be applied to some operations involving forced feeding or the discharge of heated or polluted waters. If the operation involves enhanced production of species normally present in the Bay, such as oysters or crabs, special exceptions may be required to the regulations normally imposed upon the catch of these species. Use of the Bay bottom would require a subaqueous lands lease from the State controlling the bottom lands. Other marine permits would be required only if the aquaculture operation requires dredging or alteration of wetlands. If the aquaculture operation were of sufficient scale to require a major processing plant for the product, this plant would likely require a coastal facility siting permit and an NPDES permit of its own as well as a separate State discharge permit in New Jersey.

IV.D.8.e Conflict with Policies of Permitting Agencies

Aquaculture operations should not conflict with permitting policies unless such operations threaten to harm water quality and the existing ecology in the Bay or require shoreside facilities of sufficient magnitude to encroach upon wetlands or beaches. Fixed facilities such as tanks, piers, floats or other items would require a Corps permit, since they would be located in navigable waters, but if located in the large expanse of shallow water and suitably marked with navigational warnings, there should be no objection to the placement of facilities in the Bay.

IV.D.8.f Overlapping Authorities

Some problem can be anticipated if aquaculture operations develop on both sides of the Bay and are subject to different regulations from each State despite the similarity of the operation and the ecology of the Bay on each side of the ship channel. There is no competition at this time between public agencies who are prepared to go beyond the research stage in encouraging aquaculture development. If a public agency does move in to assist in this innovation, some conflict might occur between the agency encouraging development and agencies which currently regulate the natural production of the Bay.

IV.D.8.g Changes Necessary to Implement the Project

Each State bordering the Delaware Bay would have to answer three questions before a more extensive aquaculture program were to proceed:

- Does aquaculture have the potential for significant future development?
- Is assistance in commercializing aquaculture research a proper role for State agencies?
- What public or quasi-public agency is most appropriate to take the lead to expanding aquaculture on the Delaware Bay?

IV.D.9 Comparison of Projects and Controlling Agencies

The information presented in the discussion of each development project is summarized in Table IV-4. Each major State and federal agency involved in the approval of developments is listed. Significant permits issued by each agency are identified. If a P is shown in the column, the agency has permit authority, and approval of the permit is required before the project can proceed. An S indicates that the agency has secondary authority--to review and comment or coordinate the action of the other agencies--but does not actually issue a permit required for the development. An asterisk indicates that the agency may be involved depending on the site which is chosen for the project. The list does not include local approvals (zoning, sewerage) or approvals particular

Table IV-4

Agency	Permit Authority	DEVELOPMENT PROJECT							
		New Cross Bay Bridge	Expansion of Conventional Ports	New Deepwater Port	Fishing Port Development	Marinas	Waterfront Recreation Facilities	Dredge Spoil Disposal	Mariculture
United States									
U.S. Army Corps of Engineers	§10 - Rivers & Harbors Act §104 Federal Water Pollution Act	S	P	P - inshore S - offshore	P	P	P	P	-
U.S. Coast Guard	Deepwater Ports Act Bridges 33USCA491	P	S	P - offshore S - inshore	S	S	-	-	-
Dept. of Interior Fish & Wildlife Service		S	S	S	S	S	S	S	S
Dept. of Commerce National Marine Fisheries Service		S	S	S	S	S	S	S	S
Environmental Protection Agency	Federal Water Pollution Control Act-NPDES Permits	S	S	S	P-(N.J.)* S-(Del.)	S	S	S (right to reject)	P-(N.J.) S-(Del.)
Delaware River Basin Commission**	Interstate Compact, Approved by Congress	S	S	P - inshore	S	S	S	P	S
State of New Jersey									
Department of Environmental Protection									
Division of Marine Service	Coastal Area Facilities Review Act (CAFRA)	P	P	P - inshore or terminal facilities		P-depends on size and scope	P-depends on scope	-	-
	Wetlands Permit	P**	P**	P*-shore facility	P**	P**	P**	P**	
	Riparian Lands Act	P	P	P - inshore or pipeline	P	P	P-depends on scope	P	P
Division of Water Resources	Water Pollution Permit	S	S	S	P*	S	S-if dredging		P/S-depends on size
State of Delaware									
Office of Management Budget & Planning	Coastal Zone Act	-	P (except Wilmington)	illegal inshore	P (if more than dock	-	-	-	-
Dept. of Natural Resources & Environmental Conservation	Beach Erosion	P**	P**	P-if connections cross beach	-	-	P**	P**	-
	Wetlands Permit	P**	P**	P-if connections cross wetlands	P**	P**	P**	P**	-
	Subaqueous Lands	P	P	P-inshore or connections	P	P	P**	P**	P
	State Pollution Discharge Permit	-	-	-	P*	-	-	-	P/S-depends on size

*If processing plant discharge directly to water

**Does not issue permit per se, but many large projects fall into categories requiring DRBC review and approval.

to a single industry, such as those that would be associated with energy development.

IV.E. IMPROVING INSTITUTIONAL COORDINATION

Common themes can be traced in the analysis of these eight possible development projects for Delaware Bay. While modification of State and federal policies to permit a particular development is beyond the scope of this study, some changes in agency charters, regulations, and operational procedures may facilitate the development of projects which are consistent with the existing State and federal policies. Presented here are four changes in the institutional structure governing the Bay area which are suggested by the analysis of potential development projects.

IV.E.1 Closer Integration of Land Use Plans and Environmental Permits

State and federal agencies should consider modification of policies and review procedures to reflect land use priorities developed by each State. The preference for industrial development in populated areas--stated in New Jersey's Development Guide Plan and Delaware policy--also serves an important environmental goal: the preservation of large areas of virgin wetland along the shores of the Bay. By encouraging development in the industrialized northern sector of the DRBA region, these policies relieve the pressure to create new industries in the marshes in the center of the DRBA region.

Unfortunately, most State and federal environmental policies have not been fully meshed with these land use plans. The New Jersey State Coastal Zone Management Plan does handle the industrialized upper Delaware as a separate district, and the State Coastal Facility Review Act applies only to the coast downriver from Pennsville. In Delaware the Coastal Zone Act exempts the Port of Wilmington from its prohibition on bulk terminals in the coastal zone. Other important permits required for waterfront development do not so clearly differentiate between industrialized and non-industrialized areas. Permits in this group include:

- state wetland permits
- state subaqueous lands (riparian) permits
- federal dredge and fill permits (under §401 and §404 of the Federal Water Pollution Control Act)

A strong argument can be made that these permits should be "zoned" in their application, in the same way that coastal zone siting permits are zoned. The New Jersey Coastal Zone Plan has been prepared separately for the industrialized segments of the Delaware River and New York Harbor and Raritan Bay. To zone the application of marine permits does

not mean that environmental concerns would be abandoned, but rather that a different set of criteria would be applied to development projects in industrial areas. A similar approach is taken with water quality standards, where effluents permitted in the industrialized Delaware Valley would be prohibited in a trout stream or source of untreated drinking water.

An example of the problem is seen in the attempts by the Port of Wilmington to create berths along the Delaware River on filled land. In addition to possible port growth, this project would provide a useful spoil disposal area and ultimately reduce the need for dredging in the Christina River. In general, virgin wetland would not be affected. It appears that the Port of Wilmington may not have planned in advance for the necessary environmental studies. The application for the dredge and fill permit from the Corps is being resisted by EPA, the Fish and Wildlife Service, and the National Marine Fisheries Service. Among the possible conditions that would be imposed on the Port of Wilmington would be compensation or restoration of habitats already damaged in the Wilmington area.

Projects which required waterfront space will be a necessary part of future growth in the Delaware Valley, even if this growth is much slower than the growth experienced in the last thirty years. Location of this development in the area north of the Delaware Memorial Bridge will serve State development policies (by concentrating growth where population and infrastructure are already located) and federal and State environmental policies (designed to preserve the virgin marshes of the Bay). If port developments and other developments requiring water access are to be located in the area above the Memorial Bridge, they should be encouraged by policies which modify the environmental barriers imposed lower in the Bay.

The offices responsible for coastal zone planning in New Jersey and Delaware could meet with each of the significant federal agencies (Corps of Engineers, EPA, Fish and Wildlife Service, National Marine Fisheries Service) and with State officials responsible for marine-related permits (wetlands, subaqueous lands) to coordinate growth and environmental policies. The environmental agencies might produce a distinct set of criteria to be applied to permits in the industrialized areas; criteria which would provide assurances for significant environmental goals (maintenance and improvement of water quality, passage of anadromous fish, preservation of virgin wetlands) while reducing the requirements imposed on projects which reuse industrial waterfront land or concentrate development without threatening fundamental environmental goals. The environmental agencies concerned now make some de facto adjustments in the criteria they apply to waterfront projects in developed areas; nevertheless, a review of the criteria applied to these permits, and a clear statement of future allowances to be made for waterfront projects in the growth area, could serve both growth and environmental protection policies in the Delaware River and Bay.

IV.E.2 Consolidation of State Permits for Waterfront Development

Each State should consider consolidation of different programs controlling waterfront development into a single permit process. A single waterfront project could require the following state approvals: coastal siting, wetlands, riparian (subaqueous lands), certification of federal dredge and fill permits, and beach erosion. All of these controls are designed to serve one broad purpose--the protection of the coastal environment. Because of the way in which the controls developed, with separate implementing statutes, the permits are currently administered as separate controls.

New Jersey has improved coordination of these environmental permits; wetlands, riparian use, and coastal siting controls as well as tideland leases and coastal planning are all administered from the Division of Coastal Resources of the New Jersey Department of Environmental Protection. A single Bureau of Coastal Project Review has authority over CAFRA, Wetlands and riparian permits.

In Delaware, a single program director is responsible for the wetlands and subaqueous land Acts. He has developed a working relationship with the beach erosion program which enables the dominant program to take the lead in examining a project which affects beaches and subaqueous lands. The Coastal Zone Act is administered separately, through the OMBP, which must defer to various branches of the DNREC for advice on the environmental effects of the proposed project. The 1978 Land Use Planning Act required the State to study the consolidation of permit processes, and such a study is now (Fall 1979) being funded through the Coastal Zone Management Program.

Based upon legislative history, and recognizing the need to protect different elements in the environment, the current mix of coastal protection programs is understandable. Viewed from the standpoint of the developer, however, the different programs look like a deliberate attempt to complicate approval of a proposed project. A development project--a marina, fishing port, shorefront industry--will alter an identifiable piece of the coastal environment. Why cannot the developer obtain a single reading from the State on the acceptability of the proposed project or the conditions which the project must meet to protect the environment? Why should not the State assume the responsibility of integrating the analysis of the project in conformance with the different environmental statutes affecting the coastal site and give the developer a single response?

These questions lead to a suggestion for consideration by the States of Delaware and New Jersey. Can existing permit programs in the coastal zone (including State certification of Corps permits) be handled through a single application? Exceptions would be made for projects having continuing air or water pollution discharges after construction is completed. These projects would be required to separately obtain the same discharge permits required of any similar pollution source in the State.

A unified application process would apply in a specified zone--perhaps the areas used for federal coastal zone planning in New Jersey. In Delaware, the boundary would be somewhere inland of the current coastal facility siting law boundary, but probably not including the whole State, which is included within the current federal Coastal Zone Management Plan.

Anyone seeking to build or alter the land or waters within this area could be required to file a preliminary project description with the State. Projects which are currently exempted from all coastal environmental controls could be clearly identified and listed, and notifications would not be required from these projects. Based upon the description, the State could identify the permits required by the project. Information required to evaluate the project against criteria for each permit could be requested of the applicant in a single package. The State could be responsible for pulling together the analysis of the project by each permit program and giving the applicant a single notification of:

- the reasons (under State law and regulation) why his project is unacceptable or
- the environmental conditions which must be met if the project is to receive the necessary package of permits.

Most of this "one-stop shopping" approach to coastal permits could be achieved administratively or through minor statute changes. A more significant set of statutory changes would be necessary to provide an integrated appeal if one or more permits are denied. Note, for instance, that Delaware has separate appeal boards for Wetlands and Coastal Facility Siting permits, and essentially no appeal short of the judiciary for denial of a subaqueous land permit.

Unification of the coastal permit process does not mean that the developer will require only one permit. As noted, continuing air and water pollution discharges require separate permits--and, in New Jersey, federal (NPDES) and State water pollution permit programs are still separately administered. Local zoning and development permits will still be required, often as a prerequisite for State permits. Permits from the Corps will be required for dredge and fill, dock and bulkhead activities, and the federal environmental agencies can be expected to continue a process of independent comment on these permits. However, inclusion of State certification of Corps permits in a unified State coastal permit process would be a definite service to permit applicants.

Those concerned with preserving the environment of the Bay may ask if this suggestion is "pro-development" or "anti-environment." It need not be on one or the other. In the short run, confusing permit processes may be a useful barrier to unwanted development. In the longer run, however, two effects set in:

- applicants become more sophisticated in dealing with the permit bureaucracy, and the best funded have the best chance of success (thus placing the emphasis on big developments)

- confusion over the requirements of the permit process generates opposition to environmental programs among many who would approve, or at least accept, the basic environmental goals. Frustration over complicated procedures is a powerful weapon for those who seek to get environmental protection programs.

Preferable to prolonged delay in the permit process is a clear-cut decision on a project incorporating all of a State's environmental constraints. A denial, or a restrictive environmental condition, should be properly founded on State statutes and based upon clear and defensible environmental policies. If decisions are clearly written and properly supported, there is no reason for an environmentalist to fear such a unified coastal permit process.

Both States have taken important steps toward improved management of coastal permit programs. New Jersey has introduced time limits for decisions on many coastal permits and issues a regular bulletin tracking the progress of each application. Coastal permits are now combined in a single Bureau. Delaware is studying the permit process.

There are several precedents which suggest the feasibility of this initiative. The Corps of Engineers has successfully consolidated project approvals under the Rivers and Harbors Act (§10) and the Federal Water Pollution Control Act (§404) into a single application process. The Deepwater Ports Act specifically designates the Deepwater Port and License application as a single application for all federal permits: the Coast Guard is charged with coordinating the response of other federal permit agencies. Delaware might benefit from consolidation of controls into a single coastal siting permit. New Jersey could simplify the application process still further by combining State certification of federal permits issued by the Corps of Engineers with processing of coastal permits required under State law.

IV.E.3 Clarification of Port Jurisdictions

If port development is to occur in Delaware Bay, the charters of the public agencies affected should be modified to clearly place responsibility for port development in a single agency. The State of New Jersey has chartered three agencies to develop port facilities on its side of the Delaware River and Bay. Only one of these agencies--the South Jersey Port Corporation--actually operates port facilities in New Jersey at this time. This Corporation is the only one of the three agencies which is entirely a creation of the State. Two agencies created by interstate compact--the Delaware River Port Authority (DRPA) and the Delaware River and Bay Authority (DRBA)--are empowered by their charters

to develop and operate port facilities in the same areas as the South Jersey Port Corporation (SJPC). On the Delaware Bay, each of these three agencies is chartered to operate port facilities in Salem, Cumberland, and Cape May Counties.

The overlap issue may be moot if no port facilities are to be developed on the New Jersey side below the Pennsylvania/Delaware line (although the DRPA, the SJPC, and the Philadelphia Port Corporation overlap in the upper river). However, if facilities are to be developed by agencies of either Delaware or New Jersey at Wilmington, Lewes, or Cape May --or if a grass roots port for public use is considered anywhere in the Delaware River and Bay--the overlap between the different authorities must be addressed.

The two agencies which are actually running ports--the SJPC and the Philadelphia Port Corporation--have no other sources of revenue and receive annual State subsidies. The two agencies created by interstate compact--the DRPA and the DRBA--have other revenues from their bridge operations, but do not operate port facilities. The remaining publicly-owned port in the Delaware Valley--the Port of Wilmington--is a municipal agency which to date has received neither State subsidy nor the benefit of bridge revenues realized by the bi-state compact authorities.

Unlike the bridges and other crossings, ports do not necessarily require interstate cooperation for development. Nevertheless, a coordinated interstate approach to port planning could reduce total public expenditures and permit the use of interstate bridge revenues to assist in port financing, thus reducing the need for direct tax subsidies. A tri-state Committee on Regional Development recommended combination of port and transport agencies in 1971. The recommendation was offered to enhance airport development (particularly expansion of Philadelphia International) and was never approved. An equal distribution of port benefits between the Delaware Valley ports may be hard to achieve and stands in the way of consolidation. Nevertheless, if port development--for fishing, general cargo, bulk, or possibly even marinas--is contemplated by either New Jersey or Delaware, State officials should review the charters of existing public authorities and cooperatively decide which agency is to take the lead in such development. If an interstate agency currently designated for port development is not to take the lead in building or expanding port facilities, perhaps the language of the compact should be modified to remove this responsibility from the agency's charter.[1]

---

[1] Interstate authorities often have extremely broad purposes--exceeding the current intentions of the signatory States--in order to avoid the necessity for future Congressional approval of an expanded mandate for the interstate agency.

