REGIONAL ONSHORE IMPACTS FROM OFFSHORE OIL AND NATURAL GAS DRILLING SUPPORT FACILITY DEVELOPMENT IN THE STATE OF RHODE ISLAND

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by the
Coalition of Coastal Communities

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Introduction

The Coalition of Coastal Communities is a regional council of local governments charged with realizing the full potential of Narragansett Bay and its resources. The Coalition conducts studies on matters of mutual interest and concern to its member communities, develops policies and action recommendations, and influences local, state, and federal policies to more effectively address regional concerns.

In 1980, the issue of impacts on coastal communities from proposed development of support facilities at Quonset Point/Davisville for offshore oil and gas drilling was identified as an area of study by the Coalition. The coastal communities in the region surrounding Quonset were viewed as highly vulnerable to impacts from extensive support facility development due to already existing rapid development and change in these communities. A grant was awarded to the Coalition to conduct a coastal energy impact study from the Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, administered by the Governor's Energy Office, State of Rhode Island.

The purpose of this study was to examine the effects this proposed activity would have on the surrounding coastal communities. This is accomplished by identifying and assessing characteristics and problems of the region which could be demonstrably affected by high level secondary impacts associated with offshore drilling support development in Rhode Island. Regional impacts form the limited offshore drilling support activity to date have been minimal. Future impact severity will depend upon the amount and location of offshore drilling in the eastern Atlantic Outer Continental Shelf (OCS). Onshore support development will coincide closely with the activity offshore. At this time there is a high level of uncertainity with regards to this activity. The report will examine the chief factors determining why offshore oil and gas drilling in the North and Mid-Atlantic has an uncertain future. Existing and planned offshore drilling support develop-

ment at Quonset Point/Davisville is described. Projections on employment, wages, and direction of the various OCS support activities are based primarily upon the New England River Basin Commission's comprehensive offshore oil study finding in 1976. Regional onshore impacts associated with OCS support facility development are charted based upon previous experiences of other OCS support regions in North America and Great Britain. The information is intended to assist local officials interested in the unique nature of this major coastal energy development and its impacts on communities. Together with the data provided on areas that could be affected in the region by the onshore activity, this information will help the communities prepare and plan for offshore oil and gas drilling and onshore developments in Rhode Island in the 1980s and 1990s.

A study region was selected which consists of the coastal communities adjacent to and including the host community, North Kingstown. These surrounding communities are East Greenwich, South Kingstown, Narragansett, and Jamestown. Referred to as the West Bay Region, these communities lie proximate to the source of potential impacts. The communities have exhibited important similarities such as high growth rates and pressures on services and resources. This study area allows the consideration of regional solutions as well as local recommendations. The information provided on OCS activity will be of use to all coastal communities and findings are applicable to most of the other communities in Washington County, Rhode Island.

The Coalition study is concerned with regional problem areas which could be further affected by siginificant OCS support facility development. Identification and assessment of these problems were limited to service areas by local governments where management by local government will determin the future environmental quality of the region. These areas include water quality management, drinking water supply, population and housing controls, transportation, economic development, land-use planning, and energy. Coastal management and recreation/tourism will be service areas examined in a second year study. These are not the only areas of concern in

the region which could be affected by planned offshore drilling-related development. Schools, police and fire, and medical services are other documented areas which have been affected by this development elsewhere and will require further attention.

A description of each of these regional services is provided. This description includes a survey of trends to provide an historical and relative perspective. Important findings and existing and/or potential problems are identified. These problems are analyzed for developing effective local, regional, state, and federal policies. Preliminary policy recommendations are set forth in each section. A second year study, entitled Community Assistance: OCS Impact Study Implementation, will further develop and attempt to implement recommended policies and plans.

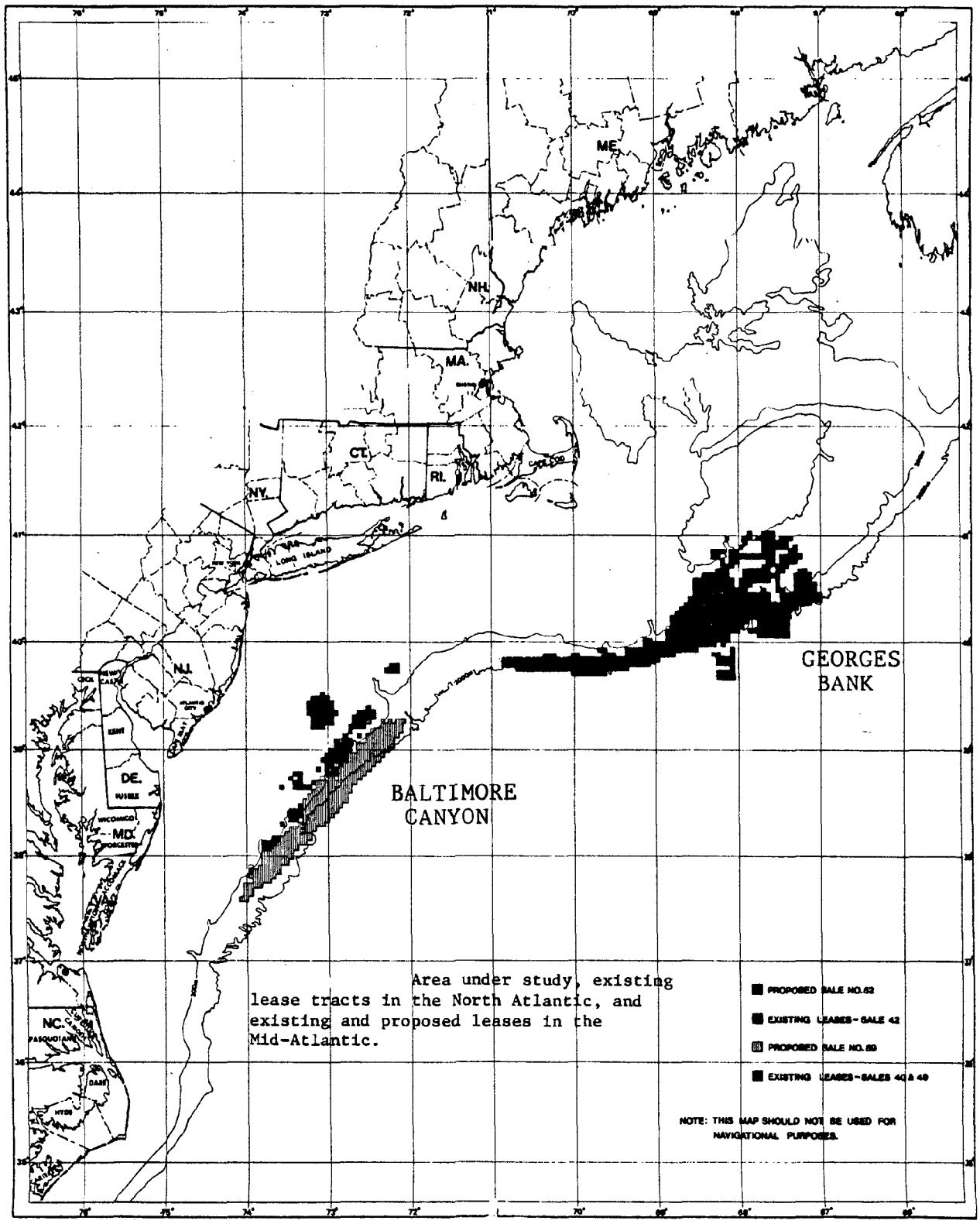
This study does not present any official policy position of this organization in regards to future development of offshore oil and gas drilling and the development of support facilities in Rhode Island. The Coalition was charged with addressing potential regional effects on coastal communities surrounding the support base at Quonset Point-Davisville. The Coalition realizes the important economic benefits to the state and communities from the projected employment opportunities. Again, due to the high level of uncertainty involving future OCS support development activities amid the ensuing speculative nature of any regional impact assessment, the study methodology identifies and assesses existing service problem areas affecting the environment which are the most vulnerable to regional impacts from this activity. The Coalition of Coastal Communities' goal is to realize the full recreational, aesthetic, and economic potential of Narragansett Bay.

Chapter One

Offshore Oil and Gas

Figure I-1

NORTH AND MID-ATLANTIC OUTER CONTINENTAL SHELF



Source: United States Geological Survey

Offshore Oil and Gas Drilling

Offshore oil and gas drilling in the Mid-Atlantic and North Atlantic Outer Continental Shelves will determine the development activity and impacts onshore. Understanding the offshore activity assists planning for onshore impacts. An examination of the drilling history of the Atlantic OCS, the science of estimating OCS oil and gas resources, and economics and technology of drilling in deep water reveal how the offshore activity determines the onshore impacts.

The history of offshore oil and gas drilling in the Atlantic Outer Continental Shelf has consisted of a relatively long-term, high-risk exploration phase. Most of the Atlantic drilling history has occurred in the outer continental shelf off the coast of Canada. The significance of the exploration of the Canadian OCS was that it took ten years before a major commercial discovery occurred. Yet, the patience and commitment of the offshore oil and gas industry resulted in a discovery estimated to contain 50% more recoverable oil and gas than the giant field in Alaska's Prudhoe Bay. A similar history occurred in the North Sea where 54 wells were drilled before a major commercial discovery occurred.

Both prior to and during the exploration phase of offshore oil and gas drilling the government and industry produce estimates on the resource potentials. Impact assessments are based upon these estimates. An examination of the history of estimating offshore oil and natural gas resources for the Atlantic Outer Continental Shelf reveals a great amount of uncertainty.

The Canadian OCS Resources estimates have varied significantly during the ten-year exploratory phase. In 1964 the Canadian Petroleum Association estimated the Canadian Atlantic Shelf contained 29 billion barrels (bls.) of oil. After four years of exploratory drilling, estimates were reduced to 3.7 billion bls. and in 1976, the large discovery occurred in the Hibernia field of the Canadian Shelf, raising the total Canadian OCS resource estimates to 16 billion bls.

Resource estimates for the United States Atlantic OCS have experienced similar fluctuations in the early stages. Table I-1 shows the OCS schedule. The most recent estimates (1981) are shown in Table I-2 following the first lease sale, five-year exploration of the Baltimore Canyon. Many experts believe recent advances in the science of computer analysis of seismic reflection data will improve the accuracy of estimating oil and gas offshore resources.

The unreliablity of OCS oil and gas resource estimates prior to commercial discoveries makes planning for onshore impacts difficult and often inaccurate. Onshore impacts are a direct result of offshore oil and gas exploratory development and production activity. The size and location of the offshore resources will determine the magnitude of the onshore impacts wherein local and state governments must make timely plans to achieve maximum benefits and mitigate any negative impacts.

Mid-Atlantic OCS Activity

Offshore oil and gas exploratory drilling in the Mid-Atlantic lease sale area, comonly known as the Baltimore Canyon, began in 1978. Twenty-eight exploratory wells have been drilled so far with five revealing some findings of oil and gas. In 1978 several major oil companies indicated that a minimum of 1 - 1.2 trillion cubic feet of gas was necessary for a commercial discovery. Estimates for natural gas in the Mid-Atlantic shelf lands leased in Sales 40 and 49 was .86 trillion cubic feet. The future course of action by the oil companies is being determined by detailed economic, engineering and geological analysis of all the available data. This is an extremely difficult task for a marginal find because of the variability in the geology of the region on which the all important reserve estimates are based.

Currently, there are no rigs exploring for oil and gas in the Mid-Atlantic. Drilling and support activity has declined from a peak of nine rigs in the Mid-Atlantic in 1979 to one rig which completed drilling in the summer of 1981.

The latest lease sale for the Mid-Atlantic was held in December, 1981. One

Table I-1

North and Mid-Atlantic OCS Leasing Schedule

Lease Sale No.	Area	Year of Sale
40	Mid-Atlantic	1976
49	Mid-Atlantic	1978
42	North Atlantic	1979
59	Mid-Atlantic	1981
52	North Atlantic	1982
76	Mid-Atlantic	1983
82	North Atlantic	1984
90	Atlantic	1985
96	Atlantic	1986

Table I-2

OCS Resource Estimates

	OIL (Billion Barrels)		GAS (Trillion Cu. Ft.)	
	Shelf (0-200 Meters)	Slope (200-2,500 Meters)	Shelf	Slope
North Atlantic	.4	1.0	2.5	3.2
Mid-Atlantic	.8	2.3	5.8	8.6
U.S. Atlantic	1.1-12.9	5.4	9.2-42.8	23.6

Source: United States Geological Survey, 1981

company plans to begin exploring in approximately eighteen months. Perhaps the most important feature of this lease sale was the bidding for leases in water depths between 6,000 and 7,000 feet (see p.8 for further discussion of deepwater drilling). The fourth lease sale for the Mid-Atlantic, No. 76, held a call for nominations in December, 1981. Under the proposed Department of Interior Accelerated Five-Year Oil and Gas Leasing Schedule, the lease sale is scheduled for February, 1983. Again, oil companies showed interest in the deep water tracts. Areas of medium to high interest to companies toalled 1,327 tracts covering 7.4 million acres over the deep water reef structure (see map p.2).

North Atlantic OCS Activities

Exploratory drilling began on Georges Bank on July 24, 1981. Both the Alaskan Star, leased by Exxon, and the Zapata Saratoga, leased by Shell Oil Company, began drilling within fifteen hours and forty miles of one another. A third rig leased by Mobil Oil Company began drilling in November, 1981, and a fourth rig began drilling in March, 1982. Four months after it began drilling, Exxon announced a dry hole and moved to a new location (Block 133). Shell temporarily suspended drilling on December 6th after a winter snowstorm resulting in problems with broken anchor lines.

The second lease sale for Georges Bank, #52, is scheduled for August, 1982. A total of 540 tracts were nominated in water depths of 171 to 9,285 feet.

Table I-1 shows the future leasing schedule for the North and Mid-Atlantic OCS. Due to the greater potential for oil and gas in the deeper water of the outer continental slope, the following sections provide information on factors affecting the exploration and development of the Atlantic slope.

Deepwater Drilling

A further indicator of a long-term exploratory phase in the North and Mid-Atlantic OCS is the growing interest in deep well drilling in an ancient reef struc-

ture of the Atlantic continental slope. The slope contains an ancient reef structure running from Main to Georgia approximately 50 to 200 miles off the eastern seaboard. As the estimates in Table II for the U.S. Atlantic slope reveal, the most promising areas for offshore oil and natural gas discoveries are within these significantly deeper waters.

The first deep water lease sale in the North and Mid-Altantic occurred in the Mid-Atlantic, sale #59, in December, 1981. Out of the $425 million the oil companies bid on ninety-four tracts, $300 million was for tracts between 6,000 and 7,000 feet of water. This expenditure for deepwater tracts in the Mid-Atlantic represents a significant commitment by the oil companies (Shell, in partnership with others) to drill in deep waters in the Atlantic. A recent lease sale in the South Atlantic also revealed strong interest by lessees in deepwater tracts.

Tremendous initial capital investments required for exploration and development in deep water may prevent the largest oil companies from entering more than a few of these risky capital-intensive projects. Present exploration costs for the Mid-Atlantic are betwen $10 and $25 million per well. Costs for deepwater drilling may increase to $50 million per well. The total costs for exploration and development of oil and gas resources of the Mid-Atlantic continental slope could run as high as $10 billion. Oil companies have invested $5.4 billion in deepwater drilling without showing a profitable return yet.

Drilling on the U.S. continental slope will have to compete for the same capital resources with costly drilling projects in the oil-rich areas of the Grand Banks, Hudson Bay, Beaufort Sea and the North Sea. Therefore, extremely large oil fields in the deep water of the U.S. continental slope are required to offset the high development cost and out-compete other oil rich OCS areas for capital investments.

Three hundred million barrels of oil have been shown to be the minimum reserve level to support deepwater oil and gas production. As of April, 1980, sixty-four OCS oil fields in the world had such reserve levels. Only fifteen were located

outside the Middle East and the North Sea. A low probability of discovering a commercial field which will be able to offset initial development investments, in conjunction with the extreme shortages of deepwater exploration rigs, frames a pesimistic picture for an immediate high level of deepwater OCS activity on the U.S. eastern continental slope.

The current deepwater exploratory drilling capability is 6,000 feet and could be extended to 8,000 feet without any further technological developments. Two types of exploratory rigs are suitable for deep water: the drill ship and the semi-submersible. Presently there are only 16 drill ships and 10 semi-submersibles capable of exploring for oil and gas in water depths of 2,000 feet. Eleven drill ships and 2 semi-submersibles can operate in waters of 3,000 feet and 3 drill ships and 2 semi-submersibles can operate in waters of 6,000 feet. Thus, 25 of the 421 exploratory rigs in the world are available to explore for oil and gas in the deep waters of the Atlantic Continental Slope.

Because of the extreme shortage of exploratory rigs, their use and siting by the oil companies is evaluated on a worldwide basis. The criteria used to prioritize an area for rig siting includes:

- past success of exploration;
- estimates of resources and reserves;
- the amount and timing of OCS available for exploration;
- regulatory requirements;
- distance to other promising geological formations; and,
- socio-economic conflicts.

Exemplifying the effect of this criteria is the low level of activity on the Canadian Atlantic OCS, one of the most promising frontier areas in the world. There are only six exploratory rigs operating in the entire 3,200 mile length of the OCS. Only four exploratory rigs are drilling in the oil-rich North Sea. This trend of low-level activity in untested frontier areas can be expected to continue for the

unexplored continental slope off the eastern United States.

The U.S. Geological Survey and industrial experts forecast that by 1980 the oil companies will be able to produce oil and gas in water depths of 8,000 feet. To date, conventional platforms have been used to produce petroleum in water depths just over 1,000 feet. Only 15% of lease sale 59 and 50% of lease 52 will be in water depths within the industry's present capability to produce oil and gas.

Two production platform designs are being considered for deep waters, the guyed tower platform and the tension let platform. The guyed tower platform is being designed by Exxon for water depths of up to 3,000 feet. The tower, a trussed structure with a constant cross section, is held vertical by a series of guy wires radiating from the top at a thirty degree angle and anchored to the sea floor. A one-fifth scale model has been successfully tested in the Gulf of Mexico. Deisgn plans show the guyed tower platform is economically preferable in water depths between 1,000 and 2,000 feet. Probably the most feasible deisng for extreme water depths is Conoco's tension leg platform (TLP). Such a platform is scheduled for operation on the Hutton Field in the North Sea by 1984. Although Conoco's design has an expected maximum depth capability of 2,000 feet, experts believe that TLPs could be operated in 6,000 feet of water. The TLP is basically a semi-submersible attached to the sea floor by twelve tethers. Once anchored, the floating platform pulls down on its sea floor anchors creating 1,000 tons of tension on each of its tethers. Thus, the legs will be in tension rather than compression like the conventional bottom supported platform. The structure will have virtually no vertical motion and very little lateral motion in heavy weather.

In water depths beyond 2,000 feet a subsea production system will be required for oil field development. Such systems may consist of deep water well heads, production manifolds, pipelines, storage facilities and a maintenance system for the deepwater facilities. Such deepwater systems have only been tested in shallow

water. However, extensive planning has begun on a system to produce the first oil and gas from 3,000 feet of water at the Mantanzo field off the coast of Spain.

In summary, deepwater drilling is a new development in the industry which may significantly determine the future of offshore oil and gas drilling on the Atlantic OCS. Greater potential exists in these deeper waters for commercial finds than in the shallow waters above the shelf. Outside factors such as would market supply of oil, availability of deepwater exploratory rigs, industrial prioritization for siting rigs, and progress in deepwater development drilling technology, will have an effect on the rate and extent of offshore drilling in the North and Mid-Atlantic. But the most important factor determining onshore activity will be the actual amount of commercially recoverable oil and natural gas in the vast North and Mid-Atlantic Outer Continental region.

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Chaper Two

Onshore Support Activity

OCS Support Activity

A major amount of industrial and commercial activity is required to support offshore oil and gas drilling operations. Because of its excellent location, almost equal distance from both Georges Bank and Baltimore Canyon, its excellent industrial and port facilities, and economic attractiveness, Quonset Point-Davisville is an excellent site for offshore oil and gas support activity. The support of OCS development is a major planning priority for Davisville by the State of Rhode Island through the Rhode Island Port Authority and Economic Development COrporation (RIPAEDC). Present land-use plans for future OCS support expansion at Quonset are shown in Figure II-1.

Quonset Point-Davisville has been used as a service base for exploratory drilling activities in the North and Mid-Atlantic. Peak activity occurred in 1979 with approximately 900 workers servicing 9 rigs in the Baltimore Canyon. In 1981, when only 1 rig was drilling, there were less than 100 OCS-related employees. Offshore rigs have come to the Quonset Pier, and Newport and Jamestown harbors for servicing. More of this activity could be expected with increased drilling activity.

Future activity at Quonset Point-Davisville would include expanded service base operations, installation services for rigs and pipelines, and possibly pipe-coating and rig fabrication. The level of this activity will, again, be determined by the local and amount of offshore drilling as well as where drilling companies and major oil companies decide to locate permanent service bases on the east coast.

The following section provides a description of the support base and facilities at Quonset Point-Davisville, the existing support activities for North and Mid-Atlantic offshore drilling operations, and potential future OCS support activities.

Physical Description

Quonset Point-Davisville Industrial Park is a 3,250 acre site on Narragansett Bay developed by the U.S. Navy at the start of World War II as part of the North Atlantic naval/air defense system. In addition to the extensive land area, much of the former naval base is waterfront acreage with three major piers, having a total of 6,800 linear feet of docking space. Nearly all of Quonset Point and the Seabee Base at Davisville were turned over to the State of Rhode Island by the Navy in 1974. The State, in turn, formed the Rhode Island Port Authority and the Department of Economic Development (RIPADED) in 1974 to promote commercial and industrial use of the area. Of the 3,250 acres, the Navy retains 260 acres.

The major non-military tenants in 1981 at Quonset Point-Davisville are the General Dynamics Division of Electric Boat, occupying 165 acres, and offshore oil drilling companies. (Fig. II-1). Davisville is the onshore service base currently being used to support oil and gas exploration activity in the Mid-Atlantic (Georges Bank). Several oil companies currently lease approximately 100 acres of mostly waterfront land plus two piers at Davisville.

Quonset Point-Davisville is characterized by level topography, direct waterfront access, contiguous marshalling and storage areas, and good air, land and water transportation facilities.

Utilities

The entire Quonset Point Industrial Park is provided with electrical service (overhead and underground cables), fresh water from a 4.75 million gallon gravel-packed well in the park, and gas service. There is a grid system of separate sanitary and storm drains, with sewerage being fed to a wastewater treatment facility at the southern end of Quonset Pier.

The Port Authority and Economic Development Corporation is undertaking studies on design, engineering, and construction of sewer lines to West Davisville

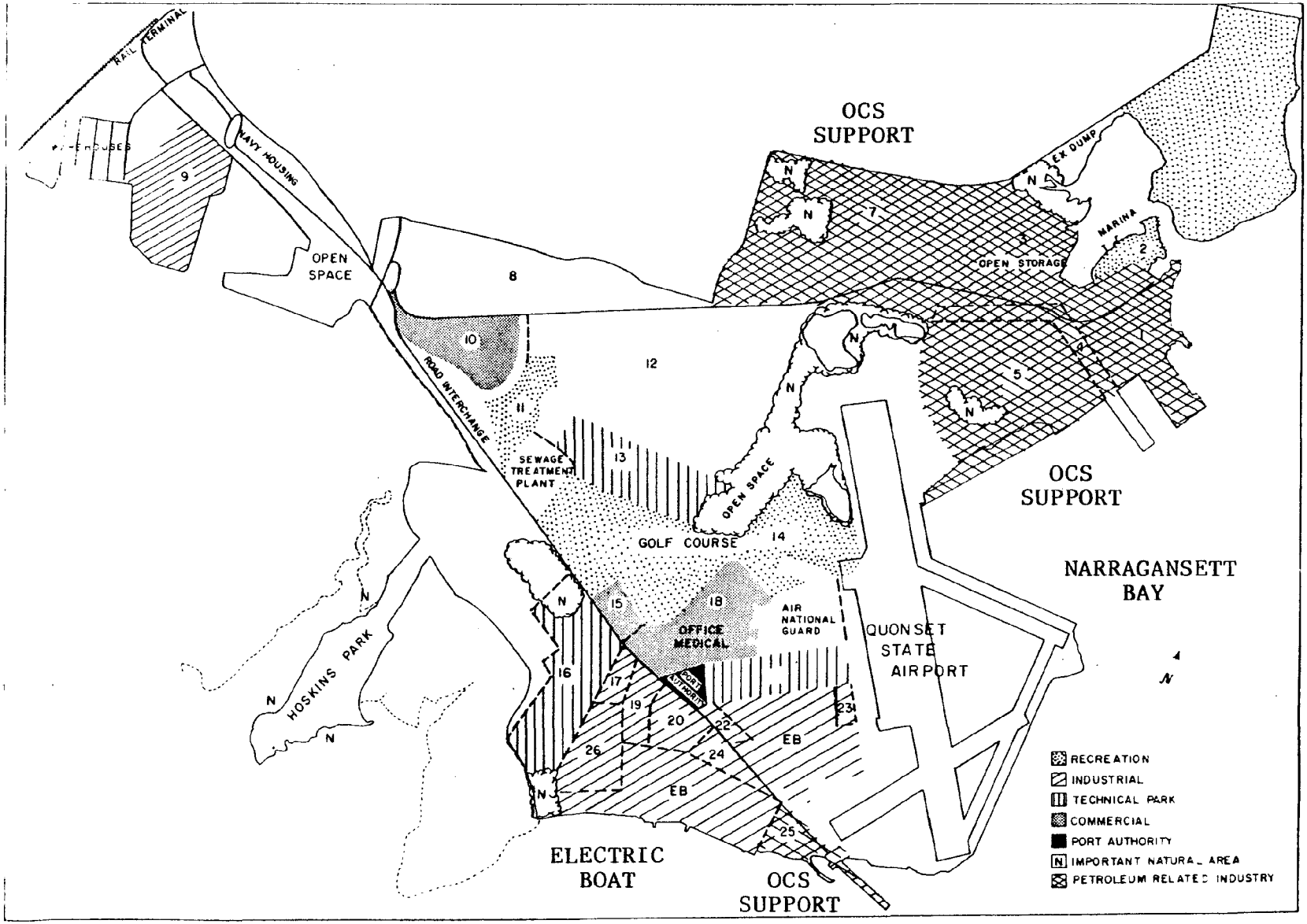


Figure II-1

REDEVELOPMENT SCENARIO II

NOTE: NUMBERS ARE AREAS DESIGNATED BY KEYES ASSOCIATES (1977) IN THEIR FACILITIES STUDY.

Source: Coastal Resources Center, 1977

to support anticipated OCS development. The plans are for construction of a sewage pumping station with discharge through gravity feed lines to an upgraded secondary treatment facility. Treated wastewater will be discharged into Narragansett Bay. According to John Dana, Port Authority Director, a $1 million upgrading of the treatment plant is in the planning stages. This will cut the plant's capacity by half, but will upgrade treatment from primary to secondary.

Transportation

A. Rail

Quonset Point-Davisville has 23 miles of rail service connecting with the main Conrail Boston/New York line. Rail lines are considered Class 1 and 2 under the Federal Railroad Administration Trade Safety Act.

B. Highway

There is direct access from the two major roads in Quonset Point/Davisville to Interstate 95 via connecting Route 403 and Devils Foot Road. A $25,000 CEIP Grant has been awarded to RIPADED for engineering, design, and specifications to construct improvements at the intersection of Routes 1 and 403 with the Quonset Point-Davisville and Devil's Foot Road, to handle the traffic expected to double from an increase in OCS activities at Davisville. Improvements will include widening the approaches, improved channeling of traffic, and signalization.

C. Air

The federal government is in the process of turning over the former Naval Air Station at Quonset Point to the State of Rhode Island. The 767-acre site, including an industrial area for airport operations, is located on the waterfront. Current users of the airport are the Rhode Island Air National Guard, Army National Guard, and Providence Air Charter Service. The airport is in the class of a general aviation facility with an 8,000 foot runway that can handle the largest jet aircraft.

D. Piers

Quonset has one pier, located at the southern end of the base, directly at the end of the Quonset Access Road. It is constructed of reinformed concrete and it is 1,400 feet long and 65 feet wide. It has 6,800 linear feet of dockage and is reached through a thirty foot shipping channel connected to the main shipping channel of Narragansett Bay. The pier is currently being used on an on-going basis by one lobster boat and a single fish wholesale/retail firm out of a small plant.

For six weeks in the Spring of 1981 the pier was used by the Ocean Drilling and Exploration Company (ODECO) to overhaul its rig, the Ocean Victory. The rig was being used for oil exploration in the Baltimore Canyon and was being repaired for the North Sea. The semi-submersible rig, 300 vertical feet by 265 feet wide, unballasted, had to fold down its tower to clear the Newport Bridge in the East Passage of Narragansett Bay. The rig was in port six weeks while repairs were being made to its support structure. Iron workers and others worked day and night around the clock to get the rig ready for its next assignment. ODECO Administrative Manager John Hume reported that nearly $10 million was spent locally in salaries, equipment, and supplies to overhaul the rig.

Pier I at Davisville is 1,200 feet long and 250 feet wide. It is constructed of reinforced concrete on wood pilings over water with solid fill support at the land end. It can withstand 1,000 pounds per square foot of weight.

Pier II is also 1,200 feet long, but 650 feet wide. It is built on filled, interlocking steel sheets interfaced along a bulkhead and can accommodate 1,000 pounds per square foot. Altogether, there are 22 acres of pier space. Additional bulkheading is being proposed for a third pier.

The piers are serviced by electricity, gas, fresh water, and storm drains. A proposed sewer line with 12" pipes will tie in the Davisville piers with the rest

of the Quonset Point Treatment Facility. Much of the pier space is being leased by mud companies.

On the pier aprons are arranged 15 cement and/or stainless steel mobile storage tanks containing unmixed drilling muds to be pumped aboard supply boats for trips out to the Baltimore Canyon. Adjacent land area is occupied by a scattering of offices and warehouses belonging to a few oil companies and suppliers, but the upland area is mostly used for outside storage of drill bits, drill casings, cable, tubulars, and other parts.

In January, 1981, three supply boats servicing the Alaskan Star rig in the Baltimore Canyon, owned by the North Star Drilling Company, were using Davisville Pier. They are fifty-footers with a draft of fourteen feet.

Diesel fuel for the boats is brought aboard via an underground pipe from the Quonset Point Fueling Corporation. Supplies being moved by the boats to the rig are fresh water, drilling muds, diesel fuel, steel tubulars, cement, and food. Rig workers are taken out by helicopter from Hyannis, Massachusetts, and/or New Jersey.

Boat bilges are cleaned every two weeks, mostly by Peabody Clean Industries, located at Quonset Point. A company manager says the hazardous waste (mostly oil) is trucked to a recycling plant in Connecticut. In April, 1981, Peabody Clean Industries was cited by the Department of Environmental Management and the Environmental Protection Agency for non-compliance with hazardous waste disposal regulations.

There are 19 berths for OCS vessels at the Davisville piers at present. OCS interests lease the pier area and uplands for a total of 100 acres of waterfront land. There is an additional 100 acres available for lease to the offshore drilling industry, without interfering with the proposed uses of the industrial park.

In the spring of 1981 there were fourteen lessees currently renting space for no more than two-year terms for the pier area. Most "leases"are on a month-to-month basis and rents remained the same in 1981 as they were in 1976, when the oil companies first moved into Davisville.

Prospective lessees are required to complete a socio-economic and environmental review form, a condition of a lawsuit settlement involving the transfer of the Naval properties to the State of Rhode Island. According to John Dana, RIPA earns approximately $200,000 per year from renting the pier to OCS drilling companies. Expansion of the pier space available at Davisville has been proposed by the Rhode Island Port Authority to accomodate increased demand for port services resulting from exploratory and production drilling on the North Atlantic Continental Shelf.

The proposed expansion involves the construction of 675 linear feet of new steel sheetpile bulkhead with a dredge depth of 25 feet, mean low water (mlw). Approximately 350,000 cubic yards of dredging is required. One hundred-ninety thousand yards will be used to fill 18 acres, 10 of which are currently at or below 0 mlw. The newly created land will be 10 to 17 feet above sea level. The remaining 160,000 cubic yards, plus an additional 550,000, will be used to create an additional 28 acres of land. Estimated cost of the project is $6.5 million. The total expanded port will include 2,400 linear feet of new berthing space.

Other OCS Activities

The Electric Boat Division of General Dynamics, the major industrial users of Quonset Point, has shown an interest in entering the offshore oil and gas support industry. They have previously announced their intentions of diversifying from submarine construction into construction of offshore oil rigs, barges, and other equipment used for the exploration and production of OCS oil and gas.

In September, 1980, Electric Boat applied to the Coastal Resources Management Council for a permit necessary to construct a rig launcher. An application

was also submitted to the Army Corp of Engineers. Specifric provisions in the CRMC permit application included:

1. Construct and maintain sheet piling and backfill from material dredged from Narragansett Bay.
2. Form a channel.
3. Construct a pile-supported tilt-beam launcher and barge grounding material.
4. Extend existing railroad siding.
5. Build a fence and pave the area.
6. Construct a building and a 2,000 KVA station.

In October, 1980, the town of North Kingstown requested an indefinite time extension from CRMC to allow the applicant sufficient time to provide more information, including environmental impacts on the area. Two areas of particular concern, according to the town's request, are: 1) that impacts be evaluated before any construction, and 2) the advantages and disadvantages of a new, on-going industry be defined in terms of local impacts.

In April, 1981, General Dynamics was reported to have bid on a contract to build an oil drilling rig. Its demensions include a 235 by 215 foot base, legs 600 feet long, and total weight of 9,000 tons. According to the company, this size rig would be the largest ever built.

In a study completed in January, 1981, entitled Preliminary Engineering Davisville Port Expansion, by C. E. Maguire, Incorporated, of Providence, it was concluded that height restrictions of the Newport Bridge and landing patterns at the Quonset Airport could restrict the dimensions of certain types of rigs fabricated at Quonset Point-Davisville and transported via Narragansett Bay. The study points out that the vertical clearance beneath the bridge is 194 feet and the widest horizontal pass-through is 1,500 feet. There is also a 169 foot height limit on buildings and other obstructions in the clide path of the Quonset Airport adjacent to General Dynamics. According to the study, General Dynamics

would be limited from building any but the smallest platform, 150 tall by 200 feet wide, as cost would preclude most alternatives including construction of the rigs in telescoping stages. This size platform, suitable for use in water depths up to 400 feet, will be smaller than the size of most rigs needed in the future to explore and develop deeper OCS tracts. However, an offsetting factor might be that a substantial number of potentially productive tracts will be in water of this depth and less, according to the report.

Whether or not these factors may hinder future rig fabrication activity at Quonset Point will not be known immediately. In August, 1981, Electric Boat announced it did not receive the contract to build the proposed offshore drilling rig. Electric Boat withdrew its permit application from the Army Corp of Engineers but, apparently, not fromm the CRMC.

Later that month, the Providence Journal Bulletin reported that Electric Boat still wanted to build oil rigs at Quonset Point. In fact, a spokesman for the company reported that Electric Boat had actually already engaged in rig fabrication activity at Quonset, employing sixty people since May on fabricating rig legs.

OCS Support Facilities Estimates

This section will provide estimates on the kinds of North and Mid-Atlantic OCS support activities and related employment and wage characteristics. These estimates are derived from planning reports from the State of Rhode Island Department of Economic Develoment and the New England River Basins Commission (NERBC). As these estimates are based upon a medium find of oil and gas on Georges Bank, redevelopment of Quonset Point-Davisville is planned for, and is in anticipation of servicing a medium offshore find.

Figure II-2 shows the timing of development and operation of the various onshore facilities to support a medium find of oil and gas. Through the first twelve years following the initial lease-sale, construction of service bases, gas plants, and a pipe coating yard will take place onshore in New England. During years six through twelve, platforms and pipelines will be installed offshore. Oil and gas production will begin in year ten and will continue over a twenty year period under the medium find scenario.

Twenty-five platforms will be required over a six year period to develop the oil and gas reserves on Georges Bank under a medium find. This development will need various types of onshore support facilities. These onshore support facilities will act as a "life support system" to the oil and gas activities on the Outer Continental Shelf. Support facilities will include service bases, platform fabrication yards, platform installation support, pipeline installation support, gas processing, and an oil refinery.

A. Service Base

The primary purpose of a service base is to serve as the logistical link between offshore and onshore operations. The major activity carried out through the service base is the delivery of drilling materials, supplies, and crews to the offshore rigs and platforms by boats and helicopters. Temporary service bases are established during exploratory drilling and require

approximately five acres of waterfront land for each exploratory rig being serviced. Upon a commercial discovery, a permanent service base is established with the greatest amount of activity during the development phase (Figure II-2). The New England River Basin Commission assumes six to twelve permanent service bases will be established in New England. A summary of requirements and impacts of services bases is provided below.

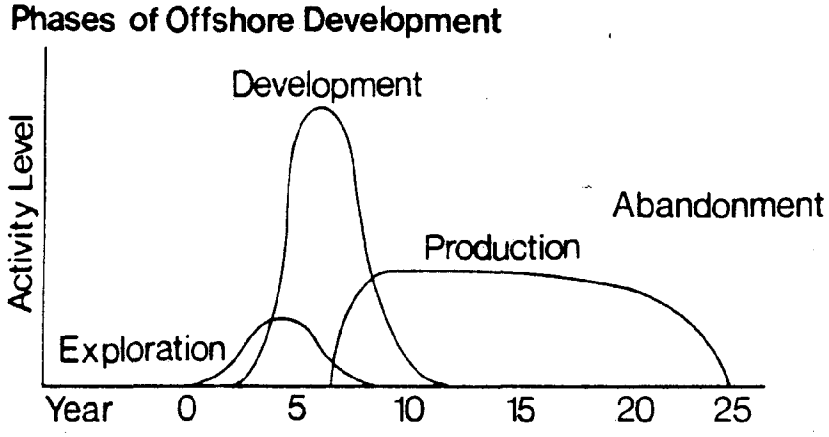
Service bases along with platform and fabrication yards facilities are considered to be the most appropriate uses of Davisville. Requirements are direct waterfront access, contiguous land area, and good transportation systems, and a thirty foot deep channel, all of which Davisville can supply. This would include use by boat operators, mud companies (mud is used for lubricating, cooling and cleaning the well as drilling processes), and ancillary industries which include cement companies, suppliers of down-hole equipment (piping, drilling tools) well head firms, diving services, and work-over and production services. Rhode Island firms can provide most of the required supplies and services through existing firms.

Helicopter service is essential to offshore operations and a probable development will be the establishment of a small helicopter service base at the Quonset Airport. The major helicopter service base will be located on Cape Cod which is closer to Georges Bank.

Employment on service bases will occur in three phases; they are, 1) Exploration, 2) Development Drilling, and 3) Production and Work-over. The primary source of service base employment is on supply boats with as much as 80% of the total serving as crew members. Table II-1 shows employment and percentage of Rhode Island labor and wages at service bases under a medium find during exploration.

Figure II-2

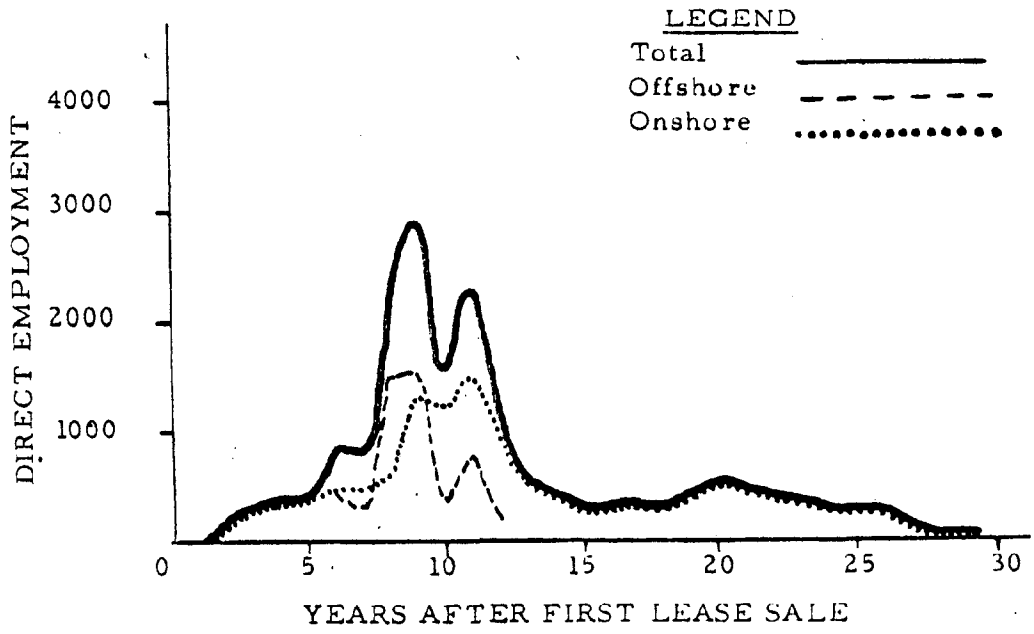
OCS SUPPORT ACTIVITIES



Source: Commonwealth of Massachusetts, 1976

Figure II-3

TOTAL DIRECT EMPLOYMENT FOR SELECTED
OCS-RELATED ACTIVITIES
MEDIUM FIND SCENARIO



Source: NERBC, 1976

Table II-1

Service Base Employment

Medium Find Scenario (Exploration)

Year After First Sale	2nd	3rd	4th	5th	6th
Total Employment	237	317	386	380	401
Total Wages*	$4.03	$5.39	$6.56	$6.46	$6.82
Resident Employment	119	162	205	213	241
Resident Wages*	$2.02	$2.75	$3.49	$3.60	$4.10

Source: NERBC, 1976 *In Millions '76 $

During these five years, it is estimated an average of 344 people will be employed at service bases in New England; 188 will be hired from the existing local labor force. Total wages paid could be over $29 million, 55% going to local residents. Total employment will increase at an average annual rate of 15% over the five year period.

Peak service base employment under a medium find will occur during the development phase. Employment will peak with just under 1,100 workers employed during years ten and eleven. Well over 700 of these workers will be hired locally.

Table II-2

Service Base Employment

Peak Years

Medium Find Scenario (Development)

Year After Lease Sale	7th	8th	9th	10th	11th	12th	13th	14th
Total Employment	472	516	894	1076	1057	846	485	413
Total Wages*	$8.0	$8.8	$15.2	$18.3	$18.0	$14.4	$8.2	$7.0
Resident Employment	297	341	608	753	761	626	364	314
Resident Wages*	$5.1	$5.8	$10.3	$12.8	$12.9	$10.6	$6.2	$5.3

Source: NERBC, 1976 *In Millions '76 $

Table II-3

Service Base Employment

Medium Find Scenario (Production and Workover)

Year After First Lease Sale	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th
Total Employment	292	307	346	335	383	483	418	393	363	338	283	239	158	50	50
Total Wages*	$5.0	$5.2	$5.9	$5.7	$6.5	$8.2	$7.1	$6.7	$6.2	$5.7	$4.8	$4.1	$2.7	$0.9	$0.9
Local Employment	225	239	274	268	306	386	334	314	290	270	226	191	126	40	40
Local Wages*	$3.8	$4.1	$4.7	$4.6	$5.2	$6.6	$5.7	$5.3	$4.9	$4.6	$3.8	$3.2	$2.1	$0.7	$0.7

Source: NERBC, 1976

*In Millions '76 $

Twenty-nine years after the first Georges Bank lease sale, oil and gas production on Georges Bank will come to an end. Employment during the final 15 years which are the Production and workover years, will average 296 workers, 235 of whom will be local residents. Wages paid during this period will total $75 million for a yearly average of $5 million in 1976 dollars. Table II-3 shows employment and wages for the final years of offshore activity.

The average annual salary of service base employees is assumed to be $17,000 (in 1976 dollars).

Figure II-4 shows the trend in service base activities in New England under medium find of oil and gas, using employment as a representative parameter.

Capital investments made in the establishment of service bases under a medium find will total $14.5 million. A large share of these expenditures will be allocated to berth and wharf construction.

Table II-4 summarizes capital investment in New England for service bases under a medium find.