IV.E.4 A Planning and Development Agency for the Delaware River and Bay

Designate a public agency to conduct the preliminary economic and environmental planning for projects desired by both States in the Delaware Bay area. Throughout this study, we have noted a number of clear parallels on the New Jersey and Delaware sides of the River and Bay:

- geography--on each side, the developed higher land to the north quickly gives way to a broad expanse of undeveloped marsh and shallow water in the center of the Bay. At the southern end, the sandy beaches of the Atlantic Coast are very similar at Capes May and Henlopen.

- development--intensive industrial development in the north; farming, fishing and a slower paced rural economy at the center of the Bay; fast growing recreation and tourism in the south. The pattern is strikingly similar in each State.

- growth policy--each State seeks to concentrate future industrial and population growth at the northern end of the region.

- environmental policy--each State seeks to preserve the fringing wetlands of the Bay in a natural state and prevent excessive development which would destroy the quality of recreational opportunities along the Atlantic Coast.

Despite these parallels within each State, there is no interstate agency currently planning for the future of the Bay. All planning below New Castle and Salem Counties is done at the county or State, not the regional level. Coordinated Bay region planning might ease come current tensions, such as the anxiety expressed by Salem County officials over differential treatment of potential developments by the coastal zone plans of New Jersey and Delaware which govern a single waterfront project along the shoreline where the Delaware state boundary extends to the New Jersey side of the river.

Perhaps more notable than the lack of a single Bay area planning agency is the lack of any suitable agency to guide necessary and desirable developments in the Bay area. Environmental constraints appear to have discouraged private entrepreneurs from the development of projects for which there is a demonstrable need--such as marinas. State agencies are understandably reluctant to spend public money on such projects when a private market should exist. But the necessary environmental planning, the long lead time, and the need to be flexible in locating a project where it will have minimal environmental effects still discourages private entrepreneurs.

Perhaps there is another approach to those developments which will meet public needs and preserve and emphasize the importance of the Bay environment. An interstate agency, or cooperative committee of State officials,[1] could develop an agreed list of priority projects for the Delaware Bay. Working from this list of needs, this agency or committee could meet with federal and State environmental officials to identify the scope and site for such projects which would minimize undesirable environmental effects. This agency would then proceed to acquire the necessary sites and permits for development. If development by a public agency were clearly in the public interest, the project would be assigned to a State or interstate agency with the necessary financial capacity. If development by private capital were feasible, a private entrepreneur would be franchised to develop the project in strict compliance with the conditions of the environmental permits. The uncertainties for the private investor would be greatly reduced by the planning and permit negotiations already completed by the public agency or committee.

This model of a cooperative public-private development has traditionally been applied to large capital intensive projects (such as an airport) or to the renewal of urban areas (redevelopment authorities). Application to smaller scale projects designed to harmonize with the environment is a newer idea, but its time may have arrived on Delaware Bay, as the public accepts the policy direction established by each State in preserving the Bay and its wetlands. To achieve the public benefits from the preservation of the Bay, it may be desirable to designate a single public agency to plan, obtain permits for, and develop where necessary the smaller scale projects such as marinas, fishing ports, or aquaculture which complement the new emphasis on preservation of the Bay.

[1] Maryland and Virginia signed a formal agreement in 1979 specifying procedures for cooperation on Chesapeake Bay problems between the environmental agencies of the two States.

V. DEVELOPMENT POTENTIALS AND CONCEPTS

Chapter I presented a broad range of background information on the Delaware River and Bay Region and outlined in general terms the types of development which have present and possibly future potentials for the area. Chapters II and III examined the transportation systems of the Region and the basic need for additional crossings. Chapter IV examined the regulatory and other governmental agencies with responsibilities in the Study Region. This chapter builds on the foregoing work to identify and assess development potentials and concepts which could be appropriate for the Region and should be subsequently addressed in further detail.

The specific development potentials and concepts presented here are:

- Fixed crossings of the Delaware Bay;
- Conventional port development;
- Deepwater port development;
- Fishing port development and commercial fisheries;
- Recreational boating marinas;
- Aquaculture;
- Other shoreline development potentials; and,
- Delaware Bay-oriented bi-state planning and development functions.

The purpose of discussions and findings contained here is to outline needs in the Region which are not necessarily, at this time, being fully addressed by any responsible agencies or interests. These regional needs may be of a physical economic, regulatory or other institutional nature. It is not necessary, of course, that these needs be addressed by the Delaware River and Bay Authority, although its broad mandate, financial resources, and bi-state focus could make its involvement appropriate if done in a manner consistent with State policies.

To make the discussions of development potentials and concepts as useful as possible and fulfill the above noted purpose, the following considerations are addressed: development potentials and needs, locational considerations of significance, existing public policies affecting possible decisions in each area, and the institutional environment that will affect development proposals.

Three points are pertinent to the potentials and concepts discussed:

- There are no specific recommendations in this chapter; only the identification of potentials which appear to be consistent with overall policies of the States of New Jersey and Delaware and are clearly worthy of further study.

- Throughout the study and in the formulation of the development potentials and concepts there is a full recognition of the existing activities in the River and Bay Region and a full appreciation of the need to maintain and enhance these activities.

- The development potentials and concepts identified and proposals forwarded with respect to their implementation are set forth within the context of established coastal zone management plans and other land use ordinances, policies and regulations of the States of Delaware and New Jersey.

V.A CROSSINGS

A water crossing and most other types of major highway improvement may be found feasible or attractive for any of three general reasons. First, it may provide needed additional traffic carrying capacity. Second, it may provide a new route which reduces the travel time (and cost) of many potential users with respect to existing alternative longer routings. Third, it may stimulate desired economic development with resulting benefits to the areas made more accessible by the improvement.

Section V.A.1 outlines traffic aspects of general crossings locations which could conceivably be practical based upon traffic volumes and travel time savings. Section V.A.2 describes the study approach required to ascertain the magnitude of the economic benefits which might result from the construction of a Bay crossing. Section V.A.3 briefly outlines bridge location and cost factors of interest, since economic and other benefits which may be realized from the construction of a crossing must be weighed against these costs and environmental and other impacts associated with the construction and operation of the facility.

V.A.1 Locations of Possible Crossings

There are many possible locations for an additional crossing, but the most likely would be: in the area of the Delaware Memorial Bridge, roughly midway between that Bridge and Capes May and Henlopen, and at the mouth of the Bay in the area of the Cape May-Lewes ferry, replacing the ferry.

The first location is totally infeasible on all three of the above counts: there is no need for added capacity in the area of the Delaware Memorial Bridge; there will not be any significant travel time or service improvements for most trips across the River or Bay; and such a crossing would not stimulate further development in the area. The second and third locations would provide additional localized crossing capacity, would provide improved travel times for some trips and might, as discussed below, stimulate development in those areas.

V.A.1.a Mid-Bay Crossing

In 1962 and 1963, Arthur D. Little, Inc., conducted an economic impact study of the proposed Delaware Bay Crossing between Cumberland County, New Jersey and Kent County, Delaware. Major conclusions were:

- The transportation cost savings of highway freight shipments in Southern New Jersey would be insufficient to cause any revision in motor carrier rate structures. These savings would also be insufficient to stimulate any significant degree of industrial expansion in Southern New Jersey.

- There would be no measurable employment benefits other than those of the bridge operation itself.

- The proposed Bridge would be flanked by two major north-south routes and would function mainly to interconnect two similar, competitive and sparsely populated peninsular economies. It would not likely become an essential north-south highway link.

In 1969 a traffic study was performed by Coverdale & Colpitts for a similar crossing between these two counties. Major conclusions were:

- The larger traffic movement using the Delaware Memorial Bridge, about 63% of the bridge traffic, is not potential to the proposed bridge. These are the trips between Baltimore or Wilmington and the New York Metropolitan Area.

- Trips between the Delmarva Peninsula and the New York Metropolitan Area, long distance trips between Virginia, the Carolinas and points south to New York and New England, and other local trips (37% of the bridge traffic) may be potential users of the proposed bridge.

- Of the potential traffic about two-thirds would use the proposed bridge. This represented 25% of the Delaware Memorial Bridge traffic.

- About 21% of the trips on the Delaware Memorial Bridge would eventually divert to other facilities such as I-95/495 and the Commodore Barry Bridge. Although these trips have no bearing on the proposed new bridge, they represent a loss to the Delaware Memorial Bridge. Some of this diversion to other facilities occurred in 1974 upon the opening of the Commodore Barry bridge, as mentioned in Chapter II-C.

- About 25% of the Cape May-Lewes Ferry traffic would be diverted to the proposed bridge.

- The proposed bridge, if provided with connecting toll-free highways, might have carried about 4.6 million vehicles in 1975 and produced $3,000,000 in toll revenues. However, almost all of this toll revenue would not be new revenue to the Authority since almost all the traffic would be diverted from existing Delaware River and Bay Authority-operated crossings. After deducting maintenance and operating expenses, the net revenue would be so small that the proposed bridge could not support a significant sum of revenue bond debt.

The traffic estimates in the 1969 study relied heavily on the completion of adequate connecting roads in Delaware and New Jersey. The major New Jersey connecting road was to be a toll-free expressway-type highway extending from the bridge northward across central New Jersey, running almost parallel to the New Jersey Turnpike, and connecting with the Turnpike in the area of Woodbridge, New Jersey. Since then the State of New Jersey has reduced considerably its program of new highway construction and does not include this expressway in any future plans. Major cost as well as environmental considerations further reduce the possibility of such a highway connection. Under these circumstances traffic using a Mid-Bay crossing might only be of the order of two and one-half million vehicles per year.

Because of the lack of connecting highways, lower traffic growth at the Delaware Memorial Bridge and other crossings than forecast in "pre-energy crisis" times, and the availability of other crossings to serve major movements efficiently, a Mid-Bay crossing cannot be justified on the basis of traffic volumes, economic development impacts, or travel time gains.

V.A.1.b Mouth-of-Bay Crossing

This crossing would be in the general area of the Cape May-Lewes Ferry. Such a crossing would replace the existing ferry and would carry additional traffic diverted from the Delaware Memorial Bridge and possibly other crossings as well as traffic induced or generated by the existence of the new facility. However, the diversion from the Delaware Memorial Bridge of possibly three million vehicles per year would be less than

that estimated for the Mid-Bay crossing, and virtually none of this traffic would represent added revenue to the Authority. The crossing at this location thus would have to depend on large volumes of generated traffic, since ferry traffic has only amounted to somewhat over 200,000 vehicles per year.

The amount of generated traffic developed by a new crossing or highway facility may vary widely, ranging from 10% to 20% of the traffic volumes diverted to the new facility to over 100%. Among the factors determining generated traffic levels are the types and intensities of land use and economic development in the areas served by the new crossing and whether there is a significant potential for increased or induced economic growth.

With respect to a "mouth-of-Bay" crossing and the order of magnitude of the generated traffic which may utilize such a facility, the following considerations apply:

- the resort areas on both sides of the Bay have similar land use and traffic generation characteristics -- thus the natural traffic interchange which might ensue if such uses were complementary (i.e., one heavily year-round residential and the other oriented towards industry or other employers) will not occur to any appreciable extent.

- the potential for induced economic growth on both sides of the Bay is constrained by existing, often intensive, resort development, natural preserves and environmentally sensitive areas, and zoning, coastal zone management and other institutional prohibitions;

- overall levels of existing development intensity are not of a type or magnitude to produce substantial volumes of auto trips on a per-square-mile basis because of the acreage devoted to conservation and wetlands and the lack of significant urbanized areas;

- the lack of traffic-carrying capacity during peak periods on the Garden State Parkway and Routes 18, 28 and 13 (U.S.) south through Delaware and the Delmarva Peninsula will substantially constrain generated and other traffic volumes potential to a mouth-of-Bay crossing; while the New Jersey Highway Authority has plans to increase the capacity of the GSP in Cape May County, limited peak hour capacity to the north and in Delaware will probably prevail for an extended period of time;

- the traffic generated by the Atlantic City casinos is substantial; however, as depicted in Chapters I and II, the bulk of it, quite understandably is travelling to and from the heavily populated urban areas such as Philadelphia, New York and Baltimore; a mouth-of-Bay crossing would not lie on

any of the routes connecting Atlantic City with major urbanized areas within reasonable auto-travel distance; and

- much of the traffic generated by the shore areas which would be most directly served by a mouth-of-Bay crossing are of an extremely seasonal nature; thus while hourly and daily traffic volumes may be high and require high capacity roadways to properly handle them during the recreation/resort season, average annual volumes and toll revenues would not be comparable to these seasonal levels.

Due to the foregoing considerations, it is highly unlikely that generated traffic attracted to a mough-of-Bay crossing will amount to more than 10% to 30% of the diverted traffic which might use the facility. Thus the total traffic potential to a crossing at the mouth of the Bay, diverted and generated traffic and that now using the ferry, will not justify a bridge.

V.A.2 Regional Economic Analysis of Development Potential

While traffic projections and related considerations do not justify a major crossing, it is possible that such a facility could produce sufficient economic growth and benefits, such as additional income and employment, to merit closer investigation of the nature and magnitude of such broad economic benefits. The specific objective of such a study would be the determination of the gross and net regional economic growth and development attributable to a crossing and the consideration of the crossing facility as both a public capital/operating investment and as a change in the region's transportation cost/access structure.

The economic growth and development analyzed may be measured in terms of sales, employment, housing, transportation costs, population, income, and new business investment. It is essential that both gross and net concepts be addressed, since a portion of the economic growth attributable to the crossing facility will be attracted from other parts of the region and only part will be new economic growth.

Our review of the economies of the coastal subregions of Delaware and Southern New Jersey indicates that these economies are similar, with no significant net economic impact due to local savings in travel time and cost. Evaluations of longer distance transportation cost savings also point to relatively minor savings not sufficient to generate substantial net economic gains for the region. However, longer term growth rates for the surrounding counties could be affected and there would also be significant local effects due to a new bridge. Should these appear to warrant more detailed assessment and be mandated by political decisions, then the study of broad secondary benefits resulting from a crossing would be appropriate.

A variety of analytical techniques could be employed to estimate the magnitude, location and components of economic growth and development

referred to above. These may include regional economic time series analyses, together with National and possibly regional input/output models, so that dollar flows may be traced among the various economic activity sectors included in the input/output matrix. Such matrices generally include sector detail for government, trade, services and manufacturing for given levels of regional output.

A study of this nature could produce the following specific outputs which would permit the overall economic benefits, direct and indirect costs, and economic impacts attributable to a crossing to be ascertained and judgments as to whether net benefits justify project development:

- methods by which public investment may be utilized to promote different kinds of economic development;
- the effect on various economic sectors of the improved access provided by the proposed crossing;
- analyses and estimates of the gains in output, income and employment in key economic sectors, including tourism, and of changes in population, housing and income for geographic areas in time-periods;
- changes in State and local income, sales and property tax revenues which may be anticipated as a result of crossing; change in tax revenues over the forecast period will also provide an indicator of the importance of the proposed regional public investment per se; and,
- the overall cost effectiveness and economic feasibility of the crossing, considering and comparing bridge construction and maintenance costs and infrastructure and other community costs with the net regional economic gains developed.

V.A.3 Bridge Location and Cost Factors

As a rough indicator of the magnitude of economic benefits which must be realized to justify costs of a fixed crossing at the mouth of the Bay, an order-of-magnitude construction cost estimate was developed.

One alignment would be to have bridgeheads at Cape May Point at the north end and in the vicinity of the western boundary of Cape Henlopen State Park at the southerly terminus. The north approach would have an alignment curving to the west and north of the built-up portions of Cape May itself and would connect to the south end of the Garden State Parkway. The south approach would extend from the bridgehead to U.S. Route 9 and State Route 14.

The horizontal alignment of the bridge structure would have a southwesterly bearing from Cape May Point over the Cape May Channel to the

area of Middle Shoal. It would then curve to a more southerly bearing in the area of the Overfalls Shoal to take advantage of the lesser water depths there and then bear southwesterly again over the Pilot Area. This alignment would then cross the Cape Henlopen spit about a half mile south of its point and extend over the easternmost portion of Lewes Harbor to the landfall or bridgehead location.

The vertical alignment would include a clearance of about 175 feet over the main deep-draft navigation channels near the Pilot Area as well as a high level crossing of the Cape May Channel. Over the shoals low-level trestle construction with clearances of the order of twenty-five feet may be practical. Transition sections at an appropriate highway grade would be utilized between high- and low-level bridge sections.