Figure II-4

Total Service Base Employment

Medium Find Scenario

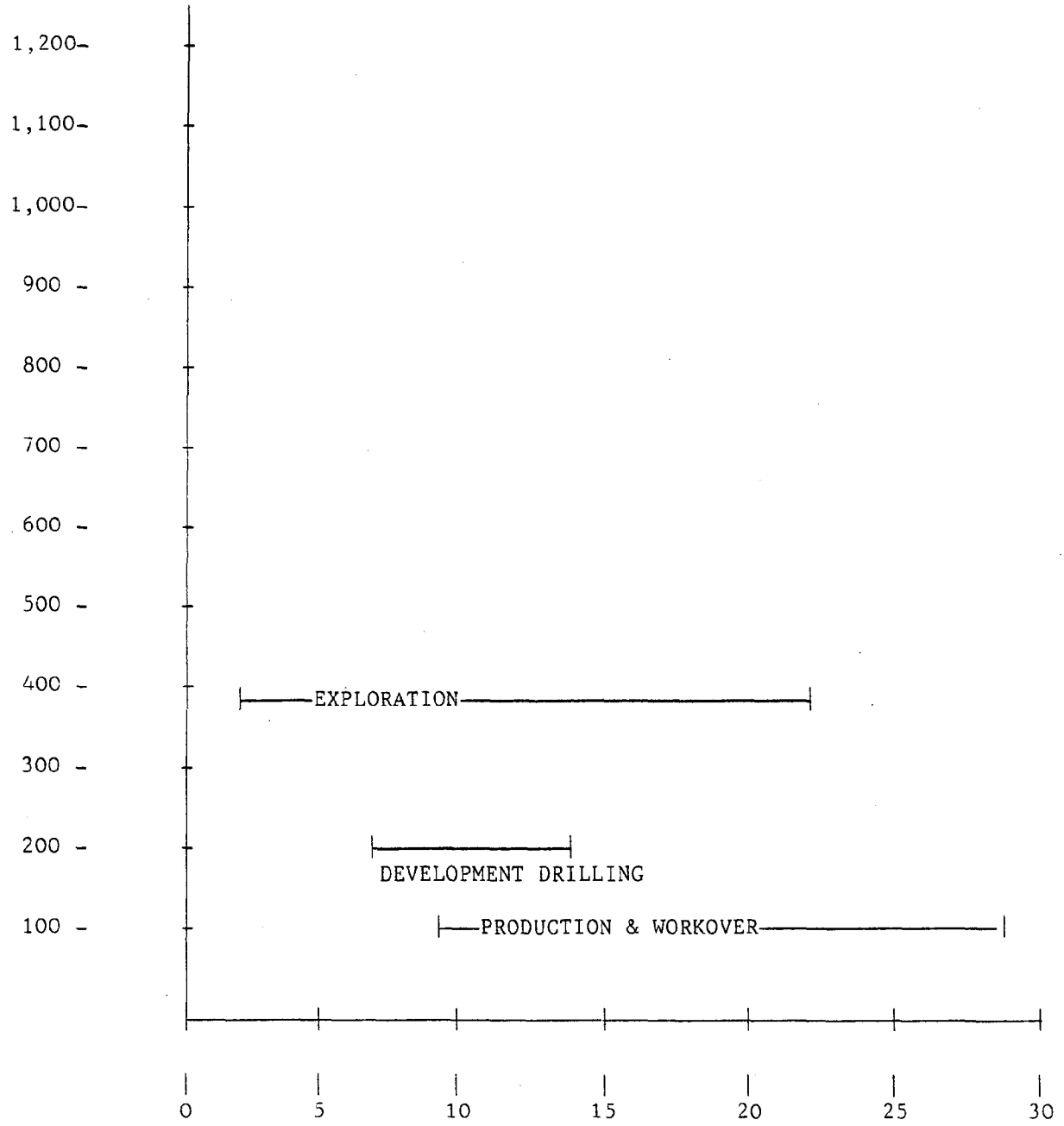


Table II-4

Service Base Capital Investment

Medium Find Scenario (Summary)

Year After First Lease Sale	Capital Investment*
2nd	$ 0.5
3rd	$ 0.2
4th	$ 1.0
5th	$ 1.0
6th	$ 6.0
.	.
.	.
.	.
8th	$ 3.0
9th	$ 3.0
TOTAL	$14.7

Source: NERBC, 1976

*In Millions

B. Platform Fabrication Yards

Platforms are used for the production of oil and gas, while an exploration rig is used for determining whether a petroleum reservoir holds enough oil or gas reserves to justify field development. While there will not be any rigs built at Quonset Point/Davisville, there may be platform fabrication, as mentioned earlier in the report 25 platforms will be needed to develop Georges Bank, but not all of them will be constructed at Quonset Point/Davisville.

Platform fabrication yards are industrial construction facilities where the platforms used to drill for and produce offshore oil and gas are built. As the depth of the water increases it becomes more economically attractive to use concrete platforms.

In the North Atlantic, for lease sale 42 & 52, water depth does not appear to be significant enough on the Continental Shelf to warrant concrete platforms. Also, the bottom conditions, which are generally rough and rocky, are not favorable to the installation of concrete gravity platforms. For these reasons, it is assumed that the more traditional steel, fixed-pile platforms will be used on Georges Bank.

Steel platform fabrication yards are large waterfront facilities, consisting mostly of cleared land, buildings, shops and administrative office, all set back from the waterfront. The steel platforms are constructed close to the waterfront and wharfs.

The NERBC study states that under a medium find the required development and production platforms will be built at facilities located outside of New England and transported to their installation sites on Georges Bank. Studies done by DED Port Authority include platform fabrication in their scenarios. Platform fabrication was included because of a serious interest shown by Brown & Root, Inc., which is one of the nation's major drilling and production platform fabricators, in locating at Quonset Point/Davisville. Although the NERBC report does not indicate a platform fabrication yard to service Georges Bank unless there is a high find, DED has planned for a modest 100 acre yard at Davisville, based on the Brown & Root interest.

In April, 1981, General Dynamics bid on a contract to build a 9,000 ton oil production platform. Its dimensions include a 235 by 215 foot base and 600 feet long. This platform will not be used on Georges Bank, but others may follow that would be used there. According to the company, this size rig would be the largest ever built.

DED Port Authority reports indicate that rig fabrication will take place over a ten year period, with peak operation occuring in years 4 and 5.

Table II-5 shows the amount of rigs that may be built over the ten year period at Quonset Point/Davisville.

Table II-5

Rig Fabrication at Quonset Point/Davisville

Years After OCS Activity Begins	1st	4th	5th	10th	11th
Rigs Fabricated	2	6	6	4	0*

*ends

Fabrication yards employ large numbers of skilled laborers, as well as supervisory, administrative and engineering personnel. As much as 85% to 90% of the work force can be hired locally. DED based these employment estimates on Brown & Roots' suggested peak production of 6 platforms per peak year.

Fabrication of rigs will employ at least 250 people per rig per year, which means that in a peak year 1,500 people will be employed in rig fabrication. This labor force will gradually decrease to 1,000 by year 10.

The largest group of skilled craftsmen employed in steel platform fabrication are welders and shipfitters which comprise roughly 50% of the total workforce. Twenty to 25% are loftsmen, painters, electricians, and machinists. Other construction crafts and helpers total about 10%; maintenance, warehousing, and general support, about 15%.

C. Platform Installation

There is a certain degree of service base support for the installation of platforms. The degree of support will depend upon the find of oil. According to DED Port Authority reports, it is possible that Quonset Point Davisville could accommodate platform installation service base activity and according to DED data, only 20 to 30 acres of land and approximately 200 feet of marginal wharf space would be required.

Platform delivery will be accomplished by towing the platform jackets and various deck modules by tugboats from the fabrication yard to the installation site. The jacket is then lifted off the launch barge by one or two derrick

barges and secured to the ocean floor by steel pilings. Twenty-five platforms will be rquired to develop the oil and gas reserves on Georges bank under a medium find. It is assured that one 500-ton derrick barge, employing 100 workers and 3 tugboats, employing 18 workers, will be needed for each platform installed. The average annual salary of these workers would be 18,000 in 1976 dollars and 25% of these workers would be hired locally.

Table II-6

Platform Installation Schedule

Medium Find Scenario

Years After First Lease Sale	1st-5th*	6th	7th	8th	9th	10th	11th
Number of Platforms Installed	-	3	2	9	7	1	3

Source: NERCB, 1976 *exploration

The service base which supports the installation of offshore platforms will employ only a small number of workers. In New England, peak employment will be 104 workers. Average employment will be 50 workers, 34 of whom may be hired from the local labor force. For the six year period that these service bases will operate, under a medium find, a total of $5.2 million will be paid in wages, $3.4 million to local residents.

Table II-7

Platform Installation - Service Base Employment and Wages

Medium Find Scenario

Years After First Lease Sale	6th	7th	8th	9th	10th	11th
Total Employment	35	30	104	74	26	35
Total Wages*	$0.60	$0.51	$1.77	$1.26	$0.44	$0.60
Resident Employment	21	19	69	50	18	25
Resident Wages*	$0.36	$0.32	$1.17	$0.85	$0.31	$0.43

Source: NERBC, 1976 *In Millions

Offshore employment and wages will average $600 million and $11 million, respectively. A total of $64 million wil be paid in wages, $16 million to local residents (based on 1976 dollars).

Service bases established to support platform installation operations will involve $1 million dollars in capital investments.

D. Pipeline Installation

Major pipelines will be installed during the ninth and eleventh years after the initial Georges Bank lease sale. In all, 750 miles of pipe will be installed to transport Georges Bank reserves, 450 miles of which will consist of major natural gas pipelines.

Throughout the pipeline installation process, the support of service bases is required. These bases serve as centers for crew changes and shipments of supplies. For a medium find it is assumed that one of these bases will be established in New England.

According to DED Port Authority studies, the primary criteria in selecting a pipeline landfall site is proximity to the field. On this basis it would seem very likely that alternative landfill sites exist which are better situated than the Quonset Point/Davisville facility, therefore, DED studies do not indicate that a pipeline will land here.

The Governor of Rhode Island, J. Joseph Garrahy, was quoted as saying, in a June 25, 1981 Journal Bulletin article, that the best place for a Georges Bank gas line to come ashore would be somewhere near the mouth of Narragansett Bay. Garrahy said he obtained this information from the New England River Basin Commission. Therefore, although the pipeline will not landfall at Quonset Point/Davisville, it is likely to landfall within Rhode Island boundaries. In fact, the draft EIS for Lease Sale 52 projects the preferred pipeline landfall to be in Little Compton, running through Tiverton, to a gas processing facility in the Fall River area.

The service base established to support pipeline installation will employ

a maximum of 38 workers over the five years during which pipelines will be installed on Georges Bank; service base personnel working in support of these activities will be paid a total of $750,000. Table II-8 shows this employment over time.

Table II-8

Pipeline Installation

Medium Find Scenario

Years After First Lease Sale	8th	9th	10th	11th	12th
Total Employment	25	38	25	25	25
Total Wages*	60	223	235	235	60
Local Employment	17	26	18	18	19
Local Wages*	40	153	169	169	45

Marine pipelines are very expensive. Undera medium find of gas, total capital investment will exceed $850 milion.

Table II-9 shows annual pipeline installation costs under a medium find.

Table II-9

Annual Costs for Pipeline Installation

Medium Find Scenario

Years After First Lease Sale	8th	9th	10th	11th	12th
Pipeline Installation Costs*	$47.5	$312.5	$177.5	$280.0	$35.0

Source: NERBC, 1976 *In Millions

E. Pipe Coating Yards

Prior to the laying of a pipeline offshore, it must be coated with a concrete and asphalt sealant for underwater use. Under a medium find, while some

competition will still exist, it is assumed that only one yard will be established. It is also assumed that required coating services during the first year of pipeline installation will be met by existing yards located elsewhere. The following year, 250 miles of 26-inch diameter pipe, generating nearly $16 million (based on 1976 figures), will lead to the establishment of a yard within New England.

The availability of specialized labor is not likely to be a major factor in the siting decision. As much as 90 percent of the total work force at a yard will not require specialized skills. The Pipeline Contractors' Association includes members from the Teamsters, Pipefitters, Operating Engineers, and Laborers International Union of North America. A pipe coating firm usually employs its workers through the Association which sets wage scales that vary from state to state.

The amount of land required by a pipe coating yard depends upon the volume of anticipated business which, in turn, dictates the amount of storage space which might be rquired. A typical yard occupies around 100 acres, as much as 90% of which is used for pipe storage, and 750 ft. of marginal wharf space. An $8 to $10 million capital investment is assumed to be required to establish this facility.

DED Port Authority reports state that assuming a pipeline is layed, Quonset Point/Davisville could accommodate pipe coating. The study also, while stating that a yard could be established, foresees problems in allocating the 750 feet of marginal wharf space that would be needed for the duration of the pipe laying activities.

During the four years of pipe coating activity in New England, a total of $6.7 million will be paid in wages, $6 to members of the local labor force.

Employment will peak during year nine of OCS oil activity, at 121 jobs. Table II-10 shows employment and wages at a pipe coating yard under a medium find.

Table II-10

Pipe Coating Yard

Employment and Wages

Medium Find Scenario

Years After First Lease Sale	8th	9th	10th	11th	12th
Average Total Employment	-	100	95	100	35
Total Wages*	-	$2.3	$1.8	$1.9	$0.7
Average Resident Employment	-	109	86	90	32
Resident Wages*		$2.1	$1.6	$1.7	$0.6

Source: NERBC, 1976 *In Millions '76 $

Pipe coating yard employment will fluctuate considerably during each year, roughly coinciding with the pipelaying season. During peak periods, as many as 200 people may be working seven days a week in order to ensure a steady supply of coated pipe for offshore operations. During slack periods, employment may be only 20 workers.

F. Gas Processing Plant

Under a medium find NERBC estimates that two gas processing treatment plants will be constructed in New England. Land requirements vary considerably ranging from 20 to 75 acres, a large percentage of which serves as a buffer zone.

Construction of gas treatment facilities will take place in years nine and eleven of OCS oil and gas development. Table II-11 shows employment and wages which will result from these construction operations.

Table II-11

Gas Processing and Treatment Plant

Construction - Employment - Wages

Medium Find Scenario

Years After First Lease Sale	9th	11th
Capacity of Plang Built**	400	700
Average Total Employment	225	300
Total Wages*	$4.5	$6.0
Average Resident Employment	113	130
Resident Wages*	$2.3	$3.0

Source: NERBC, 1976

**In Million Cubic Feet/Day
*In Millions

A total of $10.5 million will be paid in wages for construction of these facilities, $5.3 to local residents.

Capital investment could range between $35 mill and $55 million in 1976 dollars. This investment depends upon the size and complexity of the plant, and ultimately, the characteristics of the gas stream.

Since gas processing facilities are generally highly automated, few plant operation workers will be employed. The facilities constructed under a medium find will employ between twenty-four and twenty-eight people, 60% of whom would be hired from the local labor force. The average yearly salary for gas plant workers, in 1976 dololars was $15,000.

DED Port Authority reports state that it is conceivable that a gas processing plant could be located at Quonset Point/Davisville, however, they claim that there are several logistical transportation constraints as well as potential severe land use conflicts. Therefore, DED reports do not include gas processing as a viable or probable development at Quonset Point/Davisville.

Although, with the possibility of there being a gas pipeline landfall in Rhode Island, there is a high probability that a gas processing plant will be established within close proximity to the landfall site.

G. Refinery

According to DED Port Authority reports, the building of an oil refinery in Rhode Island does not seem likely to take place with a medium find of oil. DED reports state that because of the existing refining capacity in New Jersey and Pennsylvania, it is not considered likely that a new refinery would be located in New England to serve only offshore oil. Moreover, even if a new refinery would be located in New England, the land shortages and incompatability with other uses at Quonset Point/Davisville would likely preclude its location there.

Conclusion

The estimates in this section are based upon a medium find of oil and gas and the development of Quonset Point/Davisville is planned for that find level. If more, or less oil and gas is found, the development of Quonset Point/ Davisville may then take on a different form.

If Quonset Point/Davisville is used as a major OCS oil and gas support facility the towns surrounding this area will be impacted by a large influx of workers. The workers and their families may impose a strain upon the local municipalities,if this growth is not recognized and dealt with through a well coordinated planning effort.

Estimates for total workers employed by OCS related activities, under a medium find, is between 6,300 and 6,400 people. The workers will be employed in service bases, platform fabrication yards, platform installation services, pipeline installation services, pipe coating yards, and gas processing plants.

Capital investment in this OCS oil and gas activity could amount to over $900 million (1976 dollars) over a twenty-five year period.

OCS Suport Population

The social and physical infrastructure of an area may be affected in numerous ways by onshore development and O.C.S. induced growth, but rapid population increases would have the greatest affect. Rapid population growth in an area would have an ensuing impact upon housing supply, recreation, water supply, sewage treatment, solid waste disposal, and other necessary public services.

O.C.S.-induced population growth within New England counties sustaining primary industrial activity will be the result of intra-regional and inter-regional migratory trends caused by persons seeking employment and other opportunities. It is expected that there will be a large influx of persons into these New England counties between the mid-1980's and the time of peak production. Increased job opportunity, however, is likely to be greatest during the mid-1980's as drilling activity peaks. Unfortunately, during this period the level of increased job opportunity can be expected to be below the number of persons seeking employment.

An influx of population into New England may result from O.C.S. development for two reasons: the movement of skilled workers and their families into the area and the migration of the unemployed into the area to find jobs. The latter group may include individuals who do not have skills vital to offshore development, but who hope to benefit in some way from the overall economic activity. Population immigration would occur for up to 25 years after the first lease sale, followed by emigration thereafter. The draft E.I.S. for O.C.S. sale No. 42 indicates that many of the workers would be highly skilled, young, mobile, and unmarried.

D.E.D. study indicates that the redevelopment of Quonset Point|Davisville will result in a large increase in North Kingstown and West Bay employment and,

in turn, will reflect "induced" population growth.

Aggregate population generated has been estimated by D.E.D. based on the following assumptions: (1) each job represents approximately one household, and (2) average household size, in general, will be approximately 3.0 persons. Applying these indices to new employment related on-site over the long term, approximately 33,000 persons would be directly supported by Quonset employment. These statistics are based on a medium find of oil and gas and include manufacturing and related activity that will be established at Quonset Point|Davisville under current D.E.D. plans. *

Geographic distribution of this population was based on commutation patterns of future Quonset Point|Davisville employees. D.E.D. studies specifically indicate that between 35 and 45 percent of these employees will prefer to live in West Bay communities and that most of them will desire North Kingstown locations. Reasons for this judgment go to: (1) the unlikelihood that employee concentrations in North Kingstown would approach the highly concentrated pattern evidenced during the navy presence; (2) prospects that, over time, workers will seek housing; and (3) that many workers already established in populated areas of Kent County and the Urban Center will choose to remain in the area. See page 49 for for further discussion of place of residency.

* Employment estimates to support this activity have varied widely from a low of 900 to a high of 72,000.

The figures dealing with employment in Table II-12 include the total use of Quonset Point|Davisville including manufacturing and related activities, which are not associated with O.C.S. activities.

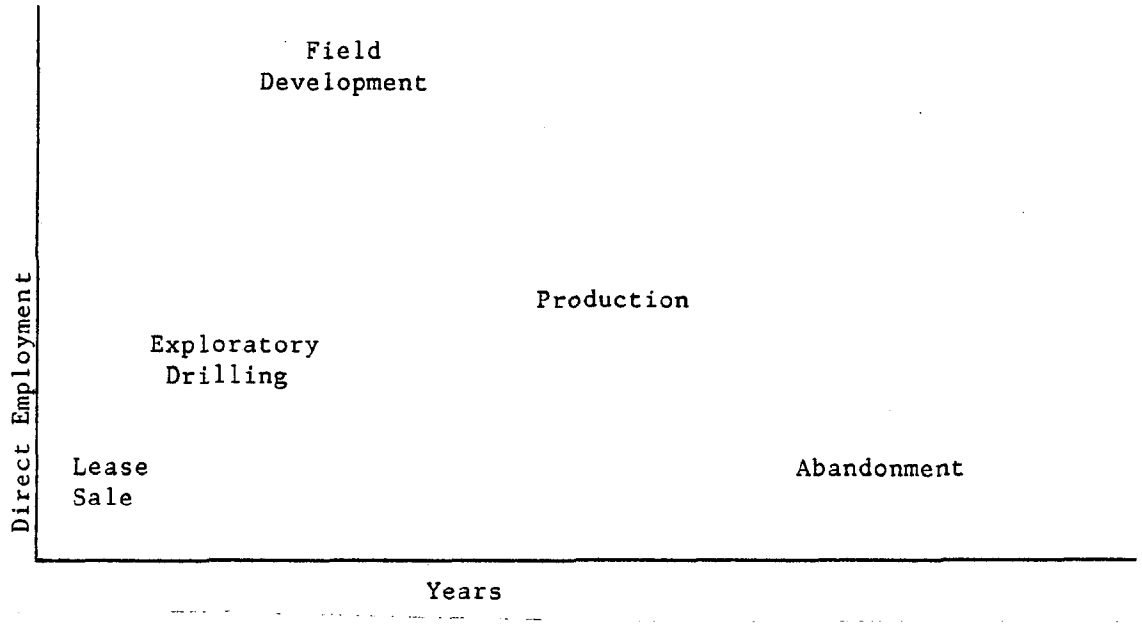
Direct Employment

Direct employment is defined as workers employed by oil companies and drilling contractors who are immediately and totally involved in O.C.S. activities including operation of exploratory and development rigs and production platforms and essential onshore functions such as manning processing plants, generally coinciding with direct hire or direct contract. Thus, direct employees include offshore and onshore employees.

Direct employment is typically greatest during the field development phase of offshore oil and gas recovery, because facilities construction requires a large labor force (Fig. II-5). Later, when oil and gas production becomes the primary activity, employment typically declines rapidly.

Figure II-5

The general pattern of direct employment during different phases of O.C.S. development.



Source: Environmental Planning for Offshore Oil and Gas, Fish and Wildlife Service, Vol. II

Table II-12

Quonset Point/Davisville Worker Residency

Place of Residence	D.E.D. Estimates for Quonset Point|Davisville Including Manufacturing and Related Activity	
	Number	Percent
West Bay		
North Kingstown	2,750-3,300	25-30
Remainder of West Bay[1]	1,100-1,650	10-15
SUBTOTAL	3,850-4,450	35-45
Kent County	2,750-3,330	25-30
Urban Center	2,200-2,750	20-25
Balance[2]	1,100	10
TOTAL	11,000	100

1 Includes South Kingstown, Narragansett, Exeter and New Shoreham.

2 Includes Commuters from cities and towns from other sections of Rhode Island and Massachusetts.

The number of jobs likely to be created in response to Georges Bank oil and gas development will vary depending on the numbers and kinds of facilities and activities which may be required through time.

Figure II-3 illustrates the trend for total direct employment for New England as estimated for a medium find, showing both offshore and onshore workers. The largest number of jobs will be in year nine when 2,900 people will be employed. Of this total work force, 2,551 (53 percent) will be involved in offshore platform and pipeline installation activities, while 1,006 (35 percent) will be employed at service bases. Nearly all of the remaining workers will be involved in pipe coating operations or gas processing plant construction.

Direct onshore employment in New England, will peak over a 3 year period (years nine through eleven) at an average of just under 1,400 workers, 970 (70 percent) of whom will be hired locally. The facility which contributes most (77 percent) to the peak onshore employment will be services bases supporting platform and pipeline installation and drilling activities. Total wages will average $11.2 million (in 1976 dollars) over the entire 28 year development period, with approximately 60 percent paid to members of the local labor force.

D.E.D. studies indicate that petroleum support industries [illegible] at Quonset Point|Davisville would result in between 6,300 and 6,400 people directly employed by year 10. Adding the average household size of 3.0 persons, approximately 18,900 to 19,200 persons would be directly supported by Petroleum support facilities at Quonset Point|Davisville by year 10.

A study undertaken by the Bureau of Land Management (BLM) concerning O.C.S. activity on Georges Bank used estimates for a medium find of oil and gas. The study directly contradicts the employment estimates made by D.E.D. Quonset Point|Davisville reports, as relating to onshore O.C.S. oil and gas activities. The BLM report states that proposed O.C.S. activity would be expected to increase

the number of jobs in the New England region, at the most, from approximately 6,800 to 10,250 persons, of which approximately 1,000 to 2,100 would be directly employed by O.C.S. related activites. Whereas the D.E.D. study estimates 6,300 to 6,400 persons directly employed by O.C.S. activites at Quonset Point-Davisville.

Table II-13

OCS Employment Comparison

	Increase in Employment Overall	Direct O.C.S. Employment
Bureau of Land Management[1.]	10,000	2,000
D.E.D. Study[2.]	12,800	6,300

1. Includes employment forecasts for the entire New England Region; primary and secondary employment.
2. Employment at Quonset Point-Davisville and secondary employment "spinoffs".

Sources: D.E.D. Study by Gladstone; BLM Economic Study, Georges Bank 1976

The above figures exemplify the fact that no degree of exactitude can be exercised in making predictions as to the magnitude of population and infrastructure impacts or precisely where they will take place if the O.C.S. action does take place. Much of what may happen onshore will be determined by constraints placed upon O.C.S.-related industry by State, county, and municipal controls. Accommodation of the O.C.S.-induced population would depend upon a timely, coordinated, comprehensive effort toward intergovernmental and private sector planning.

Induced Employment

Induced employment is defined as generated by the intial and subsequent

rounds of O.C.S. spending/related wages earned by direct and indirect employees (offshore and onshore) who reside within the regionaleconomy of the study area. Induced employment is accordingly very diverse and may occur in both public and private sectors. Examples include doctors, school teachers, store clerks, and policemen.

Induced employment is usually measured by applying a multiplier to the total direct employment, which will yield an estimate of what the employment "spin off" or induced employment will be. This employment will most likely concentrate in retail trade and certain professional services which tend to follow new employment and population growth. Induced jobs also include such categories as transportation, communications, utilities, insurance, real estate, construction and business services.

D.E.D. studies have established "spin-off" effects of 0.8 induced jobs; under a medium find of oil and gas. Thererfore, when the "spin-off" estimates are multiplied times the D.E.D. estimates for people directly employed in oil related activities by year 10 which is approximately 6,350, the amount of spin-off resulting is 5,040. Table II-14 exemplifies the above.

Table II-14

Quonset Point/Davisville
Total OCS Employment
(Year 10)

	Number
Direct Oil Related Employment	6,350
D.E.D. Studies Estimated "Spin-off" Employment	5,040
Total Employement (Year 10)	13,340

The N.E.R.B.C. estimates on direct and induced or secondary employment, as related to oil and gas activities in all of N.E.R.B.C. figures for year 10 do not differ much from D.E.D. study figures. Table II-15 includes all facilities needed for a medium find of oil and gas.

Table II-15

Secondary and Total Economic Impacts
Stemming From a Combination of All Facilities

Year After First Lease Sale	Employment			
	Direct	Secondary	Total	Total*
1	0	0	0	0
2	237	190	428	428
3	517	414	931	931
4	1,036	829	1,865	1,865
5	2,022	1,618	3,640	3,640
6	4,831	3,865	8,696	8,296
7	6,311	5,049	11,360	10,861
8	7,747	6,198	13,945	12,996
9	4,942	3,954	8,896	8,799
10	5,268	4,214	9,482	8,967
11	5,174	4,139	9,313	8,716
12	5,902	4,722	10,624	9,886
13	5,495	4,397	9,891	9,242
14	2,763	2,210	4,973	4,527
15	1,968	1,574	3,542	3,472
16	1,758	1,406	3,164	3,125
17	1,389	1,111	2,500	2,500
18	1,440	1,152	2,592	2,592
19	1.434	1.147	2,581	2,581
20	1,469	1,175	2,644	2,644
21	1,472	1,178	2,650	2,650
22	1,376	1,104	2,480	2,477
23	1,287	1,030	2,317	2,299
24	1,181	945	2,126	2,126
25	1,052	842	1,894	1,894
26	924	739	1,663	1,663
27	821	657	1,478	1,478
28	692	554	1,246	1,246
29	548	438	986	986
30	494	395	889	889
31	442	354	796	796

* Direct sum of individual facility impacts as shown in last section.

SOURCE: NERBC-RALI Report, p. 24.

Housing the Future Employment from Quonset Point/Davisville Development

At issue will be the residential location decisions of new employees of future West Bay establishments, commercial and industrial, and the possible growth impacts of unanticipated residential increase. Of particular importance to the region, especially the four towns surrounding North Kingstown, will be the potential growth impacts from development at Quonset Point/Davisville without the benefits of the industry's generated revenues.

Based on 1970 figures that showed a predominance (65%) of employees working in North Kingstown also residing there and 1974 data for four major employers in Warwick and West Warwick that showed over 50% of employees living in Kent County, estimates of residential location preferences were made by Gladstone Associates for future employees working at Quonset Point/Davisville. By the 25th year of oil and gas support facilities activity at Quonset Point/Davisville, it was expected that "between 35 and 45 percent of these employees will prefer to live in West Bay communities and that most of these will desire North Kingstown locations."[1] The Gladstone report also assumed that many workers at QP/D would be recruited from Kent County areas and would choose to remain there. Data from 1975 at the start up of Electric Boat showed employee residential locations and was included in the Gladstone Associates projections. By 1981, the fourth year of exploratory activity in Mid-Atlantic and first in North Atlantic, Electric Boat had grown by 4000 employees at their Quonset Point facility yet the figures failed to reflect significant movement towards expected trends. In Table I-181975 and 1981 Electric Boat data for employee residential locations is contrasted with anticipated estimates for Quonset Point/Davisville.

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1 Gladstone Associates report p.55

Table II-16

Electric Boat/Quonset Point-Davisville Worker Residency

Place of Residence	ELECTRIC BOAT[1] 1975 Number	%	1981[4] Number	%	Estimates for Quonset Point/Davisville[1,3] Number	%
West Bay:						
North Kingstown[2]	26	13.3	479	11	2750-3300	25-30
Remainder of West Bay	8	4.1	304	7	1100-1650	10-15
SUBTOTAL	34	17.4	783	18	3850-4950	35-45
Kent County:	57	29.2	1596	37	2750-3300	25-30
Urban Center:	55	28.2	1189	27	2200-2750	20-25
Balance[4]:	49	25.1	762	18	1100	10
	195	100.0	4330	100.0	11,000	100.0

1. Gladstone Associates

2. South Kingstown, Narragansett, Exeter, Jamestown and New Shoreham

3. Assumes average for 3 scenarios in 25 years; estimates reflect anticipated commuter preferences of new employees and do not attempt to account for cities/towns/subareas capacities.

4. Electric Boat: General Dynamics

In fact while the percent of employees living in the West Bay Region grew slightly, overall, the percent living in North Kingstown actually dropped, contrary to expectations. Kent County and the Urban Center (Cranston, Providence, East Providence, Pawtucket), the more populated areas still remained the primary residential location for Electric Boat workers, while a smaller percent of employees were living in other areas of Rhode Island or other states.

The employee-residential location figures provide an opportunity to contrast commuting pattern changes between 1975 and 1981. Unfortunately the information does not indicate what portion of the 4000-odd employees added during the time

period were already residents of Rhode Island (in particular, the West Bay, Kent County, or the Urban Center), or whether these new employees established their employment first and then made decisions about residential location. While recent studies suggest that residential location patterns are highly influenced by employment center locations and that these trends are enhanced during period of increased commuting costs, the affect of housing costs and its availability has diminished the opportunity for employees to relocate with ease.

New employees at Quonset Point-Davisville, as a result of the development of onshore oil and gas drilling support facilities, or from other economic development activities, will be, undoubtedly, drawn from several categories: 1) those already living in the West Bay or Kent County areas; 2) those already residing in the Urban Center; 3) those who currently reside well beyond commuting distance and, upon acquiring employment at Quonset Point-Davisville, relocate to the area; and, 4) those employees described by oil and gas impact studies as temporary. Estimates derived by Gladstone Associates suggest that the preponderence of oil-related employees will be drawn from existing resident Rhode Island population (Table II-17).

Table II-17

Comparative Oil-Related Estimates
Total vs. Resident Employment

	Scenario I			Scenario II		
Selected Years	Total Employment	Number	Percent of Total	Total Employment	Number	Percent of Total
4	760	540	71	885	605	68
5	1,025	755	74	1,165	815	70
6	1,635	1,230	75	1,685	1,260	75
7	2,040	1,540	75	2,000	1,515	76
8	2,410	1,830	76	2,130	1,615	76
9	2,125	1,605	76	2,060	1,580	77
10	2,250	1,710	76	2,095	1,160	77
11	2,085	1,590	76	1,845	1,430	78
12	2,075	1,605	77	1,645	1,255	76
13	2,050	1,595	78	1,350	1,035	77
14	890	680	76	270	205	76
15	660	510	77	190	145	76
20	475	380	80	315	250	79
25	305	245	80	185	145	78

SOURCE: MERBC-RALI, Onshore Facilities Related to Offshore Oil and Gas Development Estimates for New England; Gladstone Associates.

It can be assumed, for the most part, that resident employees will not choose to relocate their residences based upon:

1) past commuting trends in Rhode Island, even in the face of high energy costs;
2) public transportation routes from the Urban Center and Kent County to Quonset Point-Davisville;
3) high housing re-location costs (moving, higher mortgage rates, etc.);
4) programs such as ridesharing and vanpooling.

Of importance, then, to a study of growth impacts, will be the housing location preferences of those employees moving to Rhode Island on a permanent or temporary basis. For both sets of employees, availability (vacancy rates) for owner-occupied and rental units for permanent or semi-permanent households, as well as of housing prices in the West Bay Region presented in Chapter 3 has already shown that existing housing would be insufficient in the region to handle a sharp, accelerated increase in employment at Quonset Point-Davisville. Additional research is needed to determine the existing housing resources in communities such as Warwick, Exeter and others beyond the West Bay Region boundaries within easy commuting distance.

To assess the capacity of the region to accommodate temporary employees anticipated during the early development stages of onshore support facilities, a survey was conducted of hotels, motels, and guest rooming housing, considering, in particular, the availability of rooms with access to kitchen facilities and a rate for longer stays. This assessment is particularly important in light of exploratory activity which has been taking place since 1978 and under present leasing schedule of BLM, can continue until 1994.

The results (Table II-18) show the availability of units with kitchen access. (A complete account of the survey results is contained in Chapter 3 .) The figures presented here and in the Chapter 3 should be considered approximate, as in some cases the seasonal nature of this type of housing in a coastal community precluded a response from every facility.

Table II-18

Unit Availability with Kitchen Access

	Year-Round	Seasonal	Units With Kitchen Access
East Greenwich	35	---	--
Jamestown	30	28	4
Narragansett	217	131	9
North Kingstown	141	---	43
South Kingstown	162	105	7
Region	585	105	63

SOURCE: CCC; RCEIP, December, 1981.

Less than ten percent of the units have access to kitchen facilities; almost one-third of the units are available only "in season." Most noticeable is the seasonal character of the region and preponderance of units for temporary housing in North Kingstown, indicative, perhaps, of the past influence of the naval base. The future influence of development at Quonset Point-Davisville and its perceived impact is evident from the fact that only the North Kingstown establishments were planning to expand the capacity of their facilities.

Data about housing resources presented earlier and the results of the survey suggest the West Bay Region is not yet equipped to handle a substantial influx of either permanent or temporary employees. The figures show the present availability of over five hundred tempoary units year-round (over eight hundred in warm weather) and suggest a possible sufficiency in number to meet anticipated needs. However, there would be significant impact to the tourism and recreation industry in Rhode Island should the motel-hotel market be pre-empted by temporary employees from Quonset Point-Davisville. Future research should be directed at resources in communities bordering the region. In addition, the state's development of the former base should include an obligation to assist impacted communities and meet the need for temporary and permanent affordable housing for future employees.

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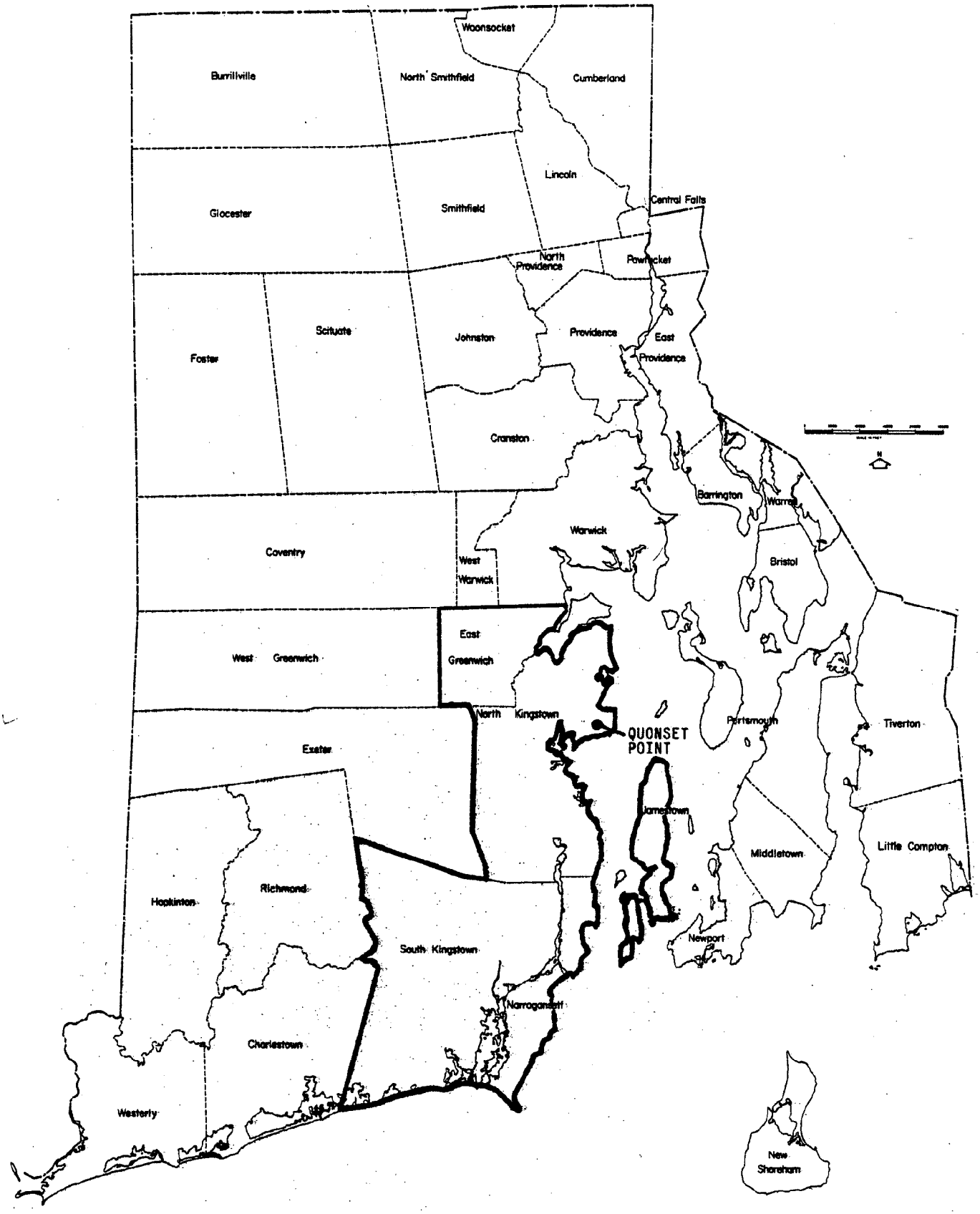
Chapter Three

Onshore Regional Issues

Land Resources

Figure III-1

West Bay Region



Population Growth

The 1980 Census of Population and Housing figures show a continued overall population increase in the region at the same time as the state experienced a loss in population. Strong regional growth trends began as early as 1940 and were accelerated by the Naval activities at Quonset Point-Davisville. At the height of Naval activity (1970), the entire region and the individual communities experienced growth rates well beyond the state and the nation. In spite of the Naval withdrawal from Quonset Point-Davisville in the mid-1970s, the communities in the region continued to gain population growth and, in some cases, by 1980 had exceeded projections made as late as 1979.

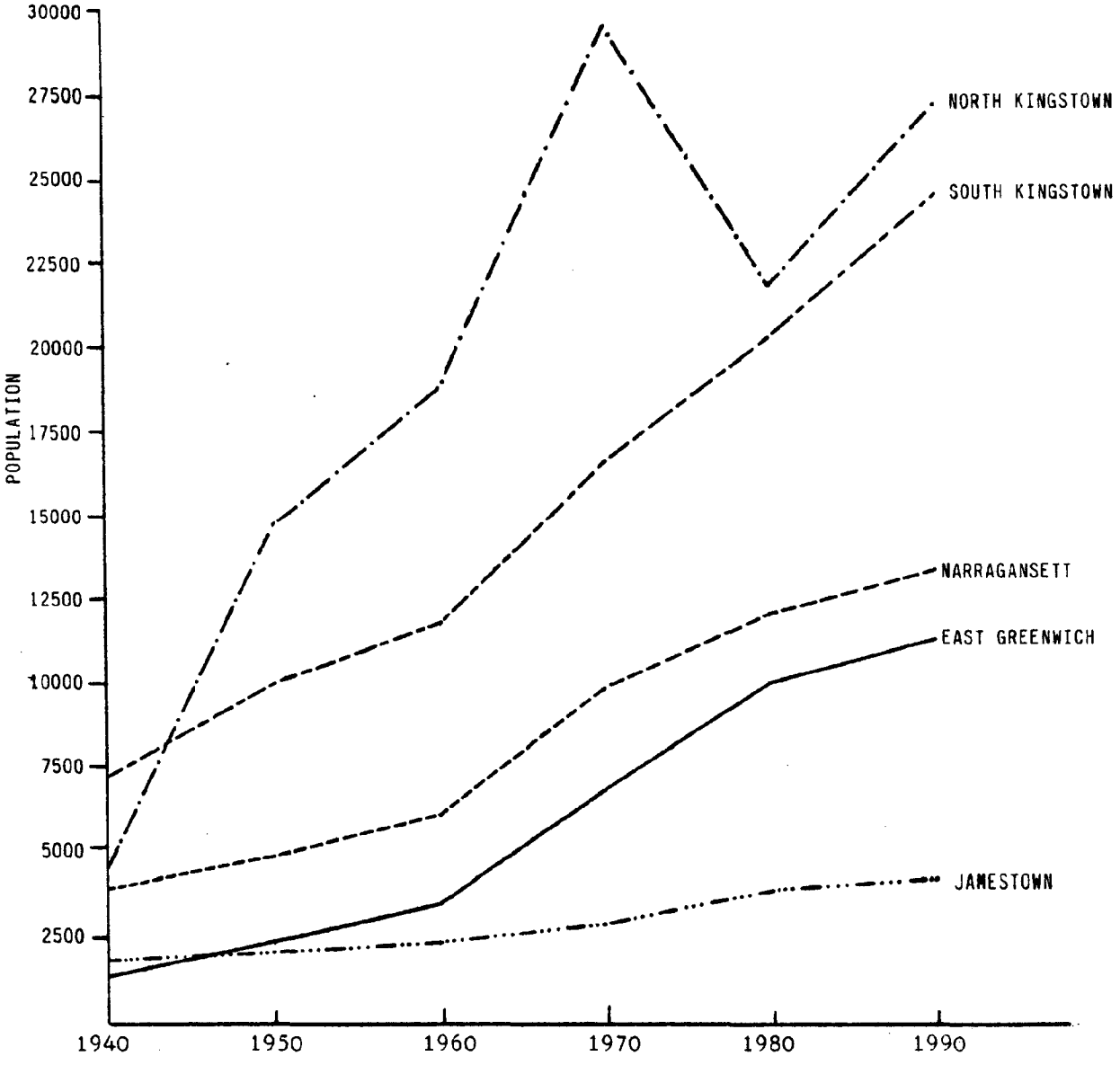
Substantially reduced growth rates are projected for the next decade (1980-1990) for the entire region except the towns of North Kingstown and Narragansett. However, plans for industrial growth and transportation improvements on a region-wide basis suggest that accessibility to employment centers will increase for residents of the West Bay Region and the region may exceed the projected growth rate in the next decade. (See Figure III-2.)

Except for the first decade of this century, the State of Rhode Island has experienced less population growth than the nation (Fig. III-1). Moreover, in 1980 the Census figures indicate that Rhode Island was only one of two states in the entire nation that suffered a population loss. While these figures also show that overall growth between 1970 and 1980 in the West Bay Region exceeded that of the state but fell short of the nation's rate, the data fails to reveal that this sudden drop in growth in the region and the state was the result of the federal decision to close the Naval installations at Quonset Point-Davisville and on Aquidnick Island.

In fact, population growth in the West Bay Region has surpassed change in both state and nation since 1940 (Table III-1). The 1980 information shows member communities in the region exceeded 1980 population projections made as recently as

Figure III-2

Population Growth



Source: U.S. Census of Population and Housing

Table III-1

Population and Population Change for the West Bay Region, the State of Rhode Island, and the Nation

YEAR	the Region	% Increase	East Greenwich	% Increase	North Kingstown	% Increase	South Kingstown	% Increase	Narragansett	% Increase	Jamestown	% Increase			Remainder of State	% Increase	State	% Increase	U.S.	% Increase
1900	14,555		2,775		4,194		4,792		1,523		1,091				414,001		428,556		76,212,168	
1910	15,069	3.5	3,420	23.2	4,048	-3.5	5,176	4.1	1,250	-18.0	1,175	7.7			527,541	27.4	542,610	26.6	92,228,496	21.0
1920	14,494	-3.8	3,290	-3.8	3,397	-16.1	5,181	.1	993	-20.6	1,633	39.0			589,903	11.8	604,397	11.4	106,021,537	15.0
1930	16,812	16.0	3,666	11.4	4,279	26.0	6,010	16.0	1,258	26.7	1,599	-2.1			670,685	13.7	687,497	13.8	123,202,624	16.2
1940	19,032	13.2	3,842	4.8	4,604	7.6	7,282	21.2	1,560	24.0	1,744	9.1			694,314	3.5	713,346	3.8	132,164,569	7.3
1950	34,237	79.9	4,923	28.1	14,810	222.0	10,148	39.4	2,288	46.7	2,068	18.6			757,659	9.0	791,896	11.0	151,325,798	14.5
1960	42,730	24.8	6,100	23.9	18,977	28.1	11,942	17.7	3,444	50.5	2,267	9.6			816,758	7.7	859,488	8.5	179,323,175	18.5
1970	66,332	55.2	9,577	57.0	29,793	57.0	16,913	41.6	7,138	107.3	2,911	28.4			885,641	8.1	949,723	10.5	203,211,926	13.3
1980	68,691	3.6	10,211	6.6	21,938	-26.4	20,414	20.7	12,088	69.3	4,040	38.8			878,463	-0.6	947,154	-0.3	226,504,825	11.0
1980*	69,800	5.2	10,900	13.8	22,100	-25.8	22,000	30.0	11,000	54.1	3,800	30.0								
1990*	81,600	14.5	11,600	6.4	27,500	24.4	24,900	13.2	13,500	22.7	4,100	7.9								

Source: Bureau of Census
RI Statewide Planning Program

* Projected in 1979

1979. Moreover, when the estimated 12,000 military personnel who were withdrawn from Quonset Point-Davisville between 1974-1975 are discounted, North Kingstown actually shows a 23% population growth rate. Town officials in East Greenwich also link the town's substantially reduced growth over the last decade to the Naval withdrawal.

The shift in population from the city to the countryside began in the region in East Greenwich, that area of the West Bay Region most proximate to Providence, during the early part of this century. Succeeding population growth has reflected nationwide suburbanization trends that began after World War II with the growing popularity of the automobile. The construction of inter- and intra-state highways increased the accessibility to formerly non-urban areas.

Key developments shaped the population growth in the West Bay Region. During World War II, the Navy aquired thé land at Quonset Point-Davisville and established a major military facility. The sudden infusion of population and civilian employment opportunities is reflected in the 222% growth experienced by North Kingstown between 1940 and 1950. The effects of the injection of growth on North Kingstown are visible in the doubled (or more than doubled) growth rates that neighboring communities experienced. Growth continued region-wide at unparalled rates.

In addition to the spillover effects of the Navy Base at Quonset Point-Davisville, South Kingstown realized population growth from the University of Rhode Island (URI). The U.S. Census conducted in 1950 was the first to include resident college students as members of the University's host community. The growth spurt during the 1960s at URI enhanced the growth increase in South Kingstown. Some population increase in Narragansett is attributable to the spillover of students unable to locate housing in South Kingstown. Between 1970 and 1980 the population increase rate in Narragansett exceeded that of all other cities and towns in Rhode Island. This sharp increase reflects the growing attractiveness of year-round living along the coastline; the population growth is also indicative of the increased accessi-

bility of the southern shore of Rhode Island.

Population figures for the West Bay Region from 1960 to 1980 show growth and are reflected, as would be expected, in increased density in the Region (TableIII-3). Naturally, overall figures for the towns show increased density (except in North Kingstown). However, the breakdown by census tract reveals important characteristics and events taking place within these communities. The most urbanized area in the region is the downtown of East Greenwich (Census Tract 209.01); as has been a nationwide trend, the downtown lost population between 1970 and 1980 while the suburban areas gained. The withdrawal of the Navy is revealed in the sharp drop between 1970 and 1980 in North Kingstown's census tracts 501.02 and 502 at the same time Wickford and the outlying areas of the town increased in density. Census tract 514 in South Kingstown encompasses only the University of Rhode Island and shows both the large increase in students between 1960 and 1970 and the subsequent decrease over the last decade.

Other characteristics of the population, in addition to increase, were revealed by the census data and are presented in Tables III-3,III-4. Between 1970 and 1980 the balance of men and women in the region remained relatively stable except in North Kingstown which increased its predominance of women due to the withdrawal of Naval forces. The communities show a high similarity in their racial balance which continued over the last decade. North Kingstown, Narragansett, and South Kingstown showed the highest percentage of black and other racial populations groups, most likely due to the influence of the Navy and URI; the drop between 1970 and 1980, then, would be linked directly to the Naval withdrawal and the decrease in students. The regional population showed striking similarity in 1980 to the population characteristics of the state.

Finally, the census showed changing patterns of age distribution not unlike national trends. Between 1970 and 1980 in the West Bay Region towns, the percentage of the population below 18 years of age dropped at the same time that the per-

Table III-2

Population Density

1960-1980

	Census Tract No.	Land Area*	1960 Population	1960 Pop./Ac.	1970 Population	1970 Pop./Ac.	1980 Population	1980 Pop./Ac.
West Bay Region		87,640	42,730	.49	66,332	.77	68,691	.78
East Greenwich (Total:)		10,540	6,100	.58	9,577	.91	10,211	.97
	209.01	633	6,100	.58	4,306	6.80	3,530	5.58
	209.02	9,907			5,271	.53	6,681	.67
Jamestown	413	6,105	2,267	.37	2,911	.48	4,040	.66
Narragansett	515	8,702	3,444	.40	7,138	.82	12,088	1.39
North Kingstown (Total:)		27,146	18,977	.70	29,793	1.10	21,938	.81
	501.01	4,989	7,370	.98	7,888	1.58	9,070	1.82
	501.02	2,511			3,369	1.34	1,527	.61
	502	2,592	4,227	1.63	9,933	3.83	665	.26
	503	5,139	4,948	.96	5,227	1.02	6,218	1.21
	504	11,915	2,432	.20	3,376	.28	4,458	.37
South Kingstown (Total:)		35,147	11,942	.34	16,913	.48	20,414	.58
	512	3,306	5,831	1.76	6,145	1.86	6,210	1.88
	513	30,672	4,039	.13	5,773	.19	9,558	.31
	514	1,169	2,072	1.77	4,995	4.27	4,646	3.97
State of Rhode Island		658,242	859,488	1.31	949,723	1.44	947,154	1.44
Remainder of State		570,602	815,498	1.43	883,391	1.55	875,911	1.54

*In Acres

Source: Bureau of Census, Technical Paper *48, Statewide Planning Program

Table III-3

General Population Characteristics: West Bay Region
1970-1980 (in percent)

	1970		1980		1970			1980		
	M	F	M	F	W	B	O	W	B	O
East Greenwich	48.9	51.1	48.8	51.2	99.3	.4	.3	98.7	.5	.8
Jamestown	48.5	51.5	48.8	51.2	98.6	.9	.5	98.8	.6	.6
Narragansett	51.7	48.3	50.4	49.6	97.4	1.2	1.4	97.4	.9	1.7
North Kingstown	60.4	39.6	48.5	51.5	94.6	3.2	2.2	97.6	.8	1.6
South Kingstown	47.8	52.2	48.1	51.9	94.9	2.7	2.4	94.3	1.8	3.9

M: Male, F: Female, W: White, B: Black, O: Other

SOURCE: Coalition of Coastal Communities
U.S. Census of Population and Housing, 1970, 1980.

General Population Characteristics: West Bay Region and State
1980 (in percent)

	Male	Female	White	Black	Other
Region	48.9	51.1	97.4	1.7	.9
State	47.6	52.4	94.7	2.9	2.4

SOURCE: Coalition of Coastal Communities
U.S. Census of Population and Housing, 1980.

Table III-4

Distribution of Age in West Bay Region
1970 and 1980 (in percent)

	18 or Younger		65 or Older		Median Age	
	1970	1980	1970	1980	1970	1980
East Greenwich	36.5	30.7	7.2	9.0	27.5	33.1
Jamestown	33.4	26.1	13.1	13.1	31.1	32.5
Narragansett	30.9	22.5	8.5	9.4	24.8	26.8
North Kingstown	32.9	30.3	3.4	9.6	22.8	30.2
South Kingstown	24.6	21.3	8.7	9.7	22.3	24.4
Region		26.2		10.2		29.4
State		25.6		13.4		31.8

centage of the population over the age of 65 increased. In every community, the median age for the population increased. Most noticeable is the change in North Kingstown and East Greenwich influenced by the age of military personnel.

Conclusions

Substantially reduced growth rates are projected over the next decade for the West Bay Region except for the towns of North Kingstown and Narragansett. However, plans for increased industrial development at Quonset Point-Davisville, Kent County and at industrial sites in the region suggest potential population levels at least at projected levels. In addition, planned highway improvements discussed on page 64, will increase accessibility to employment centers for residents of the West Bay Region.

Final population growth will be determined in each community by its land-use. Town officials in East Greenwich and South Kingstown concede that new and revised-use tools have slowed growth in their communities. Jamestown has now prepared an updated comprehensive plan and zoning ordinance which will ostensibly limit the residential capacity of the island. North Kingstown, the host community for Quonset Point-Davisville development, has set a population ceiling based on public facilities and services. The land-use tools of one community may well dictate the growth in another.

Transportation

Highways

Overview

New transportation highway projects now in the preliminary planning and design stages of development will also increase accessibility between the West Bay Region and the State's urban center, in turn, influencing new growth in the coastal communities. Local governments are now confronted by State plans inconsistent with local comprehensive plans. Highway projects which pave the way to previously undeveloped areas and produce unanticipated growth, ultimately straining the capacities of local government, threaten the existing non-urban character of the coastal areas. It is expected State efforts will continue to be directed at federally funded new highway projects or major upgrades. Future State proposals, plans and designs should reflect local government concerns and plans.

The extensive road network that winds southward from Providence to the West Bay communities provides accessibility for those wishing to avail themselves of working in the city but living in the "country," as well as those interested in using one of Rhode Island's unique natural resources: its coastal beaches and marinas. The bulk of this network is the product of the last three decades. By the mid-1800's East Greenwich was established as an industrial town and roads were constructed to link it with the hub of activity in Providence. By the end of the century the beaches and harbors of the coastal communities, especially Narragansett, were attracting a steady stream of summertime visitors and the West Bay Region was showing the first indications of its potential as a state recreation resource area; roads were extended to expedite the travel. Post Road (U.S. Route 1) was improved as part of the State Highway Act of 1902. By 1915 Boston Neck Road (U.S. Route 1A), which runs

along the coastline from Wickford to Narragansett, was graded to facilitate the passage of tourists from the city to the resort towns; it was paved with reinforced concrete in the early 1930's. In 1927, Tower Hill Road (U.S. Route 1) was paved between the burgeoning communities of Wickford and Wakefield.[1]

Increased automobile usage and the intensive growth in the region that followed the opening of the Navy Base at Quonset Point dictated a modernization effort of the transportation system for the region. A series of transportation projects beginning prior to World War II defined the amount of growth and its pattern for the West Bay communities:

- The Jamestown Bridge was constructed between 1939-1940 improving access to the island and contributing to a population increase in the following decade of almost 20%.

- In 1952 U.S. Route 1 was widened from its original two lanes (1927) to four lanes from Allenton to Narragansett and South Kingstown.

- No primary connecting route had existed between U.S. Route 1 and Route 2 until 1953 when Colonel Rodman Highway (Route 4), a four lane road, was constructed between Route 1 at Allenton and the rotary at the intersection of Routes 2 and 102. This new road linked the coastal communities with another avenue to the urbanized employment centers.

- Portions of Route 95, a product of the 1956 Interstate Highway Act were completed by 1968 making Rhode Island a single labor market. Population growth between 1960 and 1970 increased 55% in the region.

- Until the mid-1960's, Route 138 connected Route 1 and Route 1A via Bridgetown Road, a windy, 2-lane road. Route 138 continued northward to Bridge Road and across the Jamestown Bridge. Construction of Route 138 at a new site coincided with that of the Newport Bridge. Traffic along Route 138 now travels an improved roadway to the Jamestown Bridge via Route 1 (See map.).

- Finally, the completion of the Newport Bridge in 1969 increased accessibility to Jamestown and is identified as the singlemost contributor to growth in Jamestown.[2]

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1. R.I. Historic Preservation Society Reports
2. Draft EIS for Interstate Route I-895 and Jamestown Bridge Replacement.

The correlation between growth and improved highway access and increased land values in Rhode Island is well-documented in a report completed in 1976.[3] Any new construction should be carefully examined for its potential to impact the region with unanticipated growth. While many of the projects included in the Transportation Improvement Program (T.I.P.) for 1982-1984 call for minor upgrading of facilities, several elements are major in scope.[4] Among these major projects are:

- The 3.5 mile extension of Route 4 that will link its present end at Route 2 in East Greenwich to Colonel Rodman Highway at Lafayette Road eliminating a dangerous stretch of road and the site of many accidents. Sections of the roadway are currently in the design stage and the Rhode Island Department of Transporation (RIDOT) sources indicate construction could begin as early as mid-1982. Right-of-way will be acquired in East Greenwich and North Kingstown. The new roadway will change traffic patterns and potentially add pressure for development at intersections and increase traffic on presently rural roads. For communities along the coast, this new roadway, in conjunction with the planned improvements to Route 1, represents the final link in a north-south freeway system from Providence to Point Judith Pond, and will decrease commuting time into and out from the Region.

- The construction of a new Interstate 95 interchange in West Greenwich at the intersection with Hopkins Hill Road and Division Road that will facilitate commuting from the West Greenwich industrial park to currently undeveloped sections of the Region. The interchange will increase accessibility to the western area of East Greenwich and eventually dictate the upgrading of Division Road. Plans are already under way to upgrade and widen Hoskins Hill Road (Route 102). Without proper land management controls, adjoining land in East Greenwich could fall prey to increased pressure for developmment.

- Davisville Corridor Study. Daily traffic volumes in 1980 exceeded 6,000 vehicles on Devil's Foot Road, a two-lane road linking Route 4 and Quonset Point-Davisville.[5] The development of additional offshore oil support facilities at Quonset Point-Davisville and its concommitant employment will increase the use of this roadway. The 1977 Facilities Plan at Quonset Point-Davisville by Keyes Associates, estimated the use of Devil's Foot Road (or an alternative) by over 29,000 vehicles with a fully developed park. Bidding proposals for the evaluation of either an

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3. Hammerschlag
4. T.I.P.
5. Traffic Improvements at Quonset Point-Davisville Preliminary Engineering Report, Gordon Archibald..., Sept., 1980.
6. Keyes Associates, 1977, Quonset Point Technical Park Facilities Study, Prov.,RI.

upgrading of Devil's Foot Road or a new roadway have been submitted to RIDOT. Within the next 18 months the RIDOT expects to select a consultant for this phase of the project.

- Those portions of the original I-895 highway plan still under consideration. Since the early 1950s various transportation officials have envisioned a freeway type road crossing South County. By the mid-1970s State transportation plans included I-895, a new interstate, to follow or parallel the existing Route 138 road from its intersection with Interstate 95 in Richmond, Rhode Island, across Washington County, a new Jamestown Bridge, the lower bay and Aquidnick Island to Swansea, Massachusetts. While still titled "I-895" the project has been downgraded, the bridge project has been separated from the road network for impact assessment purposes, and negotiations are underway to assure the retention of the promised funding fo use on a modified highway. Agreement has been reached between RIDOT and the Washington County Project Areawide Committee (PAC), a citizens group representing the local communities, on eliminating the section of Route 138 from I-95 to Heaton Orchard Road from any new upgrading plans. Plans to improve or upgrade the remaining sections of Route 138 include:

  -- the construction of a new two-lane road from Heaton Orchard Road crossing Route 2 near Waites Corner Road to a point just north of the University of Rhode Island and Kingston Village. PAC and RIDOT agree on the need for a new road from Route 2 eastward. However, discussion centers on RIDOT's plan to cut directly from Heaton Orchard Road to Route 2, eliminating the "Usquepaug Bulge," a segment of the road (see map) Statewide Planning characterizes as substandard.[7] The new alignment would cross an historic farm over wetlands that currently separate the agricultural land from forested areas. The alternative, the improvement and minimal upgrading of existing roadway, is favored by local officials.

  -- the construction of a four-lane road to connect the University of Rhode Island and the proposed route; this segment has been dubbed the "URI Connector." The plan has been criticized by PAC for overbuilding this segment and failing to consider the non-growth posture held by the University of Rhode Island administration.[8]

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7. I-895 Transportation Corridor Position Statement.
8. Conversation with Vicki White.

-- the construction of a four-lane road from the intersection of the URI Connector and the proposed Route 138 moving eastward to the intersection of Routes 138 and 1 (see map). Traffic projections for this segment have also been the subject of scrutiny by the PAC.

-- the widening and improvement of Route 138 from Route 1 to the Jamestown Bridge. When Route 138 was constructed from Route 1 to Route 1A, sufficient right-of-way was acquired by the State to permit four lanes of traffic. Improvements to the intersections of Route 1A and 138 (signalization, additions of lanes) and the roadway from 1A to the Jamestown Bridge have not been agreed upon.

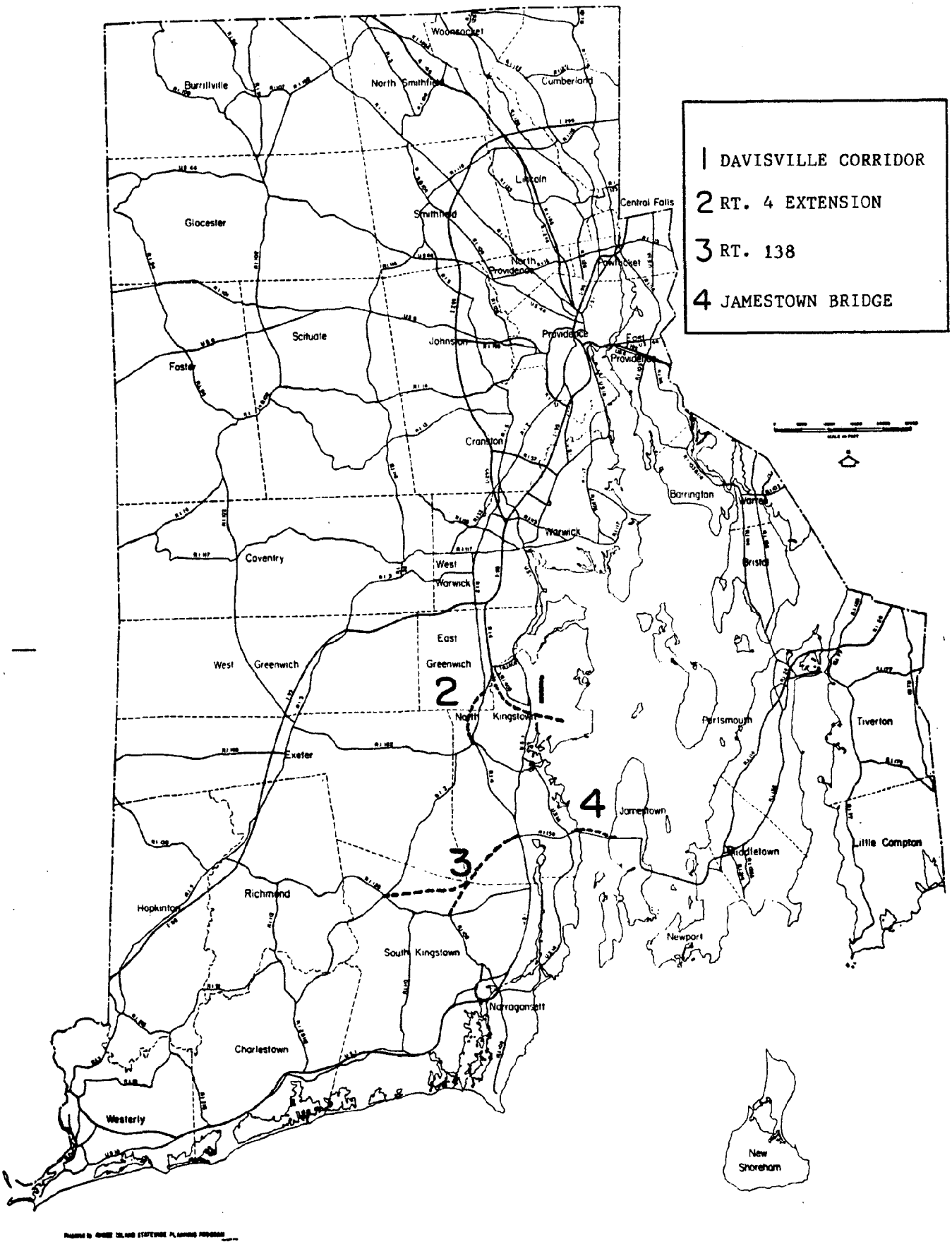
-- the widening and improvement to four lanes of Route 138 as it corsses Conanicut Island connecting the Jamestown and Newport Bridges. While transportation officials cite the anticipated traffic volumes, local officials are concerned about the impacts of a four-lane road on water, air, environmental, social, and economic quality issues they say were ignored by the environmental impact statement for the bridge. In addition, they note that Route 138 is a local road in Jamestown with schoolbus stops and over 30 adjoining driveways. The Final Environmental Impact Statement for the road will be distributed by August of 1982.

o The construction of a four-lane bridge to replace the existing Jamestown Bridge. The existing bridge has an estimated life expectancy of only 4 or 5 years and there is general agreement on need for a new bridge. Plans for the replacement have been stalemated by a lack of consensus between transportation officials and local officials and townspeople over the width of the bridge. Transportation planners began with an 88-foot wide span that included four 12-foot lanes, two breakdown-shoulder-bikepaths, two pedestrian sidewalks, and a median barrier. After public outcry the span size was reduced to 79 feet by narrowing the shoulders and the median. This width is incorporated in the Final Environemtnal Impact Statement recently approved by Federal Highway Administration officials. Language added to the recent Federal Highway Appropriations Act passed by Congress in December, 1981, would allow a further reduction to 69 feet. However, Jamestown, supported by other South County communities, is insisting that the new Jamestown Bridge be constructed at a width no larger than that of the Newport Bridge, 54 feet, plus the addition of a median barrier strip. A compromise needs to be struck between the State, Federal, and Local concerns for the bridge construction to proceed unimpeded.

The controversy over both the width of the proposed bridge and the type, size, and location of improvements to Route 138 represents the ongoing struggle local officials confront in their attempts to assure that State transportation

Figure III-3

Major Highway and Bridge Projects



plans are consistent with local land-use plans. While local pressure eventually led to the road's downgrading from interstate status, other issues have fueled the controversy.

In particular, local communities point to RIDOT's segmentation of the project. The construction of the Jamestown Bridge was ostensibly separated from the Route 138 improvements for environmental assessment purposes. State transportation officials were then able to dismiss charges that the Jamestown Bridge EIS failed to account for impacts from an improved island roadway necessitated by the new bridge. In addition, there is widespread concern within the region that should one segment be built at interstate dimension, other segments will be similarly developed if not now, at some time in the future.

Local communities insist that their comprehensive plans do not include a change from the current rural to an urbanized character that a freeway might bring. Morever, local officials and the residents affected by the I-895 and Jamestown Bridge proposals insist that Route 138 is a part of a regional transportation network and that it should remain so. State philosophy is reflected in the Interstate-95 sign which indicates Route 138 is a recognized route to Cape Cod.

Within the region other improvements have been budgeted for the 1982-1984 T.I.P. Among the most needed are the traffic improvements in the form of light signalization modifications and turning lanes which have been planned to relieve congestion at the intersections of Route 1, Quonset Point-Davisville, and Devil's Foot Road in North Kingstown. During the peak afternoon hour, almost 800 vehicles exit from the former Navy Base where current employment levels have hovered at between 5,000 and 6,000 workers; a moderate find of oil and gas would at least double that number increasing the need for a coodinated transportation system.

In addition, funds have been budgeted to plan improvements to:

- Route 1 between Westerly and Wakefield;
- Route 1 at the intersection with Route 4;
- Railroad grade crossings;
- Route 1 at the Wakefield cutoff;
- Succotash Road between U.S. Route 1 and Matunuck Beach;
- Point Judith Road;
- Ministerial Road; and
- Several key commercial center intersections in South Kingstown.

The projects described are, for the most part, the result of traffic projections and plans made as early as 1960. Projects like the Davisville Corridor Study reflect an ability to amend plans in the face of changing trends.

Although the 1980 Census figures will be used to make travel projections for the year 2000, state planners insist that the interstate system in Rhode Island is essentially built. Based on public sentiment, planners say no new major highways are expected to be considered for the State. However, decisions about previous highway proposals like I-895 have not been totally abandoned.

Unfortunately, projects recommended and given priority have, historically, and will likely to continue to be dictated by the types of categorical funding promoted at the federal level. State planners in the future expect that federal support will be available for interstate highways and primary roads, those that cross the state. Thus, it can be expected then that to maximize State monies, State plans will concentrate on these roads that can attract federal matching funds, like new highways.

State officials concede that next year federal funding may remain the same but the number of proposed projects is likely to increase. Recent reports[9] suggest that highway funds in Rhode Island were consumed by expensive studies at the expense of the construction and maintenance of roads. The reports also

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9. Providence Journal reports.

indicated that Rhode Island may be one of the states hardest hit by federal cuts because of its failure to generate funds specifically for roads. Local officials already complain that the $10,000 per year per community allocated by the State for road maintenance falls far short of their needs. A transportation bond referendum recently defeated expressed the sentiments of the public to increased tax burdens.

Should projections for a medium-find of oil and gas be substantiated, and should accompanying facilities be developed at Quonset Point-Davisville, the road network in the region will be subjected to accelerated usage by work-home trips and shopping trips from an increased population as well as from commercial carriers; maintenance and road quality will assume an added importance. While State legislation has now been introduced to siphon a small percentage of gasoline tax revenues into a maintenance fund for roads and highways, the funding resources of RIDOT remain uncertain in light of federal cutbacks and the decisive defeat of the recent referendum. Now may be the appropriate moment for a coalition of local officials to engage in serious discussions with the State to ensure that future transportation planning is consistent with local plans.

Transportation and Transit

Mass Transit

At present, due to the non-urban nature of the Region, mass transit programs in the West Bay Region are primarily limited to peak commuting hours with service to major employment centers usually over circuitous routes. Proposed funding cutbacks at the federal level and state fiscal constraints may result in sharp transit fare increases as well as a reduction in the number of routes. To adequately serve more rural communities, the state will need to be more receptive to innovative programs. At issue, also, is the lack of coordination among transportation providers in the Region.

Early mass transit systems connecting the central city with the coastal communities were available as early as the late nineteenth century. By the mid-1800s East Greenwich was established in Rhode Island as an industrial town. Thus, it was natural for trolley lines to be extended to the community and for the town to be the site of a railroad station for the major east coast rail line. In July, 1898, the Sea View Railroad, an electrified railway, began carrying passengers from East Greenwich to South County. However, by the 1920s, the railway was forced to cease its operations; it had been superceded by the age of the automobile. The continued popularity of the automobile is shown in the increased number of West Bay automobile registrations.

Today, several mass transit alternatives are available to commuters and residents of the West Bay Region. Amtrak trains make stops in the morning and evening at Kingston (West Kingstown) and East Greenwich as part of its regular Boston-Washington service. Kingston Station is second only to Providence in Rhode Island in the number of patrons using the station. Unfortunately, Amtrak has been forced, nationwide, to reduce service to cut expenses, especially on non-productive routes. Stops at the Wickford Junction which, in 1980, averaged

less than one rider a day, have recently been eliminated. In addition, Amtrak recently announced the elimination of the Beacon Hill, a commuter local between Westerly and Boston due to a lack of riders. Ridership at the Kingston Station, except for minor fluctuations, has been relatively stable. However, ridership at the East Greenwich Station was sharply down between 1980 and 1981

RIPTA

In Rhode Island the primary passenger carrier is the Rhode Island Public Transit Authority (RIPTA). In 1966 RIPTA assumed control over what was described as a "wretched fleet of vehicles," the United Transit Company. In operation from 1955-1966, during a period of mass transit decline nationwide, the United Transit Company watched its own patronage drop well below even national averages. The state's commitment to mass transit at about this time is best reflected by the data which show that between 1962 and 1972 less than 1% of the state transportation funds were expended on mass transit.

Over the past decade RIPTA has increased its ridership by updating its equipment, by increasing the number of communities served, and by providing an alternative to the high cost of automobile travel. Transit links now exist between the urban centers of the West Bay communities and the major employment centers (Quonset Point-Davisville and the University of Rhode Island (U.R.I.)) in the region. There is morning and afternoon transit service to Quonset Point from Providence, from West Warwick, and from Newport. Bus routes joining Kingston and URI with Wakefield, Narragansett Pier, Galilee, Jamestown and Newport provide connections to routes to the Providence metropolitan area.

RIPTA officials report that service between Kingston Station (Amtrak), U.R.I., Wakefield, and Galilee and between Newport and Wakefield runs six days a week with its heaviest ridership during the winter months. RIPTA has attempted to establish stops at Kingston Station which coordinate with train arrivals; these ef-

forts have been hampered by continuous schedule changes instituted by Amtrak.

On a typical weekday morning during the peak commuting period four buses depart from Narragansett, one from Jamestown, from Wickford, and one from Post Road at Frenchtown Road in East Greenwich bound for Providence, standing room only. RIPTA has ordered new 47-seater buses scheduled for delivery in January, 1982. Several of the new vehicles will replace the 30-seaters now on these routes.

While bus routes in the Region are running at capacity levels or at least within respectable levels of ridership, there are no plans to expand service by increasing the number of buses in the region or by increasing the number fo communities served. RIPTA already faced a decline in ridership at Quonset Point when Electric Boat purchased carpooling vans for its employees (see Ridership Program). RIPTA officials expect that federal cuts in operating monies will force the agency to take a statewide look at "non-productive"* routes. If proposed federal budget cuts are made, RIPTA will be faced by 1985 with the prospect of locating new funding sources to substitute for lost monies. The new funding could come in the form of increased fares or subsidy from the State, although the prospects of a state subsidy is doubtful as the state is currently facing a fiscal crisis.

RIPTA officials indicated that there was room for a more coordinated effort to bring commuter alternatives to the West Bay Region. RIPTA has little communication with Bonanza Bus lines, a private interstate carrier that services Providence, Newport, and the University of Rhode Island. At least five Bonanza trips originate at the University on a daily basis bound for Providence and Wakefield. Additional buses are used on Fridays and before holidays to meet the needs of U.R.I. students. Aside from Amtrak, Bonanza service is the only direct transit route from South Kingstown to Providence. RIPTA service is circuitous and requires connecting lines to make the identical trip.

* Conversation with Bernie Ruble, RIPTA.

SCIRTS

Van service is provided in South County by the South County Integrated Rural Transit Service (SCIRTS), an offshoot of a Community Action Program (CAP) demonstration project. The system was established to provide service in rural areas where other public transit is unavailable. The Public Utilities Commission license held by SCIRTS permits the service to follow non-fixed routes based on demand. Routes originate in Washington County and West Greenwich and stops can be made at points selected by patrons. At least seven persons are needed to establish and maintain a route.

While the CAP agency provided the seed money to begin the project, fares from patrons are used to maintain the system. In October, 1981, two of SCIRTS' four routes were cut from service due to a lack of sufficient funding. Both routes had serviced the University of Rhode Island; one from Westerly and one from Matunuck. The two remaining routes generate sufficient funds to cover their current operating expenses.

SCIRTS officials feel the system is providing a necessary service in an area neglected by other public transit facilities. Surveys conducted for SCIRTS suggest there is a larger market in the region than is currently being serviced. SCIRTS officials indicate they have not had even the funding to advertise sufficiently.

Equally disturbing is the reported lack of recognition and assistance extended by RIDOT. As described by SCIRTS officials, RIDOT is currently sitting on federal funds that would provide monies for vehicles as well as 50% of the operating expenses. SCIRTS officials also complain that RIDOT failed to inform SCIRTS of their eligibility for funding from a national ridesharing program. Finally, the SCIRTS administrator pointed to the fact that the agency had not been invited to participate in any ridesharing or mass transit commission.

Rural transit systems can provide valuable service to those living beyond

urban areas, especially the poor, handicapped, and elderly. Van service used as a feeder system to mass transit can enlarge the population benefiting from public facilities. Local officials support the concept of rural transit but expressed concern over the possibility of publicly-funded van service usurping the private sector taxi service. A coordinated approach to mass transit service on the part of RIPTA, RIDOT, and SCIRTS would better meet the public's needs and eliminate resource inefficiency. As the West Bay Region acquires new population, some continuing to locate in semi-rural areas, the need for an integrated approach becomes even more important.

COMMUTER LOTS, RIDESHARING, AND CARPOOLING

Over the past decade several periods of high automobile travel costs or limited fuel availability spawned the carpool in Rhode Island. Carpooling is another alternative to the high cost of automobile maintenance (and often parking) as well as an alternative to mass transit where unavailable or impractical. While little data exists, state transportation officials point to an increase in carpooling. RIDOT currently maintains five commuter lots, one in the West Bay Region at the intersection of Routes 138 and 1A (see map). Based on the usage of existing lots and projected demand, four more lots are planned for the region on currently-owned state land. These lots will be used as both meeting points for carpools as well as recognized RIPTA bus stops. RIPTA and RIDOT have worked closely, monitoring the use of the commuter lots.

The University of Rhode Island has made some effort to encourage carpooling to the main campus. One, sixty-five-space lot located behond the Memorial Union and central to most facilities, has been reserved for carpools of at least three persons. While the lot is identified by signs, a lack of funding for personnel to monitor the lot hampers its success.

Finally, as early as 1974, RIDOT was serving as a funnel agency for federal dollars for a ridesharing program. Early activities included the computer match-

ing of commuters. Since 1978 RIDOT has been promoting the Rhode Island Revitalized Ridesharing Program, a federally-funded effort designed to encourage the private sector to purchase vehicles for vanpooling by employees. Surveys are being conducted to identify major employers int he state, that group most likely to participate in a ridesharing project. Upon request, informational meetings are conducted by RIDOT staff. RIDOT serves as the link between the employer and the federal government who will loan 75% of the cost of a van, interest free. The employer purchases the van and provides it at a nominal fee to employees for vanpooling. At Quonset Point the Electric Boat Division of General Dynamics has purchased 25 vans as part of the program and anticipates future additions based on future levels of employment. Brown and Sharp in North Kingstown is currently conducting a pilot vanpooling program under this project.

RIDOT officials point out that while the program requires both the outlay by the employer of some monies and, more importantly, company initiative, the employer reaps the benefits of tax credits as well as employee satisfaction. Administratrs of the program note that they are studying the feasibility of State employee involvement in the program as well as identifying other large firms as potential participants in the project.

Conclusions and Recommendations

The most glaring deficiency in the region's mass transit network is the lack of coordinated effort among transportation providers. While the West Bay Region does not generate the ridership levels of the metropolitan area, it is entitled to participate in the decision-making process. It should be the obligation of the Rhode Island Department of Transportation to ensure that agencies such as SCIRTS become a part of mass transit advisory groups. Efforts should be made to encourage representatives of Amtrak to participate. Current communication between RIPTA and Amtrak is limited to the announcement of rail schedule changes and is performed by the Kingston Station Stationmaster as a courtesy. RIPTA has found

Amtrak unresponsive to other overtures. At the very least, members of Rhode Island's congressional delegation could be tapped as a voice for these concerns.

Over the next few years severe cuts are expected in programs such as the Urban Mass Transportation Administration which currently funds public transit in rural areas, operating assistance, and capital improvement programs.* To maintain the level of service in the region, State subsidy and the means for financing such monies must be secured.

The State of Rhode Island does not currently meet air quality standards for mobile source pollutants. The Transportation element of the Statement Implementation Plan for Air Quality identifications and recommends programs with air-quality benefits.** Among the strategies selected for implementation is the encouragement of bus transit ridership through park-and-ride lots, token programs, and route improvements. These programs can benefit the West Bay Region and should be supported. Other measures recommended for inclusion in the State Guide Plan — commuter parking lots, employer programs, and carpooling/vanpooling programs — should be promoted actively in the region. Consumer education about the benefits of mass transit, carpooling, and ridesharing should be ongoing; however, for the residents of Rhode Island to opt for these alternatives to single-person work-trip commuting, public transit must be continued to be made available by the state.

* T.I.P.
** T.E.S.I.P.

Economic Growth in the Region

Further extensive development of Quonset Point-Davisville, as planned by the Rhode Island Port Authority, and new industrial growth in Kent County, will produce secondary economic activity in a region that has, over the last decade, already established a measure of employment self-sufficiency. Between 1970 and 1980 regional employment in the primary sectors of the economy grew by over 13,000 jobs. Over half of the new jobs in the manufacturing sector in the state created over the last decade were located in the West Bay Region due to development and expansion of Electric Boat at Quonset Point-Davisville. Increased employment in the services and retail-wholesale sectors indicate less dependency on commercial centers outside the region. Regional commercial activity is concentrated along Post Road in North Kingstown, the Dale Carlia area of Wakefield, and the village centers. A regionwide effort towards strengthening the historic village commercial centers and encouraging industry compatible with the character and resources of the region would broaden the tax base and promote economic independence of the region.

The population growth presented in the preceding section (even the net decrease in North Kingstown represents growth in spite of the Navy's departure), fails to present the total picture of change in the region. Information about economic growth permits a more complete view of activity in the region. Employment figures for the last decade show that the number of jobs grew by 170% in the region over the last decade at the same time employment in the state increased by only 30% (Table Employment: 1960-1980). Overall, the region increased its proportion of total employment at a faster rate than population increase. Employment figures at the town level were drawn from those of the Department of Employment Security (DES) and include the primary classifications. (Table III-5).

The most dramatic change in employment in the region occured in the manufacturing sector. The figures for the West Bay reflect a region-wide trend. In

December, 1960, North Kingstown reported only 271 workers in the manufacturing industry; twenty years later that figure was 7,853. In the region the number of workers in the industry has almost tripled. Over half of the new jobs in the manufacturing sector in the state created over the last decade were located in the West Bay Region due, primarily, to the develoment in North Kingstown of Brown and Sharp and at Quonset Point-Davisville of Electric Boat.

The relationship between state and regional economic activity has significant implications for residents of the West Bay Region. Had the data shown population growth but not an attendant increase in the economic activity, the figures might suggest that the region had attained a degree of suburbanization and was serving only as a "bedroom" community for a central metropolitan area. Moreover, the implications of such findings would also suggest that the people in the towns in the region are heavily dependent upon commutation for employment opportunities, that residents are unable to locate employment nearby their homes. On the other hand, data that shows overall growth in economic sectors comparable to population growth, would suggest that the communities had reached a degree of self-sufficiency. For the West Bay Region, the latter is the case.

Regional economic activity as a percent of state activity from 1960-1980 is presented in Table III-6 as well as regional population as a percent of the state's. From 1960 to 1980 the region steadily increased its share of the state's population in spite of the decline caused by the Navy's departure from Quonset Point-Davisville. The economic activity shows similar increases.

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1. The D.E.S. computations fail to account for the self-employed and those employed by the federal, state, or local governments or institutions. While employment for government and institutions can be acquired at the county level, county boundaries do not correspond to the study region.

Other problems existed with the town level data. The information had been so disaggregated that some employment is not reported to protect disclosure. Finally, the choice of a winter month (December) to avoid the influence of the summer tourist activity may be slightly offset by the holiday season employment increases.

EMPLOYMENT
1960 - 1980

	East Greenwich					Jamestown					Narragansett					North Kingstown					South Kingstown				
	DEC. 1960	DEC. 1965	DEC. 1970	DEC. 1975	DEC. 1980	DEC. 1960	DEC. 1975	DEC. 1970	DEC. 1975	DEC. 1980	DEC. 1960	DEC. 1965	DEC. 1970	DEC. 1975	DEC. 1980	DEC. 1960	DEC. 1965	DEC 1970	DEC. 1975	DEC. 1980	DEC. 1960	DEC. 1965	DEC 1970	DEC. 1975	DEC. 1980
A., F., F.*	11	17	24	19	14	N/A	N/A	N/A	10	17	0	N/A	10	102	152	42	31	52	80	133	27	22	13	115	173
Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	8	16	0	0	0	0	25	0	0	0	N/A	0
Construction	132	162	119	100	125	29	34	31	31	24	23	38	49	71	72	103	124	102	70	130	74	82	85	84	80
Manufacturing	1,218	1,283	1,205	1,204	1,843	13	15	9	10	47	18	11	39	10	186	271	2,871	1,121	3,134	7,853	347	361	442	432	789
T., C., E., G., S.**	13	13	12	16	216	8	7	N/A	N/A	11	11	11	22	22	29	67	94	170	80	180	49	59	84	129	188
Wholesale	485	480	613	119	209	51	60	70	8	N/A	144	188	268	94	165	411	679	1,075	14	118	453	509	637	46	47
Retail				1,017	819				54	211				336	458				1,229	1,777				981	1,293
F.I.R.E.	47	65	89	114	102	13	7	7	9	13	12	7	12	21	14	83	97	174	112	112	20	45	47	51	77
Services	147	169	214	262	562	27	37	42	18	34	26	74	87	132	282	168	275	289	339	922	125	231	490	1,016	1,563
TOTAL	2,053	2,189	2,276	2,851	3,890	142	162	162	142	357	234	331	487	796	1,374	1,145	4,171	2,983	5,658	11,250	1,095	1,309	1,798	2,855	4,210

	State of Rhode Island					West Bay Region				
	DEC. 1960	DEC. 1965	DEC. 1970	DEC. 1975	DEC. 1980	DEC. 1960	DEC. 1965	DEC. 1970	DEC. 1975	DEC. 1980
A., F., F.*	784	930	1,055	1,532	1,876	80[1]	70[2]	99[1]	326	489
Mining	104	148	108	135	169	0	0	0	8[3]	41[4]
Construction	10,870	14,284	14,061	11,611	12,271	361	440	386	356[5]	431[6]
Manufacturing	115,719	122,808	116,454	120,467	130,137	1,867	4,541	2,816	4,790	10,718
T., C., E., G., S.**	13,328	13,490	14,887	12,933	12,478	148	184	288[1]	247[1,5]	624[7]
Wholesale	56,710	63,323	74,231	15,967	17,914	1,544	1,916	2,689	281	539
Retail				59,767	66,535				3,617	4,558
F.I.R.E.	12,410	13,664	15,816	17,698	20,760	175	221	329	307	318
Services	17,945	22,920	28,916	61,870	83,602	493	786	1,122	1,767	3,363
TOTAL	227,870	251,547	265,528	302,180	345,742	4,668	8,158	7,709	11,699	21,081

* Agriculture, Forestry, Fisheries
** Transportation, Communication, Electricity, Gas, Sanitation
*** Finance, Insurance, and Real Estate

Source: Department of Employment Security

Table III-6

The Region as a Percent of State Activity

1960 - 1980

	DEC. 1960	DEC. 1965	DEC. 1970	DEC. 1975	DEC. 1980
Population	5.0		7.0		7.3
A., F., F.*	10.2	7.5	9.4	21.3	26.1
Mining	-	-	-	6.0	24.3
Construction	3.3	3.1	2.8	3.1	3.5
Manufacturing	1.6	3.7	2.4	4.0	8.2
T., C., E., G., S.**	1.1	1.4	1.9	1.9	5.0
Wholesale - Retail	2.7	3.0	3.6	5.2	6.0
F.I.R.E.***	1.4	1.6	2.1	1.7	1.5
Services	2.8	3.4	3.9	2.9	4.0
TOTAL	2.1	3.2	2.9	3.9	6.1

* Agriculture, Forestry, Fisheries
** Transportation, Communication, Electricity, Gas, Sanitation
*** Finance, Insurance, and Real Estate

Source: Coalition of Coastal Communities
Bureau of Census
Department of Employment Security

Growth in the transportation, communications, electric, gas and sanitation (TCEGS), the wholesale-retail, and the service sectors reflects the increasing ability of residents to acquire goods and services locally and of the region to attain a measure of self-sufficiency. It appears that while the wholesale sector of the economy is not as strong as the retail, economic growth influences portend an increase in the region as a distribution center, particularly for water-related activities.

The service sector increase in conjunction with that of retail markets mirrors the demand that exists in growth communities for local trade sources. While the information about Jamestown suggests that the residents of the island community still bring their trade to other communities, overall the percent increase in employees in the service sector (over 500%) exceeds the population growth (59%) that the region experienced between 1960 and 1980. Most of the increased commercial development occured in South Kingstown at the Dale Carlia intersection and along U.S. Route 1 in North Kingstown. Increased employment in the agriculture, forestry and fisheries industries reflects the region's coastal influence.

It appears, with the exception of slight downturns, the construction and finance, insurance and real estate sectors have remained fairly stable over the past twenty years in spite of substantial population growth. However, it is possible that the choice of a winter month may produce a distortion of yearly activity. Historically, real estate transactions and construction starts are linked to the warm weather months.

Industrial Activity

While nationwide the economy has experienced a downturn and the immediate future of regional economic growth may be slowed, several long-range trends can be anticipated. As described earlier, state plans envision extensive development at Quonset Point-Davisville for support facilities for offshore oil and gas drilling.

This development relies on significant finds of oil and gas on the outer continental shelf. The state has already invested monies in the redevelopment of the former naval base and it can be expected that, should little or no energy resources be found, other economic development will be promoted at the site. Whether or not oil and gas is located, it would be presumed that the state, based on the sharp impacts of the naval withdrawal in 1974, would cultivate a mix of industries at the fomer base and prevent one industry from dominating the economy of the state and the region.

Other industrial activities are expected to bring employment opportunities to the region: continued high technology industrial growth in Kent County, growth of fishing and marine activities; and development of the region as a tourist and recreation center. However, to maintain and, perhaps, enhance the independence of the region commercial activity will play an increasingly significant role.

Commercial Activity

According to the figures of the R.I.S.P.P. Environmental Inventory, between 1970 and 1975 the use of land for commercial purposes increased (9%) in the West Bay Region. During the same period employment in the wholesale, retail and service sectors had grown by fifty percent of 1970 levels suggesting, perhaps, that land already committed to commercial use in 1970 was receiving more intensive use in 1975.