The low-level trestle could consist of 100-foot span lengths using repetitive design and construction methods. Transition and high-level spans other than main spans could be of girder or truss design with spans in the 300-foot to 500-foot range. The main span over the deep-draft waterway would have to be a suspension span, in all likelihood, to obtain a safe horizontal clearance for that heavily travelled channel, the character of its vessel traffic, and adverse weather conditions. The main span over the Cape May Channel could be of a cantilevered truss or cable-stayed girder design. Approximate lengths for the various types of bridge construction could be as follows:

Low-level trestle construction	6.2 miles
Transition sections	3.2
High-level spans (including main spans)	4.4
Approach roadways	7.7
	21.5 miles

Detailed engineering studies considering such factors as soil conditions, alternative foundation and pier designs and costs, alternative superstructure types and costs, advanced construction techniques, and environmental effects would undoubtedly modify the foregoing preliminary bridge description somewhat -- as well as the costs noted subsequently -- and could find that a tunnel under the Pilot Area was a viable alternative.

The cost of the bridge crossing outlined above with four lanes and including approaches would be of the order of $650 million in 1979 dollars. Assuming an average annual long-term construction cost escalation factor of 6 1/2%, the cost of the crossing would be roughly $950 million in 1985 and $1.3 billion in 1990. Were a two-lane crossing constructed, these costs could be reduced by about 20% to $750 million and $1.0 billion, respectively.

V.A.4 Ferry Service

The financial non-viability of another bridge across the Delaware Bay seems clear. However, ferry service is practical, is in operation, and is capable of providing expanded service as this becomes warranted.

This section outlines present services offered by the Cape May-Lewes Ferry; basic characteristics of the transportation demand it serves; present plans to increase its traffic-carrying capacity; and further capacity improvements which could be implemented with respect to the Ferry operation.

The Cape May-Lewes Ferry has until recently consistently maintained a volume of 400 to 450 vehicles per day since the beginning of its operation in 1964. Even after numerous toll increases were instituted, the volumes of passengers and vehicles remained fairly constant until 1978 when an increase of 20% in vehicles and 10% in passengers was recorded. As described in Chapter II, the volumes of passengers and vehicles using the ferry are estimated to increase to 676,000 and 281,000, respectively, by 1983, representing increases of 13.9% and 22.7% over the 1979 volumes.

It is most likely that the seasonality of the traffic will remain unchanged and that summer traffic in 1983 will be about 2,000 vehicles per day on the ferry with peak days during weekends reaching approximately 2,400 vehicles. The annual average daily traffic in 1983 will be 770 vehicles per day. Recent summer volumes are 1,500 vehicles per day with peaks of 1,800 vehicles per day, and the annual average daily traffic is 580 vehicles per day. These annual average daily traffic volumes, summer average daily volumes, and average peak day volumes and their relationships to each other indicate the degree of seasonality of the traffic. Average peak day volumes are more than three times the annual average daily volumes and an average day in the summer is about two and a half times the annual average day. The months of July and August carry more than 40% of the total traffic for the year.

These seasonal characteristics are also evident at other toll facilities along the shore areas of New Jersey. In particular, the Atlantic City Expressway and the southern portion of the Garden State Parkway have almost identical seasonal variations. The peak hours during July and August at the Atlantic City Expresswayand at the Garden State Parkway (southern section) are almost as high as the average daily traffic in the winter months of January and February, with the average daily traffic in the winter only 13% higher than the peak hour summer traffic.

As noted, a fourth vessel will increase capacity of the ferries and reduce headways to less than one hour during peak summer months. With present schedules and capacities of 100 vehicles, peak hour volumes cannot exceed 200 vehicles, and peak traffic is about 2,000 vehicles per day (in the summer). The additional ferry will provide for peak flows of about 260 vehicles per hour, depending on vessel speeds, and shorter headways at peak hours of approximately 45 to 50 minutes.

If the seasonality of the traffic remains unchanged, the fourth boat will provide the capacity needed for the traffic estimated through the mid-1980's and will handle peak flows of about 260 vehicles per hour with peak days of 2,600 to 2,700 vehicles. Annual average daily traffic corresponding to these conditions could be about 840 vehicles per day.

The addition of two or more vessels for a total of six vessels would increase hourly capacity to between 350 and 370 vehicles with comparable peak daily volumes being between 3,700 and 3,800 vehicles. This would provide capacity through the later 1980's, based on a growth of 8% per year.

However, if most of the increase is due to greater activity in Atlantic City, it is likely that the seasonal variations will not be as pronounced as at present. Traffic increases resulting from increased casino gambling in Atlantic City have been higher percentage-wise during the winter months than during the summer months.[1] Future increases will thus tend to reduce the extreme differences in volumes between summer and winter, and this may reduce the need for additional vessels to handle the projected growth through the late 1980's and the 1990's. Also, by that time, faster vessels which could decrease the present 70-minute crossing time and which probably will have higher per ferry capacities may provide the added service required. Extending operations through earlier morning and later evening hours and ultimately to 24-hour service may further increase the daily capacity of the ferry service.

By comparison, the Chesapeake Bay Ferries, which provided a north-south crossing between Norfolk, Virginia and the Delaware Peninsula, operated six vessels until June 1964 with a total of 90 crossings from 9:00 a.m. to 9:00 p.m. Minimum headways were 36 minutes, with crossing times of 85 minutes for the 21-mile crossing. These ships carried an annual average daily traffic of 1,900 vehicles in 1960[2] when the Bridge and Tunnel District was issuing bonds for the purpose of financing the construction of a bridge-tunnel vehicular crossing of the lower Chesapeake Bay.

As indicated above, when the annual average daily traffic across the lower Chesapeake Bay approximated 2,000 vehicles per day, the Chesapeake Bridge and Tunnel District initiated the construction of a fixed crossing.

The Official Statement for the sale of bonds for the Chesapeake Bay Bridge-Tunnel Crossing estimated traffic volumes of 5,027 vehicles per day for the first full year of operation in 1964 as compared to an estimated 2,189 vehicles per day for the last year of operation of the Ferries in 1963. It was thus estimated that the bridge-tunnel crossing would carry more than double the traffic carried by the ferries. However, as of 1978, fourteen years after the opening of the Bridge-Tunnel,

---

[1]URS/Coverdale & Colpitts Letter Report to New Jersey Expressway Authority, February 20, 1979.

[2]Official Statement of the Chesapeake Bay bridge and Tunnel District dated July 1, 1960.

annual average daily traffic was only 4,859 vehicles per day,[1] still less than the traffic projected for the first year of operation.

The volumes of 3,500 to 3,700 vehicles per day which are estimated for the Cape May-Lewes Ferry for the late 1980's or early 1990's are the peak summer flows. Annual average daily volumes corresponding to this summer traffic would be about 1,150 to 1,200 vehicles per day, well below the 2,200 vehicles per day carried by the Chesapeake Ferries when they were replaced by the Bridge-Tunnel. Annual average daily traffic in excess of 2,200 may not be reached at the Cape May-Lewes Ferry until after the year 2000. By then, there undoubtedly will be significant changes in motor vehicle usage, fuel costs and vehicle and ferry characteristics which will require the complete re-examination of the feasibility of both expanded ferry service and a fixed crossing.

A final consideration is the use of advanced design vessels, such as hovercrafts and surface effect ships, as ferries. A study sponsored by the Tri-State Regional Planning Commission in May, 1976, entitled Long Island Sound Ferry Study - Technical Supplement, explored the costs and performance of various types of ferry vessels. These costs, capacities, and other pertinent information are listed in Table V-1. This table provides a useful comparison for present study purposes of conventional and advanced design vessels.

The surface effect ships and hovercrafts are advanced design vessels that use low pressure air generated beneath the ship to lift it above the water surface. These ships are able to attain high speeds as they ride above the water on a "cushion" of air. The main difference between these two vessels is the type of skirt which surrounds the lower portion of the craft. On a hovercraft the entire skirt is flexible (bendable), thus enabling the vessel to run up over land. The skirt on a surface effect ship, however, is inflexible on the sides and cannot be run up over land.

An interesting aspect of the hovercraft is that they can readily operate over certain types of ice conditions. If substantial benefits are anticipated from the establishment of ferry service which would not be interrupted during periods of ice flows and build-up in the Delaware Bay, then the use of such vessels should be investigated.

Although hovercraft and surface effect ships cost more per auto to operate than conventional ferries, they are significantly faster. Depending on the vessel, these ships can cruise at speeds 2 to 4 times greater than conventional ferries. This fact might make this type of vessel more attractive to a prospective patron even though the ferry cost charged to him might be higher.

---

[1]Annual Report, Commonwealth of Virginia, Chesapeake Bay Bridge and Tunnel District, Fiscal Year ended June 30, 1978.

Table V-1. Comparison of Conventional & Advanced Design Ferry Vessels

	Capacity per vessel (autos)	Cruising Speed (knots)	Cost per Hour Under Way ($)(A)	Cost per Operating Hour ($)(B)	Turnaround Time (Min.)	Capital Cost ($ 000)
200 Vehicle Displacement (Double Ended)	200	20	213	185	20	15,200
100 Vehicle Displacement	100	17	80	120	25	7,480
Used Steam (Diesel Conversion)	100	14	80	120	30	1,500
50 Vehicle 'T Boat'	50	15	31	64	20	1,375
Surface Effect Ship	40	40	540	135	20	10,700
Hovercraft (SRN4)	30	60	530	170	20	15,400

(A) - Cost includes cruise fuel (not including auxiliary fuel) and maintenance.
(B) - Cost includes crew; scheduled maintenance; fuel for lights, ventilation, etc.

Source: Long Island Sound Ferry Study - Technical Supplement, Tri-State Planning Commission; May 1976.

Considering the information presented in Table V-1, estimates of crossing times, the number of crossings during a peak period which each type of vessel could make, and ferry costs per vehicle transported, the relative cost-effectiveness of the various ferry vessel types was assessed. This evaluation indicated that hovercraft and surface effect ships were roughly two to three times less cost-effective than conventional displacement ferry vessels of a 100 to 200 vehicle capacity.

This lack of economy with respect to conventional vessels would be mitigated somewhat by the increased attractiveness to prospective users noted above; further technological developments may also make advanced design vessels more cost-competitive. At this time, however, there is only rather limited justification for their consideration.

V.A.5 Existing Public Policy and the Institutional Environment

Construction of a fixed crossing below the Delaware Memorial Bridge appears to be inconsistent with existing development plans in both Delaware and New Jersey. Opposition from existing State governments is likely, particularly if State funds would be necessary to subsidize the difference between costs and toll revenues. The government of Delaware is encouraging industrial expansion in the Wilmington area, where population and infrastructure already exist, and is unlikely to commit large amounts of State funds to a bridge which might divert industry from the northern part of the State. In New Jersey, the Delaware Bay Shore counties (Cape May, Cumberland, Salem) have been designated as moderate growth areas, except for development areas at Cape May Airport, and around the cities of Salem, Millville, Vineland and Bridgeton. Areas that are not designated as development areas receive a low priority for State infrastructure investment. State policy encourages preservation of agricultural land and wetlands in the Delaware Bay counties, and development pressure from a new bridge could imperil the preservation of these areas.

Local support for a fixed crossing of the Bay is mixed. In Susses County there is very little active support for a bridge from local leaders. Some officials interviewed, such as the Mayor of Rehoboth Beach, are actively opposed to any investment, such as a bridge, which would accelerate the pace of development along the Sussex County shore. In Cape May County, several business and civil leaders interviewed actively supported the construction of a bridge to encourage economic development, although other officials displayed no active interest in the proposal.

Expansion of the existing ferry service to meet additional traffic demands is clearly consistent with State development policies and local interests. Improved ferry service would facilitate gradual growth in Cape May and Sussex Counties, but would not require significant State subsidies, and would not threaten communities such as Rehoboth Beach which are trying to preserve their existing character.

While additional ferry service would not require any new permits unless terminals are expanded at Cape May and Lewes, a bridge would require a bridge construction permit (issued by the U.S. Coast Guard), State subaqueous land permits, and dredge and fill permits for bridge approach roads (issued by the Corps of Engineers).

In New Jersey, the approach roads would require a coastal facility siting permit. While a coastal siting permit would not be required in Delaware, an alignment across the Cape Henlopen split would require a beach erosion permit from the State. Depending on the exact route, wetlands permits would likely be required in one or both States.

Whether or not federal highway funds are used to build such a bridge, the federal permits required by a project of this magnitude will require a full environmental impact statement. A comparable multi-agency review will be conducted in New Jersey. Issues of particular concern include effect on safety of shipping in the channel (including any resulting increased risk of oil spills), effect on shellfish beds and fish spawning grounds (the bridge alignment must avoid any significant areas), destruction of wetlands by bridge construction, induced pressures for development of coastal wetlands, and effect of increased traffic volume on air quality in shore resorts during peak summer weekends.

If State policy in New Jersey and Delaware were to favor bridge construction, environmentally sensitive design could minimize many of the risks evaluated in the environmental impact statement. At present, State development policies and environmental concerns both tend to support expansion of the ferry service rather than construction of a fixed crossing.

V.A.6 Role of the DRBA

If a study of the economic development impact of a fixed crossing is deemed desirable by the States of Delaware and New Jersey, the Delaware River and Bay Authority is the appropriate agency to conduct such a study because it is chartered for the "planning,* financing, development ... and operation" of crossings of the Delaware Bay. Expansion of the existing Cape May-Lewes Ferry is also a DRBA responsibility.

V.B CARGO PORT DEVELOPMENT

This report has analyzed past cargo movements in waterborne commerce, considered likely future trends, examined port capacities at the major ports of Wilmington, Camden and Philadelphia, and reviewed future expansion plans for these ports. Summarized below are planned improvements and assessments of the future adequacy of existing and planned port facilities. Also discussed are other development concepts for port-related activities in the region.

*emphasis added.

V.B.1 Planned Improvements

V.B.1.a Port of Wilmington

Present plans for expansion of this port as recently studied by the firm of Frederic R. Harris, Inc. include the installation of a multiple purpose bulk materials and container handling crane with attendant upland improvements intended to develop container traffic and substantially expand bulk cargo activities. This first phase expansion, estimated at approximately $5.4 million, would be followed by further expansion of facilities, including possible berth development parallel to the Delaware River, at costs estimated at $12 million and $18 million, depending upon the alternatives selected. This program is intended to significantly increase the Port of Wilmington's share of the maritime commerce market in the Delaware River and Bay Area.

V.B.1.b Philadelphia

A report of the consulting firm of Tippetts-Abbett-McCarthy-Stratton completed in 1978 on Philadelphia port facilities concluded that the principal development need of the port is additional container handling capacity of some 1.4 million tons annually by 1990 and recommended that such capacity could be provided most economically through further development of the existing Tioga and Packer terminals. Estimated costs for such expansion, to take place subsequent to 1984, would be of the order of $22.4 million. The report also noted the possible need for an additional container terminal after 1990, depending upon traffic growth. Estimated construction costs for that facility, exclusive of land acquisition, were $45 million.

V.B.1.c Camden

The principal port facilities at Camden are owned or operated by the South Jersey Port Corporation (SJPC). The maritime commerce volume at this location has increased to the point where SJPC facilities are operating above theoretical maximum capacity. To accommodate both this demand and forecasted tonnage, SJPC has proposed an expansion program of approximately $12 million which will extend berthing areas, expand upland storage and provide a modern multiple purpose crane. An initial portion of this program was completed earlier this year.

V.B.2 Future Adequacy of Existing and Planned Facilities

In our analysis, attention has been focused on conventional general cargo and container shipments with some discussion of bulk and similar specialized commodities. While crude oil and petroleum products have been and will remain the most important commodities in the Delaware River and Bay Region, these commodities are handled by the major oil companies which are capable, in terms of planning, engineering and financing, of developing the facilities necessary for their continuing operations. It therefore is most likely that the companies concerned will continue to provide

facilities adequate for the handling of bulk petroleum. Similarly in the case of other bulk commodities, private interests are generally capable of developing the particular or unique facilities required for their movement. However, public bodies may play important roles, catalytic and financial, in encouraging bulk and other cargo movements which stimulate port activity and confer derivative economic benefits.

Other general points related to the overall assessment of the adequacy of Delaware Region's ports are the need to address long-term trends rather than short-term commerce flow variations and the strong interrelationships between the ports of the Region. With respect to the first point, yearly variations in tonnage movements have often been greater in magnitude than the expected annual increase in tonnage based on a longer term growth trend. Thus the capacity of a particular port, which might be deemed adequate on a long-term trend basis, could become strained in one or more years because of abnormally high activity in those years. (Conversely, there are periods of significant under-utilization.) Regarding the second point, in actuality if not in form or organization, the major general cargo ports of Wilmington, Camden and Philadelphia together form a "port complex" which provides more flexibility than is immediately apparent when only the capacities of the individual ports are considered. In the analysis of cargo activity at Wilmington, it was pointed out that many of the commodities handled there were also handled at Camden and/or Philadelphia. While one port may be preferred for one reason or another, it is apparent that there are opportunities for significant diversions within the "complex" as well as considerable capacity to handle periods of abnormally high activity.

V.B.2.a Factors Affecting Adequacy

Port facilities may be considered to be "adequate" when both their overall cargo handling capacity and the type and condition of the specific facilities provided are sufficient to efficiently accommodate the amount and nature of forecasted commerce. The principal factors adversely affecting adequacy are physical deterioration, technical/economic obsolescence, lack of proper handling equipment, lack of suitable access, and insufficient vessel berthing space and cargo storage areas. In many instances these specific limitations overlap; a technically obsolete or redundant pier may be allowed to succumb to physical deterioration since the reasonably expected activity does not justify increased maintenance costs. In making appraisals of both present and future adequacy, this report uses expertise of Consultants who have studied certain of the Region's ports and formulated plans and recommendations to assure the adequacy of these ports to serve prospective cargo to 1990.

At Philadelphia, some of the existing piers have deteriorated or have been destroyed by fire and others are expected to reach the end of their useful lives in the early 1980's. These facilities are not required to handle future tonnages. The major terminals at Philadelphia -- Packer Avenue, Tioga and Northern Shipping Co. -- together with the major remaining finger piers will be the principal facilities utilized. The TAMS

Report foresaw a need for additional container capacity in the early 1980's and recommended a development program looking to the expansion of the existing container terminals which could provide Philadelphia with adequate capacity as regards containers. With respect to general cargo requiring open and covered storage, the TAMS report indicated that there would be sufficient capacity to handle projected tonnages through 1990.

At Wilmington, the new multipurpose container and bulk crane and other recommended expansion measures and alternatives of the F.R. Harris study, in addition to giving that port efficient container handling capabilities, should enable the existing facilities to serve anticipated levels of commerce to 1990. At Camden, present plans contemplate a $12 million dollar bond issue to finance port expansion. These expansion plans have been formulated to enable Camden to handle future potential tonnage at least to 1990 and possibly beyond.

V.B.2.b Overall Assessment of Adequacy

The general cargo ports of the region -- Wilmington, Camden and Philadelphia -- have developed individual expansion plans which would enable these ports to handle forecast tonnages through 1990. Inevitably there will be a diversion of the forecast or potential tonnages among the ports. However, based upon the analyses performed in the course of this study and reports of other Consultants, as a group or "complex" these ports can be expected to adequately serve both traditional general cargo and containerized waterborne commerce of the Delaware River and Bay at least through 1990. The adequacy of existing ports planned expansion depends on a continuation of historical trends in waterborne commerce and continuing maintenance of the same share of cargo handled on the Atlantic Coast by the Delaware Valley ports.

V.B.3 Existing Public Policy and the Institutional Environment

Expansion of existing ports at Camden, Philadelphia, and Wilmington is clearly encouraged by State policies which seek to attract industry to these developed areas. Creation of any grass roots cargo port below Wilmington would be inconsistent with these policies, but projection of cargo volumes from current trends suggests that there is no need for major new cargo facilities in the study area beyond the planned expansion of existing ports.[1]

At present, the three operating ports in the area compete, directly or indirectly, for cargo. Two multi-state agencies in the area are chartered to operate port facilities. They also operate bridge crossings, which generate funds that could finance port expansion. The Delaware River Port Authority does not operate any ports, although it does promote use of all Delaware River ports. The Delaware River and Bay Authority (DRBA) may develop transportation and terminal facilities other than crossings, but only with the consent of the New Jersey and Delaware Legislatures.

[1]Excludes oil and bulk commodities (coal, iron ore).

Coordination of port expansion projects might allow a more efficient expansion of regional cargo handling capacity. The U.S. Maritime Administration has proposed a broad-scale study of all the Delaware River ports. Integration of public ports with multi-state, multi-purpose agencies such as the DRPA and DRBA offers some potential for the use of bridge revenues to subsidize port development. For a number of reasons, these steps have not been taken. Each city's port is reluctant to enter into an arrangement where it might lose business or employment to other ports. The DRPA has devoted its efforts in the development of mass transit in the Philadelphia metropolitan areas. A proposal to merge port agencies in the tri-state area in order to facilitate export expansion, submitted in 1971 by the Pennsylvania, New Jersey, Delaware Committee on Regional Development, was never implemented.

Although expansion plans developed individually by each of the three public port authorities in the region appear adequate to meet projected needs, there are two possible advantages to coordination of port development through a multi-state agency: greater flexibility in the use of existing resources to meet changing cargo demands at a lower total cost, and possible use of bridge revenues, rather than direct state tax revenue, to subsidize port development.

Environmental constraints on development of ports in existing industrial locations are not as great as those which would be encountered by a new port built on wetlands or shallows in the Delaware Bay. A coastal facility siting permit is not required. However, a dredge and fill permit from the Corps of Engineers and a subaqueous lands permit from State government would be required for dredging or pier construction. A wetlands permit would also be required if existing wetlands are taken. Experience with the Port of Wilmington's recent application for a federal permit to fill land for a new pier on the Delaware River front suggests that federal environmental agencies will oppose any filling of shallow waters for port functions which could be performed on existing uplands, and any destruction or degradation of remaining wetlands. In addition, the reviewing agencies will request maximum use of floating structure or pilings rather than fixed bulkheads, and compensating restorative measures such as the creation or restoration of marshland previously degraded.

V.B.4 Role of the DRBA

The Delaware River and Bay Authority is one vehicle available for interstate cooperation in port development. At the moment, the only public port within the DRBA area is the Port of Wilmington. Assistance to the Port of Wilmington by the DRBA might appear to compete with sponsorship of the South Jersey Port Corporation (Camden) by the State of New Jersey. Cooperation between all Delaware River ports would require a tri-state agency covering Delaware, New Jersey and Pennsylvania. Useful guidelines for regional port development by a multi-state agency could be obtained by reviewing the experience of the Port Authority of New York and New Jersey.

V.C DEEPWATER PORT DEVELOPMENT

In summary, offshore deepwater port development has been proposed on numerous occasions in the DRBA region, but its future potential and viability will depend on the region's refining capacity, on the volume and composition of crude oil imports to the region, and on the comparative costs and environmental risks of lightering and offshore ports. The Texas and Gulf areas are now felt to be in a much stronger position vis-a-vis the oil industry, and one offshore port is already being built by the industry in the Gulf, and another may be developed with State support off the coast of Texas. While the area immediately inside and outside the Delaware Capes has been felt by many to be ideally suited to offshore port development, the industry is reportedly satisfied with the current lightering, and any offshore port in the region would probably require significant levels of public investment. Public policy on such offshore port development is unclear, although both States have generally been opposed to the more economically viable in-Bay proposals. Should such offshore port development become feasible or desirable in the future, the bi-state Delaware River and Bay Authority may be one of the most ideally suited institutions to direct or coordinate such development.

V.C.1 Development Potentials

When considering deepwater port potentials in the DRBA region, one is talking primarily about oil port development. As discussed in Chapters I and III, the volume of crude oil imported through the Delaware Bay has increased by more than 35% between 1972 and 1977, with an increasing proportion being imported in deeper draft tankers. These deeper draft tankers need part or all of their oil transshipped to shallower draft barges in order to be delivered to the Delaware River refineries. This has led to a major lightering operation (a de facto offshore oil port) off Big Stone Beach in Lower Delaware Bay. The volume of lightering increased more than fivefold between 1971 and 1977, and the tonnage lightered in 1977 was more than 1/3 the tonnage handled in Philadelphia Harbor that year and more than six times the tonnage handled at the Port of Wilmington for that year. With this rapidly growing lightering operation, there has been increased interest on the part of the oil industry, the government, and environmental groups in the feasibility and desirability of a more formalized offshore port development.

- The oil industry has been principally interested in the development potential of several Lower Delaware Bay operations for a Deepwater Port -- generally on the Delaware side of the Bay between Big Stone Beach and Cape Henlopen. However, the oil industry is now also reported to be generally satisfied with the existing lightering operation and its capacity to handle projected crude oil imports in Delaware Bay. It is building a port off the coast of Louisiana.

- The federal government has been interested in the development potential and lower landed costs of oil ports and has analyzed several alternatives in the area off the Delaware Capes or in the area off the northern New Jersey coast.

- The State governments of New Jersey and Delaware have looked at both in-Bay and ocean development potentials, but both States are still officially opposed to any in-Bay port development. The New Jersey Department of Energy is now evaluating the ocean deepwater port scenarios - one in the North off Raritan Bay and one in the South off Delaware Bay. Either would be assumed to eliminate the lightering activity within the Delaware Bay.

- Environmental groups, while reportedly concerned about the oil spill risks of the current lightering activities, are also concerned about the possibly greater oil spill risks of oil port development.

Previous studies have found a deepwater port off the Delaware Capes to be financially unattractive in comparison to the existing lightering operation, due to high construction costs of an Atlantic Ocean site and high operating costs due to the problem of weather. Despite this, many feel that a deepwater port in the region will become much more viable in the near future. Factors which are likely to be most critical in determining this future development potential are:

- The future volume of crude oil imports in the Delaware Bay. Although crude oil imports in the Delaware Bay increased from 43 million to 58 million short tons between 1972 and 1977, they are not projected to increase substantially more unless there is an expansion in Delaware Basin refinery capacity. Most experts believe that refinery capacity will be expanded in the Texas Gulf area and elsewhere and not in the Delaware Basin. Although there have been recent rumors of refinery expansion in the Delaware Bay, there has been no investment in major expansion in the past five years. Federal policies are also against increased crude oil imports and, in fact, now call for a 50% reduction by 1990. but general uncertainties in the national energy picture still make the long-term future of crude oil imports unclear.

- The future composition of crude oil imports in the Delaware Bay. About 1/3 of the crude oil imported into Delaware Bay was involved in lightering in 1977, compared to less than 1/10 in 1972. However, future increases in the proportion of oil imports which require lightering are not likely to be as substantial. This

is due to increasing use of the Suez Canal and the difficulty or lack of economic rationale for using deep draft tankers for oil imported from Nigeria and Venezuela. New oil discoveries in Mexico and Canada may also reduce domestic dependence on Middle Eastern crude.

- The future economic or environmental attractiveness of lightering as compared to a more rigid deepwater port operation. The current cost of lightering is estimated to be 1/3 to 1/2 the cost per barrel of handling oil through an offshore deepwater port. Furthermore, these operations have the attractive advantage of flexibility, without heavy capital investment, to expand, contract or otherwise modify these activities to meet changing demands. As long as lightering can accommodate demands with minimum environmental risks and as long as no differential public subsidies are involved, these comparisons are likely to hold. However, if restrictions are more stringent, or requirements more costly for the lightering operations, these relative costs could be altered. Governmental subsidies or investments could also affect this comparison.

V.C.2 The Development Needs

Given the oil industry's reported satisfaction with the current lightering operations and current economic factors working against industry financing in the DRBA region, major public involvement would be needed to encourage offshore port development. The Texas Deepwater Port Authority has tentatively accepted a federal license for development off the Texas coast to keep the State competitive with Louisiana, where the industry is now building an offshore port. However, in the DRBA region, public support in terms of port and pipeline construction would probably have to be significantly greater due to the higher development costs, the lower level of projected throughput, the greater environmental regulation, and the general uncertainty of the region's future as a major and growing refining and petrochemical center.

V.C.3 Existing Public Policy and the Institutional Environment

The Delaware Coastal Zone Act specifically bars construction of any new bulk terminal in Delaware waters outside the Port of Wilmington. No deepwater port could be built on the Delaware side of the Bay, or in Delaware waters on the Atlantic coast, without a change in this law.

New Jersey's coastal siting law (CAFRA) does not absolutely bar a deepwater port in State waters, but any such facility would require a State permit. Recent coastal zone plans do not favor a deepwater port within the Bay, and State officials have indicated more interest in offshore unloading facilities off northern New Jersey, or feeding the Delaware River refineries through a pipeline along the Atlantic City Expressway corridor.

A deepwater port beyond State territorial waters does not require a State coastal facility siting permit, but any tank farm or other facility at the beach head would require such a permit. The U.S. Deepwater Ports Act which controls all bulk terminals outside of State coastal waters gives State agencies the first option to construct a deepwater port and gives the governments of adjoining States a role in licensing a deepwater port.

Three existing public agencies have a charter which could permit them to construct a deepwater port under the first option offered to State governments by the Deepwater Ports Act of 1974. The South Jersey Port Corporation and the Delaware River Port Authority may build ports in waters under New Jersey jurisdiction and might be extended to the building of facilities offshore from Cape May or Atlantic Counties. The Delaware River and Bay Authority could build marine transportation and terminal facilities in the Bay and might be a vehicle for construction of a deepwater port off New Jersey or Delaware.

Without change in existing laws and statutes, no deepwater port will be built within the Bay. Environmental policies of both State governments dictate that any deepwater port be built outside the Delaware Capes. If a deepwater port is to be built within the Bay, two changes must first occur:

- the relative costs of lightering versus construction and operation of a fixed deepwater port must change;
- convincing proof must be offered to refute the current belief that lightering operations (at current levels) pose a smaller ecological threat than a fixed deepwater port handling larger volumes of oil.

Proof of these changes would likely be required before the Delaware Coastal Zone Act is amended and coastal zone plans in both States are altered so that the necessary permits would be issued for a deepwater port within Delaware Bay. Even with a change in State policies, Federal agencies commenting on the necessary dredge and fill permit from the Corps of Engineers would critically review any increase in risk to the wetlands, shellfish beds, and spawning grounds of the Bay.

V.C.4 Role of the DRBA

Water depths dictate that a true deepwater port can be constructed only in Delaware Bay or offshore. The channel above Wilmington cannot be deepened because of the threat to the underground water supply in Southern New Jersey. Potential sites for a deepwater port are within the DRBA area or offshore in the ocean where no State or interstate agency has an unequivocal mandate for port development. Because of the size of a deepwater port and its widespread effects, any project will be of concern to both States. The Deepwater Ports Act specifically gives adjoining coastal States a role in approving a deepwater port license.

If the feasibility of a deepwater port off Delaware Bay is to be reviewed at all, this study should be done by a bi-state agency which can reflect the concerns of both Delaware and New Jersey. The Delaware River and Bay Authority is an appropriate bi-state agency to undertake such planning. The drafters of the DRBA charter expected that the agency would serve this role in planning large scale regional development projects. If a deepwater port should ever become economically feasible and acceptable to both States, the DRBA could proceed to develop the facility under the transportation and terminals portion of its charter.

V.D COMMERCIAL FISHERIES

In summary, commercial fisheries have considerable promise, but as yet unproven potential, as the result of the newly instituted 200-mile limit. Cape May and Lewes are ideally suited to support this potential in the Middle Atlantic region, but new processing plants and storage facilities, expanded dockage and harbor facilities, and the development of an export capability would be needed to realize the industry's potential. Public policy in both States support expansion of the industry, but neither State has been able to establish an effective institution to aggressively promote and support such expansion. While the DRBA does not currently have such a mandate, its charter would clearly permit such activities if enabled by bi-state legislation, and the Authority's bi-state nature as well as development capabilities may make it well-suited to a development role in this area.

V.D.1 Development Potentials

As noted in Chapter I, the domestic commercial fishing industry has substantially increased development potential as the result of the newly instituted 200-mile limit and the rapidly increasing worldwide and domestic demand for fish products:

- Worldwide consumption of fish increased by over 50% between 1963 and 1975, accompanied by a severe over-fishing of some stocks.
- U.S. per capita consumption of fresh and frozen finfish has increased 3.9% annually since 1967.
- 44% of fish caught in U.S. coastal waters north of Cape Hatteras were caught by foreign fishermen in 1974.
- The Fishery Conservation and Management Act of 1976 now gives preferential American access to all of fishery resources within the 200-mile limit; however, some species such as squid and hake are not currently attractive to U.S. fishermen. Unless they become attractive, the most efficient method of harvest may be via permits to foreign fishing fleets.

The increased potential for domestic commercial fishing may be particularly significant for the DRBA region:

- Cape May, New Jersey and Lewes, Delaware have the best harbors for accommodating ocean fishing vessels south of New York City and north of Norfolk, Virginia.

- The domestic Middle Atlantic Fish Catch (New York, New Jersey, Delaware) was over one billion pounds in 1956, of which over 50% was accounted for by landings in Lewes and Cape May -- historically the center for the Middle Atlantic fishing industry. Although the Middle Atlantic Fish Catch has declined to about 20%of its 1956 level, this was due primarily to the depletion of the menhaden resource and the closing of the two fish processing plants in Lewes and Cape May.

- There has already been a substantial resurgence in fish landings with poundage increasing by about 20% and with the dockside value of these landings increasing by about 200% since 1974.

- The average dockside price per pound received for landings in the DRBA region has increased from about $0.10 per pound in 1967 to about $0.55 per pound in 1978, or at about two and one half times the rate of inflation of the consumer price index during this period.