Present trends over the last fifteen years in commercial development in the region have followed patterns similar to those taking place nationwide. Village commercial districts, historically the centers of retail activity in the region, suffered a decline in importance. Paralleling and intensifying (if not creating) the diminished attraction of the village cores has been development of "strip" commercial areas along major arterial roads and the construction of shopping centers at a distance from the downtown districts. Local officials note that the stiffest

competition still emanates from the Warwick malls. East Greenwich officials cite the development of the malls and the withdrawal of the Navy as the two major factors contributing to reduced sales in its commercial district in the last decade.

Strip commercial areas are located along Route 1 from Wickford to East Greenwich and along segments of Route 1A in Narragansett, and Route 2 in North Kingstown and East Greenwich. In South Kingstown, Wakefield, once a primary shopping district, has been superseded by the Dale Carlia Corner area, a district of eleven shopping plazas, all within a half-mile of the intersection of Routes 108 and 1A. In Jamestown most commercial activity is still located in the area near the Jamestown harbor. A few establishments, however, have located along Eldred Avenue (Route 138), the main thoroughfare crossing the island.

Conversations with town officials indicate a regionwide awareness of the importance of planning for future commercial development. All five towns believe increased commercial development will expand the tax base and bring revenues to the community. The towns in the region have begun to make decisions about where, what size, and what type of additional development is appropriate for their community. Current trends towards resource and energy efficiency have led to the recognition that new commecial activity should work toward enhancing existing commercial areas and avoiding further strip development. To that end, new zoning efforts have reflected a de-emphasis of development along major roads. However, East Greenwich and Narragansett officials noted disappointment that tracts newly zoned commercial failed to attract development.

Several trends are anticipated for the next decade. Planned neighborhood commercial districts have been proposed in South Kingstown to complement and support areas of the town of substantially increased residential development. The district is intended to provide "goods and services to the residents of the area" surrounding the development. Similarly, North Kingstown's proposed comprehensive plan envisions the creation of only one new commercial district, a complement to expected residen-

tial development in Slocum; the plan emphasizes support for the Wickford Village commercial area as well as several neighborhood commercial districts already in existence. Jamestown's Community Guide Plan (1979) prohibits future major commercial development outside the village core.

A second anticipated trend is exemplified by the revitalized economy of Wickford Village. The restoration of historic commercial blocks and the construction of visually compatible commercial structures coupled with intense promotion campaigns have attracted increased sales to the village. In East Greenwich the results of a recently released town-commissioned study of the "Hill and Harbor District" suggest the potentially increased viability of the East Greenwich downtown. The report indicates the importance of addressing the problems of visual discord and a lack of coordination as a first step towards recapturing a larger share of regional sales. The report stresses the importance of town government involvement in the private market process.

In South Kingstown it is likely that the commercial district at Dale Carlia Corner will continue to capture the greatest share of regional sales among southern coastal communities. In spite of this growth away from the village cores, downtown Wakefield is described by local officials as "holding its own," unlike the Peacedale commercial area. Both sites are rich in history; building exteriors and revitalization through marketing efforts have been left, primarily, in the hands of the private market.

A third trend is typified by the redevelopment at the Narragansett Pier area. While the development itself has not met the expectations originally described by the developer, it represents renewed interest in commercial waterfront areas. Several other proposals for the region's coastal waterfront have been received. East Greenwich is currently considering proposals for the cove waterfront including a commercial condominium project. A $1.3 million condominium-marina development has been suggested for Allen's Harbor in North Kingstown and an increased role in com-

mercial fishing has been recommended for Wickford Harbor. A $5 million motel-restaurant complex had been proposed for a three-acre land parcel across from Scarborough Beach in Narragansett.

In addition, Marina Park, the land at the heat of Point Judith Pond in South Kingstown, has been the subject of studies and commercial proposals since 1973; the town council has recently asked the Waterfront Advisory Committee to review plans for the area for "appropriate commercial and recreational development." Finally, Jamestown's commercial district, which has always been located near the harbor, has received a boost in visitors from a series of special downtown events scheduled during the spring and summer months.

Conclusions and Recommendations

In general, to support future anticipated growth, to meet the needs of current residents, and to increase and broaden the region's tax base, commercial development appropriate for the West Bay Region and for each community should be encouraged. The revitalization of historic commercial centers such as East Greenwich, Wakefield, Peacedale, and Wickford must incorporate the cooperation and coordination of the local government and the business community. Private market actions should be supported and encouraged by public sector initiatives and incentives.

The re-use of waterfronting property should build not only upon current economic industrial opportunities (tourism, fishing industry, housing), but should capture and reflect the unique characteristics of the region as well as enhance the public's use of the water. However, any use of waterfront land will be influenced by the quality of the water. For example, the water quality classification in Wickford and Greenwich Coves is SC (boating - no swimming or shellfishing) but there are times when the water quality fails to meet these standards. During the summer months nuisance offenses have been reported in both coves.

Any new zoning or land use changes should reflect continued support for existing commercial districts and the probibition of additional strip development. Com-

mercial proposals should be subjected to design review standards which encourage the extensive use of landscaping buffers and discourages excessive use of paved surfaces. Transportation improvements to Dale Carlia Corner should be accompanied by landscaping improvements.

Housing

While population figures for the last decade amply demonstrate resident increase in the West Bay Region, and employment sector counts reflect a widening economy, nowhere is growth in the region more evident than in the use of land for residential purposes. During a decade of increasing housing costs, the region maintained a continuing attraction for new residential population. Two contrasting trends served the region in similar ways. An expanded freeway system provided increased access from the major labor markets in the urban areas to the region's residential communities. On the other hand, corresponding growth in the region's commercial and industrial sectors added new employment possibilities in the region; at a time of increased commuting costs, employees were selecting residential locations in proximity to work.

Figures from the 1980 Census of Population and Housing, where possible, show substantial changes in the housing stock in the region:

	POPULATION	TOTAL UNITS	YEAR-ROUND UNITS		
	% Change	% Change	1970	1980	% Change
East Greenwich	6.6	18.7	3,046	3,612	19
Jamestown	38.8	32.0	1,106	1,631	47
Narragansett	69.3	37.9	2,844	5,089	79
North Kingstown	-26.4	20.1	7,001	8,637	23
South Kingstown	20.7	35.2	4,256	6,386	50
Region	4.0	28.5	18,253	25,355	39
Region as Percent of State	7.2	7.8			

The change in the total number of units exceeded, or was comparable (except in Narragansett) to, population increase. In other words, housing unit increase surpassed the population increase and is indicative of changing demographic trends de-

scribed later. However, when non-year-round units are removed from the total housing unit count, the change is even more remarkable. In a count of year-round housing the region and its member communities (including Narragansett) show increases far in excess of population change (Figure III-4).

To show concern for increase alone would fail to place this information into proper perspective. Indeed, the importance of the housing growth in the Region lies in its impact on the municipal services like water, sewer, roads, schools, and the use of land. Figures from the Rhode Island Statewide Planning Environmental Inventory indicate that approximately 2,700 acres of forested, agricultural or open space land in the region was lost to residential use between 1970 and 1975; 88% of this land was converted to light residential use. By the end of the 1970s the communities in the region had become increasingly aware of the costs of this type of development in terms of sprawl and its attendant energy and municipal extensions/ costs (roads, sewers, water, schools) as well as the loss of land for open space, recreation and farming. (See Table III-7.)

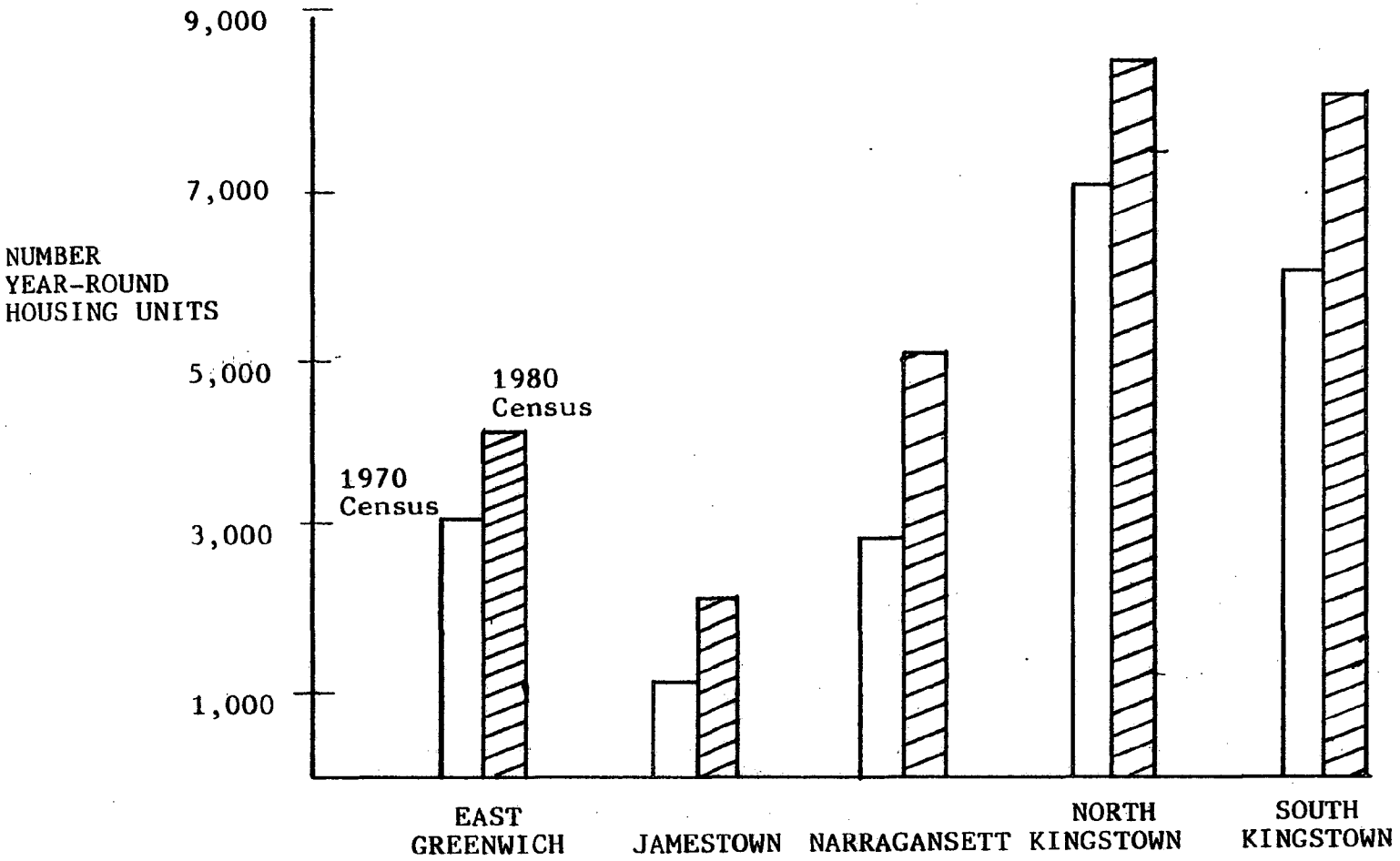
The 1980 Census of Population and Housing, in addition to other information collected about housing in the region, revealed important trends with particular significance for the future land-use patterns in the area. By far the trends of most significant impact include the increase of single-family housing; the conversion of seasonal units in these coastal towns; the development along the shorefront and in coastal areas; increases in the cost of housing; low vacancy rates; and, the potential emerging of multi-family housing. A complete set of housing data is contained in this section.

Single Family Housing

In spite of the fact these communities represent historic settlements in Rhode Island, all predating the Revolutionary War, almost as much housing was built between 1970 and 1980 as exists from pre-1939 construction (Table III-8). Over 25% of the region's housing was constructed during the last decade. In Narragansett almost

Figure III=4

CHANGES IN YEAR-ROUND HOUSING UNITS
1970 to 1980



Source: COALITION OF COASTAL COMMUNITIES

Table III-7

Land Use Changes to Residential Use in 1975

	Land Use in 1970 (in acres)			Residential Use In 1975	
	Agriculture	Open Space	Forest	Dense	Light
East Greenwich	20	20	420		460
Jamestown	20	30	90		140
Narragansett	110	60	310	180	300
North Kingstown	210	140	650	110	890
South Kingstown	130	190	380	50	650
	490	440	1,750	340	2,440

Source: R. I. SPP Environmental Inventory

Table III-8

West Bay Housing Stock Characteristics: Age
1980

Age (Year Built)	Region #	Region %	East Greenwich #	East Greenwich %	Jamestown #	Jamestown %	Narragansett #	Narragansett %	North Kingstown #	North Kingstown %	South Kingstown #	South Kingstown %
1970-1980[2.]	6,471	26	569	16	498	31	1,809	39	1,477	17	2,118	33
Year Round Units: 1960-1970	5,787	23	1,089	30	237	15	1,123	24	2,553	30	785	12
Year Round Units: 1950-1959	3,420	14	551	15	123	8	769	17	1,226	14	751	12
Year Round Units: 1940-1949	2,244	9	171	5	65	4	306	7	1,283	15	419	7
Year Round Units: Pre -1939	6,802	28	1,235	34	681	42	646	14	1,939	23	2,301	36
TOTAL	24,724[1.]	100	3,615[1.]	100	1,604[1.]	100	4,653[1.]	100	8,478[1.]	100	6,347[1.]	100

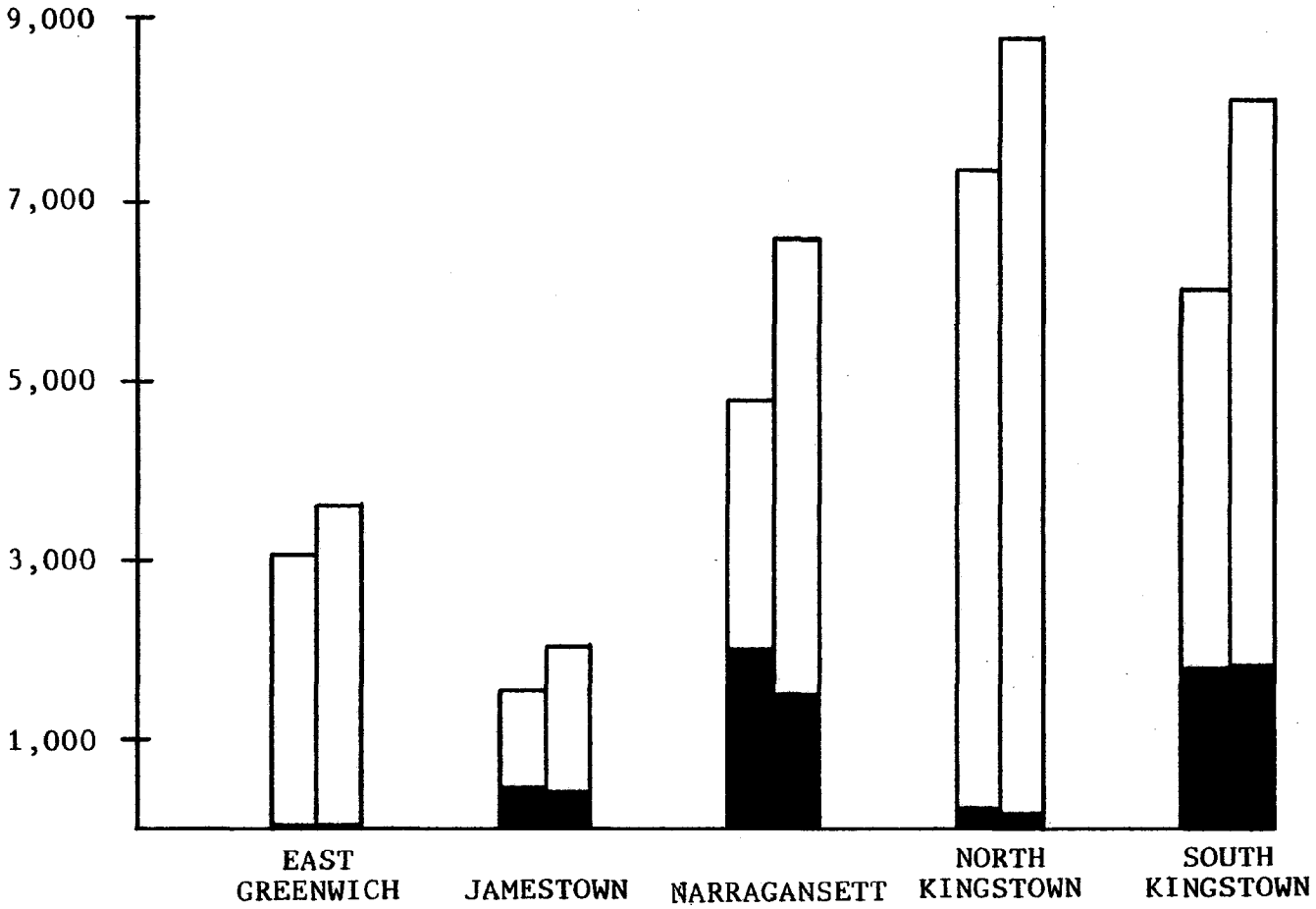
Source: Coalition of Coastal Communities
Bureau of Census, 1970 and 1980.

1. Assumes new stock for year-round use.

2. Difference between total units in 1980 and total units in 1970 -- i.e. total new construction. May be inflated by new seasonal units.

Figure III-5

Seasonal Housing as a Percent of Total Housing Stock:
1970 and 1980



Source: COALITION OF COASTAL COMMUNITIES
CENSUS OF POPULATION AND HOUSING, 1970 and 1980

40% of its existing year-round housing was constructed over the last ten years. East Greenwich and North Kingstown experienced their largest housing boom in the 1960s at the same time the Navy bolstered its forces at Quonset Point-Davisville; by 1975 the Navy withdrawal provided housing resources within the community and dampened new housing construction.

Housing growth in the West Bay Region follows historic preferences for single-family homes. Nowhere is this trend more evident than the recent census figures (see Table III-9), that reveal that single-family homes in the West Bay Region over the last decade captured an increasing share of the total housing stock growing from 73% of the housing in 1970 to 80% of the stock by 1980.

Of particular importance to the region is the fact that traditional single-family housing development brings higher costs to communities in terms of roads, services, and public facilities than the revenue it generates. It is also the type of housing that consumes the most land. To decrease population density, slow growth and effect a rural visage, communities have down-zoned large areas (Figure III-6) Municipal Zoning). The figures in Table III-7 describe the conversion of open, agricultural, and forested land to light residential use. Research has shown that large lot zoning may have potential negative impacts. It raises the cost of housing excluding a greater share of the population. Community expenditures grow as public services and facilities are spread over a wider area leading to inefficient and costly systems. Finally, it may actually prove more attractive and precipitate additional growth.

The preference for single-family homes in the region is shown, too, in building permit data Table III-10 for the last decade. Between 1971 and 1980, 77% of building permits in the region were for single-family homes. In three of the five study towns single-family housing starts accounted for more than 90% of the housing.

The preference for single-family homes is inexorably linked to another characteristic of importance: the growing predominance of owner-occupied homes. Between

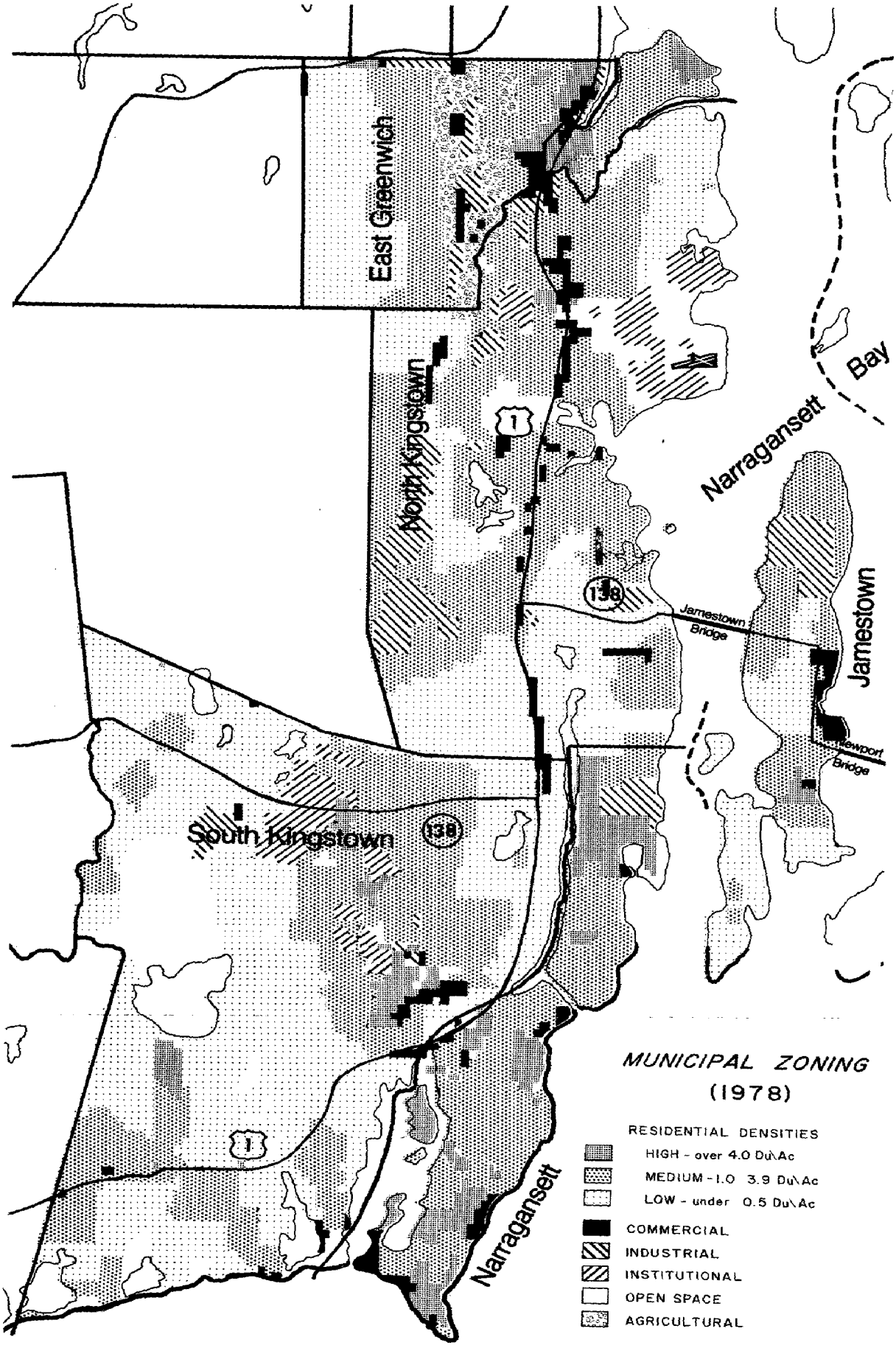

East Greenwich
North Kingstown
South Kingstown
Narragansett
Narragansett Bay
Jamestown
Jamestown Bridge
Newport Bridge
1
138
MUNICIPAL ZONING
(1978)
RESIDENTIAL DENSITIES
HIGH - over 4.0 Du\Ac
MEDIUM - 1.0 3.9 Du\Ac
LOW - under 0.5 Du\Ac
COMMERCIAL
INDUSTRIAL
INSTITUTIONAL
OPEN SPACE
AGRICULTURAL

Table III-9

West Bay Housing Stock Characteristics: Dwelling Unit Structure
1970 and 1980

	REGION				EAST GREENWICH				JAMESTOWN				NARRAGANSETT				NORTH KINGSTOWN				SOUTH KINGSTOWN			
	1970	% Total	1980	% Total	1970	% Total	1980	% Total	1970	% Total	1980	% Total	1970	% Total	1980	% Total	1970	% Total	1980	% Total	1970	% Total	1980	% Total
Year-Round Units	18,253	100	25,355	100	3,046	100	3,612	100	1,106	100	1,631	100	2,844	100	5,089	100	7,001	100	8,637	100	4,256	100	6,386	100
Units in Year-Round Structure:																								
Single-Family	13,357	73	20,218	80	2,140	70	2,779	77	914	83	1,426	87	2,396	84	4,170	82	4,569	65	6,831	79	3,338	78	5,012	78
Two or More	4,459	24	4,776	19	854	28	776	21	192	18	204	13	448	16	916	18	2,056	29	1,528	18	909	21	1,352	21
Mobile Home	437	2	361	1	52	2	57	2	-	-	1	-	-	-	3	-	376	5	278	3	9	-	22	-

Source: Bureau of Census 1970, 1980

Table III-10

West Bay Region Housing Stock

Building Permits (New Starts)
1971-1980

	Single-Family	Multi-Family	Total	% Single-Family
East Greenwich	631	2	633	>99
Jamestown	479	19	498	96
Narragansett	1,150	872	2,022	57
North Kingstown	1,223	615	1,838	67
South Kingstown	1,722	23	1,745[1]	99
Region	5,205	1,531	6,736	77

Source: Rhode Island Builders Association

[1] Does not include recent addition of 214 housing units for the elderly.

1970 and 1980, at the same time that the number of West Bay housing was increasing by 28%; the number owner-occupied dwellings was swelling at twice that rate. A comparison of tenure trends is presented in Table III-11: Tenure. In 1970, 61% of occupied dwelling units in the region were owner-occupied; by 1980, that figure was 69%. Among the region's communities, sharp increases in owner-occupancy were noted in East Greenwich, Jamestown, and North Kingstown but were offset by an increase in the renter-occupied share of the unites in Narragansett. Market forces and the inherent tax benefits of home ownership have been a primary determinant in the shape of housing markets. In the West Bay the withdrawal of the transient Naval personnel accelerated the change from an evenly split renter-owner market in North Kingstown to a predominately owner-occupied market.

On the other hand, Narragansett has been, historically, the site of second or vacation homes. University of Rhode Island records indicate that in 1979 over 1,100 undergraduates listed Narragansett as their place of residence. This increase in renter-occupancy occurred over the same period of seasonal home decline described later suggesting that owners of second homes in the town are able, by renting the homes off-season, to control personal costs while preserving a rental market in an area hard-pressed for housing. As indicated by building permit data, Narragansett experienced almost an even split between the construction of multi-family units and the construction of single-family homes.

Seasonal Housing Conversion

For over a century, the coastal communities, especially Narragansett, North Kingstown, South Kingstown and Jamestown, have served as a haven for seasonal residents fleeing Providence or Connecticut and New York for the summer. Much of North Kingstown's seasonal housing stock lay in the path of the military base at Quonset Point-Davisville and was, consequently, eliminated in the early 1940s. Second or vacation homes still dot the coastal plain but significant changes have occurred over the last decade in the quantity of seasonal housing as well as its relative

Table III-11

West Bay Housing Stock Characteristics: Tenure
1970 and 1980

	Region		East Greenwich		Jamestown		Narragansett		North Kingstown		South Kingstown	
	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
Year-Round Occupied Units	16,444	22,835	2,905	3,451	962	1,524	2,368	4,525	6,178	7,492	4,031	5,843
% Owner-Occupied	61	69	69	76	71	79	61	56	51	70	69	70
% Renter-Occupied	39	31	31	24	29	21	39	44	49	30	31	30

Source: Coalition of Coastal Communities
Bureau of Census, 1980.

share of the total housing stock. This change is reflected in figures represented in Figure III-5 and Table III-12.

Table III-12

Seasonal Units in the West Bay Region
1970 and 1980

	1970	% Total Housing Units	1980	% Total Housing Units	% 1970-1980	Estimate[1] for 1981
Region	4,412	20	3,850	13	-13	5,966[2]
East Greenwich	3	--	3	--	--	NA
Jamestown	450	29	421	21	- 6	595
Narragansett	1,994	40	1,498	23	-25	2,747
North Kingstown	218	5	176	2	-19	264
South Kingstown	1,747	29	1,752	22	1	2,360

1. Wilbur Smith and Associates.

2. Summary of estimates for Jamestown, Narragansett, North Kingstown and SouthKingstown.

Source: Coalition of Costal Communities

Overall, the region experienced a 13% decrease in the amount of housing committed solely to seasonal use. These figures represent a 25% overall drop in the share of the housing stock seasonal units captured. South Kingstown was the only community that increased its stock of seasonal units but the increase failed to maintain previous year-round-to-seaonal ratios. Estimates prepared by Wilbur Smith and Associates reflect an anticipation of continuing previous trends and are in sharp contrast to actual 1980 figures.

This definitive reversal follows a decade of substantial increases in the costs associated with the housing market. Increases in mortgage rates, in land and construction costs, house values and property taxes, and housing maintenance expeditures have placed ownership of housing beyond the means of an increasing segment of the population. These same forces have operated to diminish the quantity

of housing units used solely on a seasonal basis and have led to a new trend: the conversion of this housing for year-round use.

The impacts of conversions have not fully been assessed but the implications of this trend continuing are staggering, especially in Jamestown, Narragansett, and South Kingstown. Growth, to an extent, has been controlled by zoning controls, subdivision regulations, the permit process, and the attendant time lags associated with new housing developments, as well as the availability of vacant housing. In Narragansett, South Kingstown, and Jamestown the seasonal housing still represents almost one-quarter of the entire housing stock. A scenario where a majority of the seasonal stock is converted to year-round use is no longer implausible. Narragansett and South Kingstown already have a readily available set of rental consumers -- the University of Rhode Island students and staff. At the same time, events such as the current property revaluation process which, in Narragansett, has more than tripled property values and added to the tax assessments, could conspire to force seasonal homeowners to seek means to cover their increasing costs. Were these housing cost pressures to persist, and the demand for rentals continue, the seasonal stock represents an immediate source of housing. Admittedly, some units would require a winterization effort but time needed to accomplish these processess would be considerably less than that required by new construction. While it is unlikely that the entire seasonal stock would succumb to year-round use, a decrease similar to that between 1970 and 1980 could add (based on current regional densities) 1,400 residents. Most of this impact, naturally, would be felt in Narragansett, South Kingstown, and Jamestown. Communities already concerned with growth have little control over existing structures except in its conversion to additional units. Accelerated population growth from conversions would sorely and rapidly tax water, sewer, schools, and other municipal services and overturn current efforts in the region to control and time growth. The conversion of seasonal housing for year-round use in coastal areas such as Bonnet Shores and

Pettaquamscutt has shrunk the ability of the soils to absorb waste necessitating the sewering of the area.

Development of Shorefront and Coastal Areas

Between 1975 and September, 1979, 42% of the building permit assents for coastal develoment in the entire state were for the five towns comprising the West Bay Region. In this period Narragansett and Jamestown were the two communities with the greatest amount of activity. This confirms the belief that waterfront property continues to attract development. The change is most evident in coastal areas such as Eastwood Look behind Scarborough Beach in Narragansett, along the Narrow River in South Kingstown and Narragansett, in the coastal plain in South Kingstown, and along the Bay in Jamestown. This trend is directly counter to the current recognition of the importance of preserving and protecting the shorefront for the health, welfare and benefit of the public. Moreover, much of the coastal land has historically been the site of agricultural use, wildlife habitat, or recreation areas.

Housing Costs

Between 1972 and 1980 the average cost of single family housing in the region rose almost 70% as shown in Table III-13. By far the leader in sales price increases was the Town of Jamestown where the average price grew by 90%. Sales of seasonal and smaller homes in Narragansett and South Kingstown may have offset the sales of larger-priced homes. The sluggish housing market that occurred nationwide during the first half of the decade is exemplified by the change between 1972 and 1975. By 1980, the market in the region had recovered. In addition, East Greenwich had been identified in 1981 as the community with the highest mean sales price statewide. Unfortunately, 1980 Census figures for socio-economic indicators have not been released. Of interest would be a comparison of housing cost change and

change in household incomes. Such information would permit a more extensive analysis of the affordability of housing in the region.

Table III-13

Mean Sales Prices in West Bay Region
For Single-Family Homes

	1972		1980		
	Mean Price	Number Sales	Mean Price	Number Sales	Percent Change 1972-1980
East Greenwich	50,078	200	83,750	55	67
Jamestown	33,075	83	62,750	57	90
Narragansett	31,374	214	47,750	42	52
North Kingstown	32,223	568	55,750	45	73
South Kingstown	30,759	212	49,750	55	62
Region	35,502	1,277	59,950	51	69

Source: Sales Abstracts, Cities & Towns
Rhode Island Department of Equalization

Housing Demand

The demand for housing in the region is reflected by several indicators. First, building permit applications considered in Rhode Island as a sign of actual construction show that, except for the nationwide housing slump between 1973 and 1975, the demand for new housing has been constant with a drop around 1980. By mid-1981, when mortgage rates had hit their all-time peaks, the towns in the region were still receiving building permit applications. Moreover, as seen in Table III-14 figures for 1981 indicate an increase over the same period of time in 1980. This is in sharp contrast with nationwide reports of little or no activity in the housing market.

Table III-14

Building Permits for First Three Quarters of the Year

	January - September 1980	January - September 1981
East Greenwich	22	26
Jamestown	24	26
Narragansett	44	42
North Kingstown	39	51
South Kingstown	73	77
Region	202	222

Another indicator of demand is the vacancy rate. A "normal" vacancy rate of approximately 5.0 is desirable to allow for free movement and choice within the housing market. By those standards the region and its member communities falls short overall in the availability of housing. The difference between rental and owner-occupied vacancy rates is reflective of previously described attributes of the housing stock. Jamestown shows itself to be exceptionally short in rental units while Narragansett, in 1980 (44% renter-occupied) had a larger vacancy rate. The preference for single-family homes is shown, too, in the low vacancy rates for owner-occupied homes (Table III-15). The owner-occupied vacancy rate in East Greenwich conforms to expectations and even falls below the region average. Finally, the demand for housing may well increase even if projected growth rates fail to materialize as nationwide trends toward smaller households continue. Between 1970 and 1980 the average number of persons per household in the region dropped (Table III-16). The changing size of households may dictate a demand for changing type of housing.

Table III-15

West Bay Region Housing Characteristics
Vacancy Rates
1980

	Overall Vacancy Rate	Rental Vacancy Rate	Owner-Occupied Vacancy Rate
East Greenwich	2.2	1.5	0.8
Jamestown	2.1	0.5	1.7
Narragansett	3.0	1.8	1.2
North Kingstown	2.7	1.2	1.5
South Kingstown	2.6	1.5	1.1
Region	3.3	2.0	1.3
State	3.7	3.1	0.6

Source: Census of Population andHousing, 1980.
Coalition of Coastal Communities, OCS Impact Study

Table III-16

Average Number Persons/Household

	1970	1980
East Greenwich	3.29	2.71
Jamestown	3.00	2.31
Narragansett	2.99	2.35
North Kingstown	3.44	2.61
South Kingstown	3.05	2.40

The Trends and Recognition of Problem Areas

Five of the major trends have already been demonstrated: the conversion of seasonal housing for year-round use; the consumption of rural land for large lot residential areas to meet the demand for single-family homes; the rapid growth in year-round units, in the face of escalating nationwide housing costs; the preponderance of owner-occupied dwelling units; and the continued demand for housing in the region.

The results of these trends have brought a recognition in the region of the costs of development: the cost of extending sewer lines; the cost of servicing large scattered populations with water, roads, schools, police, and fire services; the loss of prime agricultural, forested, and open land; and, the loss of rural character. A lack of sewers (in parts of South Kingstown, Jamestown, East Greenwich and all of North Kingstown) prevents intensive use of the land, but at the same time the desire to preserve open space and the constraints of ISDS and the soils forced the towns to turn to large-lot zoning. At a time when agriculture, forests, and open space for recreation or green belts have regained the interest of local government, the communities are wrestling with single-family developments that burden municipal finances, and threaten these lands.

In this gap, multi-family housing has emerged as potential for accommodating growth, intensifying the use of land where public facilities exist and providing housing choice and diversity. In 1980 multi-family housing represented only 20% of the housing stock in the West Bay Region (Table III-2). Several trends are taking place with regard to multi-family units.

One trend, already firmly entrenched nationwide in urban areas has appeared over the last decade in the region: the condominium. While some areas of the region, notably East Greenwich, report the conversion of apartments to condominiums, emphasis has been placed on the construction of new units. Several characteristics

of condominiums as a form of multi-family housing should be noted. First, real estate experts concede that condominiums attract a different population than single-family housing, in particular, single individuals, and young, married and older, retired couples. It is not, as some may still believe, a valve to siphon the growth pressure from rural lands. Condominiums do not take pressure off the development of single-family housing unless controls are placed on single-family growth.

Secondly, condominiums tend to locate in areas of unique natural resources and create situations of intensified land use. Finally as with any form of intensified land use, condominiums can contribute to accelerated growth. To date, communities have treated the condominium as an urban or suburban use and tried to tailor locational decisions by requiring sewers for multi-family units. Recent condominium proposals and construction in the region are presented in Table III-17. Except where noted, the condominium proposals consist mainly of one and two bedroom units. All condominium construction has been built on sewered land, except in North Kingstown where sewers are not available. Most projects included extensive open space and reflected a density below that permitted by current zoning. Only the proposals already denied and those for East Greenwich represent an increased intensity of land use.

The non-urban nature of the region in combination with an urban-type housing like condominiums has led to a second trend in the region -- the clustering of units. As development costs rise, the benefits of large-lot development with its attendant extension costs, road costs, and urban sprawl plummets. The developer benefits from reduced costs which will hopefully be passed to the consumer. The community also profits as shown in Table III-18 from the reduced roads (many condominium projects retain the roads), a decreased sprawl of homes to service with fire, police and school buses, and the preservation of open space.

Table III-17

Condominiums[1] in the West Bay Region
January, 1982

Name (and/or location) of Existing Condominiums	Town	Construction Stage	# Units	Status of Units	# Acres	Other Comments
Heritage Gardens	NK	Completed	16	8 sold 8 rented		
Cedarhurst	NK	Partially Completed	102 townh. 22 s.f.		132	
Pier Village (1975)	N	Completed	88			
Shadow Farm	SK	3 Units Completed	60	2 sold	70	Retail Shops
Sweet Meadows	N	Completed		N.A.	N.A.	
RECENT PROPOSALS						
Jerry Brown Farm	SK	Proposal Denied	360		217 (83 to be left vacant)	Now proposal for 185 s.f. homes.
Polo Grounds	N	Proposal Approved 12/81	176		178	136 acres left vacant 53 three-bedroom units
Pt. Judith	N	Proposal Under Review	35-40			# units reduced from 78 ; 2-bedroom construction linked to sewer plant expansion .
Guisti-Woodland Greens Golf Glub	NK	Proposal Under Review , Needs Zone Δ to m.f.	60		67	Location Possible conflict in groundwater Aquifer.
Commerce Oil	J	Proposal Denied	240		200	Zone Δ denied in 2-acre min. district → 52 s.f. homes.
Middle Road-Route 2	EG	Under Construction	93		47.9	In sewered land m.f. zoning would permit up to 206 units
Post Rd.	EG		N.A.			
Waterfront	EG		N.A.			
Barton's Corner	EG		N.A.			

[1] Does not include condominium conversions

Table III-18

Illustrative Example of Municipal Costs and Revenues
Typical Residential Product Types
Town of North Kingstown

	Large Lot Single-Family Detached Unit[1]	Single-Family Attached Townhouse Unit[2]	New Garden Apartment Unit 3
Estimated Revenues	$ 1,470	$ 825	$ 550
Estimated Costs			
Schools	2,350	600	300
General Fund	290	190	180
Total	$ 2,640	$ 790	$ 480
Net Balance (Deficit)	($ 1,170)	$ 35	$ 70

1. Assumes sales price of $80,000 for 4 bedroom house on one acre of land, with 1.6 school children and household size of 4.0 persons.

2. Assumes sales price of $45,000 for 2 bedroom unit, with 0.4 school children and average household size of 2.6 persons.

3. Assumes mothly rent of $250 for 1 bedroom unit, with 0.2 school children and average household size of 2.5 persons.

Source: Gladstone Associates.

While the condominium may fill the need for owner-occupied housing for a select population, the rental vacancy rate indicates a substantial need for multi-family housing, for rent. A survey conducted by the Planning Department of South Kingstown discovered waiting lists at every apartment complex. Both North Kingstown and Narragansett experienced large increases (see building permit data) in multi-family housing stock over the last decade and were subsequently forced by the end of the 1970's to declare moratoria while new guidelines were developed. At present, little land is zoned for multi-family units in the region. New zoning tied to soil constraints in North Kingstown effectively bars apartment development.

Several sites in the village areas of Jamestown and South Kingstown are currently zoned for multi-family units but little or no development has occurred due to tight money market conditions.

Finally, compounding the shortage of multi-family rental units is the inadequate supply of low and moderate cost rental housing, in particular, housing for families (Table III-19). Subsidized developments in the region have waiting lists of a year of longer. While the need for additional housing is recognized, town officials are looking to the private sector to provide it. However, resistance to wholly-subsidized projects exists; proposals to rehabilitate Navy housing into a cooperative for moderate income families met strong oppsoition in North Kingstown. South Kingstown's Housing Element of the Comprehensive Plan suggests that single-family scattered subsidized dwellings would be preferable to a project that resulted in economically segregated residential areas. Such results could be obtained through the use of Section 8 Existing Housing Certificates. However, current federal proposals indicate severe cutbacks or total elimination of funding for housing subsidies.

Community Action

After the residential boom (30% increase) of the 1960's, East Greenwich adopted zoning and subdivision regulations that town officials today concede slowed the town's housing growth. Over the last decade similar actions took place regionwide.

Today, the West Bay communities have adopted additional land use controls to manage and, hopefully, direct growth. East Greenwich relies on its current subdivision regulations and zoning adopted in 1975 that added 2-acre minimum-sized lots in the rural western half; a condominium ordinance is in preparation but the town is limited in the growth controls it can adopt by the existing state enabling laws.

Table III-19

West Bay Region Housing Characteristics:
Building Permits
(& New Starts)

	1971			1972			1973			1974			1975			1976			1977			1978			1979			1980			Total 1971-1980			
	SF	MF Units	T	SF	MF Units	T	SF	MF Units	T	SF	MF Units	T	SF	MF Units	T	SF	MF Units	T	SF	MF Units	T	SF	MF Units	T	SF	MF Units	T	SF	MF Units	T	SF	MF Units	T	% SF
East Greenwich	60	2	62	86	-	86	84	-	84	46	-	46	51	-	51	84	-	84	76	-	76	57	-	57	51	-	51	36	-	36	631	2	633	99
Jamestown	56	-	56	77	11	88	66	-	66	32	-	32	27	-	27	40	6	46	38	-	38	59	-	59	45	-	45	39	2	41	479	19	498	96
Narragansett	197	157	354	178	92	270	109	48	157	82	90	172	75	-	75	116	-	116	89	-	89	133	48	181	99	-	99	72	37	109	1,150	872	2,022	57
North Kingstown	164	182	346	157	44	201	93	9	102	62	26	88	80	-	80	99	6	105	137	115	252	214	103	317	153	122	275	64	8	72	1,223	615	1,838	67
South Kingstown	135	21	156	207	-	207	181	-	181	128	-	126	190	-	190	260	-	260	153	-	153	181	2	183	194	-	194	95	-	95	1,722	23[1]	1,745	99
	612	362	974	705	147	852	533	57	590	348	116	464	423	-	423	599	12	611	493	115	608	644	153	797	542	122	644	306	47	353	5,205	1,531	6,736	77

SF = Single-Family Dwelling Units
MF = Multi-Family Dwelling Units

Source: Rhode Island Builders Association

1. Building permit data fails to include recent addition to elderly housing stock.

Jamestown is reviewing a new zoning ordinance which complements its recently approved Comprehensive Plan. The ordinance includes two new categories: the 2-acre and the 5-acre lot, for farmland and fragile and watershed areas, respectively. In addition, intensive use of the land for residential purposes is directed to the village center. Clustering is encouraged in undeveloped areas.

South Kingstown, Narragansett, and North Kingstown have in place residential cluster ordinances that are expected to encourage group residential dwellings and the preservation of open space. North Kingstown is relying on its innovative overlay system and clustering to preserve remaining open land.

Conclusions and Recommendations

Future housing in the West Bay Region must be tied to decisions about open, agricultural and forested land or the communities risk losing a historic rural character, recreation sites, wildlife retreats, and a tourist attraction. Local officials concur the questions then are how to accomplish this process and what time frame exists.