- Almost all fishermen and industry representatives interviewed by the Delmarva Advisory Council in 1978 were "positive" that there were sufficient fish and shellfish resources off the Mid Atlantic Coast to warrant increasing the size or number of their vessels.

- Although surfclams and menhaden are reportedly being fished near or beyond their sustainable yield, the National Marine Fishery Service reports significant underfishing for many species.

- The species having the greatest potential for expanded Middle Atlantic catches by the domestic fishing fleet are squid, mackerel, hake and herring -- which are now 90% harvested by the foreign fleet. The exploitation of much of this potential would, however, require entry into the export market -- a difficult task.

- The shellfish industry should not be significantly affected by the 200-mile limit, and necessary quotas may in fact reduce landings.

V.D.2 The Development Needs

In order to take advantage of opportunities for expansion, the domestic commercial fishing industry in the DRBA region has several reported needs:

- Fish and shellfish processing plants are needed to stabilize the market and take advantage of increased demand. A recent study by Arthur D. Little, Inc. in Middle Township of Cape May County found that a facility with a capacity of 12 to 20 million pounds per year could be supported by the whiting and hake resource and the domestic market.

- An expanded port capability is needed to permit the domestic fishing industry to take advantage of the large mackerel, squid and herring resource now harvested by foreign fishermen off the Middle Atlantic Coast.

- Fishermen indicate that depths in excess of 15 feet would be preferable, a controlling depth of 12 feet at low tide seems to be a realistic minimum. Areas protected from storms are essential.

- Dockside freezer capacity is needed to help stabilize prices and may be needed to support export potential.

- Larger vessels are needed to take advantage of offshore fishing resources and to enhance the feasibility of fish processing plants.

- Inlet dredging and/or dockage facilities are needed to accommodate longer and deeper draft fishing vessels.

- For a medium size fishing processing plant (12-20 million pounds per year), 200 feet of dock space with 12'-15' of water depth is needed for off-loading, and a site of about 3 acres is needed for the plant.

V.D.3 Locational Considerations

Shallow inlets, shoaling and overcrowding restrict Middle Atlantic Coast expansion of commercial fishing ports except near Cape May, New Jersey and Lewes, Delaware:

- Although fishermen want to live near their home port, they are reasonably flexible as to where they off-load their catch; they report that they will go "wherever the buyers or plants are."

- The DRBA region's commercial fishing industry is currently based in Cape May/Wildwood, where there is a fleet of approximately 50 vessels; however, the harbor is now somewhat congested, and many of the potential sites are too small or too shallow for significant expansion.

- The edges of the Cape May Canal cannot be developed for commercial fishing.

- Most oceanside sites in Cape May County are severely restricted by wetlands regulation; a bayside site near the Cape May Canal may have excellent potential but it would require new breakwaters and might best be part of a multipurpose waterfront development.

- Lewes, Delaware once supported a substantial commercial fishing industry, and 70% of the Delmarva Peninsula fishermen surveyed by the Delmarva Advisory Council reported that they would locate or land in Lewes if there were sufficient loading facilities and buyers.

- The eastern portion of Breakwater Harbor at Lewes (near the former menhaden plant) is rapidly shoaling and projected to fill in without constant dredging. Some dredging in this area will be carried out in 1980.

- The western portion of Breakwater Harbor and Roosevelt Inlet (where there is an operating clam processing plant) have adequate depths and few dredging problems.

V.D.4 Existing Public Policy and the Institutional Environment

The Governor's Office of Policy & Planning recently prepared a "proposal for the development of the New Jersey Fisheries Industry" recommending:

- The State should assist in the development of new pier and processing facilities and other support services needed to modernize the fishing industry.

- The State should assist the private sector in exploration of the export potential of fish caught and processed in the State.

- The State should investigate potential for a wholesale fish market and distribution center and for large scale integrated fish processing distribution and marketing facilities.

- The State should encourage and assist in waterfront development projects which integrate aspects of the fishing industry with new recreational and commercial development.

The Delmarva Advisory Council is the Federally recognized Economic Development District Agency for the Delmarva Peninsula and recently published a Delmarva Ocean Fishery Port Survey (December, 1978) recommending:

- "The State and community need to become more involved in financing improvements in landing facilities, particularly dockage."

- "Lewes is in a particularly strong position for a major fish handling facility."

- "With improvements in groin protection devices, dockage and storage capabilities, Lewes could very well become one of the better fishing ports along the entire Middle Atlantic Coast."

There is as yet no State agency or public authority recognized or chartered to plan, promote or finance fishery development or various support for the commercial fishing industry: DRBA, DRPA and the South Jersey Port Corporation have potential jurisdiction to build port facilities. The New Jersey Economic Development Authority is becoming involved in providing financial support for some aspects of the commercial fishing industry in New Jersey; New Jersey has recently been considering reorganization of the State's management of fishery resources. The Delmarva Advisory Council is the U.S. Department of Commerce sponsored Economic Development district Agency for the Delmarva Peninsula. This Council's Seafood Committee is committed to the improvement and expansion of the Peninsula's commercial fishing industry. The U.S. Economic Development Administration represents a major funding source for supporting both capital investments and operating expenses in the commercial fishing industry; other Federal sources of development assistance include the National Marine Fisheries Service, the Maritime Administration and the Small Business Administration.

Permits which would likely be required to provide expanded support for the commercial fishing industry include wetlands permits, Corps of Engineers dredge and fill permits, water pollution permits, and coastal facility siting permits.

V.D.5 Role of the DRBA

Construction of the dock and terminal facilities necessary to support an expanded fishing industry could be an appropriate task for the DRBA. Fishing ports are a "terminal" within the contemplation of the DRBA charter. The Authority's experience in financing and development could be used by the States to acquire shorefront sites for unloading, processing, and storage, dredge access channels, construct piers and bulkheads, apply for the permits required for facilities, prepare the site for storage and processing plants, and negotiate a lease, sale, a more innovative arrangement for the construction and operation of storage or processing plants by private operators or a cooperative venture.

V.E. AQUACULTURE

V.E.1 Development Potentials

As noted in Chapter I, aquaculture (or marine farming) is a rapidly developing industry worldwide with an as yet undetermined future in the Delaware Bay.

- Domestically aquaculture has grown rapidly over the past 10 years but its contribution to the total domestic fishery harvest is still less than one-half of what it is worldwide.

- Although still largely in its early research and development phases viable commercial enterprises have been established for trout, salmon, crabs, lobster, shrimp, oysters, abalone, kelp, seaweed, and other marine life along the Atlantic and Pacific shorelines.

- In the Delaware Bay the only major commercially viable marine farming activity is for oysters, which are only now recovering from their near elimination by disease in the early 1950's. There were more oysters planted in the Delaware Bay last year than in any other year, but harvests are still limited by natural predation and other factors. The expansion of oyster farming has not yet met expectations and its future as a major Bay industry remains in question.

- The establishment of important marine research and development facilities at Lewes (The College of Marine Studies) and at Bivalve and Cape May should help determine the viability of expanded oyster farming activities as well as other aquaculture development.

V.E.2 Development Needs

Most of the research needs in the aquaculture industry have generally been met by colleges and universities, often with special federal funding. However, the development needs of the industry, which are just now becoming known,[1] have not generally been met by this source, and most existing commercial ventures have been started on a shoestring or with very high risk venture capital. As the development needs of the industry become better known they will probably reflect a need for both public and private investments as well as joint public-private activities. The nature of the resource and the need for public land leases, etc., is likely to require major public involvement if this industry continues its rapid development in the future.

V.E.3 Existing Public Policy and the Institutional Environment

Expansion of commercial aquaculture in the shallow waters of Delaware Bay would appear to be an economically productive innovation entirely consistent with existing development and environmental policies in both States. As the natural productivity of the Bay increases with decreased pollution, aquaculture could generate new income from the Bay without threatening wetlands and environmentally sensitive areas or interfering with recreational uses of the Bay. It would not generate pressure for the development of coastal land. Processing plants would provide jobs in smaller shoreside towns.

Regulatory restrictions on expansion of aquaculture are not insurmountable. Depending on the size of the operation, approval may be necessary to assure that water quality goals are not adversely affected. Processing plants will require discharge permits. Use of the Bay bottom will require State approval under Subaqueous Lands Acts, and in-water structures such as holding tanks or pens may require a Corps of Engineers permit. So long as naturally occurring marine life is not displaced, environmental agencies should be willing to approve these permits.

V.E.4 Role of the DRBA

At the moment, no State agency has a clear mandate to encourage aquaculture on the Bay. Rutgers University and the University of Delaware are conducting research on marine farming techniques, but assistance to commmercial venture would come only from the Small Business Administration or State economic development agencies which consider investments in all industries. If New Jersey and Delaware wish to lend support to developing aquaculture projects, the DRBA is one public agency which could construct support facilities or even provide limited investment capital for some new operations. Such a task is a departure from the Authority's past involvement in bridge and ferry operations, but the DRBA is the only quasi-independent State agency with a direct focus on Delaware Bay development.

---

[1] An EDA study is now investigating the capital requirements of the U.S. Aquaculture Industry.

V.F RECREATIONAL BOATING MARINAS

While recreational boating marinas have conventionally been developed privately, current demands are reportedly not now being effectively met in the private market place -- largely due to increased environmental regulation and development risk. Although the Delaware Bay shoreline in the vicinity of Cape May and Lewes may offer the most attractive sites, development of these sites could require the involvement of an agency such as the DRBA with potentially strong development and coordinating capabilities.

V.F.1 Development Potentials

As discussed in Chapter I, marinas have expanded rapidly in the DRBA region over the last 15 years -- particularly along the inland waterway. This development has occurred concurrently with the national expansion of recreational boating activity and with the dramatic increases in recreation and tourism along the Atlantic shoreline. While recreational boating continues to increase along with the demand for recreational marinas, environmental restriction and higher development costs have begun to restrict the ability of the private sector to expand boating facilities -- particularly in the extensive areas dominated by protected and environmentally sensitive wetlands. One indirect result has been substantially higher berthing rates at existing marinas and a larger volume of trailering which has increased summer traffic congestion.

While most boating interest in the last 15 years has been focused on the Atlantic shoreline and the inland waterway, there has recently been an expansion of interest within Delaware Bay -- particularly for fishing-oriented boaters. This newly expanding interest is due in part to improved water quality and fishing within the Bay and in part to increased congestion along the inland waterway. The result of continued expansion of boating interest in the Bay will increase the development potential for marinas along those limited segments of the Bay shore which are not dominated by wetlands.

V.F.2 Development Needs

Although there are numerous public boat launching ramps, recreational boating marinas have been conventionally developed by private operators. In New Jersey, however, the Parks Department owns and operates three public marinas and leases a fourth to private operators (Fortescue on the Delaware Bay). While neither State has specific plans for development or operation of additional marinas, there does appear to be growing interest in facilitating private development at appropriate locations. There also appears to be some perceived need for joint public-private development of combined recreational boating and commercial fishing development in the Cape May and Lewes areas.

V.F.3 Locational Considerations

Most areas along the Bay are protected wetlands infeasible for recreational boating development. There are, however, three specific areas which may have potential for major new marina development, if locally supported and accompanied by appropriate infrastructure development and environmental protection: the Delaware Bay shoreline of southern Cape May County, New Jersey; the Delaware Bay shoreline of Sussex County, Delaware; and Breakwater Harbor at Lewes, Delaware.

These areas appear to have potential due to their good road access to major population centers, their potential for complying with environmental regulations and policy, and their access to reasonable water depths. In addition, the Delaware River shoreline of Salem and New Castle Counties may have additional development potential, although the demand appears to be less.

V.F.4 Existing Public Policy and the Institutional Environment

Construction of additional marina capacity is not inconsistent with coastal zone plans in New Jersey and Delaware. A coastal facility siting permit is not required in Delaware and might not be required in New Jersey, unless the marina had substantial accompanying development, such as housing or hotels. Nevertheless, a new marina would require the Corps of Engineer dredge and fill permit, State subaqueous land permit, and State wetland permit (if any wetlands are altered or filled).

Policies imposed by environmental permit agencies would include:

- restriction of filling or bulkheading to those activities which must have water access (no use of filled land for boat storage, housing, commercial properties, etc.)
- preference for piling and floating docks which do not hinder tidal flow
- prohibition of dead end basins and other configurations which are not purged of pollutants by tidal action
- siting which minimizes the need for maintenance dredging, and assures sites for dredge spoil disposal
- avoidance of any degradation or pollution of spawning grounds and shellfish beds

In addition, coastal zone plans would discourage marine developments which encroach on undeveloped shorefront or increase the density of water usage to the point where water quality and the quality of the recreational experience are affected. Preferred sites for marina development would be on the fringe of areas which are already developed.

With these limitations, it is understandable why private marina development has decreased in recent years, even though an active market exists for yacht berths. The uncertainties in obtaining an environmentally acceptable site and securing the necessary permits apparently are sufficient to deter the investment of private capital which has traditionally funded marina expansion.

V.F.5 Role of the DRBA

Despite the existence of four public marinas in New Jersey, marina development has generally been considered a private sector function. With the decrease in construction of private marinas in recent years, some interest in public sponsorship has been expressed. The Governor's Committee on Marine Tourism in Delaware has investigated approaches to increasing boat berthing facilities in order to limit traffic congestion caused by boat trailering. A public agency might contribute to solution of the marina shortage by undertaking the environmental planning, site acquisition and permit application tasks which make marina development a time-consuming and risky business. An approved environmentally acceptable site could then be sold or leased to a developer who would raise private capital to construct and operate the marina. If the State governments favor this approach, the DRBA could readily provide the technical capacity to manage the early stages in site planning and acquisition.

V.G SHORELINE DEVELOPMENT POTENTIAL

V.G.1 Development Potentials

The shoreline of the lower Delaware River and Bay has remained largely undeveloped -- due in large part to the extensive stretches of wide wetland areas. With the growing interest in environmental preservation, these wetland areas have been increasingly recognized as important breeding and nesting grounds for both birds and marine life. Consequently, large areas have become designated as State or Federal wildlife preserves, and coastal zone management plans and facility siting acts have strictly regulated or prohibited virtually any other kind of development in these areas. For the non-wetland stretches of the shoreline (principally along the lower Delaware River, along the Lower Delaware Bay, and along a few scattered beaches in between) identified development potentials other than those previously outlined in this chapter include:

- Beach restoration and development - Beaches along the Delaware Bay enjoyed considerable popularity prior to the extensive development of the Atlantic coast beaches. With crowding and beach erosion now becoming serious problems along the Atlantic, and with the prospects of cleaner Bay waters, these beaches may enjoy renewed potential.

- Dredge spoils disposal - Maintenance dredging of the Delaware River channel and of the numerous harbors and smaller rivers along the shoreline generates large volumes of dredge spoils which must be disposed of under increasingly stringent regulations. Extensive areas along the Lower Delaware River have already been set aside for Corps of Engineers dredge spoils disposal, but the limited capacity of these sites, when compared to the volume of spoils being generated, means that additional sites or alternative methods of disposal will be needed.

- Port Oriented Industrial Development - Recent years have seen substantial development of industrial districts at major seaports of the United States, and such development could be considered for the Port of Wilmington. Often such developments are on port-owned land, leased to tenants, with the capital requirement of industrial tenants often financed by industrial revenue bonds. Carefully planned industrial development can result in marked benefits to a port community.

- Foreign Trade Development - Under such a zone, foreign and domestic merchandise may move for storage, exhibition, manipulation, manufacture or other processing with definite advantages to users, including reduced custom duties.

- Specialized Bulk Facilities - For several years the concept of a modern coal shipping terminal has been under investigation and discussion for the Port of Wilmington. With the increasing urgency for utilization of alternative energy sources worldwide, it appears appropriate that further thoughts be given to this project, including reviews of its contribution to the economy and the port area, benefits to the balance of payments, economic feasibility and possible financing alternatives. Consideration also should be given to other specialized bulk facilities which may be feasible but which may require financing assistance or other inducements for their development at Wilmington.

- Outer Continental Shelf (OCS) Support - Both the Port of Wilmington and the Lewes area may have potentials for the development of OCS support facilities. To the extent that offshore oil drilling in the Baltimore Canyon progresses, supplies, material and personnel will require transport to and from drilling sites. The nature of the vessels involved can range from shallow draft crew boats to pipe laying barges and tug supply vessels, and berthing, maintenance and storage areas for these operations will be

required on-shore. Although other areas are actively interested in this trade, the attributes of both Wilmington and Lewes with ready access to drilling areas, protected harbors, available land and overland transport may offer competitive advantages and should warrant further investigation.

V.G.2 Development Needs

While most of the development potentials identified above have active sponsors or proponents, all seem to share the need for more coordinated and comprehensive development programs. Current sponsors or proponents tend to be special interest groups or single-purpose entities not charged with or capable of a more comprehensive development effort.

V.G.3 Public Policy and Role of the DRBA

Planning for shoreline development is currently undertaken by New Jersey and Delaware under the Coastal Zone Management Act, and the coastal zone plans of each State provide a guide to determination of acceptable development. Coastal Facility Siting Laws, Wetland Acts, and Subaqueous Land Acts in each State provide the regulatory controls to assure conformance with these development policies. In some cases private capital and existing State programs may not produce the kind of positive development envisioned by the Coastal Zone Plans. To the extent carefully controlled public development is desired but not forthcoming, the DRBA may provide a useful mechanism for planning and financing such projects.

V.H BI-STATE DELAWARE BAY-ORIENTED PLANNING AND DEVELOPMENT FUNCTIONS

In the course of the study it became evident that "institutional gaps" existed and that a bi-state, Bay-oriented planning and development function is needed to fill these gaps. Basic goals to be accomplished would be to coordinate bi-state efforts to conserve the natural resources of the Bay area and to stimulate economic development within the region consistent with the Coastal Facilities Siting Acts of Delaware and New Jersey, other policies and regulations of the States, and the desires of local governmental units and populations.

Specific planning functions of such an agency might include:

1. The coordination of State policies and regulations affecting the Bay Region;

2. The identification of specific conservation and development projects which are consistent with State and local goals;

3. The preparation and periodic updating of a comprehensive shoreline conservation and development program focusing on dredge spoils, beach restoration, ports and harbors, and shoreline recreation;

4. The monitoring of activities in and uses of the lower River and Bay and preparation of a plan for conservation and development of the lower Delaware River and Bay addressing waste discharges, dredging, boating, aquaculture, marine navigation and waterborne commerce.

Specific development functions to be performed for the Bay might include:

1. The detailed formulation of identified conservation and development projects;

2. The execution or supervison of detailed market and feasibility analyses for such projects;

3. Location and acquisition of environmentally acceptable sites for developments which prove to be feasible and are endorsed by State and local interests;

4. The identification and contacting of possible users and/or lessees for projects found to be feasible and desirable;

5. The preparation of applications for all necessary Government approvals and permits;

6. The obtaining of necessary legislative approvals, and the development of information required to fulfill this objective;

7. Development activities, including solicitation of and negotiation with users, similar to those undertaken by a private developer so that identified projects can be implemented;

8. The monitoring and control of users and lessees to insure that the original objectives of the project are achieved.

In the exercise of all planning and development functions the concerned agencies of both New Jersey and Delaware must be kept fully informed and the technical and other resources of these agencies utilized to the fullest possible extent. In addition, permanent advisory committees of representatives of local government and of citizens at large should be established to insure that local feelings are fully reflected in the actions of any group or office addressing the function outlined herein.

Funds for such an agency would be required to maintain a staff to fulfill planning and development responsibilities; finance and construct infrastructure improvement required to implement development plans; and support users/lessees by means of loans or other types of financial support other than direct grants, where private capital is not available.

Given that the DRBA is the only bi-state New Jersey-Delaware agency dealing with the issues concerning the Delaware Bay region, it may very well be an appropriate agency to perform some or all of the functions described above.

APPENDIX A

Table I-1 - Change in Permanent Population 1950-1970

DRBA Counties	1950	1960	1970	Percentage Change 1950-1970
New Castle	218,879	307,446	385,856	+76.3
Salem	49,508	58,711	60,343	+21.9
subtotal	268,387	366,157	446,199	+66.3
Kent	37,870	66,651	81,892	+116.3
Cumberland	88,597	106,850	121,374	+37.0
subtotal	126,467	173,501	203,266	+60.7
Sussex	61,336	73,195	80,356	+31.0
Cape May	132,399	160,880	175,043	+32.2
Atlantic	37,131	48,555	55,554	+49.6
subtotal	230,866	282,630	310,953	+34.7
TOTAL DRBA REGION	625,720	821,288	964,418	+54.1
Middle Atlantic	36,945,000	42,446,209	47,082,507	+27.4
Northeast	46,260,000	52,955,576	58,929,752	+27.4
U.S.	151,325,798	179,323,175	203,235,298	+34.3

Source: U.S. Census of Population and Housing 1950, 1960, 1970

Table I-2 - Change in Number of Housing Units 1950-1970

DRBA Counties	1950	1960	1970	Percentage Change 1950-1970
New Castle	62,901	94,684	120,683	+91.9
Salem	15,582	19,208	19,598	+25.8
subtotal	78,483	113,896	140,281	+78.7
Kent	12,242	19,915	25,242	+106.2
Cumberland	27,793	35,297	40,005	+43.9
subtotal	40,035	55,212	65,247	+63.0
Sussex	21,870	29,122	34,287	+56.8
Cape May	32,233	47,377	53,152	+64.9
Atlantic	48,604	64,601	73,848	+51.9
subtotal	102,707	141,100	161,287	+57.0
TOTAL DRBA REGION	221,225	310,208	366,815	+65.8

Source: U.S. Census of Housing, 1950, 1960, 1970

Table I-3 - Change in Total Employment 1950-1970

DRBA Counties	1950	1960	1970	Percentage Change 1950-1970
New Castle	87,901	116,028	152,997	+74.1
Salem	18,404	21,505	23,203	+26.1
	106,305	137,533	176,200	+65.7
Kent	15,068	20,163	33,386	+121.6
Cumberland	35,512	41,509	46,942	+32.2
	50,580	61,672	80,328	+58.8
Sussex	23,804	27,041	33,011	+38.7
Cape May	11,773	15,059	18,667	+58.6
Atlantic	50,757	60,057	65,462	+29.0
	86,334	102,157	117,140	+35.7
DRBA REGION	243,219	301,362	373,668	+53.6
U.S.	58,920,000	65,778,000	78,627,000	+33.4

Source: U.S. Census 1950, 1960, 1970

Table I-4 - Changing Composition of Regional and National Employment

DRBA Region	1950	1960	1970	Percentage Change 1950-1970
Agriculture & Fisheries	21,704	15,753	9,967	-54.1%
share of total	8.9%	5.2%	2.7%	
Manufacturing	71,997	84,954	106,061	+47.3%
share of total	29.6%	28.2%	28.4%	
Wholesale & Retail Trade	43,555	53,775	72,871	+67.3%
share of total	17.9%	17.8%	19.5%	
Government			26,761	
share of total	NA	NA	7.2%	NA
Services & F.I.R.E.			108,014	
share of total	NA	NA	28.9%	NA
Other			49,994	
share of total	NA	NA	13.4%	NA
U.S.				
Agriculture & Fisheries	7,160,000	5,458,000	3,462,000	-51.6%
share of total	12.2%	8.3%	4.4%	
Manufacturing	14,467,000	16,150,000	18,090,000	+25.0%
share of total	24.6%	24.6%	23.0%	
Wholesale & Retail Trade	10,742,919	12,306,315	15,607,900	+45.3%
share of total	18.7%	18.5%	19.7%	
Government (excl. schools)	3,559,254	5,011,739	6,207,929	+74.4%
share of total	6.2%	7.5%	7.8%	
Services & F.I.R.E.	12,223,474	17,003,423	24,140,658	+97.5%
share of total	21.3%	25.6%	30.4%	
Other Employment	10,767,353	9,848,523	11,799,393	+9.6%
share of total	18.3%	15.0%	14.9%	

Source: U.S. Census 1950, 1960, 1970

Table I-5 - Change in Agricultural & Fisheries Employment 1950-1970

DRBA Counties	1950	1960	1970	Percentage Change 1950-1970
New Castle	2,414	2,263	1,413	-41.5
Salem	2,754	1,741	960	-65.2
	5,168	4,004	2,373	-54.1
Kent	3,107	2,041	1,262	-59.4
Cumberland	4,605	3,166	1,807	-60.8
	7,712	5,207	3,069	-60.2
Sussex	5,831	4,448	2,907	-50.1
Cape May	657	357	452	-31.2
Atlantic	2,336	1,737	1,166	-50.1
	8,824	6,542	4,525	-48.7
DRBA REGION	21,704	15,753	9,967	-54.1
U.S.	7,160,000	5,458,000	3,462,000	-51.6

Source: U.S. Census 1950, 1960, 1970

Table I-6 - Change in Farm Acreage 1950-1970 (1,000 Acres)

DRBA Counties	1950	1960	1970	Percentage Change 1950-1970
New Castle	179	130	113	-36.8
Salem	123	121	105	-14.6
	302	251	218	-27.8
Kent	282	252	220	-22.0
Cumberland	136	118	95	-30.1
	418	370	315	
Sussex	390	381	341	-12.6
Cape May	29	20	16	-44.8
Atlantic	42	46	31	-26.2
	461	447	388	-15.8
TOTAL DRBA	1,181	1,068	921	-22.0

Source: U.S. Census of Agriculture

Table I-7 - Change in Value of Farm Products Sold ($1,000)

DRBA Counties	1949	1959	1969	Percentage Change 1949-1969 Actual Dollars	Percentage Change 1949-1969 Constant Dollars[1]
New Castle	7,582	10,276	16,079	+112.1	+35.4
Salem	13,015	16,060	36,915	+183.6	+81.1
	20,597	26,336	52,994	+157.3	+64.3
Kent	11,949	17,242	36,141	+202.5	+93.1
Cumberland	21,182	27,263	40,118	+89.4	+20.9
	33,131	44,505	76,259	+130.2	+47.0
Sussex	56,469	58,482	175,436	+210.7	+98.3
Cape May	2,159	1,676	3,271	+51.5	-3.3
Atlantic	8,992	14,679	22,678	+152.2	+61.0
	67,620	74,837	201,385	+197.8	+90.1
DRBA REGION	121,348	145,678	330,638	+172.5	+74.0
U.S.	22,217,000	30,493,000	45,609,000	+105.3	+31.1

Source: U.S. Census of Agriculture 1950, 1959, 1969

[1]Adjustments for constant dollars were made by using the U.S. consumer price index for all items. This index was 70.0 in 1949 and 109.8 in 1969.

Table I-8 - Change in Manufacturing Employment 1950-1970

DRBA Counties	1950	1960	1970	Percentage Change 1950-1970
New Castle	31,336	43,469	46,592	+48.7
Salem	8,028	10,010	10,391	+29.4
Subregion Subtotal	39,364	43,479	56,983	+44.8
Kent	3,687	4,492	6,802	+84.5
Cumberland	14,067	17,969	19,483	+38.5
Subregion Subtotal	17,754	22,461	26,285	+48.1
Sussex	6,631	7,866	9,876	+48.9
Cape May	1,526	1,921	2,123	+39.1
Atlantic	6,722	9,227	10,794	+60.6
Subregion Subtotal	14,879	19,014	22,793	+53.2
TOTAL DRBA REGION	71,997	84,954	106,061	+47.3%
U.S.	14,467,000	16,150,000	18,090,000	+25.0%

Source: U.S. Census 1950, 1960, 1970

Table I-9 - Manufacturing Employment by Place of Residence, 1970

	Chemicals and Allied Products	Food & Kindred Products	Textiles & Apparel	Transportation Equipment	Glass & Clay Products[A]	Other	Total
New Castle	20,307	1,121	1,830	7,119	650	15,024	46,051
Salem	4,849	631	604	455	2,500	1,352	10,391
Sub-region sub-total	25,156	1,752	2,434	7,574	3,150	16,376	56,442
Share of sub-region	44.6%	3.1%	4.3%	13.4%	5.6%	29.0%	100.0%
Kent	634	1,841	1,650	193	90	2,304	6,712
Cumberland	633	2,102	3,740	652	9,000	3,356	19,483
Sub-region sub-total	1,267	3,943	5,390	845	9,090	5,660	26,195
Share of sub-region	4.8%	15.1%	20.6%	3.2%	34.7%	21.6%	100.0%
Sussex	2,706	3,245	1,222	77	90	2,483	9,823
Cape May	67	289	294	152	150	1,171	2,123
Atlantic	427	790	3,266	757	1,800	3,754	10,794
Sub-region sub-total	3,200	4,324	4,782	986	2,040	7,408	22,740
Share of sub-region	14.1%	19.0%	21.0%	4.3%	9.0%	32.6%	100.0%
DRBA Region Total	29,623	10,019	12,606	9,405	14,280	29,444	105,377
Share of DRBA Region	28.1%	9.5%	12.0%	8.9%	13.6%	27.9%	100.0%

Source: U.S. Census, 1970

[A] Arthur D. Little, Inc. estimate based on 1970 Census and 1974 County Business Patterns.

Table I-10 - Manufacturing Values 1970

DRBA Region Counties	Value Added By Manufacture (million $)	Value of Industry Shipments (million $)
New Castle	702.9	1,854.8
Salem	272.2	519.1
subregion subtotal	975.1	2,373.9
Kent	203.7	403.0
Cumberland	267.4	457.7
subregion subtotal	471.1	860.7
Sussex	164.6	373.4
Cape May[A]	38.0	56.0
Atlantic	188.3	282.5
subregion subtotal	390.9	711.9
DRBA REGION TOTAL	$1,837.1	$3,946.5

Source: U.S. Census of Manufactures, 1970

[A]Cape May County not included in census data, Arthur D. Little, Inc. estimates based on prevailing ratio of employment to value and value-added.

Table I-11 - Change in Services & Finance, Insurance & Real Estate Employment 1950-1970

DRBA Region Counties	1950	1960	1970	Percentage Change 1950-1970	Percentage Share of 1970 Employment
New Castle	n/a	n/a	49,206	n/a	32.2
Salem	n/a	n/a	4,948	n/a	21.3
subregion subtotal			54,154		30.7
Kent	n/a	n/a	7,368	n/a	22.1
Cumberland	n/a	n/a	10,392	n/a	22.1
subregion subtotal			17,760		22.1
Sussex	n/a	n/a	7,756	n/a	23.5
Cape May	n/a	n/a	6,534	n/a	35.0
Atlantic	n/a	n/a	21,810	n/a	33.3
subregion subtotal			36,100		30.8
TOTAL DRBA REGION	n/a	n/a	108,014	n/a	28.9
U.S.	12,223,474	17,003,423	24,140,658		30.4

Source: U.S. Census 1970

Table I-12 - Change in Wholesale & Retail Trade Employment 1950-1970

DRBA Counties	1950	1960	1970	Percentage Change 1950-1970	Percentage Share of 1978 Employment
New Castle	14,584	19,703	29,593	103.6	19.4
Salem	2,402	2,887	3,549	+47.8	15.3
Subregion Subtotal	16,986	22,590	33,242	+95.7	18.9
Kent	2,490	3,646	5,357	115.1	16.0
Cumberland	5,424	6,221	7,573	39.6	16.1
Subregion Subtotal	7,914	9,867	12,930	+63.4	16.1
Sussex	3,540	4,424	6,039	70.6	18.3
Cape May	2,561	3,182	4,353	70.0	23.3
Atlantic	12,554	13,712	16,307	29.9	24.9
Subregion Subtotal	18,655	21,318	26,699	+43.1	22.8
TOTAL DRBA REGION	43,555	53,775	72,871	67.3	19.5
U.S.	10,742,919	12,306,315	15,607,900	45.3	19.7

Source: U.S. Census 1950, 1960, 1970

Table I-13 - Retail Sales 1967-1972 ($1,000)

DRBA Region Counties	1967	1972	1972 Sales Per Capita (1970 population)
New Castle	$ 668,323	$1,048,793	$2,718
Salem	85,025	110,935	1,838
Subregion Subtotal	753,348	1,159,728	2,599
Kent	134,154	243,687	2,975
Cumberland	202,652	303,290	2,498
Subregion Subtotal	336,806	546,977	2,691
Sussex	114,438	187,904	2,338
Cape May	131,410	214,493	3,602
Atlantic	371,275	494,976	2,828
Subregion Subtotal	617,123	897,373	2,849
TOTAL DRBA REGION	$1,707,277	$2,604,078	$2,711

Source: U.S. Census of Retail Sales 1967, 1972

Table I-14

Change in Resident Population 1970-1977

DRBA Region Counties	April 1, 1970	July 1, 1977	Percentage Change 1970-77	Net Migration Number	Net Migration Percent
New Castle	385,856	397,800	+ 3.1	- 6,700	- 1.7
Salem	60,343	62,700	+ 3.9	+ 200	+ 0.3
Subregion Subtotal	446,199	460,500	+ 3.2	- 6,500	- 1.5
Kent	81,892	93,700	+14.4	+ 4,900	+ 5.9
Cumberland	121,374	130,800	+ 7.8	+ 2,600	+ 2.1
Subregion Subtotal	203,266	224,500	+10.4	+ 7,500	+ 3.7
Sussex	80,356	90,200	+12.3	+ 7,100	+ 8.8
Cape May	55,554	76,100	+37.0	+ 18,200	+32.8
Atlantic	175,043	189,800	+ 8.4	+ 13,800	+ 7.9
Subregion Subtotal	310,953	356,100	+13.1	+ 39,100	+12.6
TOTAL DRBA REGION	964,418	1,040,100	+8.0	+ 40,100	+ 4.2
Middle Atlantic[A]	47,082,507	47,565,000	+1.02	-203,000	- 0.4
Northeast[B]	58,929,752	59,821,000	+1.51	-168,000	- 0.3
U.S.	203,235,298	216,383,000	+6.47	+3,185,000	+ 1.6

Source: U.S. Census 1970, U.S. Census estimates 1977.