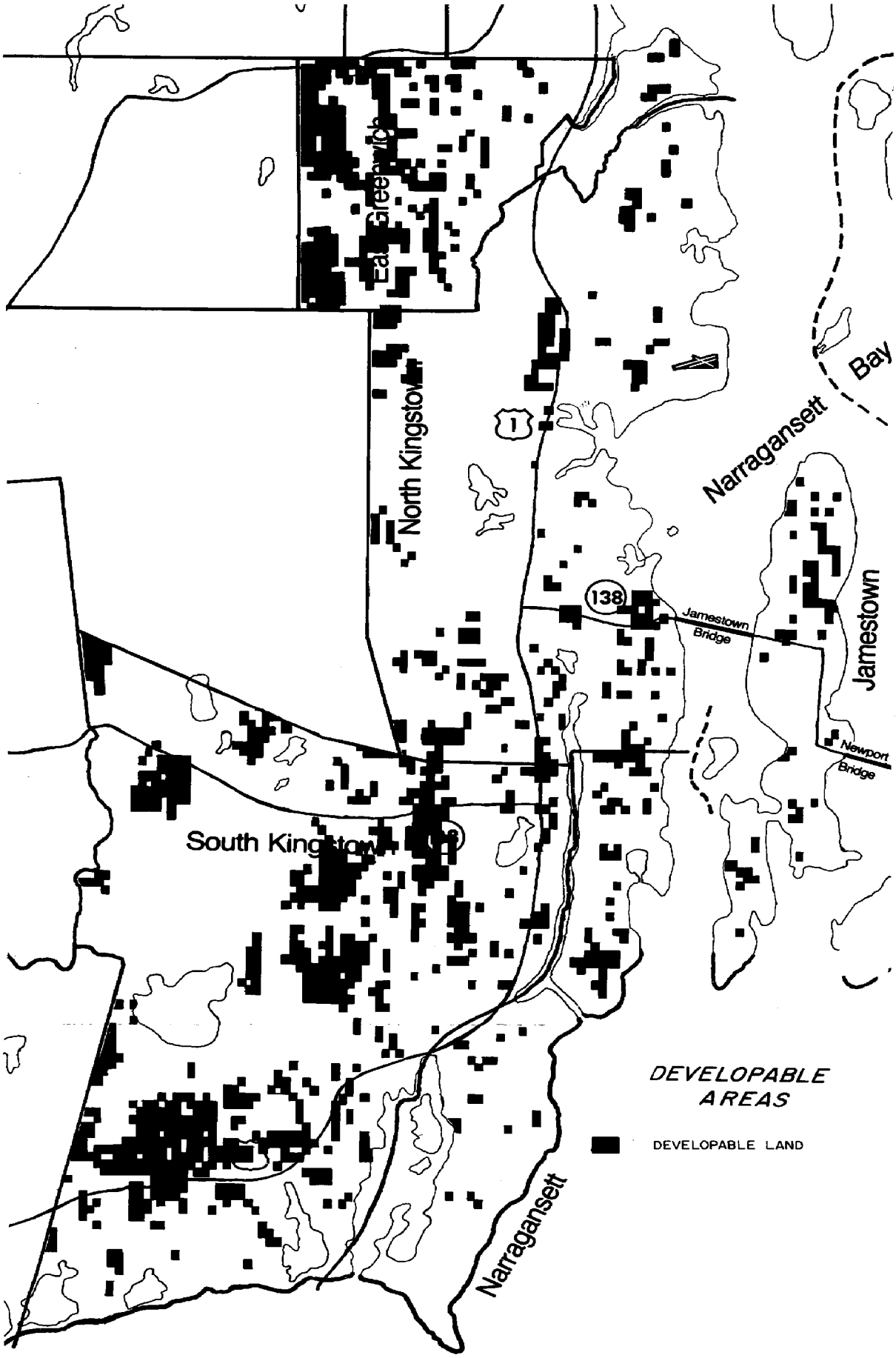
The OCS study suggest that communities need to take immediate action. Jamestown, Narragansett, North Kingstown and South Kingstown have already begun the task with the complete updating of their Comprehensive Plans, a step that provides a substantive basis for making future land-use decisions.

The process is facilitated by research already conducted by various state and federal agencies (listed in the bibliography) which identifies, among other things, natural and critical areas, historic and cultural sites, prime farmland and wetlands, as well as management options. In addition the R.I. Statewide Planning Program has developed a computer-catalogued environmental inventory capable of generating an extensive amount of information about land, its use, and existing land-use conflicts. One product of the inventory work has been a land capability analysis which identifies land most suitable for development (Figure III-7);

consideration in this analysis was given to infrastructure availability (sewer and water), natural constraints (wetlands, slope, flood zones) and resource and policy constraints (agricultural soils, groundwater aquifers, natural and historic areas and water quality).

The second task involves the incorporation of new and innovative tools to the arsenal of land use management techniques. The West Bay towns are now handicapped by existing zoning enabling legislation. Land management legislation that would expand the regulatory capacity of municipalities has, to date, been defeated in the legislature. The Rhode Island League of Cities and Towns has drafted and will be proposing an amended state zoning enabling Act which, if passed, will update the existing legislation originally passed in 1923. Land use concerns, growth patterns, and pressures for development have changed considerably over the last half-century. This new Act would enable the West Bay towns and R.I.'s other communities to address these issues through the use of clustering, planned unit development, and other ordinances that take a comprehensive approach.

It is encumbant upon all communities to act, for the decisions in one town may well affect the growth patterns of another.


East Greenwich
North Kingstown
1
Narragansett Bay
138
Jamestown Bridge
Jamestown
Newport Bridge
South Kingstown
Narragansett
DEVELOPABLE AREAS
DEVELOPABLE LAND

Land Use

The growth and change that has occurred in the West Bay Region, and is documented in the population and employment figures for the region are further revealed in its patterns of land use. Historically, agricultural uses, open space, and forests predominated during the early settlement of the West Bay Region up until World War II. Paralleling this development was the birth (and quick growth) of the tourist and recreation industry along the coastline. The first hotel built in Narragansett Pier was constructed in 1856. The popularity of the coastal communties has never waned.

The advent of the automobile and the highway brought the coastal communities within commuting distance of centers of employment and opene4d the West Bay Region to suburbanization.

Among the West Bay communities, East Greenwich felt the pressures of develoment first. In addition, the arrival of the Navy at Quonset Point-Davisville in the 1940s and the growth of the University of Rhode Island in South Kingstown signaled major changes in the face of the West Bay area.

In spite of the withdrawal of the Navy in 1974 from North Kingstown, the region has acquired more growth from new industry, more commercial centers, and an increased residential population.

The figures presented here are part of the Rhode Island Statewide Planning Program Environmental Inventory, a computerized system for analyzing land use. As described in the Coastal Community Land Use Review the "characteristics of this system and process used to generate various computer data...unavoidably involves some generalization of the data." the "predominant use within a cell" influenced the assignment of that cell to a land use category resulting in "specific acreage figures...[that] may not agree exactly with empiracal measurements.* While the inventory has some limitations in terms of preciseness, it provides a general overview of changes and is one of the few sources of data for two time periods.

*Coastal Community Land Use Review

Figures in Table III-7 reflect trends from 1970-1975 that continue as corroborated in conversations with local officials. Two trends in the West Bay Region are evident: 1) the diminution of forested, open space, and agricultural lands; and, 2) the substantial increase in the use of residential land for low-density housing.

The development of residential areas on rural land coincides with local efforts to lower the housing densities outside their village centers where the land usually lacks public services such as sewers or water or both.

The five communities have taken varying land use management approaches to the current situation.

Open and Agricultural Lands

Between 1970 and 1975, over 2,700 acres of open, agricultural, and forested land in the West Bay Region was converted to residential use. This is the land that has, historically, defined the rural character of the region. The loss of agricultural land is a region-wide problem. Between 1970 and 1979, the region suffered a loss of 59% of its agriculturally-used land. Land use management tools such as large lot zoning and use-value taxation are being used to protect and retain prime agricultural land; however, the protection of this land from residential developments may be difficult as over 70% is suitable for development with septic systems.

Agriculture

Between 1970 and 1979, over 9,500 acres of farmland in the West Bay Region was converted to other uses. This figure represents an average loss of about 1,100 acres per year and a 59% drop in that time period. Within the region, the towns of Narragansett and East Greenwich experienced the sharpest decline in agricultural land, 74% and 83%, respectively (Table III-20). Atthe same time, figures recently released by the Governor's Task Force on Agricultural Preservation indicate that between 1969 and 1974 the amount of land in all of Rhode Island in agricultural use decreased 12% continuing a decline that began in 1950. However, the Census of Agriculture in 1978 shows a +9% rise in the amount of agricultural land in the state

between 1974 and 1978. Unfortunately, a lack of comparable data at the town level leaves open to question whether the 9,000+ acre loss of farmland between 1970 and 1979 represents a total decline in the region. Actually it shows a trend similar to the state: a decline between 1969 and 1974 and an increase between 1974 and 1979. It is known that agricultural land in Washington County increased, overall, twenty-four percent between 1974 and 1978. In any case, while state and local officials are encouraged by the 9 percent increase, historic trends would point to a continuing decline without a change in land use management techniques. Since the mid-1800s an increase in the amount of land farmed has been reported only three times.

Table III-20

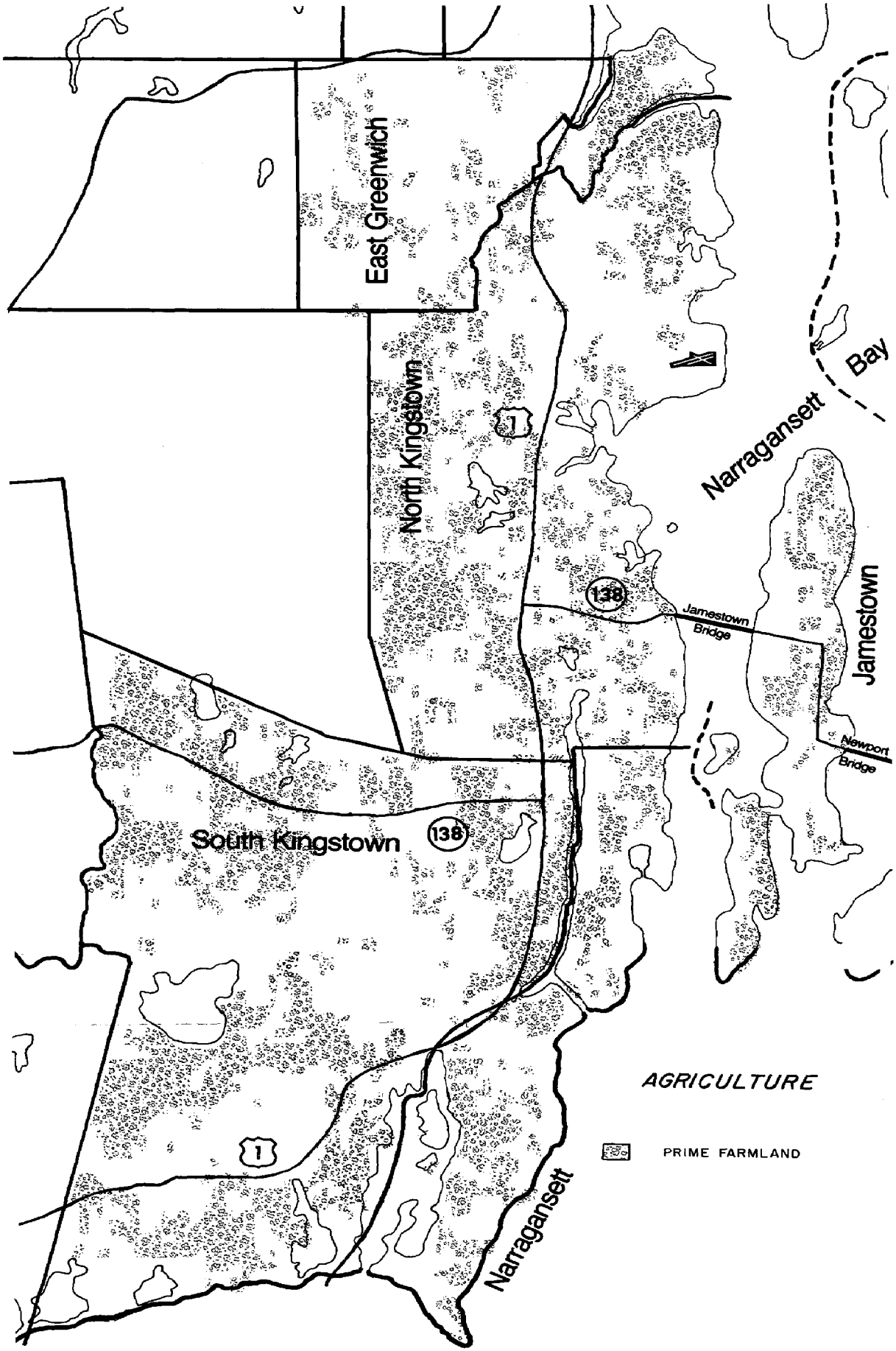
Agricultural Land in the Region
1970 and 1979

	1970[1]	1979[2]	Percent Change
East Greenwich	1,298	340	-74
Jamestown	1,744	711	-59
Narragansett	1,235	207	-83
North Kingstown	4,849	1,648	-66
South Kingstown	7,212	3,733	-48
Region	16,338	6,639	-59

1. Land & Vegetation Cover in R.I., U.S. Dept. of Agriculture, July, 1974, Bulletin #200; Preserving Open Space, 1978.
2. Governor's Task Force on Agricultural Preservation, 1981.

Source: Coalition of Coastal Communities

The loss of farmland in the region is representative of the land use conflicts facing these coastal communities. The land in the coastal region has been characterized as the most prime land in the state. Yet, today, in the face of inflation and increasing construction and land costs, the pressure for development remains constant. Considerable prime farmland still exists in the West Bay communities and is shown in Figure III-8. In sharp contrast to the actual prime farmland in the


East Greenwich
North Kingstown
South Kingstown
Narragansett
Narragansett Bay
Jamestown
Jamestown Bridge
Newport Bridge
138
1
AGRICULTURE
PRIME FARMLAND

region is that amount that is actually in agricultural use (Table III-21).

A picture of agricultural activities in the West Bay Region and its relationship to the state is shown in Table III-21. While the region occupies only 13 total acreage in the state, it predominates in crop or tilled land and land committed to nurseries. One-quarter of all tilled land in the state is located in the region. South Kingstown accounts for over half of the agricultural land in the region and for almost three-quarters of the land actively tilled. In 1979 11% of the land in South Kingstown and 12% in Jamestown were in active agricultural use. A comparison of prime farmland and cultivated land as shown in Table III-22 shows that much of the prime farmland remains unused.

Recognition of the social, economic, and aesthetic roles farming can add to the community welfare is the first step in the preservation of farmland. Similarly, further steps to stem the loss of agricultural land revolve around an acknowledgement of land-use conflicts. Some of these conflicts are readily visible in a comparison of the previously presented figures, existing prime farmland and actual land committed to agricultural use.

The first conflict concerns the use of marginal land for farming. While the region contains an abundance of uncommitted prime farmland, some farmers are conducting agricultural uses on land that is less than prime. High land prices often put prime farmland beyond the reach of those interested in farming. In addition, uncommitted land is often being held for speculative purposes.

An overlay of prime farmland and current zoning reveals a second conflict. While discussions with community leaders revealed a region-wide belief in the importance of retaining a rural character to the area much of the prime farmland is currently zoned for development. Even land currently in agricultural use is zoned for development. While exact figures are not available, most of the prime farmland in the region is currently zoned for residential use. Few land-use management options are now available to Rhode Island communities wishing to retain land for agricul-

tural use. The use of special agricultural districts is not authorized by the existing general state zoning enabling legislation. Modification to current laws would enable communities to create exclusive agriculture zones.

For the present, community efforts on a reduced scale have addressed the farmland preservation issues. To impede development in agricultural areas East Greenwich in its most recent zone changes, created two farm districts where two acres is a minimum-sized lot. Similarly, South Kingstown, guided by locational factors, soil types, degree of urbanization, and potential "best use," incorporated two-acre zones in its last rezoning effort. Unfortunately, large lot zoning may not discourage growth but only serve to increase the costs of development (water lines, roads, etc.) and thus limit the amount of affordable housing. North Kingstown, in its new comprehensive plan (yet unapproved) deals with the conflict of residential uses of prime land by encouraging in prime agricultural areas the incorporation of residential clustering to preserve the farmland. Jamestown, too, has incorporated large lot zoning (two-acre) in undeveloped districts on the island; however, these efforts have ostensibly been directed at reducing residential growth. Outside the region the town of Foster, Rhode Island, made a commitment to farming by zoning some land for five-acre minimum-sized lots; none of the West Bay communities have taken such steps.*

None of the current efforts assures the preservation of prime farmland for agricultural use. North Kingstown and Jamestown each have one farm area that is listed on the National Register of Historic Places assuring its protection from federally or state-funded or licensed projects. The Dutra Farm, part of the Windmill Historic District, in Jamestown, and the Casey Farm in North Kingstown are actively farmed. The Sunset Farm in Narragansett has been identified as historic by the Rhode Island Historic Preservation Commission but lies idle and is zoned for residential development. The historic identification will not protect the land from de-

* Jamestown's proposed new zoning ordinance specifies five-acre lots in the watershed area.

Table III-21

Farm Activities in the Region and the State
1979
(in acres)

	Total Land Acreage	Tilled	Pasture	Nursery	Orchard	Open	Total Land Farmed	Percent of Town	% of State
East Greenwich	10,541	20	252	0	5	63	340	3	1
Jamestown	6,106	53	512	0	0	146	711	12	2
Narragansett	8,703	31	126	0	0	50	207	2	1
North Kingstown	27,148	641	614	276	9	108	1,648	6	4
South Kingstown	35,148	1,889	1,434	95	39	276	3,733	11	10
Region	87,646	2,634	2,938	371	53	643	6,639		
State	658,242	10,708	18,976	1,680	633	6,168	38,165		
Region Share of State	.13	.25	.15	.22	.08	.10	.17		

Source: Report of Governor's Task Force on Agricultural Preservation, Office of Statewide Planning.

Table III-22

Prime Farmland and Land Farmed
1979

	Total Acres	Prime Farmland	Land Farmed
East Greenwich	10,541	1,855	340
Jamestown	6,106	4,018	711
Narragansett	8,703	4,419	207
North Kingstown	27,148	10,309	1,648
South Kingstown	35,148	11,087	3,733
Region	87,646	31,688	6,639

velopment. South Kingstown in conjunction with the Coastal Resources Pond Study, is investigating the use of the transfer of developments rights (TDR) for the coastal plain, an area of prime agricultural land. TDR is a land use tool that would operate similarly to a land easement restriction and could serve to permanently protect designated land.

Population growth and its attendant increase in housing (between 1970 and 1980 the number of housing units in East Greenwhich grew at a rate 3 times the population increase) are quickly changing the character of a region where farmland once predominated. During the 1960s residential developments on agricultural land were facilitated by outdated zoning and weak subdivision regulations. East Greenwich experienced its largest residential boom during this decade; by the end of the decade strong subdivision regulations were in place and the residential growth spurt eased.

However, subdivision and zoning regulations have not eased the pressure for development on the coastal communities. Prime farmland is not only appropriate for agriculture but it is often highly suited for residential use. In 1979, over 70% of the existing prime farmland in the region was suitable for development and septic tank operation. Prime farmland is increasingly threatened by the acquired acceptability of the individual septic disposal systems. Financial constraints, political realities and locational factors have prevented the communities in the region from relying on the extension of sewer and water hook-ups as a growth management tool.

Almost one-quarter of the remaining prime farmland suitable for development in Rhode Island is located in these West Bay coastal communities. South Kingstown and North Kingstown (Table III-23) together account for 18% of the state's total. This availability of prime farmland in the coastal communities coincides with several growth trends which increase pressure for development and further threatens the existence of farmland in the region and the state:

- the near completion of the highway system linking employment centers with the primarily residential coastal communities;
- the increasing popularity of the coastal areas for year-round and seasonal homes;*

*CRC Coastal Ponds Study, CRMC assents.

- the establishment of West Bay regional commercial areas outside the metropolitan area;
- the growth of the industrial sector in the West Bay economy;
- population growth between 1960 and 1980;
- continued home-building at a time of national housing slump.

Table III-23

Prime Farmland by Suitability for Development

	Total Acres	Percent Prime	Prime Farmland Slight Limitations	Prime Farmland Severe Limitations	Total Prime Farmland Acres
East Greenwich	10,541	18	1,480	375	1,855
Jamestown	6,106	66	2,605	1,413	4,018
Narragansett	8,703	51	1,039	3,380	4,419
North Kingstown	27,148	38	9,037	1,272	10,309
South Kingstown	35,148	32	8,184	2,903	11,087
Region	87,646	36	22,345	9,343	31,688
State	658,242	21	95,576	43,111	138,687
Regional Share of State	.13		.23	.22	.23

Source: Soil Conservation Service

This growth pressure has increased the value of developed farmland forcing landowners to reassess the economic returns of farming.

The typical financial pressures of farming have led to several region-wide trends. In many instances subdivisions have eventually encircled farmsteads; landowners have bowed to pressure and either developed or sold for development their entire parcel. Several agricultural parcels in the Quidnesset area of North Kingstown and the coastal areas of South Kingstown have been transformed wholly (or are currently in transit) to residential subdivisions.

Pressure for development and financial incentives have led to a second region-

wide trend, the systematic dimunition of land at the farmland edge along public roads. The secondary impacts of such development include land-locked farmsteads, a proliferation of individual driveways along roadways, a reduction in the efficient use of land, and a diminishment in rural visage.

A renewed interest in farming and a growing recognition of the economic, social and aesthetic benefits at the state level is evident in the 1981 recommendations emanating from the Governor's Task Force on Agricultural Preservation as well as the expanded and updated version of the Farm, Forest and Open Space Act. First passed in the late 1960s, the bill permits the assessment of agricultural, forested, or open space land at its use-value for taxing purposes. To date, few farmers have availed themselves of the program; however, mandated re-evaluations of land recently completed in Narragansett and planned for North Kingstown and South Kingstown in the next two years will increase the importance of financial incentives for the farmer. Property value in East Greenwich was re-evaluated in 1975 and the community reports that farmers have used the Farm, Forest, and Open Space to reduce their tax burden.

To be effective a program of farmland presevation must be conducted on several fronts with a combination of land use tools. At the state level, agricultural preservation legislation is expected to be introduced in the next General Assembly session. One bill, The Right to Farm Act, would "limit nuisance actions against properly conducted agricultural operations, tracts encircled by residential developments. A second bill would eliminate the sales and use tax from farm marchinery purchased in Rhode Island. Farmers can now avoid the sales tax by purchasing equipment in other states. Finally, an attempt to update the state enabling zoning laws will incorporate language encouraging local ordinances that preserve agricultural land.

Support for this legislation must be generated at the local and regional level. The historic, social, and economic roles that agriculture has played in shaping these communities must be demonstrated to officials and townspeople.

Open Space and Forested Land

Betwen 1970 and 1975, over 100 acres of open, agricultural, and forested land in the West Bay Region was converted to residential use (Table III24).The loss of this land is particularly significant because it is this land that has helped define the non-urban character of the region. Over 60% of the land lost to residential construction was forested. This is the land that has provided open space, existing recreation areas, wildlife habitat, and a diversity from urban development.

Pressure for development continues on remaining open and forested land. In East Greenwich this represents the area west of Route 2. In South Kingstown housing units increased 35% overall in the town; however, housing units in the coastal plain increased 40%.* Similarly to agricultural land preservation, a combination of land use tools, such as clustering, open space zoning, use-value taxation, would be necessary to preserve the green areas of the region.

Recommendations

Information and educational presentations must be made to town councils, regional groups, local private groups (League of Women Voters) stressing the importance of preserving agricultural and open land and conveying this interest to state legislators. Agricultural land should be evaluated for its economic, social and historic value to the community. With farmer consent, these farms should be highlighted in the community. At present an agricultural land evaluation and assessment procedure is under development for use by the state office of the Soil Conservation Service of the U.S.D.A. This project will provide an analytical process for determining, through a combination of land and site evaluation, those lands most viable for continued and future agricultural use. Owners of large tracts of open land should be contacted and informed of the land's community value and ways to financially offset the cost of retaining the land in its open, forested, or farmed use. South Kingstown has already begun this process.

*CRC Coastal Ponds Study

It is unlikely that the communities in the region, given the appropriate enabling legislation, would enact exclusive agricultural zones. In keeping with the regional importance of private initiative, communities can utilize techniques that encourage the use of land for agricultural pursuits. Those communities with special enabling legislation, North Kingstown and South Kingstown, already encourage residential clustering to save land.

Communities should mandate clustering in certain areas and encourage conservation easements, land trusts, and other land use options that ensure a more efficient use of prime agricultural land. Tools such as the transfer or purchase of development rights should be adopted. Should the proposed zoning enabling legislation fail, special enabling legislation should be adopted in communities now lacking this control. Finally, comprehensive plans should be updated to reflect current trends.

Table III-24

Land Use Changes from 1970 to 1975 from Open Space to Residential Use in 1975

	Land Use in 1970 (in acres)				
				Residential Use in 1975	
	Agriculture	Open Space	Forest	Dense	Light
East Greenwich	20	20	420		460
Jamestown	20	30	90		140
Narragansett	110	60	310	180	300
North Kingstown	210	140	650	110	890
South Kingstown	130	190	380	50	650
	490	440	1,750	340	2,440

Source: R.I. SPP Environmental Inventory.

LAND USE CONTROLS

WEST BAY COMMUNITIES

	Subdivision Features	Zoning Ordinance Features
East Greenwich	- Land dedication for public recreation - Fees in lieu of land	- 4 residential, 3 farming, 4 commercial, 1 industrial - Planned Apartment Dwelling - Multi-Family on public sewer and water - Historic District - Proposed: Planned Apartment Ordinance

Jamestown	- Land dedication	- 4 residental, 2 commerical, 1 industrial, 1 recreation
		- Construction in watershed by special exception
		- Proposed Ordinance
		  - 5 residential, 3 commercial, 1 open space
		  - 200 ft. setback from wetland
		  - development plan in RR-200 zone
		  - multi-family by special exception
		  - density based on bedrooms
		  - cluster development
		  - 5 acre minimum in watershed

Narragansett	- Land dedication - Flocd specifications - Erosion control	- 4 residential, 2 industrial, 3 commercial - Multi-family by special exception - Residential Cluster
North Kingstown	- Land dedication	- Cluster Development - Residential Compound - Historic District - Overlay Zoning

LAND USE CONTROLS

WEST BAY COMMUNITIES

Subdivision Features

Zoning Ordinance Features

South Kingstown

- Residential Compound
- Land dedication

- 7 residential , 5 commercial, 2 industry, 1 public, high flood danger zone
- Flood Zone Requirements
- 150 Feet Setback from Wetlands
- Residential Cluster
- Multi-Family on public water and sewers
- Proposed: Planned Neighborhood Commercial Zone
  - Open Space Preservation via combination transfer of development rights, easements, tax relief
- Erosion Control

The Use of Land for Industrial Purposes

To preserve and broaden the community economic base, industry compatible with the character and resources of the region should be encouraged. To this end, all five towns have committed by zoning some portion of its land for industrial purposes. In 1978, 65% of industrially-zoned land in the region was still vacant, one-third of that in North Kingstown. At least half of the land zoned for industrial development over the last decade was carved from forested, open space, or agricultural lands. Half the industrially zoned land now vacant in North Kingstown is prime agricultural land and land use management techniques should be used to preserve it in this highest and best use. To prevent industrial sprawl, communities should encourage infilling at sites only partially developed.

The dramatic ten-fold increase in employment between 1970 and 1980 in the manufacturing sector reported earlier is also reflected in the figures from the Rhode Island Statewide Planning Environmental Inventory showing a 225% jump between 1970 and 1975 in the amount of land in the region committed to industrial use. Of the 780 acres identified by the Inventory as in industrial use in 1975, approximately half of that was carved from previously forested, open space, or agricultural uses, indicative of the increasing development of the more rural areas in the region.

Communities, historically, have shaped development patterns through the judicious use of zoning. Similarly, in the interest of preserving and broadening the tax base, land has been set aside by the West Bay towns for industrial use. Today, over 3,000 acres in the West Bay Region are zoned for industrial use. (FigureIII-7). 1978 Zoning Map.) These figures and the following discussion do not include the 850 acres at Quonset Point-Davisville excessed by the Navy in 1974 and now owned by the Rhode Island Port Authority. A detailed description of present and planned industrial growth at the former naval base is contained in Chapter 2 .

The results of a study conducted in 1978 by the Office of Statewide Planning indicated that only 11% of this land is actually used for industrial purposes.

These figures reflect similar statewide trends as shown in Table III-25. Of the 32 industrial sites in the region, 10 are totally occupied or committed. Regional importance, however, lies in the future of the partially vacant or empty tracts. Central to the issue are the following question: Is the use of this land for industrial purposes its highest and best use?

Several measures of accessibility define the suitability of land for industrial use: proximity to transportation such as rail and airport service or highway access; availability of public utilities like electric, gas, water and sewers. In addition, the size and/or shape of the land parcel plus soil types and natural limitations place constraints on the use of the land. Some of the land that is currently vacant consists of either smaller fragmented tracts that surround existing industrial uses or land that is partly swampy or ill-suited for develoment. A complete review of land suitability in the region for industrial use is provided in Table III-26.

The development of an industril "strip" along Route 2 in East Greenwich is an example of the conversion of farmland fringe urban uses. Along this segment Route 2 is a major state road with access to interstates. Of the 112 acres of vacant industrially-zoned land in East Greenwich, over 90% is located along Route 2 between Frenchtown Road and Division Street While some of this land has development limitations (swampy, flood hazard, stony soils), most is suitable for industrial use. Of the six industrial sites near Route 2 only one is totally occupied; the other five sites are partially developed and it can be expected this vacant land will remain in this use category until developed.

In a recent town decision, an additional six-acre agriculturally zoned parcel along Route 2 was re-zoned, in spite of public opposition, for industrial use to accomodate a West Warwick firm seeking to relocate in East Greenwich. The town's willingness to allow the private market to dictate the shape and pattern of growth in East Greenwich suggests that other open space, agricultural, or forested land, especially along Route 2, will be subjected to the pressures of development.

Table III-25
Land Zoned for Industrial Use, 1978

	Total Land Acreage	Land Zoned For Industrial Use	Industrially Zoned Land As Percent of Total Land	Number of Sites	Acres of Industrially Zoned Land In Industrial Use	Percent of Industrialiy Zoned Land	Acres In Other Use	Percent of Industrially Zoned Land	Acres Vacant	Percent of Industrially Zoned Land
East Greenwich	10,540	307	3.0	10	137	45.0	58	19.0	112	36.0
Jamestown	6,105	809	13.0	1	-		8	1.0	801	99.0
Narragansett	8,702	290	3.0	2	2	.7	87	30.0	201	69.0
North Kingstown	27,146	1,363	5.0	14	124	9.0	528	39.0	711	52.0
South Kingstown	35,147	239	1.0	5	59	25.0	63	26.0	117	49.0
Region	87,640	3,008	3.0	32	322	11.0	744	25.0	1,942	65.0
State	658,201	35,403	5.0		6,756	19.0	7,938	22.0	20,709	59.0

Source: Land Zoned for Industrial Use: Inventory and Analysis (First Update), November, 1978

Table III-26

Restraints on Land Zoned For Industrial Purposes, 1978

	Number of Acres	Number of Sites	Without Water		Without Sewer		Without Gas		Five Miles From Interstate Highway		Over Five Miles From Airport		Without Rail		Hazards		Soil Limitations	
			Acres	Sites	Acres	Sites	Acres	Sites	Acres	Sites	Acres	Sites	Acres	Sites	Acres	Sites	Acres	Sites
EAST GREENWICH	307	10	2	1	265	6	-	-	-	-	304	9	266	7	204	3	33	1
JAMESTOWN	809	1	809	1	809	1	809	1	809	1	809	1	809	1	809	1	809	1
NARRAGANSETT	290	2	-	-	-	-	20	1	290	2	290	2	290	2	290	2	270	1
NORTH KINGSTOWN	1,363	14	7	1	1,363	14	546	5	1,047	10	1,363	14	334	8	45	3	577	5
SOUTH KINGSTOWN	239	5	180	1	180	1	180	1	239	5	239	5	34	3	-	-	26	1
TOTAL	3,008	32	998	4(33%)*	2,617	22(87%)*	1,555	8(52%)*	2,385	18(79%)*	3,005	31(99.9%)*	1,733	21(58%)*	1,348	9(45%)*	1,748	9 (58%)*

Source; Land Zoned for Industrial Use: Inventory and Analysis (First Update), November, 1978

*Percentage of Acres

The extension of the existing "strip" could diminish the rural character town officials say they wish to preserve.

A small percentage (less than 1%) of the land currently zoned industrial in Jamestown has now been converted to other uses. The remaining 801 acres are vacant and highly unsuitable for industrial development. Once intended for an oil refinery, the site at the northern end of Conanicut Island is inaccessible, the soils have limitations for intensive development and portions of the tract are wetlands. The new zoning ordinance and maps currently under consideration would eliminate industrial uses from the island and change this parcel to a rural residential area more in keeping with the character of the island.

Industrially zoned land in Narragansett is divided into two sites, the fishing port at Galilee and a 270-acre tract which adjoins the Narragansett Bay Campus of the University of Rhode Island. The latter parcel is owned by the Narragansett Industrial Development Corporation, a subsidiary of the State's Department of Economic Development, and has been earmarked for water-related research industries. The site has public water and services but has not been able to attract many users partly because of a weak State marketing effort in the past.

As part of a five-year plan, the twenty-acre parcel at Galilee has been developed to feature Rhode Island's fishing industry. A fish processing plant was built with state subsidy at the site to capitalize on the industry's activities but is currently vacant after attempts by several different firms to receive an economic return failed. The building was recently acquired by a fish processing firm from Stonington, Connecticut. In addition, work has begun on the construction of two new 200-foot piers. The new piers will replace existing ones and will increase the capacity of the docking area from 24- to 32-foot boats and will allow the Point Judity Fishermen's Cooperative to enlarge its membership. No other parcels in Narragansett have been identified as potential industrial sites. The town expects future industrial growth to be limited to water-related technological

or fishing industries both to be determined primarily by the marketing practices at the state level.

Three of the five industrial sites in South Kingstown are totally occupied; a fourth site is half-vacant but the remaining land is poorly drained and ill-suited for industrial purposes. Approximately 60% of the fifth site, which represents over 75% of the total industrially-zoned land in the town, remains vacant. The land at this site, formerly in agricultural use, is well-suited to development but industrial growth has been constrained by a lack of public sewers and water, as well as locational factors. A town committee is currently reviewing the status of industrially-zoned land and will be making recommendations during 1982. Sentiments expressed during recent political campaigns reflected a consensus of opinion that only a minimum of additional industrial growth was anticipated in South Kingstown. At present, among the West Bay communities, South Kingstown has allotted the smallest percentage of its land for industrial use. A research park, a compatible industrial use in many university communities, has already been located in Narragansett.

In the 1978 study, 1,363 acres in North Kingstown were identified as zoned for industrial use outside the Quonset Point/Davisville complex. At the time of the study, over half of the land was vacant and only 9% was in industrial use. One small site has been partially developed for residential use and it is unlikely that incompatible uses will be permitted on the remainder of the tract; thus, the parcel should be re-zoned. A second parcel of land owned by Narragansett Electric fronts on the Bay; this tract was originally selected for the site of a nuclear plant but plans were subsequently withdrawn.

Two other large parcels, one at the intersection of Post Rd. and Frenchtown Rd. and the other located between Rts. 2 and 4, are only partially developed and still have extensive areas of vacant land, suitable soils, and good access to transportation, making the tracts prime for development. Future industrial growth should be directed at these tracts and at vacant land in the smaller partially

developed tracts.

Finally, three sites have regional importance and current zoning should be re-assessed in light of new scientific findings and changing trends. Twenty-seven acres at the southern end of Belleville Pond are currently zoned for industrial use. The western half contains fragile wetlands and soils and is unlikely to be developed industrially; the eastern portion is occupied by a junkyard but could potentially be developed. Portions of this tract overlay the groundwater reservoir as well as recharge areas. By definition, these areas should be protected by the new North Kingstown overlay zoning ordinance which specifies groundwater recharge and reservoir overlay districts and defines "acceptable land use." However, the zoning on this parcel should be changed to make it consistent with the ordinance.

The other two tracts consist of four hundred seventy acres located near the Exeter-North Kingstown boundary zoned for industrial use but currently in active turf farming and horticultural use. The soil is well-drained and these parcels are but a portion of a larger area that has been identified as prime agricultural land. Other sections, not designated for industrial use, have been zoned for residential use allowing this entire prime agricultural resource, important not only to the region and the state, to be the potential subject of future development. A zone change in combination with conservation easements and other land use controls would help to protect the agricultural uses. However, previous attempts to preserve this area through re-zoning have failed. Political realities may prevent any modification of existing regulations.

Recommendations

New industry brings added revenues and broadens the community tax base. New growth consistent with current regional trends, such as the fishing industry at Galilee or boating-related activities in Jamestown, should be encouraged. Likewise, any new industrial growth that would fail to preserve the character of the region or would have a deleterious effect on natural resources should be prohibited.

In keeping with the 1981 report of the Governor's Task Force on Agricultural Preservation, lands now zoned for industrial use but identified as prime agricultural land and already committed to agricultural use should be protected by re-zoning and any other land-use controls available. In North Kingstown, the overlay zoning system should be expanded to include an overlay that identifies prime agricultural land. Similarly, land ill-suited for industrial development (location, access, soil limitations, lack of public services) should be re-assessed in terms of its highest and best use.

New industrial growth should be encouraged to infill at existing sites. This process can be facilitated by additional public sector investments in roads, sewers, water lines, et cetera, at these sites.

New industrial park growth regulations should include extensive setback and landscaping requirements to preserve the rural quality of the region.

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Chapter Four

Onshore Regional Issues

Water Resources

Surface Water

Surface Water in the West Bay Region includes lakes, ponds, rivers, streams, reservoirs, and salt water bodies. The Region can be broken down into six drainage basins: the Pawcatuck River, Saugatucket River, Pettaquamscutt River, the Annaquatucket River, Hunt River and the coastal drainage area. The significance of the surface water resources lies in the recreational, aesthetic, and economic benefits it offers the Region. The value of these resources is dependent on the maintenance of its high environmental quality.

The water quality classifications of the fresh and salt water bodies in the West Bay Region are shown in Fig. IV-1.. The vast majority of these water resources are fishable and swimable. Table IV-1 lists the water bodies in the region and sources of pollution which threaten their water quality. Greenwich Cove, the Hunt River from Fry Brook to Forge Bridge, and Wickford Cove are the only major water bodies classified SC or C.

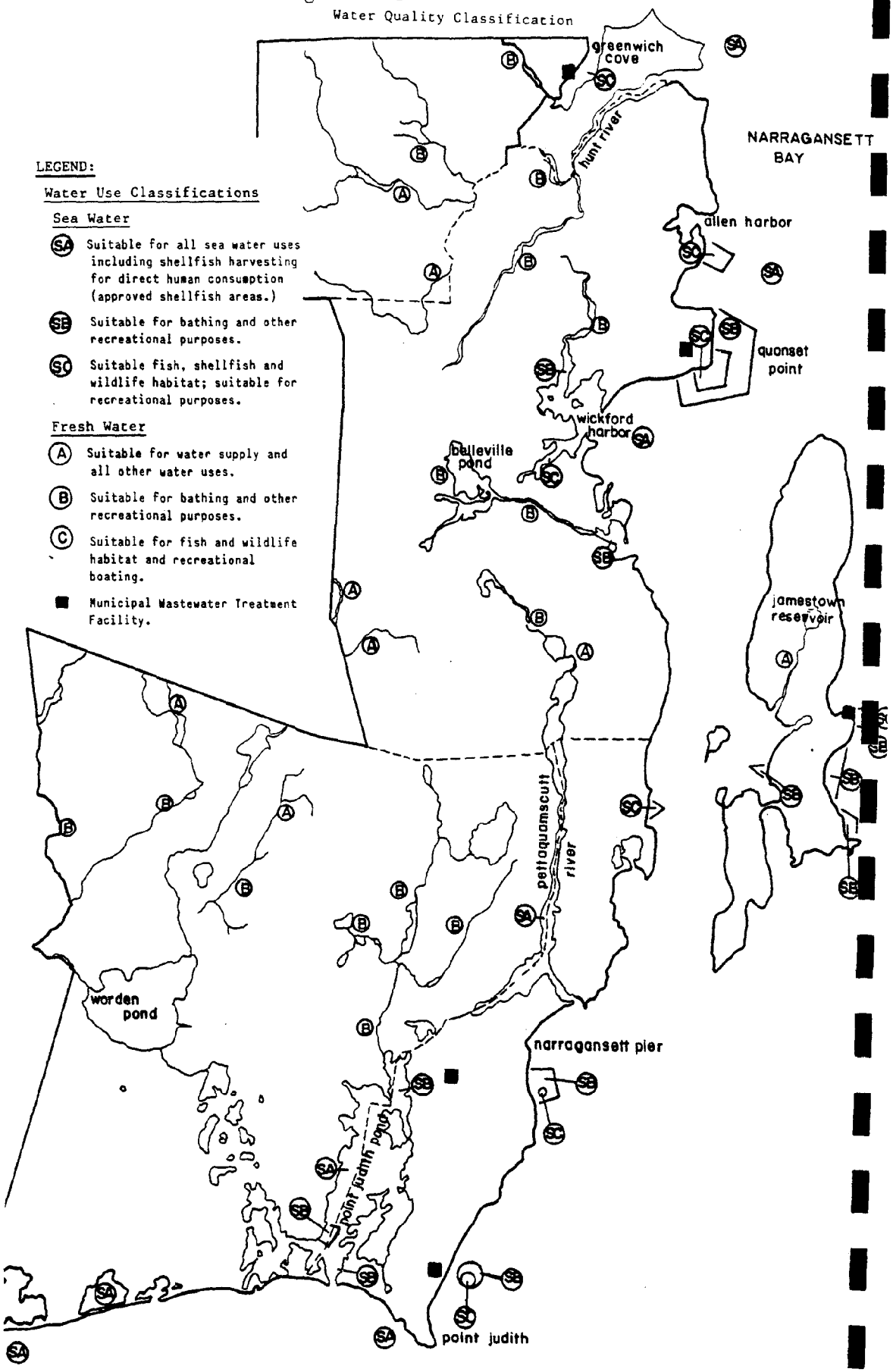
The major point sources of pollution in the region are the six publically-owned wastewater treatment plants (WWTP) and the one industrial WWTP (Table IV-1). The Region's non-point source pollution originates from groundwater, surface runoff, marinas, boats, and landfills.

Land-use in the drainage area, for the most part, determines the major sources of pollution for a water resource. Specific pollutants or groups of pollutants are associated with each source. Nitrogen is the most common contaminant carried in the Region's groundwater. Surface runoff transports a suite of pollutants, the concentration dependent on the land-use (Table IV-1). Petroleum hydrocarbons and human wastes enter the aquatic systems from marinas and boats. Whatever the source or transport mechanism, pollutants most often impact the regions surface waters by causing eutrophication or health hazard by high levels of pathogens.

Eutrophication is a major threat to the water qualities within the Region. Eutrophication is the process of overfertilization or the stimulation of growth by

Figure IV-1

Water Quality Classification



Source: Coalition of Coastal Communities

Table IV-1

State Water Quality Classification
and
Pollution Sources for West Bay Region

Water Resource	State Water Quality Classification	Pollution Source
East Greenwich:		
Greenwich Cove	SC	East Greenwich WWTP Urban Runoff Leachate from East Greenwich Landfill Boat Marinas and Anchorage
Maskerchugg River	B	Septic Systems Urban Runoff
Bleachery Pond	C	Urban Runoff Septic Systems
Fry Brook	B	Urban Runoff Septic Systems
Hunt River	C	Brown & Sharpe WWTP Urban Runoff Septic Systems
Jamestown:		
Taylor Point	SC	Jamestown WWTP
Jamestown Harbor	SB	Boat Marinas and Anchorage
Dutch Island Harbor	SB	Boat Marinas and Anchorage
Narragansett:		
West Passage		
South Ferry	SC	U.R.I. WWTP
Narragansett Pier	SC	South Kingstown WWTP
Scarborough	SC	Scarborough WWTP
Point Judith Pond	SA	Septic Systems Urban Runoff
Port of Galilee	SB	Major Fishing Port
Snug Harbor	SB	Boat Marinas
Upper Point Judith Pond	SB	Septic Systems Urban Runoff Saugatucket River

Table IV-1 (contd.)

Water Resource	State Water Quality Classification	Pollution Source
Narragansett (cont.)		
Pettaquamscutt River (Narrow River)	SA*	Septic Systems Urban Runoff
North Kingstown:		
Fishing Cove	SA	Septic Systems
Mill Creek and Cove	SB	Septic Systems Urban Runoff
Wickford Cove and Harbor	SC	Septic System Boat Marinas & Harbor Wickford Navy Housing WWTP
Duck Cove	SA	Septic Systems
Bissel Cove	SB	Septic Systems Urban Runoff
Davisville Pier	SB	OCS Activity
Quonset Point	SC	Quonset Point WWTP
Hunt River	SC	Brown & Sharpe , Inc. WWTP
Annaquatucket River	B	Septic Systems Leachate from Town Landfill Urban Runoff
South Kingstown:		
Snug Harbor	SB	Boat Marinas
Upper Point Judith Pond	SB	Boat Marinas Saugatucket River
Potters Pond	SA	Septic Systems Stormwater Runoff
Cards Pond	SA	Septic Systems Stormwater Runoff
Green Hill Pond	SA	Septic Systems Stormwater Runoff
Trustou Pond	SA	Septic Systems Stormwater Runoff
Saugatucket River	B	Urban Runoff Septic Systems

* Temporarily Closed to Shellfishing in Fall of 1979

Table IV-1 (contd.)