[A] New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, District of Columbia

[B] The Middle Atlantic plus New England

Table I-15

POPULATION PROJECTIONS (NEW JERSEY) AND FORECASTS (DELAWARE)

	1977-85		1985-95	
New Castle & Salem Counties	+ 29,900	6.5%	+ 56,300	11.5%
Kent & Cumberland Counties	+ 48,600	21.6%	+ 36,600	13.4%
Sussex, Cape May and Atlantic Counties	+127,000	36.0%	+ 80,400	16.7%
TOTAL	+205,500	19.8%	+173,300	13.9%

Source: Delaware Population Consortium, Delaware Population Growth, prepared by Division of Urban Affairs, University of Delaware, 1975.

New Jersey Department of Community Affairs, State Development Plan, 1977 based on Seris II Population Projections 1980-2020 New Jersey Department of Labor & Industry, March, 1977.

Table I-16 - Estimated Direct Employment in the Agricultural Sector in the Counties of the DRBA Region, 1969-1974

		Employment				
		Operators[1]	Farm Empl. Over 150 Days[1]	Farm Empl. 25-149 Days[1]	Food Processing[2]	Total
Kent	69 -	1,073	378	1,000	1,847	4,298
	74	976	377	855	2,947	5,155
Cumberland	69 -	733	1,695	2,600	2,102	7,130
	74	580	1,102	1,758	3,003	6,443
Sussex	69 -	2,121	908	2,300	3,245	8,574
	74 -	1,992	1,177	825	4,489	8,483
Cape May	69 -	111	59	100	289	559
	74 -	81	50	91	298	520
Atlantic	69 -	422	715	1,700	790	3,627
	74 -	372	497	1,488	934	3,291
New Castle	69 -	516	286	500	1,121	2,423
	74 -	432	342	386	1,135	2,295
Salem	69 -	702	1,055	1,500	631	3,888
	74 -	601	603	1,733	1,270	4,207
DRBA Region	69 -	5,678	5,096	9,400	10,019	30,193
	74 -	5,034	4,148	7,136	14,076	30,394

Sources:

(1) Bureau of Census, 1974 Census of Agriculture.

(2) 1969 data for food processing is from U.S. Bureau of Census Population Census (by place of residence), 1974 data is from U.S. Bureau of Census County Business Patterns (by place of employment).

Table I-17 - Farmland & Harvested Cropland, by County 1969-1974 DRBA Region

	Land in Farms and % of All Land		Harvested Cropland and % of Farmlands	
	1969	1974	1969	1974
Kent	219,788	196,410	141,110	142,288
%	57.8	51.7	64.2	72.4
Cumberland	95,492	81,231	53,588	57,299
%	29.9	25.4	56.1	70.5
Sussex	340,856	334,023	213,974	238,381
%	56.1	54.9	62.8	71.4
Cape May	15,863	11,295	7,509	7,114
%	9.3	6.6	47.3	63.0
Atlantic	31,478	30,251	14,299	14,587
%	8.6	8.3	45.4	48.2
New Castle	113,251	100,172	67,900	71,083
%	40.4	35.7	60.0	71.0
Salem	104,755	99,347	58,236	66,154
%	44.8	42.5	55.6	66.6
Total	921,483	852,729	556,616	596,906
%	39.1	36.2	60.4	70.0

Source: U.S. Census of Agriculture

Table I-18 - Major Harvested Crop Acreage and Poultry Sales by County in the DRBA Region 1969-1974

		Harvested Crop Average						Poultry Sales	
		Corn	Soybean	Wheat	Other Grains	Hay	Vegetables	# of Broilers	Hens & Chickens
Kent	69 -	48,471	52,917	6,627	12,472	8,063	11,436	2,968,168	110,589
	74 -	40,049	66,252	13,355	10,272	6,720	14,169	4,488,405	133,179
Cumberland	69 -	3,144	2,323	2,063	3,209	3,144	30,154	37,026	410,457
	74 -	3,549	7,135	5,676	1,443	5,648	24,334	-	404,565
Sussex	69 -	105,198	72,513	3,372	13,129	3,833	24,217	109,530,283	396,201
	74 -	97,692	112,274	18,426	16,280	4,672	17,643	119,959,046	586,616
Cape May	69 -	324	127	190	93	667	3,893	60	-
	74 -	445	105	705	7	499	3,078	170	29,286
Atlantic	69 -	352	0	8	60	561	4,485	-	13,266
	74 -	2	187	0	0	199	4,669	-	10,997
New Castle	69 -	26,684	17,281	7,378	3,757	7,467	3,581	352,500	117,012
	74 -	20,914	31,451	9,435	2,048	6,459	1,910	100	69,596
Salem	69 -	10,620	3,870	2,630	4,557	8,671	26,077	17,200	395,143
	74 -	11,400	16,380	7,399	4,462	7,939	21,490	192,867	350,556
DRBA Region	69 -	194,793	149,031	22,268	37,277	32,406	103,843	112,905,237	1,117,121
	74 -	174,051	233,788	54,996	34,512	32,136	87,293	124,640,588	1,584,795
Change 69-74 #		(20,742)	+84,757	+32,728	(2,765)	(270)	(16,550)	11,735,351	467,674
%		(10.6)	+56.8	+147.0	(7.4)	(0.8)	(15.9)	+10.4	+41.9

Source: U.S. Census of Agriculture, 1969, 1974

Table I-19 - Market Value of Raw Agricultural Products (excluding farms with sales of less than $2,500)

(In 000's)

		Poultry	Vege-tables	Grains	Other Crops	Other Live-stock	Total Agricultural
Kent	69 -	4,591	4,980	12,501	6,035	8,034	36,141
	74 -	7,504	10,733	26,123	7,791	7,595	59,746
Cumberland	69 -	7,688	22,482	759	6,763	2,426	40,118
	74 -	3,698	24,593	3,705	6,147	2,126	40,629
Sussex	69 -	138,230	6,831	20,951	1,122	8,302	175,436
	74 -	178,913	6,404	50,080	1,082	11,766	248,245
Cape May	69 -	685	1,732	56	381	417	3,271
	74 -	455	1,699	145	492	329	3,120
Atlantic	69 -	5,631	4,633	4	12,230	180	22,678
	74 -	2,453	6,739	58	13,992	215	23,457
New Castle	69 -	1,777	1,009	5,911	1,670	5,712	16,079
	74 -	892	915	16,243	1,346	5,222	24,618
Salem	69 -	5,261	17,598	1,056	2,192	10,808	36,915
	74 -	5,913	17,857	6,835	2,475	10,466	43,546
DRBA Region	69 -	163,863	59,265	41,238	30,393	35,879	330,638
	74 -	199,828	69,300	103,189	33,325	37,719	443,361
% Change 69-74	-	+21.9	+16.9	+150.2	+9.6	+5.1	+34.1

Source: U.S. Department of Agriculture, 1974 Census of Agriculture translanted by Arthur D. Little, Inc. into constant 1978 $.

Table I-20 - Employment in Food Processing Industries (SIC 20) in the DRBA Region, 1974-1976

DRBA Region Counties		Total Employment	Meat Products	Fruits & Vegetables	Seafood	Other Food Processing
Kent	74 (March)	2,947	991	148	175	1,633
	76 (March)	2,453	742	325	-	1,386
Cumberland	74	3,003	452	1,881	401	269
	76	2,569	480	1,521	294	274
Sussex	74	4,489	1,212	1,469	750	1,058
	76	4,171	1,472	1,452	525	722
Cape May	74	298	-	-	298	-
	76	266	-	-	266	-
Atlantic	74	934	-	325	-	609
	76	807	-	325	-	482
New Castle	74	1,135	-	252	-	883
	76	927	-	210	-	717
Salem	74	1,270	353	225	-	692
	76	376	60	175	-	141
DRBA Region	74	14,076	3,008	4,300	1,624	5,144
	76	11,569	2,754	4,008	1,085	3,722
Percentage Change	74-76	-17.2	-8.5	-6.8	-33.2	-27.6

Source: U.S. Census County Business Patterns, 1974 and 1975.

Table I-21 - LANDINGS IN SELECTED COUNTIES, NEW JERSEY & DELAWARE, 1967, 1974, 1978

	FINFISH		SHELLFISH		TOTAL	
1967						
NEW JERSEY	Pounds	Value $	Pounds	Value $	Pounds	Value $
Atlantic Co.	3,102,604	625,745	1,689,100	688,695	4,791,704	1,314,440
Cape May Co.	35,351,800	1,633,177	18,925,700	2,050,853	54,277,500	3,684,030
Cumberland Co.	473,600	48,111	1,727,200	1,002,672	2,200,800	1,050,783
Salem Co.	23,400	3,720	55,000	7,151	78,400	10,871
DELAWARE						
Kent Co.	95,600	14,626	345,600	66,623	441,200	81,249
Newcastle Co.	13,300	2,230	750	135	14,050	2,365
Sussex Co.	106,900	13,420	303,000	162,008	409,900	175,428
TOTAL DRBA	39,167,204	$2,341,029	23,046,350	$3,978,137	62,213,554	$ 6,319,166
REGION		(78 $) 4,026,570		(78 $) 6,842,396		(78 $) 10,858,965
1974						
NEW JERSEY						
Atlantic Co.	2,135,000	526,235	7,685,600	1,923,450	9,820,600	2,449,685
Cape May Co.	14,307,500	2,213,960	14,269,700	2,510,291	28,577,200	4,724,251
Cumberland Co.	378,200	58,325	2,839,600	1,450,276	3,217,800	1,508,601
Salem Co.	11,400	2,154	404,900	96,715	416,300	98,869
DELAWARE						
Kent Co.	283,700	72,929	1,515,100	431,563	1,798,800	504,492
Newcastle Co.	34,300	3,473	844,100	166,678	878,400	170,151
Sussex Co.	440,500	113,069	6,096,500	940,108	6,537,000	1,053,177
TOTAL DRBA	17,590,600	$2,990,125	33,655,500	$ 7,518,581	51,246,100	$10,509,226
REGION		(78 $) 4,048,629		(78 $) 10,180,158		(78 $) 14,228,787
1978						
NEW JERSEY						
Atlantic Co.	813,500	534,050	3,903,500	2,082,511	4,717,000	2,616,561
Cape May Co.	17,116,500	4,634,438	31,721,400	20,552,856	48,837,900	25,187,294
Cumberland Co.	338,000	56,934	2,038,500	2,199,745	2,376,500	2,256,679
Salem Co.	-0-	-0-	263,100	111,304	263,100	111,304
DELAWARE						
Kent Co.	408,500	134,016	703,900	212,956	1,112,400	346,972
Newcastle Co.	100,600	46,490	82,900	37,704	183,500	84,194
Sussex Co.	430,100	157,810	186,800	160,120	616,900	317,930
TOTAL DRBA	19,207,200	$5,563,738	38,900,100	$25,357,196	58,107,300	$30,920,934
REGION		(78 $)				

Source: National Marine Fisheries Service Department of Commerce for 1974 and 1978 figures;
U.S. Bureau of Commercial Fisheries, Department of Interior for 1967 figures.

Table I-22

TOTAL FISH CATCH IN THE U.S. ATLANTIC-NORTH COASTAL WATERS* BY SPECIES, 1974 (METRIC TONS)

	Total Catch	U.S. Catch	U.S./U.S. + Foreign	Foreign/U.S. + Foreign
(E) Tuna	1,178	1,030	87.4%	12.6%
(E) Smelts	19,726	31	.2	99.8
(E) Herring	204,424	45,174	22.1	87.9
(I) Menhaden	257,378	257,288	99.9	0.1
(E) Halibut	76	46	60.5	39.5
(E) Sole/Flounder	41,867	40,924	97.7	2.3
(E) Cod	36,826	27,232	73.9	26.1
(E) Hake	167,425	20,514	12.2	87.8
(E) Haddock	5,121	3,289	64.2	35.8
(E) Pollack	12,393	5,731	46.2	53.8
(E) Groupers	4,772	4,772	100.0	0.0
(E) Croakers	7,198	7,198	100.0	0.0
(E) Atlantic Redfish	10,611	8,677	81.7	18.3
(E) Mackerel	294,962	1,079	0.3	99.7
(E) Mullets	279	279	100.0	0.0
(S) Crabs	37,362	37,362	100.0	0.0
(S) Lobster	11,330	11,152	98.4	1.6
(S) Shrimp	8,615	8,615	100.0	0.0
(S) Oyster	199,808	119,808	100.0	0.0
(S) Scallops	76,197	25,263	33.1	66.9
(S) Clams	289,719	289,719	100.0	0.0
(E) Squid	55,878	2,422	4.3	95.8
Other	60,954	17,068	--	--
	1,804,099	1,016,698	56.3%	43.7%

Notes:

*Atlantic-North coastal waters extend northward from Cape Hatteras, North Carolina, to the U.S.-Canada border.

(E) Indicates an edible finfish
(I) Indicates an industrial finfish
(S) Indicates a shellfish

Source: The U.S. Commercial Fishing Industry - Present Condition and Future of Marine Fisheries, Controller General of the United States, 1976 (CED-76-130).

Table I—23

Manufacturing Employment and Output in the
Counties of the DRBA Region--1970-1976
(Including Manufacture of Food and Kindred Products)

		Production Workers	Non-Production Workers	Total Employees	Value Added by Manufacture (constant 1978 dollars) 000,000	Value of Industry Shipments (constant 1978 dollars) 000,000
New Castle	1970	21,600	30,800	52,400	1,209.0	3,190.3
	1976	19,700	29,900	49,600	1,228.4	4,270.2
Salem	1970	8,000	3,200	11,200	468.2	892.9
	1976	7,400	2,400	9,800	440.6	983.2
Subregion Total	1970	29,600	34,000	63,600	1,677.2	4,083.2
	1976	27,300	32,300	59,400	1,669.0	5,253.4
Kent	1970	6,000	2,400	8,400	350.4	693.2
	1976	5,100	1,800	6,900	331.1	775.8
Cumberland	1970	18,800	3,600	22,400	459.9	787.2
	1976	15,000	3,600	18,600	476.8	1,003.0
Subregion Total	1970	24,800	6,000	30,800	810.3	1,480.4
	1976	20,100	5,400	25,500	807.9	1,778.8
Sussex	1970	7,900	2,200	10,100	283.1	642.2
	1976	7,300	2,300	9,600	294.7	869.0
Cape May	1970	-	-	-	-	-
	1976	-	-	900 [A]	n.a.	n.a.
Atlantic	1970	10,000	2,300	12,300	323.9	485.9
	1976	7,600	1,800	9,400	323.7	468.1
Subregion Total	1970	17,900	4,500	22,400	607.0	1,128.1
	1976	14,900	4,100	19,000	618.4	1,337.1
DRBA Region	1970	72,300	44,500	116,800	3,094.5	6,691.7
	1976	62,100	41,800	103,900	3,095.3	8,369.3
Net Change 1970-1976		-14.1	-6.1	-11.0	0.0	+25.1

Source: U.S. Bureau of Census, Annual Survey of Manufacturers, 1970, 1976.

[A] Cape May County Figures are from County Business Patterns, 1975.