Water Resource	State Water Quality Classification	Pollution Source
South Kingstown (cont.)		
Hundred Acre Pond	A	Leachate from Plains Rd. Landfill
Worden Pond	B	Chipuxet River Septic Systems

Source: 208 Water Quality Management Plan, Rhode Island Statewide Planning Program, March 1979.

large additions of nutrients causes over-production of algae which leads to the decomposition of the plant material in such a way that odors and low levels of O_2. These conditions will cause changes in the quality of life in and around a water body. Two nutrients are mainly responsible for eutrophic conditions in the West Bay Region: nitrogen, in marine systems, and phosphates, in freshwater lakes and ponds. The nitrogen compounds which have been found to stimulate alga growth at low concentrations are transported by stormwater runoff and groundwater. The nitrogen enters the groundwater and surface water from a number of transport mechanisms which are listed in Table IV-1. The importance of these processes varies from water body to water body. However, the vast majority of the coves, harbors, and coastal ponds probably receive large percentages of nitrogen from the groundwater. For example, groundwater inputs have been found to be the largest source of nitrogen for the coastal ponds in Narragansett and South Kingstown. Septic system leachate and lawn fertilizer are the major sources of nitrogen that contaminate groundwater within the coastal pond watershed. Researchers have found that the higher the housing density, the greater the groundwater contamination which relates to the density of septic systems and the amount of lawn fertilizer applied.[1]

The blooms of algae common along the densely developed northern edge of Green Hill Pond have been attributed to the over-fertilization of the pond by nitrogen contaminated groundwater. Eutrophic conditions in other areas of the ponds can be partially attributed to contaminated groundwater. In addition, eutrophic water quality conditions are common to Bissel's, Duck, and Mill Cove North Kingstown. The residential development within these watersheds certainly contribute large quantities of nitrogen to the groundwater via the septic systems or lawn fertilizer.

Stormwater runoff contributes large quantities of nitrogen to the Narrow River, Wickford Cove and Greenwich Cove. Nitrogen in lawn fertilizer, puddles of sewage

1. Deason, Ellen Non-point Pollution of Salt Pons, Waters & Adjacent Groundwater, CRC, 1981.

from failing septic systems, pet litter, and roadside debris are transported by stormwater to nearby water bodies. The magnitude of the impacts of stormwater runoff on Greenwich Cove has been estimated to be so great that even the elimination of WWTF discharge effluents would not prevent the eutrophic condition of the cove.[2]

In conclusion, the shallow, poorly flushed coves, harbors or ponds of the Region are impacted by nitrogen inputs from groundwater and stormwater runoff which cause eutrophic conditions.

In contrast, ponds and lakes became eutrophic from over-fertilization by phosphates. Stormwater runoff transports the vast majority of phosphates to lakes and ponds. Phosphates discharged to the groundwater by septic systems or stormwater runoff are rapidly absorbed by soil particles which accounts for low levels of the nutrient in the water table. Only a few ponds, lakes or rivers in the Region exhibited eutrophic conditions: Bleachery Pond in East Greenwich, Sand Hill Cove and Saw Mill Ponds in North Kingstown and the Saugatucket River within Wakefield Center.

The storm sewers in these areas drain large quantities of phosphate-contaminated runoff from watersheds that are densely developed and impact the receiving waters by causing eutrophic conditions. The other freshwater environments in the Region remain relatively undeveloped, therefore, water quality problems are rare.

Septic system discharges and stormwater runoff are the most common sources of pathogens which enter water bodies in the Region. The level of pathogens in a water body is measured by the presence of coliforms, a bacteria commonly found in the feces of humans and other warm-blooded animals. By experience, the safe concentration of coliform bacteria for a water body has been determined so that there is little chance of contracting a disease by eating raw shellfish gathered from the shore or swimming in the water. To meet the State's coliform standards, the feces of one person must be diluted by a large volume of water. One source estimates that it would take some eight million cubic feet of coliform-free

2. East Greenwich 201 Facilities Plan, 1980.

dilution water. Whatever the quantity, small water bodies have little assimilative capacity for fecal coliform.

Coliform pollution of the Narrow River is well-documented. An extensive survey of the river was conducted by DEM from 1959 to 1961 which showed that 73% of the samples taken during the summer shellfishing and recreational season were polluted. However, the yearly median used by DEM for the river's water quality classification were within the acceptable limits for shell-fishing. This is an interpretation that obscured the water quality problems of the Narrow River for twenty years.[3]

In 1978-79, the NRPA conducted studies on the river which showed that 57-59% of the samples taken, year-round, and 90% of the summer samples were polluted. Upon release of these data, the DEM temporarily closed the river to shellfishing. Further studies by DEM in 1979 confirmed that these results showed the highest levels of bacteria were found at dinner time when water consumption and waste disposal was the highest and the dilution volume of the river lowest. The DEM, NRPA, and RIPE concluded that a significant amount of the coliform pollution in the Narrow River comes from septic systems within the watershed.[4]

The magnitude of coliform pollution originating from septic systems is dependent on the amount of water within the soils of the watershed. Households that contribute most to the coliform pollution have septic systems that cause ponding of sewage on lawns with soils that are water saturated directly via surface runoff or indirectly via storm drains into the River.[5]

The drought conditions of the 1980-81 summer increased the assimilative capacity of leach fields which prevented the ponding of sewage on lawns by reducing the amount of water in the soils. The result of dry weather was an acceptable level of coliform bacteria in the Narrow River for much of the period.

Coliform pollution of the coastal ponds has been reported by the CRC as part of the study that focuses on the impact of the human environment on the pond ecosystems. High values of coliforms were recorded following heavy rainfall

3. Sieburth, John, Water Quality of the Narragansett River, 1979.
4. Ibid.
5. Ibid.

throughout the year which indicates the importance of runoff as a source of pathogens in the coastal ponds system. Although coliform pollution from septic tanks can occur when ponded sewage above leach fields is washed into a water body, septic systems can contaminate groundwater which then infiltrates a lake, river or estuary. Such instances are presumed to occur in the coastal ponds.[6]

Point Source Pollution

The East Greenwich WWTF is the only point source in the region that may be related to a water quality problem. The sewerage treatment plant discharges 770,000 gallons of wastewater per day into Greenwich Cove. With the present level of pollutant removal from the treated effluent, 1100 lbs/day of BOD and 775 lbs of suspended solids are discharged into Greenwich Cove a day. In addition, pollutants are transported from the urban and waterfront area of East Greenwich by stormwater runoff which are discharged directly into the cove by storm sewer outfalls. Groundwater contaminated by leachate from the East Greenwich Landfill infiltrate the shallow headwaters of the cove. Pollutants from the boats and activities associated with the five marinas in the cove are also a source of pollution.

The pollution of Greenwich Cove can be traced back to its industrialization in the 1830's. Two wool mills were constructed: the Bay Mill and Orion Mill, which were responsible for discharging large quantities of pollutants into Greenwich Cove. In 1928 the town constructed a WWTP to collect sewage from the downtown area and discharge the treated effluent into the cove.

The cove presently meets SC water quality characteristics. However, summer alga blooms occur and the decomposition of organic material often causes low oxygen levels resulting in nuisance odors characteristic of highly polluted areas. The construction of an advanced secondary treatment facility in 1956 was in response to these nuisance water quality conditions which occurred in the summer when the Cove's use is recreational and commercial. Even with the elimination of

6. Deason, Ellen, 1981.

the WWTF discharge, pollutant loading from urban runoff and groundwater discharge are believed to be sufficient to maintain the SC water quality classification of the cove. In response to these conclusions the EPA has required further sampling and analysis to assess the impacts of expanded and upgraded WWTF on the cove.[7]

It is interesting to note that the five coves of Greenwich Bay experience similar water quality problems. The shallow, poorly flushed basins provide ideal conditions for euthropication to occur. Euthrophic conditions result from an over-fertilization of the water column which leads to excessive algae growth. Algae common to the coves are the species ulva and entercmorpha types of sealettuce which form dense mats and require large supplies of O_2 to decompose. The resulting lack of oxygen in the water causes nuisance odor conditions and the production of H_2S gas which is highly toxic to marine life.

Results from the coastal ponds study being conducted by the U.R.I. CRC show that low level inputs of the most important nutrient in estuaries-- nitrogen, can cause nuisance water quality conditions.[8] In the relatively undeveloped coastal pond area there is a sufficient concentration of nitrogen in the groundwater which feeds the ponds to cause these periodic blooms of algae in the summer.

In comparison, Greenwich Cove is supplied large quantities of nitrogen by a groundwater aquifier which is contaminated by leachate from the East Greenwich Landfill, stormwater runoff from the downtown area, inputs from the marinas, and a WWTF. The diversity of pollutant sources which discharge large quantities of contaminants into Greenwich Cove coupled with its small size and low flushing volume have been the basis for a number of investigations to conclude that the Cove will always have a water quality problem.[9]

Coastal Water Quality

The coves and harbors in the region serve as a valuable recreational and fisheries resource in the area (Fig. IV-1). These nutrient rich brackish waters produce an abundance of food for populations of scallops, quahogs, steamers,

7. 201 Facilities Plan, 1980.
8. Deason, Ellen, 1981.
9. 208 Water Quality Plan, 201 Facilities Plan, 1980

oysters, and a number of fin fish species. In addition, a large fleet of recreational and commercial boats are provided dock space or anchorage. The qualities that make the coves and harbors a valuable resource also make the water bodies susceptible to pollution.

The shallow, productive waters of even the unpolluted coves such as Bissel's and Duck Coves teeter on the brink of a eutrophic condition during the summer months. Wickford and Greenwich Coves have the most severe water quality problems. Both coves are impacted by urban runoff and pollutants originating from boating activities. Significant amounts of sewerage derived nutrients are discharged into Greenwich Cove by the WWTFand into Wickford Cove by septic systems which leach the effluents into the groundwater which infiltrates the coves. Mill Creek and Bissel's coves have slight water quality problems (SB) resulting from the inputs of septic systems. The watersheds of the fishable, swimable waters of Duck Cove, Potowamut River, Fishing Cove of North Kingstown and Sheffield's Cove of Jamestown are under considerable development pressure. Stormwater runoff and septic system effluents from new development could affect the water quality of these coves.

Because coves and harbors act as settling basins from fine particulates the water bodies need frequent dredging (Table IV-2). Two management problems from a dredging project are the disposal of spoils and the resuspension of polluted sediments.

Table IV-2lists the dredging needs for the West Bay Region. The lack of an approved disposal site for dredge spoils have hampered cities and towns ability to revitalize or expand their waterfront dependent industry. This is especially the case for projects where ocean or near shore disposal is too expensive and land disposal is environmentally unacceptable. The present alternatives are to fill and bulkhead the spoil in the immediate area of the project. This solution is dependent on the characteristics of the spoil, soft liquid sediments are usually

Table IV-2

Dredging Needs for West Bay Region

	Number of Facilities Need Dredging	Channel Dredging[1,1a]	Number of Slips & Moorings
Point Judith Pond	10	Yes	1,057
Narrow River	In Need	Yes[2]	32
Wickford Harbor	6	Yes	581
Electric Boat (OES Platform Fabrication)	-	240,000 Cubic Yards	-
Davisville Piers (Extension)	-	350,000 Cubic Yards	-
Allen's Harbor	1	-	54
Greenwich Cove	4	Yes	594

1. RI Dredging Needs Survey, January, 1981, CRC, URI.

1a. Between 1980 - 1985.

2. Clarkson Collins and Stephen Sedgwick Recreational Boating in RI COastal Waters - A Look Forward, CRC, URI, Marine Tech Report 75.

3. Possible Future Project.

not used as fill. The creation of saltmarshes from spoils has been proposed for a number of sites in Narragansett Bay.

Highly polluted dredge spoils can further complicate a project. The most highly polluted sediments in the five town region that may need dredging in the near future are found in Greenwich Cove. Pollutants are associated with suspended solids discharged from the East Greenwich STP or Urban Runoff as well as sediments polluted from the past land uses in the Cove (e.g. textile mill effluents). Table lists the concentration of heavy metals in East Greenwich STP effluent as well as some levels of pollutants that have been measured in the cove's sediments.

Table IV-3

1977 Metal Concentraions (mg/l)
In Sewage Treatment Plant Effluents[1]

STP	Cadmium	Lead	Mercury	Copper	Chromium	Zinc	Nickel
Cranston	.002	-	-	.04	.02	.08	.19
East Greenwich	.085	-	-	.39	.10	.66	.04
Providence	.004	-	-	.98	.15	1.55	.89
South Kingstown	.001	.18	-	.37	.01	.23	.14
East Greenwich Cove Sediments	3.9	150	1.6		50 to 200	430	

Source: Olsen S. and Lee V. A Summary and Preliminary Evaluation of Data Pertaining to the Water Quality of Upper Narragansett Bay, Coastal Resources Center, 1977.

On-Site Wastewater Treatment

In the five-town region 80% of the households depend on individual subsurface disposal systems (ISDS) to treat their wastewater. Generally, the ISDS is an efficient and inexpensive means of wastewater disposal. The RI 208 Water Quality Management Plan recommends the use of ISDS for residential wastewater treatment. The failure of septic systems to function correctly is the major problem with the method of wastewater treatment. This is a characteristic that most systems will exhibit after twenty to thirty years of service.

Table IV-4
Dwelling Units with ISDS for
Wastewater Treatment in Region

	Number	Homes	% ISDS	% Failure/Year
East Greenwich	3,615	2,765	76	1.9
North Kingstown	8,800	8,650	98	3.5
South Kingstown	8,138	5,587	72	NA
Narragansett	6,589	4,689	71	5.0
Jamestown	2,052	1,492	72	2.5
Total	29,194	23,503	80	
State				4.3

1. 1980 Census

2. Coastal Community Land-Use Review

The operation and expected life of the system is dependent upon the location, design, installation and maintenance of the unit. The location and/or design of an ISDS are the factors which are responsible for many of the premature failures in the West Bay Region. The areas with a high failure rate are characterized by soils with a high or low permeability, high water tables, and older housing stock. The Narrow River watershed has gained notoriety from the septic system failures

associated with these traits. In areas with soils of low or high permeability and high water table leach fields easily become saturated with water and cause a back-up into the house or release untreated effluents onto a homeowner's yard causing nuisance conditions and a health hazard. An ISDS located in soils of low permeability have a high rate of failure for the first few years but a low failure rate thereafter. In soils of high permeability systems function for the first five years but are characterized by a high failure rate thereafater. In both soil types the failure rate is dependent on how well the system is designed. An undersized system will fail to function shortly after being overloaded with wastewater no matter how suitable the soil. In the Narrow River watershed as well as the rest of the West Bay region seasonal homes with small septic systems have been converted to year-round residences which makes the systems undersized. Year-round wastewater loads to these undersized systems will most often lead to a failure soon after the conversion has occurred.

Although a failure of an ISDS is usual for older systems, problems only arise when house lots are small, which restricts or prevents the siting of a new leach field. The 208 Plan recommends 15,000 square feet as the minimum lot size for on-site wastewater treatment with a public water supply. Many developments subdivided for seasonal use have 5,500 square foot lots in areas poorly suited for an ISDS (i.e., high groundwater and rapid or poor drainage). Thus, new leach fields must be constructed on sites with soils that are often not able to treat the wastewater load and fail to function shortly after construction. In some cases, soil and groundwater levels are so unsuitable for an ISDS that the septic tank, which acts as a holding tank for sewage, must be pumped every day.

Areas within the region that are experiencing a high rate of septic system failures are listed in Table IV-5 .

The management of the on-site wastewater needs for these areas is not a simple task. Each of these sites is unique and the management goals vary from area to

Table IV-5

Existing Housing Developments Characterized
By a High Rate of Septic System Failures

	Impacted Resource	Soil Permeability
East Greenwich:		
Ayrault Road Area	Hunt River Aquifer	Rapid
River Farm	Hunt River Aquifer	Rapid
Glenn Drive	Residential Neighborhood	Moderate
Cindy Ann Drive	Residential Neighborhood	Moderate
North Kingstown:		
Wickford-Shore Acres[1]	Mill Cove, Fishing Cove, Wickford Harbor	Rapid
Hamilton[1,2]	Duck Cove, Bissel Cove, Annaquatucket River	Rapid
Plum Point[1,2]	West Narragansett Bay	Rapid
Kingstown Heights[1]	Mill Creek	Rapid
Davisville[1]	Saw Mill Pond	Rapid
Mountainview[1,2]	West Narragansett Bay	Rapid
Post Road[1]	Commercial Area	Rapid
South Kingstown:		
Middlebridge[1,2]	Narrow River	Rapid
Snug Harbor[1,2]	Coastal Ponds	Rapid
East Matunuck[1,2]	Coastal Ponds	Rapid
Green Hill[1,2]	Coastal Ponds	Rapid
West Kingston	Chipuxet River Aquifer	Rapid
South Road[1]	Residential Neighborhood	Moderate
Dock Ray Street[1]	Residential Neighborhood	Moderate
Narragansett:		
Narrow River[1,2]	Narrow River	Rapid & Slow
Great Island[1,2]	Point Judith Pond	Rapid
Harbor Island[1,2]	Point Judith Pond	Rapid
Jamestown:		
East Shores[1]	Individual Wells	Slow
Jamestown Shores[1,2]	Individual Wells	Slow

1. Identified as needing sewers in RI 208 Water Quality Management Plan
2. Seasonal Housing Stock

Sources: 201 Water Quality Management Plan: East Greenwich
North Kingstown Building Inspector: North Kingstown
Coastal Community Land Use Review: South Kingstown, Narragansett, Jamestown

area or, for that matter, from town to town. In general, the problem areas are older seasonal subdivisions located within a watershed of extremely valuable water resources. With few exceptions, failure of the wastewater systems in these areas are threatening the quality of the resources which the residents come to enjoy. The Narrow River, the coastal ponds, and Wickford, Duck and Bissel's Coves are the most notable water resources being threatened. Residential development in West Kingston and Ayrault Rd. area of East Greenwich may threaten the quality of the potable groundwater supplies which underlie the subdivisions. Nuisance odor conditions resulting from overflows in the commercial or historic districts of North Kingstown have an impact on the shoppers or tourists who visit the town as well as the businesses they frequent.

Recently, the towns and a number of interested environmental or academic groups have developed management plans for some of the problematic areas in the region. The Narrow River Preservation Association was organized in 1970 by the residents of the Pettaquamscutt River watershed to protect undeveloped areas in the watershed. Since then, the scope of the interest for the homeowners association has expanded to include the promotion of uniform and coordinated planning policies, laws, ordinances and regulations for the conservation, use, and management of the watershed. They formed The Narrow River Watershed Council consisting of officials from the three local governments which is the first step in their attempt to manage the Pettaquamscutt watershed.

With the help of C.C.C., DEM, CRMC, Soil Conservation Service, and RIPE, the NRPA has identified the septic system as a major source of coliform pollution in the River. In the near future, the watershed council will vote to accept the recommendations listed in Table IV-6 in an effort to coordinate the management of septic systems within the watershed towns.

Although Jamestown has no formal management plan for Jamestown shores and East Shores problem areas, the sites are similar in housing stock and soil conditions

Table IV-6

Recommendation on Septic System Management Ordinances to the Narrow River Watershed Council
from the Narrow River Preservation Association, December 1981:

A. Septic system management ordinances.

1. That land-use planning never be predicated on future sewers. Recent studies such as those by Statewide Planning, the Environmental Protection Agency, and the Coastal Resources Center show that sewer line construction and sewage treatment are no longer cost effective and indirectly cause other pollution problems.

2. That the Watershed Council encourage the State to approve the use of alternative and innovative septic disposal systems, because of the unique features of the Narrow River Watershed (soil types, poor drainage, high water table, and small lot size).

3. That inspection and maintenance ordinances require periodic inspections of all individual subsurface disposal systems (ISDS) in the watershed. The costs of location and inspection of the ISDS would be borne by the land-owner, the inspection certificate monitored by existing computerized recordkeeping (e.g. Tax Assessor's office) and substandard systems brought into compliance with standards of the Department of Environmental Management (DEM).

4. That alternative IDSD suitable for the soil and water table conditions be required in all areas where the river would be affected. These alternatives include considerations of multiple house on-site treatment, composting, mounds and other technology. Any ISDS system must be designed to take into account the pollution impact in a particular location.

5. That all new ISDS be inspected from perc test through installation by qualified state or town officials and that engineers who design systems also supervise construction. The cost of the inspection would be based on a fee system to be borne by the owner.

6. That when real estate containing ISDS changes ownership, a certificate of current inspection and compliance be filed before the deed can be recorded.

7. That whenever one applies for alteration in the use of an existing dwelling, an inspection of the ISDS be required to determine if the system will be adequate. Alterations include an increase in building size, change from summer to year-round occupancy, and any other activity which could increase hydraulic loading.

8. That there be consistent zoning in the watershed based on the South Kingstown ordinance requiring a 150 foot setback of the leach field from the river on a conventional ISDS.

9. That an environmentally safe way to effectivelyhandle the septage from all three towns be found. Tha Appendix provides an example of how five towns in Massachusetts collaborated to establish an effective management system. (We are not necessarily endorsing the particulars of their solution to our area.)

to parts of the Narrow River watershed and the recommendations in Table IV-6 are applicable to Jamestown. Most soils in the problematic areas of Jamestown have low permeability with a seasonally high water table which causes wastewater disposal problems. However, the shallow bedrock and drinking water supplied by individual wells on small lots complicate the problems and make the implementation of a managament plan a matter of protecting the potable water supply.

Much of the lands surrounding the coastal ponds in South County are characterized by highly permeable soils that allow pollutants to perculate rapidly through the sediments to the groundwater reservoir. Preliminary results of a study to determine how land-use patterns affect the coastal pond ecosystem show that inputs of nitrogen (a major pollutant found in septic system effluents) transported by the groundwater are a major threat to the water quality of the salt ponds. Other major sources of nitrogen are agricultural and lawn fertilizers. The investigators are presently developing on-site wastewater management options specifically tailored to prevent the degradation of the coastal ponds.

The soils, housing, and therefore, the wastewater problems of the Hamilton which lies within the watershed of Bissels and Duck Coves are similar to the coastal ponds. Nitrogen and other pollutants associated with septic system (e.g. phosphates and pathogens) are transported in the groundwater to the coves which is partially responsible for the eutrophic conditions and their SC water quality classification.

A wastewater management plan to improve or preserve present water qualities of Bissel's and Duck Coves would be similar to the plan proposed for the coastal ponds.

The densely populated areas of West Kingston and Ayrault Road, East Greenwich, lie within the sensitive groundwater reservoir areas which supply large amounts of drinking water to the communities. Both areas have higher than average failure rates for septic systems which has been related to the old age of the systems. Since the health, safety, and welfare of people depend on the potable groundwater supplies which underly these housing developments, a simple management plan should

be implemented to insure that the high groundwater quality will be maintained. A requirement to pump septic tanks every two years and inspect the system every five years would ensure a minimum level of treatment for wastewater discharge to a groundwater aquifer.

In conclusion, the management of existing on-site wastewater treatment facilities is based upon the premise that the function of a septic system and its impacts on the environment is dependent on what is released into the system, and that those wastes are treated at a minimum level. Towards this end, the present study recommends the following on-site wastewater management tools.

1. 208 Recommendations for Water Conservation and ISDS.
2. Mandatory pump-out of septic tank every two years and inspection every five years for any system located in groundwater reservoir areas or other sensitive areas identified by the towns.
3. Mandatory inspection of septic system upon sale of a property . This could be statewide policy enforced by the banks or real estate firms in Rhode Island.
4. The State and Towns should plan for and use innovative and alternative methods of on-site wastewater treatment where cost-effective.
5. Towns should continue or institute a refund for one septic tank cleaning per year for private residents.
6. Rebates on purchases of water conserving fixtures should be considered on a town by town basis.

These are traditional tools that the coastal communities can implement. However, officials in Rhode Island are beginning to approach on-site wastewater management on a holistic scale. Stormwater management, land-use controls, and the regulation of design are being emphasized as important to on-site wastewater treatment programs.

We have learned much about on-site wastewater treatment from our previous

mistakes and, hopefully, new development will reflect this knowledge. The recommendations proposed by the Rhode Island 208 water quality plan is an important first step for the communities and the state. Additional precautions can be taken to protect sensitive areas within the region. Table IV-16 lists the sensitive areas within the region that have been identified by the Rhode Island Heritage Program, Coastal Resources Center of U.R.I. and the C.C.C. The recommendations of the U.R.I.-CRC, Narrow River Watershed Council, and the Coalition of Coastal Communities and the 208 Plan are the beginnings of specialized on-site wastewater management programs for the West Bay Region. Lastly, communities must plan their development with wastewater goals fully developed.

Table IV-7

Recommendations for Sewage Disposal from the
208 Water Quality Management Plan for Rhode Island

- The U.S. Environmental Protection Agency should provide a grant to a private environmental organization in Rhode Island to conduct a statewide education program on water conservation.

INDIVIDUAL SUBSURFACE DISPOSAL SYSTEMS

- Because subsurface disposal systems are less expensive than sewer systems, and because they are an effective means of sewage treatment, individual subsurface disposal systems should be used wherever possible.

- Chapter 45-22 of the General Laws should be amended to require communities to develop sewer plans as part of their comprehensive plan.

  The sewer plan would include the following elements:

  . identification of areas currently sewered and non-sewered
  . physical characteristics of the non-sewered areas of the community (e.g. soil type, location of water bodies)
  . criteria to assess the location of future sewers (e.g. population movement, current zoning requirements)
  . a projection of those areas to be sewered over the next 20 years
  . projected costs of sewering these areas
  . specific actions (e.g. zoning, establishment of local maintenance program) to be taken to ensure that sewers will be required only in the designated area.

- As a guideline for future zoning, the following minimum lot sizes are recommended:

  . 15,000 sq.ft. in areas that will be served by public water and on-site sewage disposal
  . 60,000 sq.ft. in areas that will be served by private wells and on-site sewage disposal.

- Although groundwater sampling has not indicated many problems with nitrates from subsurface disposal systems, lot sizes of two acres in existing and potential municipal water supply watersheds are recommended to ensure that nitrate concentrations in drinking water will be below the established standard of 10 ppm.

- DEM should amend the 201 facilities planning grant for the City of Warwick to include a pilot study for determining if on-site sewage disposal systems can be rehabilitated as an alternative to public sewers.

Table IV-7 (contd.)

- Local communities should review approved ISDS permits upon their receipt from DEM to ensure that they are in accordance with ISDS regulations.

- Conversion of a home from seasonal to year-round use should be brought to the attention of DEM by the local building inspector, so that a determination can be made by DEM as to whether the system will be adequate for increased loading.

- In order to obtain better information on the reasons for septic tank failures in Rhode Island, DEM should initiate a system whereby septic tank failures will be recorded, with a notation of the street location, and the reason for failure. This information could be compiled in the Statewide Planning Program computer so that areas with high failure rates could be readily identified and corrective action taken.

- Chemicals and acids should not be used to clear clogged systems because of the potential for polluting drinking water supplies or other water bodies.

- Communities which rely upon subsurface disposal systems for sewage disposal should voluntarily institute some type of septic tank maintenance program, even if only a minimal effort aimed at providing information to homeowners.

- Septic system users should avoid disposing of greases down the drain and institutions and restaurants should clean grease traps at least once a year, if not more frequently, to prevent grease buildup.

Municipal Wastewater Treatment Facilities

There are presently six WWTF in the West Bay Region (Table IV-8). They serve 24% of the households in the region representing 21% of the population. An average of 4 MGD of sewage per day is treated by municipal systems in the region. The South Kingstown, Scarborough, and Jamestown STPs* have adequate capacity to meet the needs within the towns for the next 20 years. The South Kingstown facility, a regional system serving Wakefield, U.R.I. and Narragansett was completed in 1979. The additional area in Narragansett, Mettatuxet, Bonnet Shores and the U.R.I.-Narragansett Bay Campus - Industrial Park complex will be served by June 1982. Jamestown completed a new WWTP in January of 1980. East Greenwich's STP, which is presently over its design capacity by 66%, plans on completing the final design and construction phases for a larger facility as soon as federal funds are available. The Scarborough STP, which serves the southern portion of Narragansett and the port of Galilee will be completed by the end of 1981. The facility will provide secondary treatment for 1.4 MGD of sewage. The existing primary system is not capable of treating the flow of sewage and seldom meets its NPDES permit levels. The Quonset Point STP serves the industrial park. It can provide 2.5 MGD of sewage with primary treatment. The Port Authority plans to upgrade the facility to secondary treatment and decrease the capcacity of the plant by 50%. A small STP serves the Wickford Navy housing and discharges its effluent into Academy Cove. Sludge from the WWTPs in the region are disposed in local landfills. South Kingstown and Narragansett are studying the feasibility of a regional composting facility which would treat the sludge from the regional and Scarborough STPs. The small amount of sludge from Jamestown could be accepted at the facility. Septage disposal facilities in the region are located at the Jamestown STP which only accepts material from its residents and South Kingstown. South Kingstown's facility treats septage from North Kingstown, Charlestown, Exeter, and East Greenwich.

*Please note, STP refers to Municipal sewage treatment plants.

Table IV-8

Municipal Wastewater Treatment Facilities in the Region

	Capacity (MGD)	Present Flow (MGD)	User Fee	Number of Households Sewered	Percent of Households Sewered	Sludge Disposal	Septage Disposal
East Greenwich	.51	.77	34	850	25	Landfill	*
Proposed Facility	1.24	---	109-135	---	---	Landfill	**
Jamestown	.73	---	139[6]	560	38	Landfill	Have Facilities
Narragansett	---	---	113	(2,550)[4] 1,900[3]	39	---	---
North Kingstown							
Quonset-Point-Davisville Industrial Park	2.50 (1.25)[1]	.50	---	Industiral Users, 3 Apartment Houses, and Potters Rd. & Hoskins Schools		Landfill	None
Scarborough WWTP	.28 (1.40)[2]	.50	---	---	---	SKWWTP[5]	SK
South Kingstown	4.13	2.00	78	2,281	40	Landfill[5]	Have Facilities
Brown & Sharp Mfg. Co.	.33	---	---	Industrial WWTP		Landfill	---

* West Warwick, Cranston, or South Kingstown WWTPs
** Provide Septage Disposal for Residents

1. Proposed capacity for upgraded secondary WWTP.
2. Proposed capacity of upgraded secondary WWTP.
3. Total number of sewered households in Narragansett.
4. After Mettatuxet-Bonnet Shores hook-up.
5. Regional composting facility being studied by Narragansett and South Kingstown.
6. For average family producing 60,000 gal. of sewage per year.

Septage haulers in the region also use facilities in West Warwick and Cranston. Recently, the DEM's authority has been expanded so that it can designate a STP a regional center of septage disposal when the public health and safety is in jeopardy.

As a municipality, North Kingstown is the only community in the region that does not own a STP. It has recognized areas within town that have an immediate need for sewers, however, the residents have voted down a bond referendum that would have financed a wastewater treatment system. The Public Works Director and Town Planner have indicated that another bond referendum will be proposed within the next couple of years.

Due to the high costs of sewerage collection and treatment facilities, only projects that can demonstrate a definitive town-wide benefit have any chance of being locally funded in the near future. A cost comparison of some sewerage facilities in the state (shown in Table IV-9) exemplify the high costs. A 1976 plan to build a WWTF and sewer 2200 homes in North Kingstown was estimated at an annual cost to a sewer user of $240 for a 20 year total of $4800. Since 1976, costs for sewerage facilities have skyrocketed. A 1979 proposal to build a WWTF and sewer 4100 homes in Portsmouth would have cost the sewer user $479 per year for a total expense of $9580 for a 20 year period. In 1982, the extension of sewers to only 650 homes of the Mettatuxet-Bonnet Shores area of Narragansett will cost the user $63 per year for a total expense of $8200 for a 20 year period. According to Town officials, conventional means of financing sewerage systems as well as the proven methods of wastewater treatment have become too costly for local governments. However, the need for centralized sewerage facilities in the West Bay region is immediate and is not only based upon environmental issues, but is important for the expansion of the commercial and industrial base of the region. Table IV-5 lists the major areas within the region that have wastewater disposal problems. The continued growth within the region during the 1980's will further pressure communities to provide wastewater treatment facilities. (See Figure IV-2 for sewered areas.)

Table IV-9

Cost Comparisons for Sewerage Facilities in Rhode Island

Sewer Extension Projects	Sewer Assessment Total	Cost Per Year	User Fee	Cost to User for 20 Years
Littlebridge Plat[1] East Greenwich, 1975	1360	138	34	4200[c]
Sand Hill Cove[2] Narragansett 1979	2185	109	113	5240[c]
Mettatuxet-Bonnet Shores[2] Narragansett 1982	3500	250	113	8200[d]
WWTF and Sewers				
Portsmouth 1979[3]	1500	320[e]	150	8600[f] (9580)
North Kingstown 1976[4]	1500	190[e]	50	3800

Sources:
1. John Cook, telephone call, November 25, 1981
2. George Allaire, telephone call, November 18, 1981
3. Portsmouth Draft Facilities Plan for wastewater treatment, December 1979, Metcalf & Eddy, Inc., Boston, Massachusetts
4. Quonset Facilities Plan for Wastewater Treatment in North Kingstown,C.E. Maguire, Inc., Providence,Rhode Island

a) Total costs of local share at a project divided by number of users

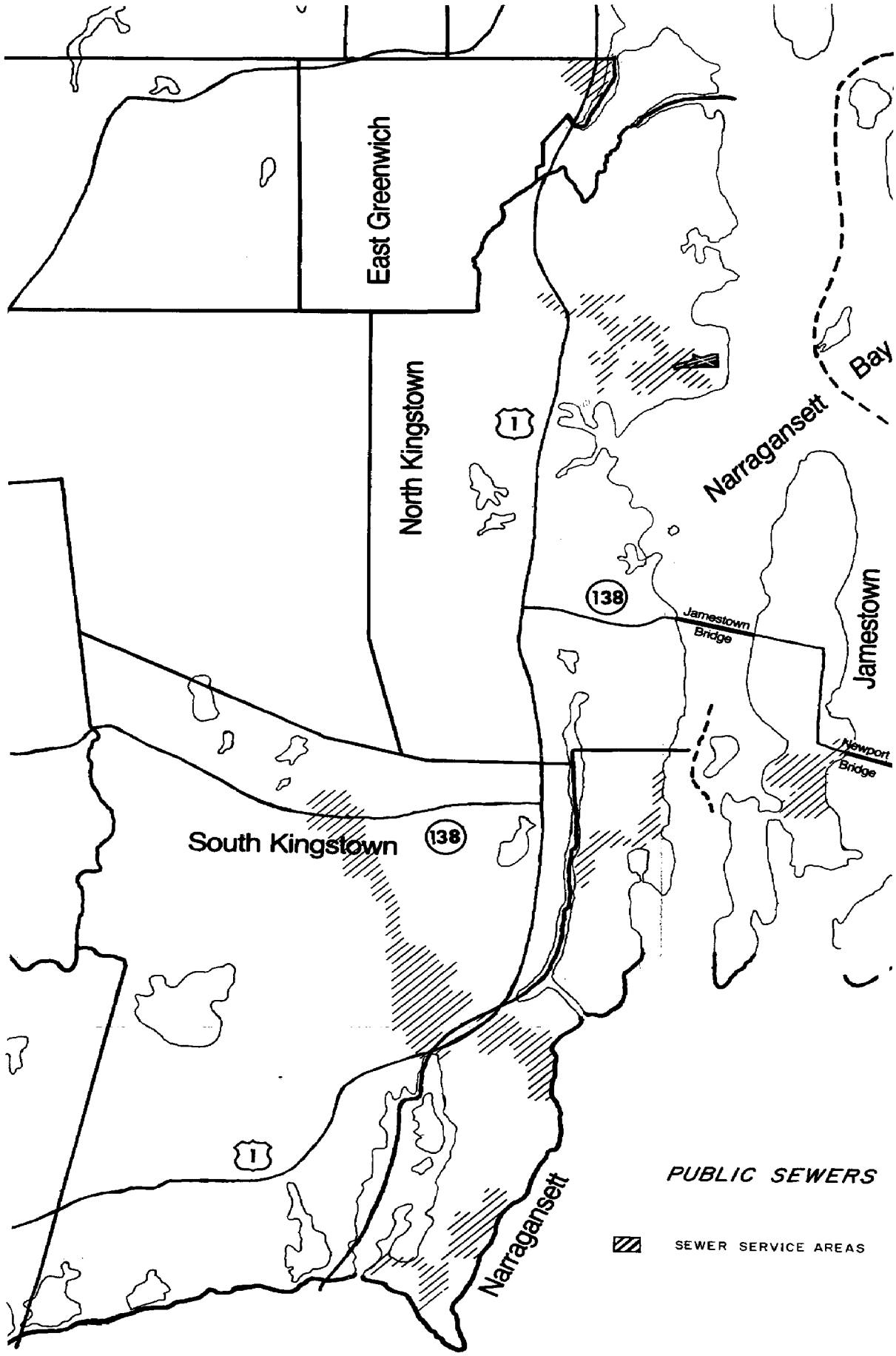
b) For 20 years

c) $800 for sewer connection costs

d) $1000 for sewer connection costs

e) Includes increase in property tax for average home in town

f) Updated number in Executive Summary


East Greenwich
North Kingstown
South Kingstown
Narragansett Bay
Narragansett
Jamestown
Jamestown Bridge
Newport Bridge
1
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PUBLIC SEWERS
SEWER SERVICE AREAS

Industrial WWTF

Brown & Sharpe, Inc. is permitted to discharge .04 MGD of treated industrial and sanitary sewage 1 lbs. BOD/day and 4 lbs. suspended solids/day into the Hunt River. Because of the industrial discharge the water quality of the river from Fry Brook to the Forge Bridge is classified as Class C. The University of Rhode Island's Bay Campus sewage treatment plant discharges .04 MGD of wastewater to the West Passage of Narragansett Bay. By June of 1982, the sewerage from the Bay Campus and the associated industrial park will be pumped via the Mettatuxet-Bonnet Shores interceptor to the South Kingstown STP.

Water Quality Problems created by WWTF

Other than very localized impacts, the East Greenwich STP is the only treated discharge in the region that may be causing a water quality problem. The present WWT facility is permitted by EPA to discharge 98 lbs. per day (15 MGL) of BOD and suspended solids (SS) to Greenwich Cove during the summer (May-October) and twice that amount in the winter. Since the STP does not meet EPA's standards, the average daily loadings of BOD and SS by the STP is 1100 lbs./day and 775 lbs./day respectively. The upgraded and expanded East Greenwich facility will discharge 156 lbs./day of BOD and SS which will decrease the loading of BOD and SS by 1100% and 800% respectively.

The 208 water quality management plan identifies four pollution sources that degrade the water quality of Greenwich Cove by causing eutrophic conditions: urban runoff, effluent from the WWTP, groundwater and surface water contaminated by the former East Greenwich Landfill, and the boats from the five marinas in the cove.

Table IV-10 shows that urban runoff and WWTF are the major pollutors of the cove. The 208 report states that elimination of the STP discharge would substantially reduce the eutrophication problems in the cove.

Table IV-10

Pollution Loading Sources in Greenwich Cove

Cove	Pollution Source	Loading (X 10^3 lbs./May - October)			
		BOD_5	TSS	N	PO_4
Greenwich Cove	Urban Runoff	15.3	207	1.8	0.5
	Boat Wastes	0.68	3.66	0.5	0.2
	E. Greenwich STP	13.5	16.5	11.25	2.25

Source: R.I. 208 Water Quality Management Plan, March 1979.

However, the East Greenwich 201 facilities plant concludes that there would be no change in the present water quality classification of SC if the discharge of the STP was eliminated by establishing a regional WWTP at Quonset Point for the sewage of East Greenwich and North Kingstown. Therefore, the facilities plan recommended the construction of a 1.24 MGD secondary wastewater treatment plant at the existing site.

The EPA's finding of no significant impact for the 201 facilities plan of East Greenwich stated there is a lack of data to confirm or dispute the need for a greater level of treatment than recommended in the plan to ensure SC water quality in the cove. EPA has required further sampling and analysis of Greenwich Cove before construction of the new WWTP can begin. The study will identify the sources and assess the impacts of nutrients discharged to the cove. If the sewage treatment plant is a major contributor to the existing or potential eutrophication and resultant water quality violations or is the only controllable factor that will prevent continued violations the new plant will have to remove a sufficient amount of nutrients to ameliorate the problem. The environment and water quality problems of the coves and harbors of the region is further discussed on page .

Groundwater

Drinking Water Supply

A large unpolluted drinking water supply exists in the region Table IV-12. Currently, 19,553 are supplied 8.8 MDG of drinking water from six groundwater reservoirs plus .25 MGD from the Jamestown surface reservoirs (Table IV-11). Approximately 9,500 homes in the region draw up to 3 MGD from private wells.

Two major issues in the region's public drinking water systems have been identified. The five major water suppliers are at capacity or will be within the next five years which will necessitate development of part of the 7.7 MGD of groundwater reserves not presently utlized (Tables IV-12 & 13). A trend towards higher levels of pollutants in the public water supplies is evident and there are a number of localized areas of aquifers in the region that are contaminated. These issues necessitate the following policy commitments by the towns in the region to ensure a high quality and adequate water supply in the future. First, the management of groundwater withdrawals from the six aquifers that serve the region coupled with the implementation of a water conservation plan; and, second, land-use controls to protect drinking water quality.

Public Water Supply Systems

A description of the water supply systems is presented in this chapter. The data are summarized in Table IV-11 & Figure IV-3. Two major trends are shown by these data. First, five of the eight water suppliers in the region are at capacity or will be within the next five years; and, second, 23% of the public water services consume less than the minimum quantity the suppliers will charge for, therefore preventing any incentive for conservation.

Private Wells

The vast majority of homes using private wells in the region are located in the rural areas of the West Bay Region. Figure IV-3 shows the areas of the Region with and without public water. Of these areas not served by public water, only three undeveloped areas do not meet the minimum zoning standards set by the 208 Water Quality

Table IV-11

Water Supply Systems in West Bay Region

	Capacity (MGD)	Peak Day Use	Average Use (MGD)	Number Of Services	Seasonal Services	Percent Under Minimum Charge	Need For New Supplies	Growth In Services Per Year
Jamestown	.47[A]	.34	.25	1,100	150	15%	Near Capacity- No Planned Expansion	15
North Kingstown	4.00	4.20	2.30	6,300	200	3%	Immediate	130
South Kingstown South Shore	1.00	.80	.30	1,800	500	27%	Near Capacity; Moratorum on Expansion	50
Wakefield Water	5.80	3.60	2.00	4,195 (2,013*) (2,182**)	(803)[B]	25%	Near Capacity; Need 1 MGD more by late 1980s	50
Kingston Fire District	.60	.40	.26	500	---	20%	50% Capacity	10
URI	.90	.70	.60	12,000 (people)	---	---	66% Capacity	None
Indian Lake Shores	---	---	---	52	---	--	Will be Supplied by Wakefield Water	---
Narragansett	---	---	1.10	3,257	1,970[E]	74%	*	**
East Greenwich	---	4.20	1.80	2,698	---	21%	Near Capacity; (76%)	33

A. .37 MGD is maximum substainable yield.
B. Most of seasonal services in Narragansett.
C. Number for whole system.
D. Narragansett Water Department services.
E. Assuming under 4,000 cu. ft. is seasonal usage and 803 seasonal [redacted] se[redacted]es [redacted] Wa[redacted]eld[redacted]er [redacted]are[redacted]m B[redacted]t S[redacted]es a[redacted] Scarborough and 1,167 from Narragansett Water Department.

* Have contract with Wakefield Water Co. for 1.7 MGD more in Pt. Judith System. Planned expansion of N.K. system will accomodate Narragansett.

** Public water will be provided for new development.

Table IV-12

Groundwater Resources of the Region
(Millions of Gallons per Day)

	Average Day Withdrawal	Peak Day Withdrawal	Substainable Yield	Undeveloped Resources
East Greenwich-North Kingstown				
Hunt River	2.5	4.3	7.0	0.0
North Kingstown				
Annaquatucket-Pettaquamscutt	2.0	3.0	4.0	2.0
South Kingstown				
Chipuxet	1.0	1.25	3.0	1.6
Mink	2.0	3.6	2.6	0.0
Usquepaug-Queen	---	1.1	5.2	4.1
Southshore	0.3	0.8	0.8	0.0
TOTALS	7.8	14.0	22.6	7.7

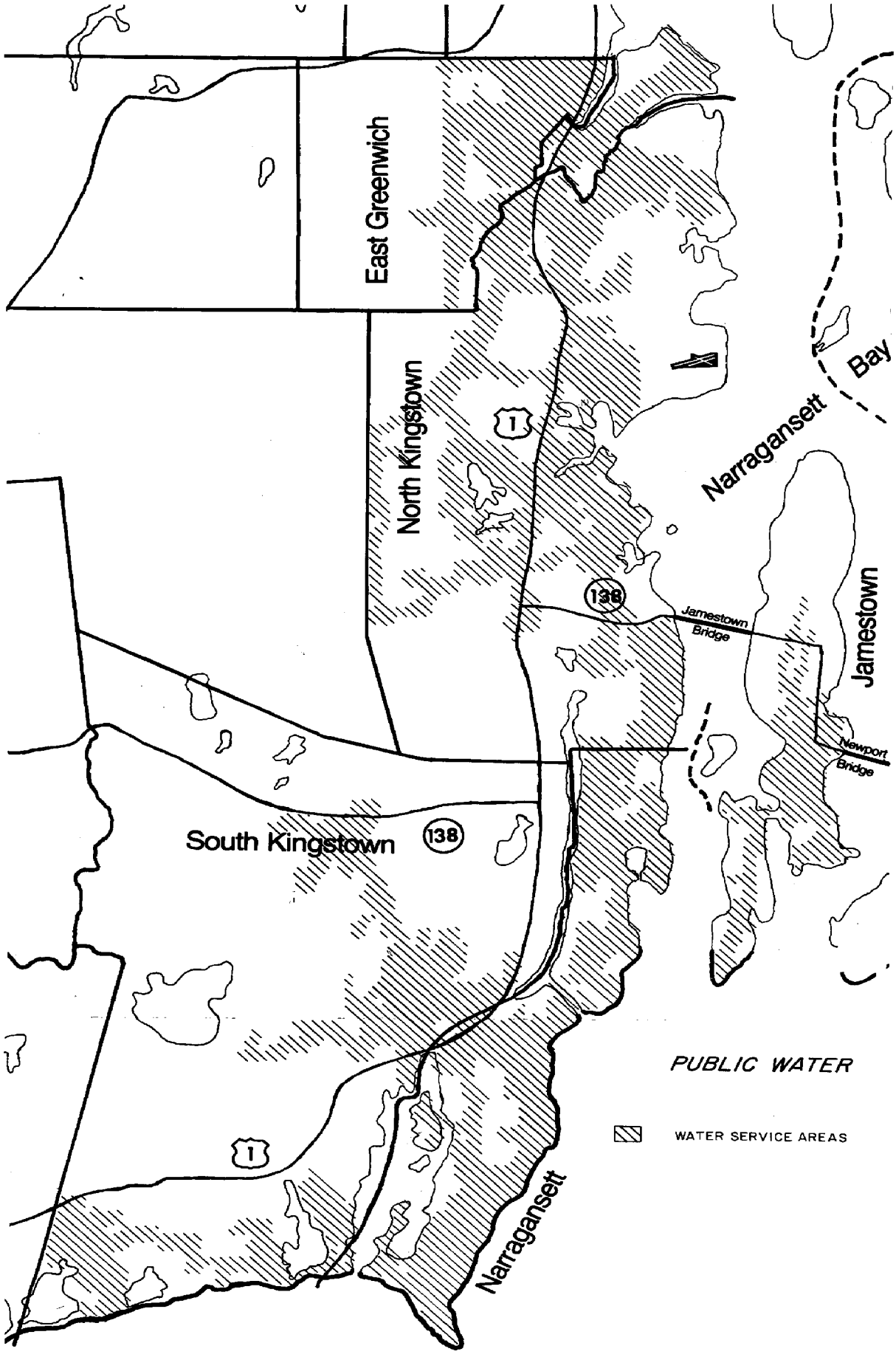
Table IV-13

Drinking Water Withdrawals from
Groundwater Aquifers in the West Bay Region

	Maximum Substainable Yield	Present Use*	Capacity*
Hunt River Aquifer			
K.C.W.D.[1] Well Center		1.0	3.0
U.S. Navy Quonset Well Centers		.5	3.0
North Kingstown Stony Lane Well Center		1.0	1.0
TOTAL	7.0	2.5	7.0
Annaquatucket River Aquifer			
Well Center East of Colonel Rodman Highway		0.5	0.5
Well Center West of Colonel Rodman Highway		1.5	1.5
TOTAL	4.0	2.0	2.0
Pettaquamscutt River Aquifer			
Carr Pond Well Center		0.3	0.3
TOTAL	1.3	0.3	0.3
Chipuxet River Aquifer			
University of R.I. Well Center		0.6	0.7
Kingston Fire Dist. Well Center		0.4	0.7
Wakefield Water Co. Well Center		Proposed for late 1980s	
TOTAL	3.0	1.0	1.4
Mink Brook Aquifer			
Wakefield Water Co. Well Centers		2.0	5.8
TOTAL	2.6	2.0	5.8
South Shore Aquifer			
South Kingstown Water Department Well Center		0.3	0.8
TOTAL	0.8	0.3	0.8
Usquepaug-Queen Aquifer			
Ladd School		---	1.1
TOTAL	5.2	---	1.1

* MGD

1. Kent County Water District


East Greenwich
North Kingstown
South Kingstown
Narragansett Bay
Jamestown
Jamestown Bridge
Newport Bridge
1
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PUBLIC WATER
WATER SERVICE AREAS

Table IV-14

Drinking Water Use

	NUMBER OF HOMES[1]	PUBLIC SUPPLIES[2]		PRIVATE WELLS	
		HOMES USING PUBLIC WATER	% HOMES USING PUBLIC WATER	HOMES USING PRIVATE WELLS	% HOMES USING PRIVATE WELLS
East Greenwich	3,615	2,698	75%	917	25%
South Kingstown	8,138	4,034*	50%	4,104*	50%
Narragansett	6,589	5,438*	83%	1,151*	17%
North Kingstown	8,800	6,300	72%	2,500	28%
Jamestown	2,052	1,100	53%	969	47%
West Bay Region	29,914	19,553	67%	9,641	33%

1. 1980 Census

2. Numbers from Water Suppliers in Region

* Numbers based on residential services. Multi-family housing is often counted as one residential service. Therefore number of homes using private wells may be inflated.

Management Plan for areas without public water or sewers. They are located in South Kingstown one in the southwest and one in the northwest section of town, and one tract is located in the Slocum section of North Kingstown.

The lack of data on the water quality from the wells in the study area prevents an overall assessment of the potable groundwater. This is a result of the absence of state or local power to monitor water quality of private wells as well as the lack of adequate methods for a thorough assessment. Historically, drinking water quality problems in the region have been related to developed areas with a seasonal housing stock on small lots. Expansion of public water service to the area of poor water quality has been the accepted policy in the region. Jamestown Shores is the only remaining developed area in the region with small lots and private wells. It is essential for the town to protect the water quality of wells in Jamestown Shores because the town does not have a surplus capacity in the public water supply system to accomodate the additional growth.

Septic system leachate and lawn fertilizers and major sources of groundwater pollution in residential areas served by private wells. Nitrogen from septic systems and lawn fertilizers, and coliform bacteria from septic systems are the substances that most often pollute the private wells in the region. High nitrogen levels are dangerous to infants and high coliform levels are an indicator of pathogens. Dug wells as opposed to drilled or driven wells are most often polluted by coliform bacteria. The coliform bacteria, in most cases, is transported by surface runoff. The runoff finds a direct pathway to the well through a crack in the tile lining or well cap. New tile lining or a tightly fitting well cap usually solves the vast majority of these problems. Nitrogen from lawn fertilizers is leached through several soil layers to the water table. Once in the water table, the nitrogen travels with the flow where it can contaminate wells in its path.

Regular maintenance of septic systems and conservative application of lawn fertilizers are ncessary to provide protection to potable groundwater in areas served

by private wells. New development with private wells and septic systems should be cited on lots larger than two acres.

Ground Water Supplies

There are six groundwater aquifers in the region. The groundwater aquifer or reservoir is a geological formation that willyield water in sufficient quantity to supply a large demand. Sediments of a reservoir 20 to 120 feet thick are saturated with water and capable of producing over 100 gallons/minute to a well. The substainable yeild of a reservoir is not a function of its size but is determined by the annual rate of recharge or the rate that precipitation replenishes the water in the aquifer. In order to ensure an adequate quantity and quality of ground water, the path of the recharge must be identified and protected. Protection guarantees an unobstructed, pollutant-free pathway of rainwater and runoff from the surface to the saturated sands and gravels of the aquifer. Areas of primary recharge in the region are often flat, well-drained soils with an attractive vegetational cover. These characteristics make the areas extremely desirable for many land uses which have direct impact on the quality of the groundwater. Land use impacts can range from the obstruction of the recharge by a large parking lot, to the leaching of toxic substances from a hazardous waste site. The high porousity and permeability of recharge areas make the underlying aquifer susceptible to pollution. Contaminants originate from such sources as solid waste disposal facilities, industrial storage, and disposal of hazardous and non-hazardous material, road salt storage and use, individual sewage disposal systems, and agricultral practices. Polluted recharge from these sources is carried to the aquifer from the surface by gravitational forces. Some of the contaminants may be absorbed, chemically degraded, or diluted by the soil layers. Once in the groundwater, dispersion of the pollutants is determined by the flow characteristics of the aquifer. The pollutants are not diluted by the total amount of groundwater but spread through a specific layer of the aquifer. The rate of dis-

persion and extent of groundwater pollution is related to physical and chemical properties of the contaminants, soil characteristics, and meteorological conditions. Eventually, the groundwater will discharge to a wetland, pond, lake, stream or well.

Groundwater

With the exception of localized areas with elevated levels of minerals and dissolved solids, the public drinking water of the groundwater aquifers in the region is of high quality.[9] However, there are indications that some local uses of the land may cause degradation of the water quality in the future.[10]

Highways may cause a water quality problem in two groundwater reservoirs of the region. The data from Table IV-15 show the Annaquatucket-Pettaquanscutt and the Hunt Aquifers having the largest acreage of major highways in the region.

Within both recharge areas, localized areas with high levels of chloride in the groundwater have been attributed to road salting. Another threat to these aquifers is the potential for spills of hazardous materials, e.g., gasoline, resulting from a traffic accident. Pollutants other than salt in stormwater runoff (nitrogen, lead and petroleum hydrocarbons) may also impact groundwater quality in the area.

The present zoning of the aquifer recharge areas within the region is a potential water quality problem. Although much of the recharge area in the region remains undeveloped (Tab. IV-17) most of this land is zoned for medium or medium-low residential housing, a density higher than that (low density residential) recommended by the 208 Plan to abate groundwater pollution from septic systems. The Hunt River Aquifer is the only area where elevated levels of pollutants (nitrogen) might be related to septic system recharge. Other areas within the region that have reported elevated nitrogen levels (Mink, Chipuxet and Annaquatucket-Pettaquamscutt) contain a blend of residential and agricultural land uses both of which could be responsible for the aquifer degradation.

9. Allen, William B. Unpublished Water Resources Board Data.
10. Jamestown Community Guide Plan, 1979

Some of the state's prime agricultural land is located within the region's groundwater recharge areas. Turf, potatoes and corn are the major crops. Table IV-17 lists the percentage of the recharge area that is being farmed. Fertilizers and pesticides may be partially responsible for localized degradation of the groundwater quality in the region. The agricultural soils are highly permeable which makes the groundwater susceptible to pollution from the toxic pesticides used on potato fields or the nitrates originating from fertilizers. To date, no tests to determine levels of pesticides or fertilizers originating from agricultural sources have been conducted in Rhode Island.

The contamination of groundwater by landfills in the region has been studied by the 208 program and the University of Rhode Island. Three landfills are located in the Annaquatucket-Pettaquamscutt Aquifer. Two have been found to pollute the reservoir in the immediate area of the landfill. The only remaining active landfill (Hamilton-Allenton Road) will be closed in the Summer of 1982. Their leachate will continue to contaminate the groundwater aquifer. Therefore, the landfills must be monitored for a number of years after closure. The Plains Road Landfill in the Chipuxet Aquifer was found to pollute a localized area of the aquifer. The URI study group recommended measures to mitigate the impacts of the closed landfill on the water table. Finally, the inactive East Greenwich Municipal Landfill discharges its leachate directly into Greenwich Cove.

Six groundwater aquifers are located in the five-town study area: the Hunt, Annaquatucket-Pettaquamscutt, Chipuxet, southern portion of the Usequepaug-Queen, Mink, and South Shore. Only the South Shore Aquifer which supplies coastal areas of South Kingstown, has not been mapped. (Figure IV-4).

The Hunt River Aquifer begins at the head of Greenwich Cove and follows the Hunt River southwest to a point just south of the Route 102-Route 104 traffic circle. There are presently four pumping centers in the aquifer capable of producing 7 MGD. The Rhode Island Water Resources Board estimates that the reservoir is capable of

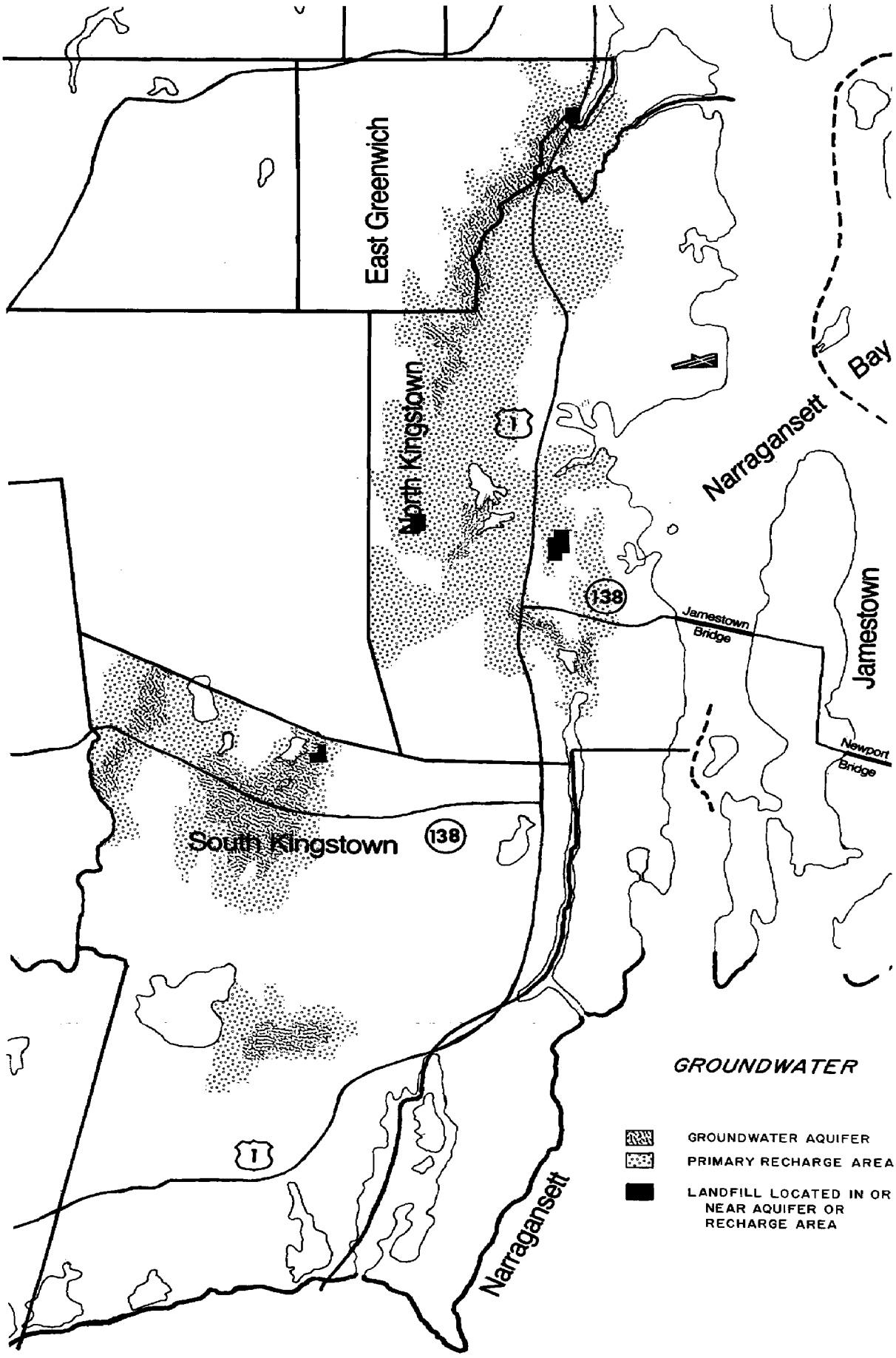

East Greenwich
North Kingstown
South Kingstown
Narragansett Bay
Jamestown
Jamestown Bridge
Newport Bridge
138
1
GROUNDWATER
GROUNDWATER AQUIFER
PRIMARY RECHARGE AREA
LANDFILL LOCATED IN OR NEAR AQUIFER OR RECHARGE AREA

Table IV-15

Acreage of Highways in Groundwater Aquifers

	Number of Interchanges	Acres	Miles of Highway 2-Lane	4-Lane	Super
Hunt	3	53	.7	5.5	1.5
Annaquatucket-Pettaquamscutt	2	69	3.0	7.0	0.0
Chipuxet	1	10	2.5	0.0	0.0
Mink*	0	8	2.5*	0.0	0.0
Queen-Usquapaug	0	3	.75	0.0	0.0

*town-owned roads

Table IV-16

Zoning of Recharge Areas in Region
(percentage)

	Residential					Open
	High	Medium	Medium-Low	Low	Commercial	Industrial	Space
Annaquatucket-Pettaquamscutt	49	30	0	3.5	9.7	7
Chipuxet	Most of Area: Low Density West of Kingston: Medium Density				NA	19.0	NA
Mink	0	3	97	0	0.0	0.0	0
Queen-Usquapaug		10	29	19	10.6	0.0	28
Hunt			NA		NA	NA	NA

NA: Not Available

*Ladd School

Table IV-17

Present Land Use in Aquifer Recharge Areas
(percentage)

	Open Space	Agricultural	Commercial-Industrial	Residential
Hunt*	NA	NA	NA	NA
Annaquatucket-Pettaquamscutt	51	9.8	1.4	17
Chipuxet	47	35	2	5
Mink	64	23	0	2.4
Queen-Usquapaug	71	19	-	2

*Data Not Available

safely producing 9.5 MGD. However, a withdrawal of 9.5 MGD from the reservoir during dry years such as 1949, 1957, 1963-65, 1980-81, will result in no streamflow for as many as 160 days in a sizable reach of the Hunt and Potowomut Rivers and an undetermined decrease in marsh and pond water storage in the area and little or no flows in many of the brooks and streams in the primary recharge area. The RIWRB estimates that a withdrawal of over 4.3 MGD from the KCWD and Quonset Point/Davisville well centers would leave much of the adjacent Hunt River dry. With additional withdrawal from North Kingstown's Stony Lane well, flow conditions in the river would be reduced. Present flow at the USGS Hunt River guaging station is 12 CFS when pumping from the KCWD wells, from the Quonset wells, and from the North Kingstown well. This low river flow during the drought is compared to an average flow of 19 CFS in October. In the 1965-66 drought the river flow was reduced to a dribble (.3 CFS) when the KCWD wells were pumping 2.21 MGD and the Quonset wells were pumping 2.75 MGD. With an increase in water demand from expansion of Quonset Point-Davisville Industrial Park, and increased pumping at the KCWD wells, the Hunt. Aquifer may be over-pumped during periods of low recharge. Therefore, it is important to have an intergrated water supply plan for the Hunt groundwater reservoir. The plan must include fair and equitable allocations to suppliers as well as measures to protect the quality of the groundwater.

The groundwater quality in the Hunt Aquifer is suitable for drinking. However, the Rhode Island Water Resources Board reports indications of increased mineralization and degradation of groundwater quality in localized areas that may result from highway salting, infiltration of pollutants through the Pawtucket Sand and Gravel Pit, septic tank discharges, and over-pumping of the aquifer.

One major land-use conflict in the recharge area is the presence of major highways and highway exchanges. Runoff from the roads contributes to the mineralization and degradation of the aquifer in the proximity of the highways. The highways within the recharge area are Route 4 from a point just north of the Frenchtown

interchange, South to and including the Route 2 and the Route 102 traffic circle. The segment of Frenchtown Road east of Route 4 and a .7 mile of Davisville Road crosses the recharge area. A total of 53 acres of paved roads are in the recharge area which includes 1.5 miles of limited access, four-lane highway, 5.5 miles of four-lane highway, and .7 miles of two-lane roads. These roads are heavily travelled, the Route 4-Route 2 segment being the major north-south thoroughfare in the region. The Frenchtown-Davisville Road complex distributes traffic from Route 4, Quonset Point-Davisville, Brown and Sharp, downtown East Greenwich and the industial and commercial facilities on Route 2. These high-use roads demand intensive snow removal and road salting services. The increase in the chloride levels of the public well water from the aquifer between 1963 and 1974 may be related to road salt runoff from these highways (Figure IV-5).

Other pollutants carried in stormwater runoff from heavily travelled highways that may enter the aquifer are heavy metals such as lead and cadmium, nitrogen, petroleum hydrocarbons and gasoline additives. These contaminants can infiltrate the groundwater from the Hunt River, which is polluted by storm runoff. Contaminated river water will then flow into the groundwater reservoir in the direction of a public well which is puming large quantites of water. For example, in the dry year of 1963 it was estimated from a groundwater model of the aquifer that 1.6 MGD of the 3 MGD pumped from KCWD and Quonset wells was withdrawn from the Hunt River. In support of the model, the U.S. Navy has analyzed the water from their wells and found that during dry years the mineral content of the drinking water and river water was very similar.

Three major residential centers located in the Hunt River recharge area impact the aquifer. Possible contaminants from these residential areas which can pollute the ground water originate from the septic systems and stormwater runoff (lawn fertilizer, pesticides, petroleum hydrocarbons).

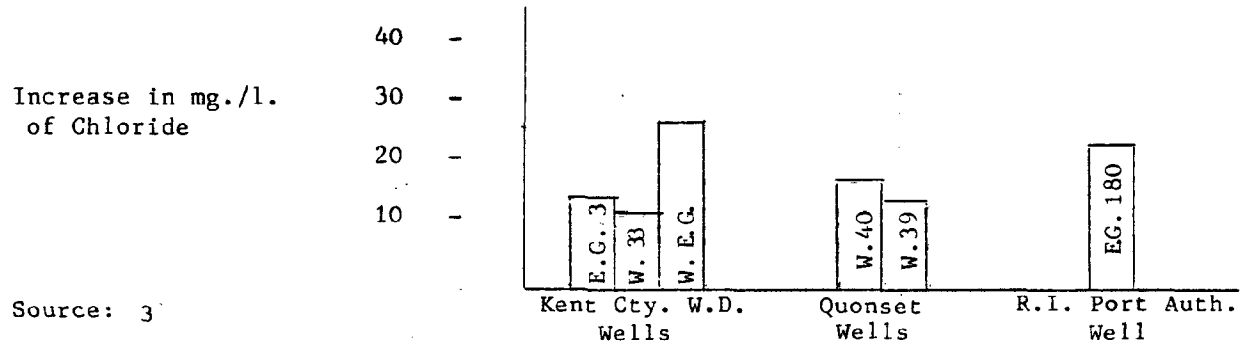
A total of 460 homes are located in three major residential areas of the Hunt River recharge. These centers are Ayrault Road area, east of the Naval Reserve Center on Route 2 in East Greenwich; the River Farm area south of the drive-in theatre in East Greenwich and the western side of Old Baptist Road in North Kingstown. Whether the occassional elevated nitrate contamination in the public well water stems from the input of wastewater from these homes cannot be determined. However, recharge from the wastewater of residential developments can represent 50% of the total input to an area of the aquifer.

The Pawtucket Sand and Gravel facility on Frenchtown Road is a land-use which will impact the water quality of the aquifer recharge. The removal of the highly porous and permiable sediments in the area will decrease the soil layer above the aquifer which is responsible for the purification of the recharge. Furthermore, the removal of the overlying soils often exposes the water table to direct pollution.

Commercial development of Frenchtown Road east of the sand and gravel company further impact the aquifer by the obstruction of recharge, disposal of wastewater and pollution of stormwater runoff. Much of the primary recharge of the Hunt River is undeveloped wetlands, conservation land owned by the Audubon Society of Rhode Island, or undeveloped areas protected by North Kingstown groundwater reservoir protection overlay zoning. North Kingstown restricts development to single-family homes on lots larger than 3 acres with 300 feet of road frontage and where the maximum development of the lot is 20% of the surface area.

Figure IV-5

Increase from 1963-1974 of Chloride Ions in the Hunt River Aquifer from the Department of Health



Source: 3

The Annaquatucket-Pettaquamscutt Aquifer is two distinct groundwater reservoirs interconnected by a common recharge area. It covers 19 square miles of which 51% is woodland, 11% is residential, 9.8% is agricultural, 1% is commercial and .4% is waste disposal. The safe yield of the acquifer is 5.3 million gallons per day and the current production is 2.0 MGD from three well centers located in the Annaquatucket Aquifer. A potential of 1.3 MGD may be produced from the Pettaquamscutt and 4 MGD from the Annaquatucket. The quality of groundwater is suitable for drinking. Landfills, salt/sand stockpiling and septic systems may contribute to localized elevation in nitrate, chloride and calcium concentrations in the groundwater.

Of the three landfills located in the recharge area, two are closed (R.I. Sand and Gravel and Oak Hill Road) and one is active (Hamilton-Alltenton Road Landfill). The Oak Hill and Hamilton-Allenton landfills were studied as part of the "208" Water Quality Management Plan. The Hamilton-Allenton Road was found to degrade the water quality by the discharge of leachate from the existing collection system which flows directly into a swamp north of the landfill and contaminates a small tributary brook of the Annaquatucket River. No evidence of the pollutants entering the Annaquatucket was found. Contaminated groundwater was found up to 1,000 feet down gradient from the landfill. The leachate entering the groundwater was formed by two processes: 1) precipitation infiltrates through the landfill and discharges into the groundwater; and, 2) the groundwater mixes with that portion of the refuse which is below the top of the water table and then flows away from the landfill. The report concludes that the contamination of the groundwater and surface water is limited to an area around the landfill.

Leachate from the Oak Hill Road Landfill discharges directly into Bellview Pond as surface runoff or infiltrates into the groundwater and then discharges into Bellview Pond. The report warns that increased pollutant loadings to the pond system could cause a water quality problem.

Road salting and storage have been suggested as the sources for elevated levels of sodium and chlorides in localized areas of the aquifer. Three of the four sand/salt storage facilities within the recharge area remain uncovered which allows rainwater to leach through piles and enter ponds and streams or the groundwater. Seven miles of the four-lane Colonel Rodman Highway are located within the recharge area as well as three miles of U.S. Route 1. These roads are heavily travelled and require intense snow removal activities. In addition, the proposed extension of the upgraded Route 138 from its present junction with U.S. 21-Route 1 will corss the southern portion of the primary recharge area for the Pettaquamscutt Acquifer. These highways may cause the localized elevated levels of sodium and chlorides.

The above land-use patterns that may have a serious negative impact on the groundater quality are not presently cited as posing potential water quality problems. The town has zoned 49% of the rechargable area medium-density residential, 30.2% as medium-low density, 7% open space, 3.5% as commercial, and 10% as industrial. The industrial area has been sited along the railroad tracks a reasonable distance from the public wells. In an attempt to prevent the future contamination of groundwater reservoirs, North Kingstown has mapped overlay districts within the town where only designated types of land-use are allowed. Groundwater reservoirs and recharge areas are identified.[12]

The Chipuxet Reservoir is just west of the University of Rhode Island. It is 15 miles square of which 46% is forest, 35% is agricultural land, 5% is residential and 2% is industrial. To the south, the Great Swamp receives the groundwater discharge from the aquifer and because the southern portion of the reservoir is a wetland, the size of the aquifer fluctuates in response to the amount of recharge.

The safe yield of potable water from the aquifer is 3 MGD and current withidrawal is 1 MGD (.75 MGD from the URI water system and .25 MGD from the Kingstown Water District). The additional 2 MGD will be developed by the Wakefield Water

12 R.I. Statewide Planning Program Tech. Paper No. 98, Land Use and Groundwater Quality, South County, R.I., 1981.

Company in the '80s. Because the majority of the water withdrawn from the aquifer leaves the recharge area as either sewage or public water supply, the water resources of the reservoir must be managed with extreme care. This is particularly true during drought conditions when over-pumping the aquifer could significantly impact the water levels of an extensive wetlands area which includes the northern part of the Great Swamp. With the exception of a few areas, the drinking water withdrawn from the Chipuxet Aquifer is acceptable. The West Kingstown landfill contaminates 1,200 linear feet of the aquifer from the site west to Hundred Acre Pond. The high concentrations of manganese is the most detrimental to the groundwater quality. A study estimated that the landfill leachate took 2½ years to travel from the site to the pond (1,200 feet). Agricultural use of fertilizers and pesticides in areas of the reservoir where the groundwater table is high have been coupled to high calcium and sulfate concentrations. The large turf farms in the area are Kingston Turf Farm, Washington County Turf Farm, Turf, Inc., and Tuckahoe Turf Farm, which represent more than 925 acres of land.

Other areas of concern are the septic systems from residential, commercial, and industrial development in the village of West Kingstown. The 208 Program identified the area as a priority for sewers because of the impacts development could have on the underlying aquifer. However, the impacts of additional sewers on the groundwater yields should be assessed.[12]

The Mink Aquifer has been developed by the Wakefield Water Company to serve as the public water supply for Wakefield and Narragansett. The company withdraws 2 MGD from three pumping centers. Wakefield Water Company has the capacity to pump 5.8 MGD but the Rhode Island Water Resources Board estimates a safe yield of 2.6 MGD. The aquifer has a limited natural recharge because induced infiltration from Mink Brook, Tucker Pond and Worden Pond is limited which leaves precipitation as the

12. R.I. Statewide Planning Program, Technical Paper No. 98

major source of recharge. Thus, groundwater withdrawals must be closely monitored so that the aquifer is not over-pumped. The potential sources for groundwater contamination are limited to the use of fertilizers and pesticides on potatoe fields overlying the reservoir. Twenty-three percent of the area is agricultural land, 64% is woodland or conservation areas, and 2% is in residential use. The tests of the groundwater show slight elevated levels of calcium, chloride, sulfates, and disolved solids. The Rhode Island Water Resources Board suggests that the degradation of water qualty may be related to agricultural particles in the recharge area. The recharge is presently zoned medium-low (97%) and medium density (3% residential). Within the year, the town plans to re-zone the area to protect the groundwater reservoir.

The Usquepaug-Queen groundwater aquifer covers 36 square miles with an estimated yield of 5.12 MGD. Current withdrawals are from two well centers operated by the Ladd School. Only the southern part of the reservoir lies within South Kingstown.

In general, the water quality of the aquifer is excellent. The only source of pollution is wastewater from the Ladd School which enters the Queen River about a half mile from the northern well center. Whether river water could infiltrate the north well center is not known.

Two large potatoe farms are located within the recharge area, the Gerard Albert Farm (468 acres in Exeter) and the Vernal Tibbits Farm (106 acres in West Kingstown). It is not known whether pesticides and fertilizers are contaminating the groundwater of the aquifer.

13. R. I. Statewide Planning Program, Tech. Paqper No. 98.
14. IBID.

Water Supply Systems in the West Bay Region

Jamestown

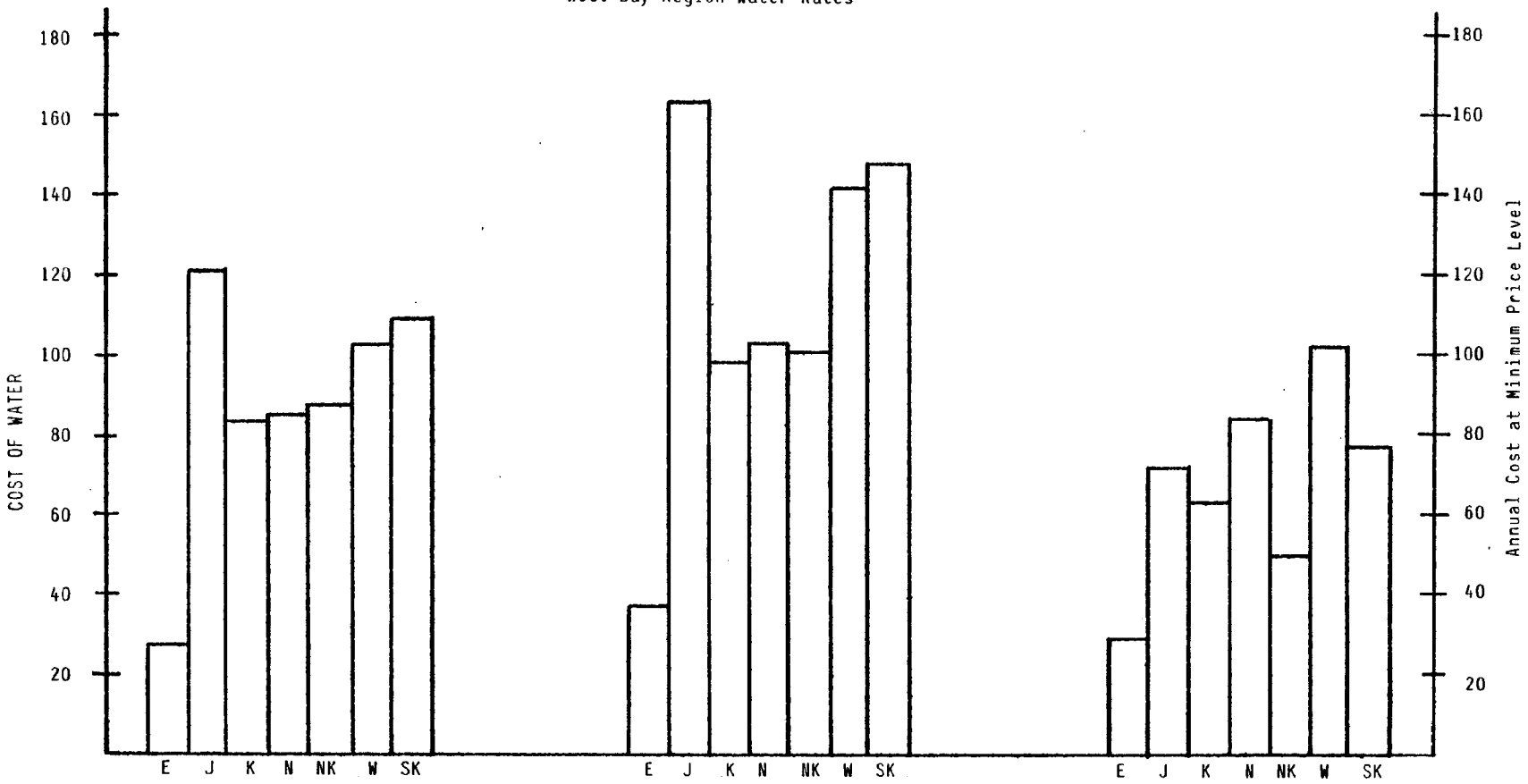
Jamestown supplies water to 850 year-round and 150 seasonal services from 2 surface reservoirs, Carr Pond (52 MG storage capacity) and the much smaller Watson Pond (8 MG storage capacity). Only the village and southern portion of the town have water service. The pumping capacity of the system is presently limited to .4MGD. The average daily demand is .25MGD with a peak demand of .34 MGD. The comprehensive plan for Jamestown has projected a water supply shortage by the early 1990's. the plan projects an average daily demand of .4 MGD by 1995 which is over the safe substainable yield of .37 MGD for the water supply system. The plan proposes recommendations which would alleviate future water shortages in the town. The first recommendation was to expand the storage capacity of the reservoir by dredging or increasing the size of the ponds and replacing deteriorated pipeline between the two reservoirs. The second recommendation was to protect the 800 acre watershed from pollutants and from any action that would inhibit the collection of potable water in any way. The third recommendation was to provide the option to import water from South County via the Jamestown Bridge. The final recommendation was for the town to develop a dual approach coupling growth management of the water system to a water conservation program that would reduce demand by 50% and extend the life of the system to the year 2000.

The town administrator and the town engineer agree that there is a water shortage problem in Jamestown. The town council has appropriated money for a water supply study which will begin within the year. The study will assess the present capacity of the reservoirts, possible methods to expand the system, and improve water quality, will be explored.

The rate structure presented in Figure IV-6 has not been published since 1973.

Figure IV-6

West Bay Region Water Rates



E - East Greenwich
J - Jamestown
K - Kingston Fire District
N - Narragnsett
NK- North Kingstown
W - Wakefield Water Company
SK- South Kingstown

Presently, the town has no plans for restructuring the water rates to provide incentive for water conservation. This sentiment stems from the recent increase in sewer use charges which average $150 per year and are assessed by a household's water consumption which is an incentive to save water in itself.

South Kingstown

The Town of South Kingstown is supplied water by the South Kingstown Municipal Water Department, the Wakefield Water Company, the Kingston Fire District, the Indian Lake Shore Fire District, and the University of Rhode Island. The combined capacity of the systems is 9 MGD with a peak demand of 5.2 MGD (TableIV-12).

The South Kingstown Municipal System has a capacity of 1 MGD from one main well and a back up well located near Factory Pond. The system supplies 1,800 services in Snug Harbor, Green Hill, and Matunuck areas of South Kingstown and the Jerusalem section of Narragansett. In addition, the town buys water from the Wakefield Water Company to supply 150 homes in the Middlebridge area. The system can supply ample water to its customers most of the year, however, during the peak demand periods of July and August the system is very near its capacity. These periods of shortages will increase in the coming years as 50 new services per year are added to the system from buildable land along the existing pipelines. There is presently a moratorium on further extensions of the water mains with the system.

The town engineer has proposed a plan to expand the system connecting the southshore system with the Wakefield Water Company. The connection would originate from the water main at the eastern end of Tuckertown Road and follow the Old Post Road to a connection near the East Matunuck Water Tower. In addition to providing for the expected 50% increase in customers over the next five to ten years, the town sees the Wakefield Water connection alleviating any interruption in the water supply to the Snug Harbor area resulting from the hurricane damage to the pipeline buried under East Matunuck's barrier beach. The town engineer considers the connection to be the least expensive water supply alternative to the south shore system.

The Wakefield Water Company supplies water to 2,182 services in South Kingstown and 2,013 more in Narragansett. The Middlebridge section of South Kingstown and Pt. Judith section of Narragansett are also supplied by the Wakefield Water Company.

Present capacity of the Howland and Tuckertown well fields is 5.7 MGD. The Company also owns the May Farm property along Plains Road which could supply an additional 3 MGD. The Company believes that by 1986 one of three planned wells of the Plains Road Center will be developed. the need for this additional supply is necessitated by the planned connections of the South Shore system, Indian Lake Shores connection and a contract agreement with the Town of Narragansett to supply the Pt. Judith area a maximum of 2.3 MGD of which the Town now only uses .6 MGD. Additional growth of the water system will occur along the planned water main between the west end of Tuckertown Road and Plains Road well field.

The Company expects the number of services in the Wakefield-Narragansett area to increase by 2-3% (50 services) each year for the next five years.

Water usage in the system was 731,886 MG of which 227,746 MG (31%) was distributed to the Pt. Judith System and 3,715 MG (1%) was distributed to the Middlebridge System. The remaining 500,425 MG (68%) was supplied to the Wakefield-Narragansett Pier region.

Kingston Fire District supplies the village of Kingston and East Farm of U.R.I. The 500 services consumed 95 MG in 1980, one third of that was used by the URI East Farm. Less than 10% of the service was used under 4,000 cubic feet per year and 20 to 25% use over 10,000 cubic feet per year. The well is located on Plains Road in West Kingston and can supply 211 MG per year or more than double the present demand. The growth in number of services was 7% in 1978 and has since decreased to 2-3% range.

U.R.I. supplies 5,000 residents on campus and a maximum of 12,000 people per day. The average use is .6 MGD with maximum capacity of .7 MGD which is supplied from 3 wells near Thirty Acre Pond. The University and the Kingston Fire District

are connected to provide each other with emergency services when needed.

A small system services 52 houses in the Indian Lake Shores area which is supplied by one drilled well and a spring located on the southern end of the lake. The water district has received a grant and match loan from the Farmers Home Administration to connect to the Wakefield Water system via a main following Route 1. Construction will be completed before the summer of '82.

East Greenwich

Seventy-two percent of the homes in East Greenwich are supplied by the Kent County Water District (KCWD). The KCWD supplies an average of 1.8 MGD to 2,698 residential and 207 commercial services. The peak demand for the system is 4.2 MGD. Growth in the number of services during the last four years has been 133 or 5%. The major growth in the system will occur along Rt. 2 in the industrial and commercial area. There are no plans to provide water to the western part of the town. The Kent Country Water District owns three well centers in the Hunt River Groundwater aquifer and three in the Mishnock aquifer with a pumping capacity of 10.8 MGD. The average daily use is 9.8 MGD. The Kent County Water District estimates its maximum sustainable yield to be 14.8 MGD.

Narragansett

The Town of Narragansett depends on the Wakefield Water Company, the Town of North Kingstown and the Town of South Kingstown for its water supply needs because there are no resources in the town large enough to supply a public system. The Wakefield Water Company supplies water to Narragansett Pier, Scarborough, and Bonnet Shores (Figure IV-3). The 2,013 services in the area use an average of .3 MGD of water. Of these customers, 803 are seasonal residents.

The Narragansett Water Department is divided into two systems, the Pt. Judith System, supplied by the Wakefield Water Company, and the North End, supplied by

the Town of North Kingstown. The Water Department also purchases a small amount of water from South Kingstown for the 150 customers in Jerusalem.

The Pt. Judith System supplies 2,222 services who consume an average of .6 MGD. Approximately 46% of the customers in the Pt. Judith System are seasonal homes. Seasonal Services were defined as those customers who use less than 4,000 cubic feet per year. The North End system supplies an average of .25 MGD of water to 1,053 customers, 180 of which are seasonal users.

Seventy-three percent of the customers in the entire system use under 8,000 cubic feet per year, and pay $85 per year, the minimum charge. In contrast to Narragansett's water rates, Kent County Water District pays $36 for 8,000 cubic feet and North Kingstown pays $49 for the same amount. The high water rates of Narragansett as well as South Kingstown are related in part to the high percentage of seasonal users and the low density of housing in the service areas. Thus, 39% at the Water Supply System in Narragansett and 20% of the Wakefield Water Company are only used 3 months of the year. However, 100 percent of the system must be operated on a year-round basis.

Because the minimum charge is payed by 73% of the services in Narragansett, there is no price incentive in the system to conserve water. In addition, the town's sewer user fees do not promote water conservation but are a flat rate of $112 per housing unit. The town presently has no plans to include water conserving incentives into the rate structure. In summary, the 5,270 water services in the town use 3.0 MGD of water on a day of peak usage. Average use per day is 1.1 MGD. The town will continue to expand water service through the 1980's.

North Kingstown

The Town of North Kingstown supplies water to 90% of the population from 4 well fields in three groundwater aquifers which are shown in Figure IV-3 . The Water Resources Board estimates that the maximum sustainable yield of the

Annaquatucket,Pettaquamscutt reservoirs is 5.3 MGD. This capacity in addition to 1 MGD that the Hunt River aquifer will give the town a total sustainable water supply of 6.3 MGD. Of the total sustainable water supply, only 3.0 MGD is capable of being continuously pumped, 1 MGD from the Hunt River reservoir wells and 2 MGD from the Annaquatucket-Pettaquamscutt reservoir wells. The sixty three hundred customers can demand up to 4.2 MGD during a hot summer day which is a consumption rate that the pumping and distribution system of the town cannot sustain for more than a few hours. To alleviate this problem, the community has passed a bond referendum for 2.3 million dollars of which $2 million will be spent for 2 or 3 new wells, 2 more storage tanks, and additional water mains. The town is presently studying the alternative for siting new wells. One alternative is the purchase of two or three Kent County Water District wells just north of the Hunt River in East Greenwich. Other wells might be drilled in the Annaquatucket-Pettaquamscut aquifers. The major reason for purchasing the KCWD wells as opposed to drilling new ones is the high cost of land acquisition required for the wells. However the town decides to solve its water supply problems it believes an additional 2 MGD of water will be neded during the next 15 to 20 years for a total capacity of 5 to 5.5 MGD.

The present maximum sustainable yeild of 6.3 MGD for the groundwater reservoirs of North Kingstown could safely supply 11,800 services at an average monthly consumption rate of 535 gallons per day per service, a level only reached during the high use months of June, July and August. The purchase of the KCWD wells would supply an additional 3,700 to 5,600 customers with water. Although North Kingstown has the water resources to supply 15,000 homes it barely has the facilities to service its present customers.

Sensitive Areas in the West Bay Region

East Greenwich:

Hunt River Groundwater aquifer

Managed Areas -
- Davis Memorial Wildlife Refuge (Audubon)

Jamestown:

Mackeral Cove Beach

Sheffield Cove

Sheffield Cover Salt Marshes

Managed Areas -
- Beavertail State Park (D.E.M.)
- Foxhill Pond Saltmarsh (Audubon)
- Marsh Meadows Wildlife Preserve (Audubon)
- Racquet Road Thicket (Audubon)
- The Dumplings (Audubon)
- Fort Wetherall State Park (D.E.M.)

Narragansett:

Ram Island

Pettaquamscutt River estuary

Wesquage Pond

East Matunuck Barrier Beach

Sand Hill Cove Barrier Beach

Pt. Judith Coastal Pond

Escape Road Marshes

Bonnet Point Cliffs and Rock Outcrops

Foddering Farm Road Salt Marshes

Managed Areas -
- Galilee Bird Sanctuary (D.E.M.)
- East Matunuck State Beach (D.E.M.)
- Fisherman's Memorial State Park (D.E.M.)

Narragansett (cont.):

Managed Areas (cont.) -
- Scarborough State Beach (D.E.M.)
- The Shadblow Preserve (Audubon)
- Canochet Farm (Town of Narragansett)
- Pettaquamscutt River Wildlife Habitat (Audubon)
- Wesquage Pond (Audubon)

North Kingstown:

Chipuxet River Groundwater aquifer

Hunt River Groundwater aquifer

Pettaquamscutt-Annaquatucket Groundwater aquifer

Pettaquamscutt River Watershed

Mill Creek

Mill Cove

Fishing Cove

Duck Cove

Bissel Cove

Potowomut River estuary

Carr Pond

Rabbit and Cornelius Islands

Managed Areas -
- Davis Memorial Wildlife Refuge (Audubon)
- Cocumcussoc State Park (D.E,M.)
- Central Park (Town of North Kingstown)
- Camp Nokema (Girl Scouts of R.I.)
- Saunderstown Military Reservation (U.R.I.)