Table I-24

Change in Manufacturing Indicators for the Middle Atlantic Region and Other Parts of the U.S. - 1970-1976

		Production Workers	Non-Production Workers	Total Manufacturing Employment	Value Added by Manufacture (Constant 1978 $'s)	Value of Industry Shipments (Constant 1978 $'s)
Virginia	1970	273.0	81.1	354.1		
	1976	288.9	88.4	377.3		
District of Columbia	1970	10.5	10.8	21.3		
	1976	8.6	9.3	17.9		
Maryland	1970	191.2	81.2	272.4		
	1976	164.4	78.4	242.8		
Delaware	1970	35.6	35.2	70.8		
	1976	32.2	33.8	66.0		
New Jersey	1970	563.6	295.2	858.8		
	1976	458.4	277.3	735.7		
Pennsylvania	1970	1,084.6	429.4	1,514.0		
	1976	915.7	394.5	1,310.2		
New York	1970	1,173.6	654.6	1,828.2		
	1976	906.9	548.4	1,455.3		
MIDDLE ATLANTIC	1970	3,332.1	1,587.5	4,919.6		
	1976	2,775.1	1,430.1	4,205.2		
Net Change 70-76		-16.7	-49.9	-14.5		
NEW ENGLAND	1970	1,025.3	454.0	1,479.3		
	1976	901.2	438.1	1,339.3		
Net Change 70-76		-12.1	-3.5	-9.5		
BALANCE OF U.S.	1970	9,170.6	2,720.0	11,890.6		
	1976	9,375.7	3,832.8	13,208.5		
Net Change 70-76		+2.2	+40.9	+11.1		
U.S.	1970	13,528.0	4,761.5	18,289.5	516,390	1,091,051
	1976	13,052.0	5,701.0	18,753.0	598,421	1,387,269
Net Change 70-76		-3.5	+19.7	+2.5	+15.9	+27.1

Source: U.S. Bureau of the Census Annual Survey of Manufacturers, 1970, 1976

Table I-25

Composition of Manufacturing Employment in the DRBA Region by County-1976

DRBA Counties	Chemicals, Petroleum & Allied Products[1] (SIC 28,29)	Transportation Equipment	Textiles & Apparel (SIC 22,23)	Glass & Clay Products (SIC 32)	Food & Kindred Products (SIC 20)	Other	Total
New Castle	27,861*	8,565*	1,185	422	927	12,787	51,687
Salem	6,494	-	606	1,750	376	343	9,569
subregion totals	34,355	8,565	1,791	2,172	1,303	13,130	61,256
Kent	60*	-	680*	91	2,453	3,549	6,833
Cumberland	289	750*	2,927*	8,668	2,569	2,673	17,876
subregion totals	349	750	3,607	8,759	5,022	6,222	24,709
Sussex	3,643*	-	605	66	4,171	1,823	10,300
Cape May	-	-	-	175	266	489	930
Atlantic	789	750*	2,902	1,755	807	2,082	9,085
subregion totals	4,432*	750*	3,507	1,996	5,244	4,394	20,323
TOTAL DRBA REGION	39,136	10,065	8,905	12,927	11,569	23,746	106,288
%	36.8%	9.5%	8.4%	12.2%	10.9%	22.2%	100.0%
U.S. TOTALS	1,000,297	1,679,119	2,108,016	580,512	1,480,577		18,965,344
%	5.3%	8.9%	11.1%	3.1%	7.8%		100.0%

Source: U.S. Bureau of the Census, County Business Patterns, 1976

[1] DRBA region totals for this sector include Administration & Auxiliary Category (headquarters and research)

* Estimates based on some data available in ranges only.

Table I-26 - United States Petrochemical Demand

PRODUCT SECTOR	VALUE OF SHIPMENTS--$ BILLIONS (1970)						ESTIMATED GROWTH RATES*				
	1964	1970	1975	1980	1985	2000	64/70	70/75	75/80	80/85	85/2000
Organic Chemicals	$ 4.3	$ 7.4	$11.4	$16.8	$24.0	$ 65.0	10.0	8.5	8.0	7.5	6.5
Plastics	2.5	4.3	6.6	9.7	14.3	43.0	9.5	9.0	8.0	8.0	7.5
Fibers	1.4	2.8	4.4	6.6	9.7	28.0	12.5	9.5	8.5	8.0	7.5
Elastomers	0.8	1.0	1.3	1.7	2.0	3.5	4.0	5.0	5.0	4.5	4.0
Other	1.3	3.1	4.8	6.7	9.3	25.5	15.5	9.0	7.0	7.0	6.0
TOTAL	$10.3	$18.6	$28.5	$41.5	$59.3	$165.0	10.5	8.5	8.0	7.5	7.0

*All growth rates have been rounded.

SOURCE: Arthur D. Little, Inc., "Potential Onshore Effects of Deepwater Oil Terminal-Related Industrial Development," Council on Environmental Quality, Washington, D.C., October 1973.

Table I-27 - Volume of Oil Imports Involved in Lightering

Year	Total Activity	
	Barrels/ Calendar Day	Million Barrels/Year
1968	48,000	17.4
1969	49,000	18.9
1970	53,000	19.3
1971	60,000	21.7
1972	176,000	64.3
1973	218,000	79.7
1974	240,000	87.7
1975	280,000	102.2
1976	293,000	107.0
1977	341,000	124.4

Table I-28

SUMMARY OF ECONOMIC IMPACT – MID-ATLANTIC REGION
(Delaware, Pennsylvania, New Jersey)

CUMULATIVE

	Impacts High-Level Crude Imports		Impacts Low-Level Crude Imports (Baseline)	
	1985	2000	1985	2000
(1) New Refinery Capacity (M B/D)	3,655	4,855	460	1,080
(2) No. of New Petrochemical Complexes	25	39	6	11
(3) Value of New Production (millions 1970 $)	33,806	52,497	6,750	13,373
a. Primary	14,276	21,000	2,795	5,487
b. Suppliers	8,590	12,988	1,675	3,286
c. Induced	10,940	18,509	2,280	4,604
(4) New Permanent Operating Employment (thousands)	515.8	666.5	107.7	175.7
a. Primary	111.8	132.6	25.9	36.9
b. Suppliers	182.8	241.0	35.7	61.0
c. Induced	221.2	292.9	46.1	77.8
(5) Value of New Earnings (millions 1970 $)	5,834	10,927	1,215	2,505
a. Primary	1,635	2,966	374	825
b. Supplies	2,011	3,857	385	976
c. Induced	2,188	4,094	456	1,082
(6) Impact Multipliers				
a. Production (3/3a)	2.8			
b. Permanent Employment (4/4a)	7.2			
(7) Additional Employment (thousands)	50.0	50.0	13.0	13.0
a. Construction[1]	30.0	30.0	8.0	8.0
b. Equipment Producers	20.0	20.0	5.0	5.0
(8) Total Employment Impact (thousands)	565.8	716.5	120.7	188.7

1. Excludes temporary (imported) construction employment and construction employment for new housing.

Source: Arthur D. Little, Inc., Potential Onshore Effects of Deepwater Oil Terminal Related Industrial Development, Volume II, East Coast.

Table I-29

CUMBERLAND/CAPE MAY COUNTIES
SUMMARY OF ECONOMIC IMPACT

CUMULATIVE

		Impacts High-Level Crude Imports		Impacts Low-Level Crude Imports	
		1985	2000	1985[1]	2000[1]
(1)	New Refinery Capacity (thousand B/D)	1,600	1,900	–	–
(2)	No. of new Petrochemical Complexes	9	13	–	–
(3)	Value of New Production[2] (millions 1970 $)	$9,351	$12,772		
	a. Primary	5,569	7,423		
	b. Supplies	2,061	2,747		
	c. Induced	1,721	2,602		
(4)	New Permanent Operating Employment[2,3] (thousands)	130	150		
	a. Primary	40	44		
	b. Supplies	42	53		
	c. Induced	47	52		
(5)	Value of New Earnings[2] (millions 1970 $)	$1,555	$ 2,315		
	a. Primary	623	995		
	b. Supplies	507	695		
	c. Induced	425	625		
(6)	Impact Multipliers[4]				
	a. Production (3/3a)	1.8	2.0		
	b. Permanent Employment (4/4a)	3.1	5.2		

1. Small economic impact resulting from the terminal and the construction and operations of terminal storage facility.

2. Totals may not add due to rounding.

3. Construction employment excluded from impact analysis because of seasonality, mobility and/or non-permanent nature (see Cumberland/Cape May heading – Additional Impacts and Mid-Atlantic Chapter).

4. Two impact multipliers have been calculated, one for production, the other for employment. They serve as an indication of the production and employment generating strength of the primary activity in this region which, in this study, is petroleum refining and petrochemical operations. Thus for each $1.00 of final output produced in petroleum refinery-petrochemical activity during 1980-1985 an additional $0.80 worth of output, on the average, is generated in all other industries located in Cumberland/Cape May counties. The employment multipliers are all interpreted in similar fashion. Note that these multipliers do not capture all impacts completely. We have omitted from this calculation the additional economic activity generated in and by the actual construction of the physical plants and the manufacture of all required capital equipment (see Additional Impacts). Since the latter two impacts are not necessarily realized upon expansion of output in the petroleum refining and petrochemical industries, we have omitted them in this segment of our analysis and from the calculation of the multipliers. Thus, the multipliers more accurately represent impacts expected under conditions of some excess capacity which is more in keeping with the traditional meaning of impact multipliers.

Source: Ibid

APPENDIX B

APPENDIX B

List of Contacts

Delaware River and Bay Authority Study

Dean William Gaither, University of Delaware, College of Marine Studies

Mr. N.C. Vasuki, Delaware Solid Waste Authority

Mr. Robert Ruggio, Kidde Consultants, Inc., Newark, Delaware

Mr. William F. Moyer, Director of Wetlands Division, Department of Natural Resources and Environmental Conservation

Mr. Ronald Donovan, City Manager, Lewes, Delaware

Mr. Robert Bernard, Industrial Development Coordinator, Sussex County, Georgetown, Delaware

Mr. Roy Miller, Biologist, Division of Fishery, Department of Fish and Wildlife

Mr. Nathan Hayward, Director, Delaware Office of Management, Budget and Planning

Mr. Alfieri, Director, Wilmington Port Authority

Mayor Marion Howard, Mayor of Rehoboth Beach, Delaware

Mr. Lawrence I. Turner, City Manager, Rehoboth Beach, Delaware

Mr. Robert O'Brien, Kent County Planning Director

Mr. Lawrence Liggett, Wilmington Department of Planning and Economic Development

Mr. Eliott Galinkoff, Wilmington Department of Planning and Economic Development

Ms. Phyllis Rabb, University of Delaware, Division of Urban Affairs

Mr. Jeff Light, New Jersey Governor's Counsel

Mr. Tom Hall, New Jersey Governor's Office, Policy/Planning

Mr. D.C. Agrawal, New Jersey Department of Transportation, Policy Analysis

Mr. Don Linky, New Jersey Department of Community Affairs, Planning

Mr. Paul Arbesman, New Jersey Department of Environmental Protection

Mr. Rocco Guerrieri, New Jersey Department of Labor and Industry

Mr. Bruce Stewart, Delaware River Basin Commission

Mr. Cecil Hull, Delaware River Basin Commission

Mr. David Hugg, Delaware Office of Management, Budget and Planning

Ms. Helen Gelof, Delaware Office of Management, Budget and Planning

Mr. John Sherman, Delaware Office of Management, Budget and Planning, Coastal Facility Siting

Ms. Dorothy Sbirglia, Delaware Department of Community Affairs, Division of Economic Development

Mr. John Babiarz, Wilmington Department of Commerce

Mr. Bob Wrede, New Castle County Executive's Office, Industrial Development Specialist

Ms. Jill Hoover, Delaware Economic Development Division, Sussex County 208 Plan Office

Mr. Bernard Dworski, Division of Water Resources Planning, New Castle County

Mr. Bob O'Brien, Kent County Land Use and Zoning

Mr. Charles Lasser, Delaware Division of Fisheries

Dr. Robert Lipson, National Marine Fishery Service, Oxford Lab

Mr. Tim Goodger, National Marine Fishery Service, Oxford Lab

Mr. Ron Gatton, National Marine Fishery Service, Oxford Lab

Mr. David Smith, Ecological Assessment Branch, U.S. Fish and Wildlife Service, Annapolis

Mr. David Everett, Delaware River Basin Commission

Mr. Herb Howlett, Delaware River Basin Commission

Mr. John Bryson, Director, Mid-Atlantic Fisheries Council

Mr. Ed Spear, Delmarva Power and Light Co., Wilmington

Mr. Frank Cianfrani, U.S. Corps of Engineers, Philadelphia

Mr. Randy Ponponio, Wetlands Branch, EPA Region III

Mr. Bill Maier, Wetlands Branch, EPA Region III

Ms. Andrea Tapper, Office of Coastal Zone Management, DEP, State of New Jersey

Mr. Bill Yoskin, Office of Coastal Zone Management, DEP, State of New Jersey

Mr. Allan Campbell, Office of Coastal Zone Management, DEP, State of New Jersey

Mr. Stephen Schweiz, Division of Water Resources, DEP, State of New Jersey

Mr. Charles Geter, Division of Tourism, Department of Economic Development, State of New Jersey

Mr. Lee Jennings, Department of Community Development, Salem County, New Jersey

Mr. Jim Ogilvie, Public Relations Department, Cumberland County, New Jersey

Mr. Louis Dalbert, South Jersey Economic Development Council, Atlantic City, New Jersey

Mr. William Brey, National Marine Fishery Service, Oxford, Maryland

Mr. Mahoney, National Marine Fishery Service, Statistics Division, Gloucester, Massachusetts

Mr. Robert Meyers, Cape May County Planning Department, Cape May Court House, New Jersey

Mr. Ed Filipski, Cape May County Planning Department, Cape May Court House, New Jersey

Mr. Dereksen, Sussex County Planning Department, and Governor's Commission on Marine Tourism, Georgetown, Delaware

Mr. Robert Henry, Delaware Department of Natural Resources and Environmental Control, Soil & Water Division, Dover, Delaware

Mr. Jim Wheatley, Division of Travel and Tourism, State of New Jersey

Mr. Gary Rice, Tourist Information Center, Cumberland County, New Jersey

Mr. Elwood Jarmon, Planning Director, Cape May County, New Jersey

Mr. Jim Waldron, Office of Industrial Development, Department of Labor and Industry, State of New Jersey

Ms. Virginia Parker, Office of Economic Development, City of Cape May, New Jersey

Mr. Lou Rodin, Public Affairs Coordinator, Cape May County

Mr. Charles Thomas, President, Chamber of Commerce, Wildwood, New Jersey

Mr. Ed O'Donnell, Planning Department, New Castle County, Delaware

Mr. Paul Dentiste, Planning Department, New Castle County, Delaware

Mr. Fred Rudkin, Supervisor of Marinas, Department of Environmental Protection, New Jersey

Mr. Ray Mellanfan, Wilmapco

Mr. Steven Walsh, Wilmapco

Mr. William Whipple, Institute of Water Resources, Rutgers University

Lt. Col. John Calaghan, U.S. Army Corps of Engineers, District Office, Pennsylvania

Mr. Charles D. Worthington, City Executive, Atlantic City, New Jersey

Ms. Bernice Paul, Director of Economic Development Division, County Executive Office, New Jersey

Mr. John R. Galloway, President, Delaware Bay Transportation Company

Mr. Howard Seymour, College of Marine Studies, University of Delaware

Mr. Joseph Conaway, Administrator, Suffolk County, Delaware

Mr. Gerald M. Thornton, Freedholder/Cape May County, New Jersey

Mr. Donald Kelly, Director, Industrial & Economic Development Agency, Cape May County

Mr. Austin P. Olney, Secretary, Department of Natural Resources and Environmental Control, Delaware

Mr. O.F. Biondi, Attorney, Council for Delaware River and Bay Authority

Mr. William Gemmel, Commissioner, Delaware River and Bay Authority

Mr. Walter Maack, Commissioner, Delaware River and Bay Authority

Mr. John Vinci, Commissioner, Delaware River and Bay Authority

Mr. Barnard, Commissioner, Delaware River and Bay Authority

Mr. McCormick, Commissioner, Delaware River and Bay Authority

Mr. Keith Rosser, Director, New Jersey Department of Transportation, Planning and Research

Mr. Bob Engle, New Jersey Department of Transportation, Division of Comprehensive Transportation Planning

Mr. George Thomas, New Jersey Department of Transportation

Mr. R. D. Bewick, Acting Secretary, Delaware Department of Transportation

Mr. Bill Elgie, Office of Planning, Delaware Department of Transportation

Mr. John Sipple, Chief, Office of Planning, Department of Transportation

Mr. Jim Ho, Office of Planning, Department of Transportation

Mr. Jim Haas, Office of Planning, Department of Transportation

Mr. K.A. Katz, Delaware Bureau of Traffic

Mr. Alex Castro, Howard, Needles, Tammen & Bergendoff

Mr. Vetter, Corps' River & Harbors Board, Ft. Belvoir, Virginia

Mr. Henry Watson, Assistant Director, New Jersey Department of Labor and Industry, Office of Business Economics

Mr. Dick Ginman, New Jersey Community Affairs - Planning

Mr. Joe Kanda, New Jersey Department of Transportation, Bureau of Data Resources

Mr. Whiteley, New Jersey Department of Transportation, Bureau of Data Resources

Mr. Wolfe, Delaware River and Bay Authority, Office of Comptroller

Mr. James R. Kelly, Delaware River Port Authority

Mr. John T. Sexton, Delaware River Port Authority

Mr. William A. Harrison, The Philadelphia Maritime Exchange

Mr. William Bennington, Delaware River Port Authority

Mr. John P. Gaffingan, Delaware River Port Authority

Mr. John Malone, Philadelphia Port Corporation

Mr. Samuel Hudson, J.E. Brenneman Co., Philadelphia

Mr. Ray Heingelman, Frederic R. Harris, Inc., Lake Success

Mr. Marvin Searles, Mobil Oil Corporation

NOAA COASTAL SERVICES CENTER LIBRARY
3 6668 00000 7320