South Kingstown:

Chipuxet River Groundwater aquifer

Usquepaug-Queen Groundwater aquifer

Mink Brook Groundwater aquifer

South Shore Groundwater aquifer

South Kingstown (cont.):

Coastal Ponds and Barrier Beaches

Kettle Hole Pond Systems

Pitch Pine Barriers

Pettaquamscutt River estuary

Indian Lake

Worden's Pond

Mixed Oak Mesophytic - Holly Plant Community

Worden Pond Bog

Managed Areas -

East Farm (U.R.I.)
Hazard Tract (U.R.I.)
Indian Run Woods (Audubon)
St. Dominic Savio (Greater Providence Y.M.C.A.)
The Shadblow Preserve (Audubon)
Camp Fuller (Greater Providence Y.W.C.A.)
Matunuck Hill Woods (Audubon)
Trustom Pond National Wildlife Refuge (U.S. Fish & Wildlife Service)
Tuckertown Woods (Audubon)
Aquapaug Scout Reservation (R.I. Boy Scouts)
Great Swamp Management Area (D.E.M.)
Camp Hoffman (Girl Scouts of R.I.)
Great Swamp Addition (D.E.M.)
South Kingstown Town Land
South Kingstown Town Land
Peckham Farm (U.R.I.)
Un-named University of R.I. property
Hoffman-By-The-Sea (Girl Scouts of R.I.)
Eldred Wildlife Refuge (Audubon)
Sherman Farm (U.R.I.)
Eppley Wildlife Refuge (Audubon)

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Chapter Five

OCS Regional Issues

Energy Resources

Preface

As part of the larger coastal Energy Impact Project which has reviewed impacts related to outer continental shelf development, the Regional Energy Project (REP) has examined problems associated with the rising cost of energy at the community level. The project has concentrated most of its efforts in the Town of South Kingstown which sponsored the grant and which represents, in many ways, a "norm" for the larger study region.

The Regional Energy Project has focused on three goals: 1) to collect and assess energy price and use information, 2) to suggest possible actions by the towns to initiate community-wide and in-house energy conservation policies, and 3) to work with the towns on specific energy related projects. The Regional Energy Project has prepared this report with the assistance of the Coalition of Coastal Communities and the Town of South Kingstown. Director, Cynthia Collins and staff, Connie Grove, are responsible for the one year research and writing effort resulting in this report.

Special thanks are due to Anna Prager, South Kingstown Town Planner, and many other town personnel who provided their time and made information readily available to the project. Finally, the project benefited from the assistance of the Coastal Resource Center and, in particular, owes many thanks to Dr. Clement Griscolm and Donald Robadue, Jr., for their guidance and help.

Initiatives For Community Energy Planning

INTRODUCTION

As part of a larger Coastal Energy Impact Project, which is reviewing impacts related to Outer Continental Shelf Development, the Regional Energy Project is examining problems associated with the rising costs of energy at the community level.

To varying degrees all the towns in the study region have experienced growth management problems in the past decade. No town has been immune from the costs associated with the rapid influx of population in the coastal region. Some of these costs are impossible to quantify precisely such as losses in land and water resources and diminution of the region's unique coastal amenities. Other costs, associated with the operation of town services and facilities, are more readily understood. Recent re-evaluations in the region serve to underscore the public's outcry at rising property taxes.

One often neglected but ever growing pressure on Rhode Island communities is the skyrocketing cost of energy. Over the last decade the cost of all traditional forms of fuel have risen dramatically and unpredictably. Where there was once confusion and skepticism about the true magnitude of the "energy crisis" there is now overriding certainity and concern about unalleviated energy costs.

Energy and its expense affect every aspect of community life. In many respects town government is the only available instrument for initiating community-wide energy policies. In past years federal grants and state assistance were available to promote energy planning at the state and community level. Planning models, energy data, and pilot projects were developed and serve as examples of community involvement. However, the withdrawal of federal assistance has left communities with the task of grappling with their own energy problems, a task made all the more difficult by long years of reliance on cheap and reliable forms of fuel.

There are dual objectives to community energy management: 1) to save energy and money in-house and 2) to initiate community energy savings by educating the public and regulating land development to promote conservation. On the face of it towns do not directly spend a large portion of their budget on energy costs. Although energy represents less than 5% of a town's budget this still represents a substantial sum, approximately $400,000 in South Kingstown in 1980, for example.

In a more important sense towns make decisions every day which effect energy use in the community. Development and land use patterns, building regulations and tax policies are major factors deciding energy patterns in the town. Promoting conservation in the community provides measurable economic benefit to the region. Every dollar not spent on imported fuels is a dollar available for better use within the community.

THE CEIP STUDY - Outline of Project

The Regional Energy Project has focused on three goals: 1) to collect and assess energy price and use information, 2) to suggest possible actions by the towns to initiate community-wide and in-house energy conservation policies, and 3) to work with the towns on specific energy related projects. As a practical necessity the project has concentrated most of its efforts in the town of South Kingstown which sponsored the grant and which represents in many ways a "norm" for the study region.

1. Energy Information - Statewide Energy Patterns

Since community specific information on energy patterns was not available in many instances, a statewide perspective serves as introductory energy data for the report. This information is a useful tool for communities and individuals who are interested in determining energy goals and priorities. 1980 census information on fuel equipment use and cost and regional commuting patterns should become available in 1983 and serve as additional references.

The project collected and analyzed use and price data over a 10 year period on fuel oil, electricity, natural gas, gasoline and coal and reviewed the recent development of solar energy, hydropower, wind-power and solid waste systems. Although the commercial and industrial sectors are discussed briefly, the report emphasizes residential energy use and costs.

2. South Kingstown - Energy Profile

As a starting point for a town energy profile, REP collected community specific information on fuel usage and cost in South Kingstown. The project also examined town accounts and energy audit material which address in-house energy consumption and expenditures. The town profile serves as a general guide for prioritizing energy policy and projects in the community. As more detailed information becomes available through the 1980 census it may be possible for the town to set specific conservation goals and institute projects with measurable results. At this juncture it is important to define and understand the nature of the problem and set governmental sites accordingly.

3. Town Energy Initiatives

Lack of a cohesive energy policy at any level of government has left a vacumn where energy information and direction could have been most helpful to the individual consumer. It is now the common experience of those involved with energy planning to encounter public confusion, frustration and apathy about an energy situation which appears out of the individual's control. In fact, just as the individual consumer bears many of the costs of rising energy prices it is the cumulative decisions and activities of these individuals which determine community and ultimately national energy usage.

The possibilities for workable energy initiatives at the community level are too often thwarted by limitations inhibiting energy planning. The withdrawal of federal support from community energy planning and public malaise on energy issues ccontribute to a general lack of determination in an already difficult and confusing area. Past town practices, including land use development which were premised

upon presumptions of cheap energy, are now difficult to change or influence. Although literature abounds on costly, federally subsidized community energy programs, there are few examples of successful small scale local initiatives in energy management.

There is a need for positive community and individual energy saving activities. With the goal of raising energy awareness and embarking on a consumer energy-saving project, the Regional Energy Project assisted the South Kingstown Conservation Commission in organizing a Community Farmers' Market in South Kingstown. Rising costs of energy have effected the region not only in terms of heating and transportation costs but also inflated costs of such basic necessities as food which is almost entirely imported to the New England area. The farmers' market serves several community functions by providing less expensive home-grown produce to consumers, by encouraging local agricultural interests, and by providing a community forum for the exchange of information and ideas.

The South Kingstown energy audit committee is in the process of reassessing its role and possibly broadening its perspective on town energy activites. To date the committee has concentrated most of its efforts on in-house audits and energy savings in town facilities. In light of lack of immediate funding opportunities REP has outlined small scale energy initiatives to engage the audit committee or other interested town boards in energy planning efforts. Areas discussed include land use review, transportation, street lighting and the promotion of residential energy audits.

STATEWIDE ENERGY PROFILE

There has been a net decline in energy consumption in Rhode Island in the late 1970's. From 1976 to 1980 energy consumption dropped from approximately 163 trillion BTUs to 148 trillion BTUs, a decline of 9%. Substantial reductions in fuel oil and gasoline use were responsible for the overall decline. Consumption of other fuels increased during this period to varying degrees. Electricity consumption rose by only 4% while natural gas increased 33% (TableV-1).

Table V-1

Total Statewide Energy Consumption
1976/1980

	1976		1980		
Fuel Type	BTUs 10^{12}	% Total	BTUs 10^{12}	% Total	% Change 1976-1980
Fuel Oil					
# 2	56.	.35	44.62	.30	- 20.3%
# 4	1.73	.01	.81	.005	- 53 %
#5 & #6	13.37	.08	9.66	.065	- 27.7%
Total Fuel Oil	71.1	.44	55.09	.37	- 22 %
Natural Gas	20.44	.13	27.2	.18	+ 33 %
Electricity	16.69	.10	17.44	.12	+ 4 %
Coal	.05	--	.17	--	+240 %
Wood	1.68	.01	2.38	.02	+ 41 %
Solar			(34.5×10^{6})		
Wind			(8.23×10^{5})		
Gasoline	53.28	.33	46.28	.31	- 13 %
TOTAL	163.24	100	148.45	100	- 9%

Sources:
1. R.I. Fuel Allocation Office, January 1982
2. GEO report June 1981 "Energy Consumption Figures for the State of RI"
3. State Energy Data System: 1979 U.S. Dept. of Energy, DOE/EIA-0214 (SEDS Report)
4. GEO report July 1981 "Coal Use in Rhode Island"
5. GEO report 1980 "RI Energy Picture"

There is a direct correlation between usage trends and price increases in the different fuel types. Fuel oil and gasoline prices have risen more steeply than other fuels in a continuation of price increases since the energy crisis in 1973. The price of residential fuel oil has risen more than 400% and gasoline prices have tripled (Table V-2).

Table V-2

Table of Price Increases

	1973	1974	1975	1976	1977	1978	1979	1980	% increase 73-80
Gal. #2 Fuel Oil	.197	.388	.412	.429	.489	.501	.845	1.02	417
Gal. #4 Fuel Oil		.21	.33	.30	.33	.35	.47	.79	276
Gal. #5 & #6 Fuel Oil		.22	.30	.27	.32	.33	.38	.72	227
MCF Gas, Residential Rate	2.3	2.47	2.99	3.26	4.10	4.05	3.5	5.3	130
KWH Electricity Residential Rate	3.3	4.6	4.8	4.8	5.4	5.5	6.2	7.1	115
Ton Coal	39.7	43.1	46.5	59.0	71.5	83.9	89.9	94.9	139
Gal. Regular Gas	.39	.50	.58	.60	.63	.64	.88	1.15	1.95

Sources:
1. RI Fuel Allocation Office
2. SEDS Report 1979
3. Providence Gas Co.
4. Peoples Coal Co., Cumberland, RI
5. RI Division of Taxation

Fuel oil and gasoline still account for the lion's share of the Rhode Island fuel mix. Together they represented 76% of the total use in 1976 and 68% in 1980. During this period, the figures indicate a switch from fuel oil use not only to natural gas but to wood and other alternate fuels as well.

While energy usage has declined, the total amount spent on energy increased from approximately 720 million dollars in 1976 to 1.140 billion dollars in 1980, a

58% jump. Amounts spent on fuel oil and gasoline registered the greatest increases although these were the fuels most conserved. While equal amounts were once spent on fuel oil and electricity, fuel oil is now 34% of the energy budget and electricity has dropped to 24% (Table V-3).

Table V-3

Total Fuel Expenditures 1976 + 1980

Fuel Type	1976 $ 10[1]	1976 % Total	1980 $ 10[2]	1980 % Total	% Change 1976-1980
Total Fuel Oil	203.1	28	363.31	32	+ 78%
Electricity	200.68	28	271.27	24	+ 35%
Natural Gas	62.27	9	83.52	7	+ 34%
Gasoline*	255.6	35	425.5	37	+ 66%
TOTAL	721.65	100	1143.60	100	+ 58%

* Gas expenditures were approximated by multiplying total gallons by price of reg. gas

Sources: [1]R.I. Fuel Allocation Office, January 1982

[2]GEO Report: 1981 Energy Consumption Figures for The State of Rhode Island

These figures can be better understood when broken down into residential, industrial and commercial sectors -- discussed later in the report. In Rhode Island the residential sector is by far the major energy consumer but has had a better record of conservation than the commerical and industrial sector. From 1976 to 1980 the residential sector dropped from 69% of total consumption to 65%. When gasoline is factored in, it dropped from 79% to 76% of total consumption. In 1980 Rhode Islanders paid approximately 900 million dollars on gasoline and other forms of residential energy as compared to approximately 225 million spent in the industrial and commercial sectors.

Residential Energy Consmption 1976-1980

In Rhode Island use of No. 2 fuel oil continues to dominate fuel consumption in the residential sector, however, natural gas, which is undergoing phased deregulation and has had a significant price advantage in the late '70s accounts for an increasing percentage of home energy use (See Table V-4). High natural gas prices in 1981 and 1982, and continued deregulation of prices, may cause a reduction of natural gas usage in the '80s.

In the residential sector, use of No. 2 fuel oil has dropped significantly from 56 trillion BTUs in 1976 to 44.6 trillion in 1980, a reduction of more than 20%. During the same period, use of electricity rose very slightly from 6.2 trillion BTUs to 6.3 trillion. Consumption of natural gas increased 10% from 12.6 trillion BTUs to 13.9 trillion. Coal, on the other hand, is experiencing a modestcomeback as a residential source of fuel. Although coal still accounts for a very small percentage of total residential fuel consumption (less than 1%), there are approximately 7,000 tons of coal in residential use today as compared to 2,000 tons in 1976. The coal currently used in Rhode Island is anthracite coal, sold either by the bag or by bulk tonnage. A 1981 G.E.O. publication, "Coal Use in Rhode Island," lists 12 bulk coal dealers in Rhode Island, nearby Massachusetts, and Connecticut, and 29 posible suppliers of bagged coal. The Governor's Energy Office estimated that as many as 2,129 households heated with coal in 1980 as compared to 431 households in 1978.

Table V-4

Residential Energy Use

	1976		1980		
	BTUs 10^{12}	% of Total	BTUs 10^{12}	% of Total	% Change
No. 2 Fuel Oil*	56.00	75	44.62	69	-20
Electricity	6.21	8	6.32	10	+ 1.7
Natural Gas	12.56	17	13.86	21	+10
Coal	.05	--	17.00	--	+340
TOTAL	74.826	100	64.979	100	-13

SOURCE: [1] R.I. Fuel Allocation Office; [2] SEDS Report: 1979; [3] G.E.O. Report: 1981, "Energy Consumption Figures for the State of Rhode Island."

*Fuel oil is categorized by #2, #4, #5 and #6, and not by consuming sector. For the purposes of this report #2 fuel oil is designated as residential fuel and the heavier grades are designated as commercial and industrial.

Residential Sector Expenditures

While net consumption of residential energy droped 13% from 1976-1980, energy expenditures increased in all fuel types. The total amount spent on all forms of energy in the residential sector increased 62%. Even with a 20% reduction in usage, 88% more was spent on #2 fuel oil in 1980 than in 1976. (Table V-5.)

Table V-5

Residential Energy: Amount Spent
1976 and 1980

	$ Spent 10^6	% Total	$ Spent 10^6	% Total	% Change
No. 2 Fuel Oil	174.90	57	328.13	66.7	88
Electricity	87.93	29	113.78*	23	+29
Natural Gas	41.42	14	49.25*	10	+19
Coal	.118	4	.66650	14	+463
TOTAL	304.368	100	491.825	99.84	62

SOURCES: [1]R.I. Fuel Allocation Office; [2]G.E.O. Report: 1981, "Energy Consumtpion Figures for the State of Rhode Island; "[3]Peoples Coal Company, Cumberland, Rhode Island.

*1979 figures

There were approximately 298,000 year-round housing units in Rhode Island in 1980, according to 1980 census figures. Using these figures, over $1,650 per housing unit was spent, on the average, in Rhode Island, on heat, hot water, and electricity in 1980. This figure is a conservative estimate because the total amount spent on fuel oil was calculated at $1.02 per gallon and the price was rising during the year to approximately $1.26 per gallon in 1981.

Transportation Sector

In 1980 use of gasoline outranked #2 fuel oil as the major source of Rhode Island residential energy, although consumption of both fuels was substantially reduced.

Consumption of Gasoline and #2 Fuel Oil

	1976 (BTUs 10)	1980 (BTUs 10)	% Change
Gasoline	52.38	46.28	-13
No. 2 Fuel Oil	46.28	44.62	-20

SOURCES: [1]R.I. Div. of Taxation; [2]R.I. Fuel Allocation Office

Gas consumption has been dropping consistently since the mid-'70s (See Figure V-1). During this same period car registrations in the state have increased by 12% from approximately 561,000 cars in 1973 to 628,000 in 1979. According to these figures, Rhode Islanders used approximately 760 gallons per car in 1973 and 628 gallons in 1979, a reduction of 17%. (See Figure V-2)

Another indication of the conservation ethic is the rise in diesel fuel sales in the state (See Figure V-1). While gasoline declined 13%, use of diesel fuel rose 30% from approximately 20 million to 26 million gallons and has risen as a percentage of total motor fuel from only 5% to 7%

During the period from 1973 to 1981 the price of gasoline quadrupled in Rhode Island; one gallon of regular gas costing 39¢ in 1973 cost aproximately $1.32 in 1981. (See Table V-6)

Table V-6
Gasoline Average Cost Per Gallon

	Regular	Premium	No-Lead	No-Lead Premium	Diesel
1973	$ .39	$ .43	$	$	$
1974	.50	.545			
1975	.58	.63			
1976	.602	.6467	.611		
1977	.6326	.6862	.625		
1978	.6414	.7057	.6658	.7424	.642
1979	.88	.942	.921	.948	.861
1980	1.15	1.24	1.232	1.274	1.123
1981	1.329	1.399	1.374	1.44	1.321

SOURCE: AAA Fuel Guage Survey

Prices have not risen consistently over this period but jumped suddenly in 1973 and again in 1978 as a result of worldwide and domestic oil policies (See Figure V-3). The rise in gasoline prices has thus presented the problem of sudden and dramatic increased cost at unexpected intervals. Given current uncertainties in oil supply, the eratic and unpredictable patterns of the '70s are likely to be repeated in the '80s.

FIGURE V-1

CONSUMPTION OF GASOLINE

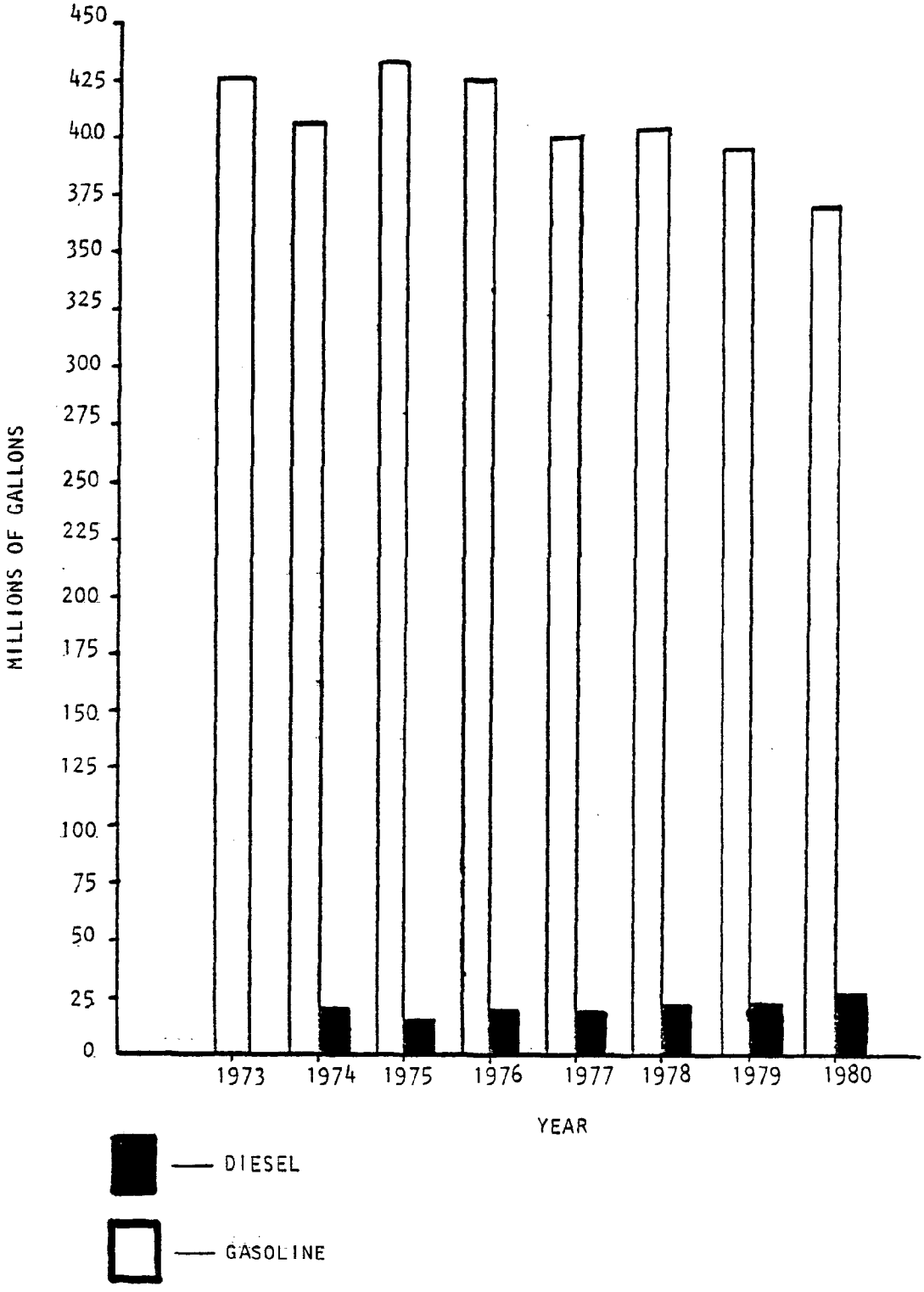


FIGURE V-2

STATE GALLONS CONSUMED PER CAR PER YEAR

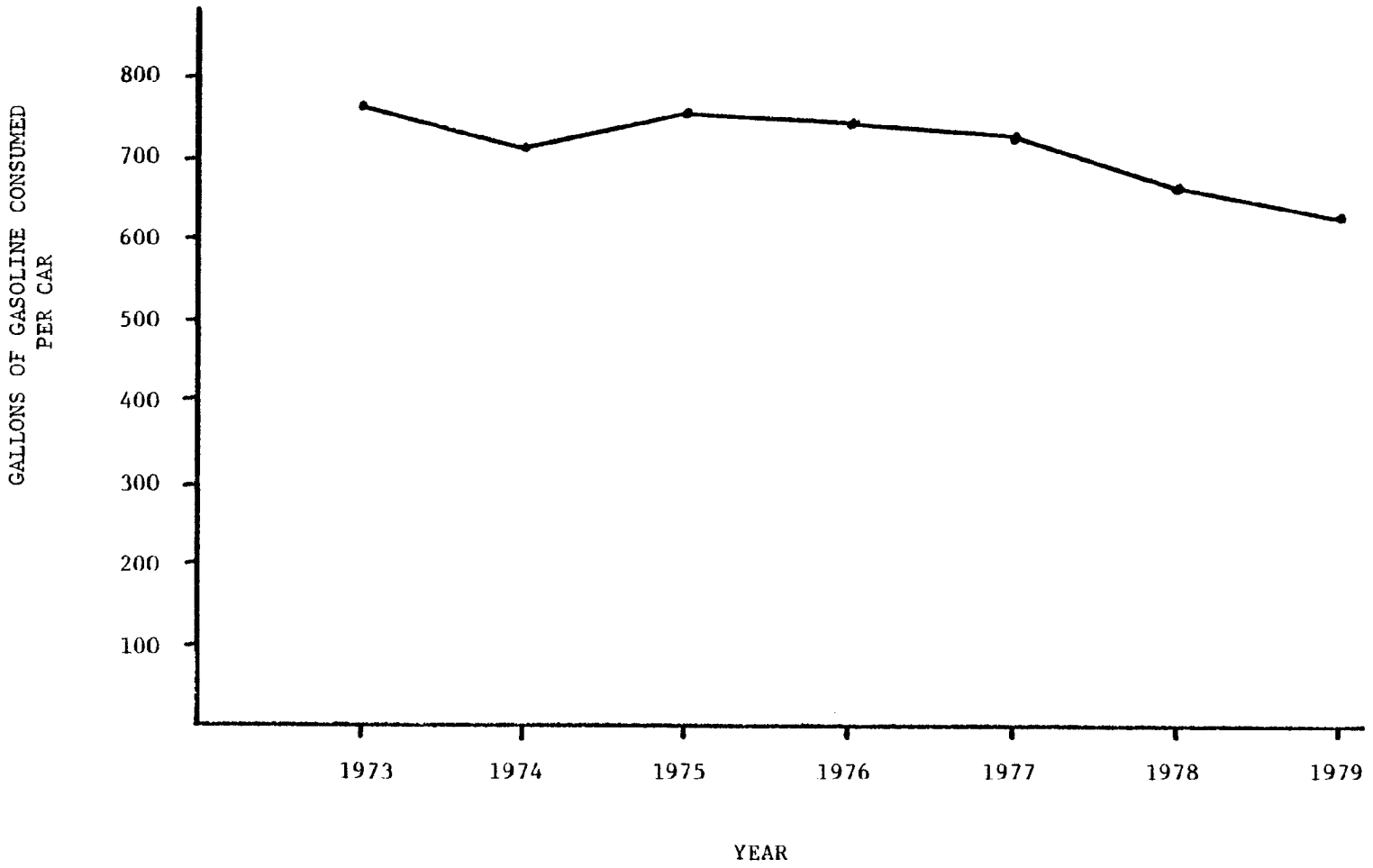
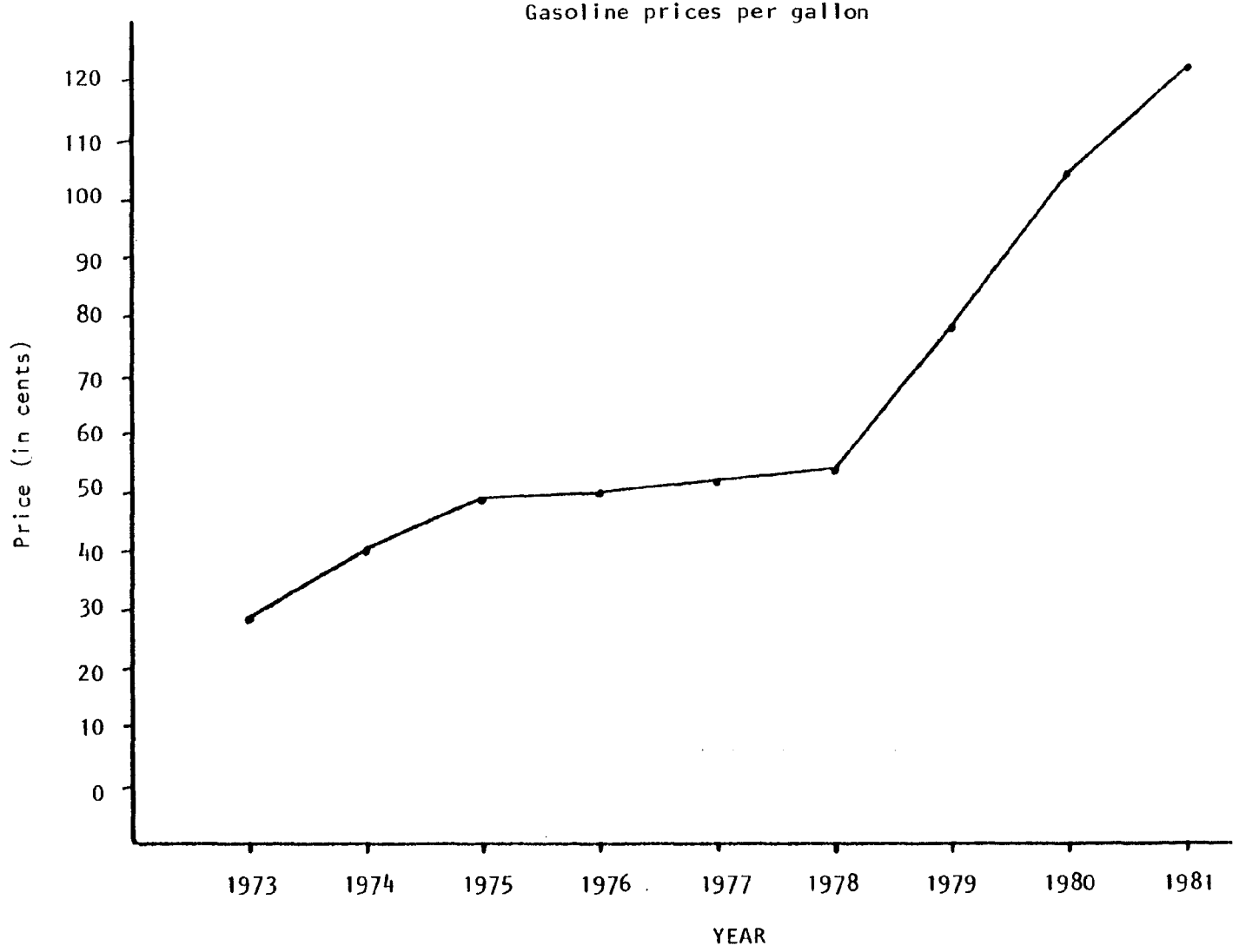


FIGURE 3

Gasoline prices per gallon



There are no figures on the total amount spent on gasoline in Rhode Island. A conservative estimate can be arrived at by multiplying total gallons by the price for regular gasoline. According to this calculation, Rhode Islanders spent $425.5 million on gasoline in 1979 or over $1,200 per household.

Commercial and Industrial Energy Consumption

In the commercial and industrial sector, use of #5 and #6 fuel oils were the major sources of fuel in 1976 but comprise only 30% of the total fuel mix in 1980. Combined, natural gas and electricity provide over 60% of total fuel use as compared to only about 30% in the residential sector.

Energy consumption trends in the commercial and industrial sectors resemble the trends in the residential sector. There has been a significant drop in the use of the heavier grades of fuel oil, an increase in the use of natural gas, and a very slight rise in the use of electricity. Mostly because of a 69% increase in the use of natural gas, total consumption rose by 2.6% in the commercial and industrial sector from 1976 to 1980.

Table V-7
Commercial and Industrial Consumption
1976 and 1980

	1970 BTUs 10	% of Total	1980 BTUs 10	% of Total	% Change '70-'80
Fuel Oil					
No. 4	1.73		.808		
Nos. 5 & 6	13.37		9.656		
Total Fuel Oil	15.10	45	10.464	30	-30
Natural Gas					
Commercial	2.950		4.503		
Industrial	4.928		8.840		
Total Natural Gas	7.878	24	13.343	39	+69
Electricity	10.480	31	10.528	31	+ .4
TOTAL	33.448	100	34.335	100	+ 2.6

SOURCES: [1] R.I. Fuel Allocation Office; [2] SEDS Report: 1979; [3] G.E.O. Report: 1981, "Energy Consumption Figures for the State of Rhode Island."

Although consumption of energy has increased less than 3% in the industrial and commercial sectors, the cost of this energy has risen 40%. Prices for industrial and commercial fuels have not risen as steeply as in the residential sector, however, where overall expenditures increased by 62%.

Table V-8
Commercial and Industrial Expenditures
1976-1980

	1976 BTUs 10^6	% of Total	1979 BTUs 10^6	% of Total	% Change
Fuel Oil					
No. 4	3.7434		5.5902		
No. 5 and 6	24.4556		29.5858		
Total Fuel Oil	28.1990	17	35.1760	16	+25
Natural Gas					
Commercial	9.800		18.690		
Industrial	11.050		15.580		
Total Natural Gas	20.850	13	34.270	13	+64
Electricity	112.650	70	157.490	69	+40
TOTAL	161.699	100	226.936	100	+40

SOURCES: R.I. Fuel Allocation Office; S.E.D.S. Report: 1979; G.E.O. Report: 1981, "Energy Consumption Figures for the State of Rhode Island."

Renewable Sources of Energy

It is estimated that alternate sources of energy contributed approximately 4% to the energy supply in New England in the mid-1970s and can be expected to contribute as much as 25% by the year 2000. A recent report on Renewable Sources of Energy in Rhode Island prepared for the Governor's Energy Office by Dr. Clement Griscom, described the 1980 level of development of alternate energy systems and feasible goals for 1985. The goals for substituted energy in Rhode Island for 1985 include the use of solid waste, wood, hydro-electric and solar (active and passive) and wind power for a total of 6.55 trillion BTUs of energy.

Table V-9
Rhode Island's 1985 Goals for Substituted Energy

Energy Source	BTUs 10^{12}	Characteristic Measurement
Solid Waste	4.81	728,000 tons/year.
Wood	.87	61,000 cords/year.
Hydro-electric	.23	6.3 MW capacity.
Solar (active & passive)	.58	17,500 active intall. & 20% passive in 17,500 homes.
Wind	.06	1.9 MW capacity.
	6.55	

SOURCE: Renewable Sources of Energy in Rhode Island, 7/1/81, Clement Griscolm.

Dr. Griscolm estimates that fulfilling these goals would result in achieving only a 3.8% substitution of our total energy consumption by 1985, a conservative goal in light of the existing 4% use of alternate fuels in New England. Dr. Griscolm's report, as well as recent publications by the Governor's Energy Office, provide a current picture of the status of alternate fuels in Rhode Island. Although Rhode Islanders have a good record of conservation, current utilization of many alternate sources of fuel has, so far, been disappointing.

Solar

The Governor's Energy Office estimates that as of mid-June, 1981, there was approximately 1,919 solar hot water heaters and 230 solar heated homes in Rhode Island.

Table V-10
Installed Solar

	Hot Water	BTUs	Space Heating	BTUs
Pre-1980	607		148	
1980	600		55	
Jan.-June, 1981	712		27	
TOTAL	1,919	23 Million	230	11.5 Million

SOURCE: G.E.O. Report, June, 1981, "Energy Consuomption Figures for the State of Rhode Island."

Using these figures, solar energy contributed approximately 34.5 million BTUs of Rhode Island's energy consumption in 1980. In order to reach the .58 trillion BTU

goal for 1985 more than 15,000 new systems would need to be installed. Additional efforts to promote solar energy are necessary in Rhode Island for the state to achieve its solar potential.

Although a solar solution to the energy problem is universally appealing, the actual market for solar systems in the state is limited by many factors including income level, housing suitability, energy consciousness and confidence level of the buying public. The potential for passive solar systems which include new housing design, attached greenhouses, sunspaces, double-glazing and south facing windows is even more difficult to assess.

According to Dr. Griscolm's report, an average of 1,200 BTUs per square foot is available from the sun in Rhode Island or 438,000 BTUs annually. At 25% efficiency, solar collector systems deliver approximately 111,000 BTUs per square foot to the household. Taking an overall average of 100 square feet per installation, Dr. Griscolm estimates that 17,500 solar panel installations (1 out of 20 housing units) are necessary by 1985 to meet the goal of .58 trillion BTUs. The goal could also be reached by passive techniques if all new housing accomplished a 20% reduction in purchased energy for heating by 1985.

Federal and State solar tax credits; the state sales tax rebate and town property tax breaks combine to make investment in solar systems an attractive alternate energy. Unfortunately, the relatively high up-front investment is a major impediment to many. According to Rhode Island sales tax rebate figures, the average rebate for solar installation in Rhode Island was approximately $186.90 in 1981. Since the rebate is 6% of the total coast, the average solar unit cost over $3,000. The current money crunch is a major deterrent to solar investment.

Solar energy is available in Rhode Island in ample quantities. There are approximately 30 panel distributors who can offer 20 types of commercial panels. A do-it-yourself solar workshop with a $1,000 solar kit is regularly offered at URI. Literature abounds on passive and active solar systems. Public awareness and con-

fidence grow slowly as more installations prove themselves. However, there is a need to distribute information and results from either a governmental or utility source and provide uniform and easily understood guarantees. As the cost of traditional fuels continues to increase, solar technology will be called upon as one path to energy self-sufficiency.

Wood

The use of wood as a residential source of heat has nearly doubled in the last five years. An estimated 131,000 cords of wood were burned in 1980-81 as compared to 84,000 in 1976-77 (See Table V11). Rhode Islanders used 2.38 trillion BTUs from wood in 1980 compared to over 44 trillion BTUs of energy derived from No. 2 fuel oil. Each cord of wood burned displaced over a barrel of oil, saving the state a total of 172,920 barrels of oil in 1981.

An estimated 23% of urban Rhode Island households and 48% of rural households burned wood as a source of fuel in 1980. There is little or no management of wood as a fuel source and the depletion of Rhode Island's forested land as well as potential pollution and safety problems raise questions about unlimited exploitation of wood as an energy source.

Sixty percent or 360,000*of Rhode Island is hardwood forest of which 70% or 272,000 acres are estimated to be hardwood. Since each acre yields an approximate .6 cords of wood each year, only 216,000 cords of wood are currently produced annually in Rhode Island. According to the forest service, 80% of Rhode Island's forest needs thinning for the benefit of the forest. A 20% cut plus removal of dead or diseased trees would yield seven cords per acre. 1.7 million cords could thus be harvested, or 170,000 cords per year for 10 years. The annual growth would provide an additional 180,000 cords per year. Based on these numbers Griscolm estimates, in his report, that Rhode Island's forests under statewide forest management are capable of yielding 350,000 cords for 10 years, dropping to a 150,000-200,000 cord harvest for future years.

*acres

Table V-11

Wood

Year	Burned in R.I.	Wood Equals Trillion BTUs	No. of Barrels of Oil Displaced
1976-1977	84,000	1.68	110,880
1977-1978	98,000	1.96	129,360
1978-1979	108,000	2.16×10^{12}	142,560
1979-1980	119,000	2.38×10^{12}	157,080
1980-1981	131,000	2.62×10^{12}	172,920

Conversion factor: at 23% efficiency one cord of wood displaces 132 barrels of oil.

SOURCES: [1]G.E.O. Report, June, 1981, "Energy Consumption Figures for the State of Rhode Island."
[2]G.E.O. Report, 1980, "R.I. Energy Picture ."

Use of wood as an alternate fuel source already exceeds the 1985 goals set for Rhode Island. It is the only alternate fuel which substantially fulfills its estimated potential. However, there is little state or local wood resource management. Many areas experience winter shortages of seasoned wood, implying that the state is not utilizing its dead wood surplus, but rather, its productive forest.

Wind

According to figures from the Governor's Energy Office there were 19 wind generators in operation as of June, 1981, with a total capacity of 241.1 KW. The wind turbines in Rhode Island range from a 200 watt windcharger in Westerly to a 200KW generator on Block Island. The majority of wind turbines (nine out of nineteen) are 1.5 KW. Assuming a 30% capacity factor for Rhode Island wind generators in 1980, there were 670,403 KWH/yr. produced.

There are no immediate plans for commercial wind generation in Rhode Island. Good wind sites on the megawatt scale require large tracts of land. Smaller, modular units such as the 200 KW site on Block Island may require as much as fifteen acres of land. A study of potential coastal wind sites is currently in progress under the Coastal Energy Impact Program and will result in a better overall assessment of wind potential in Rhode Island. There are approximately 670,000 KW of wind

power in use. In order to meet the 1985 goal of 1.9 MW capacity, it would appear that more commercial applications of wind power are necessary as well as additional residential applications.

Hydro-electric

According to a January, 1981, report from the Governor's Energy Office, there were 13 hydro-projects in some stage of planning and 2 operational hydro-power dams in Rhode Island: The Gainer Dam on the Pawtuxet and the Tupperware Dam on the Blackstone. The Gainer Dam operated at 45% capacity in 1978 resulting in almost 6 million KWH but decreasing water flow has caused a drastic decline in production, only 423,000 KW in 1981, or 3% of capacity. Partial figures for the Tupperware Dam show it operated at 70% in 1981 for an estimated 10,700,000 KWH produced per year. Assuming good water flow, Rhode Island has the potential of approximately 17 million KW of hydro-power.

Table V-12

Dam	Installed Capacity	Est. KWH
Gaines	1,500 (at 50%)	6,570,000
Tupperware	1,740 (at 70%)	10,700,000
TOTAL	3,240	17,270,000

The New England River Basins Commission 1980 publication, "Potential for Hydropower Development at Existing Dams in New England," surveyed 11,000 existing dams in New England and 900 dams in Rhode Island. The inventory identifies sites which should be considered for hydropower including a ranking for economic feasibility. According to this ranking a "top ten" list of Rhode Island dams includes five projects on the Pawtuxet River, two on the Blackstone, and three on the Pawcatuck. The total power generation of just these ten dams is an estimated 4.2 MW or 25.7 million kilowatt hours per year.

Table V-13

Top Ten Hydro Sites in Rhode Island at 70% Capacity Factor
As Based on Size, Benefit-Cost Ratio and Capital Recovery Energy Cost

Rating	Dam Name	No.	Theoretical Capacity (KW)	River Basin	Town	County
1	Albion	60	732	Blackstone	Lincoln	Providence
2	Arctic	148	227	Pawtuxet	W. Warwick	Kent
3	Horseshoe Falls	249	205	Pawcatuck	Richmond-Charlestown	Washington
4	Alton	247	167	Pawcatuck	Hopkinton-Richmond	Washington
5	Phenix	156	162	Pawtuxet	W. Warwick	Kent
6	Woonsocket Falls	56	1,391	Blackstone	Woonsocket	Providence
7	Woodville	246	98	Pawcatuck	Hopkinton-Richmond	Washington
8	Natick	145	702	Pawtuxet	Warwick	Kent
9	Arkwright	158	262	Pawtuxet	Coventry	Kent
10	River Point Upper	147	285	Pawtuxet	W. Warwick	Kent

In recent years there has been renewed interest in developing small hydro plants. Turbine technology is becoming more readily available for small hydro-applications. Financing difficulties are offset by beneficial tax provisions and federal and state utility regulations have established permit and rate setting procedures for small hydro plants. As the cost of energy continues to rise, use of small hydro sites becomes increasingly attractive for the private and public developer.

While the technology and economics of hydro projects are encouraging, there are some unresolved environmental constraints on hydro development. The hydro development position paper of the Governor's Energy Office in June of 1981 discourages hydro power on the Pawcatuck River insofar as it threatens adromous fish runs. The state Department of Environmental Management which administers a program to restore anadromous fish is also responsible for administering the wetlands permit necessary for hydro development. This licensing process has curtailed hydro development on the Pawcatuck River which is the major river basin on Washington County.

Solid Waste as an Energy Source

At the present time, solid waste in Rhode Island is disposed of at landfills except in Pawtucket, which has an incinerator. According to the D.E.M.'s 1980 "Inventory of Solid Waste Management Practices in Rhode Island," the total waste collected in Rhode Island was 440,000 tons per year or 1,205 tons per day in 1978-79. This total averages to about 2½ lbs per person based on 1980 census figures.

Waste is an important untapped energy resource in Rhode Island. According to figures used in Dr. Griscolm's study, the 1,200 to 1,400 tons of waste collectable each day has an energy content of 10.8 to 12.6 billion BTUs. Not only do we waste this potential resource but we pay to bury it at an average of approximately $18 per ton, according to the D.E.M. report.

In 1974 the Rhode Island Solid Waste Management Corporation was created by the Rhode Island legislature to develop a statewide resource recovery program. The Solid Waste Management Corporation has pursued procurement of a 1,200-tons-per-day central facility. In 1979 questions about the validity of the central resource recovery facility led to a new round of planning which included consideration of other options. In 1979 the Solid Waste Management Corporation also purchased the Silvestri Landfill in Johnston which can meet Rhode Island's disposal needs into the mid-1990s.

The "System Integration Planning Report" has presented several options for resource recovery including a central facility at the Warwick Sewage Tratment Plant or Quonset Point and modular units at the Newport Navy Base, The University of Rhode Island and North Central Industrial Park. Decisions which individual cities and towns make concerning waste disposal will affect the development of Rhode Island's resource recovery system. In addition, better technology is becoming available for small, modular units. As other energy costs increase, large industrial and commercial energy users may choose to supply themselves with energy from mini-solid waste facilities.

It seems certain that the future of Rhode Island will include some sort of solid

waste recovery facilities. At the moment, the type, size and location of these facilities have not yet been determined.

SOUTH KINGSTOWN --TOWN-WIDE AND IN-HOUSE ENERGY PATTERNS

PART I - Town-wide Energy Profile

Introduction and Overview

It is possible to estimate a breakdown of energy usage and costs in the town for 1980 by combining local and where necessary state data. Local information on fuel oil is not available but can be approximated by multiplying year-round housing units utilizing fuel oil by state consumption averages. South Kingstown electrical and natural gas consumption figures are available from the state Public Utilities Commission and gasoline consumption can be estimated by multiplying registered cars by average individual gasoline consumption (see Table V-14).

Table V-14

1980 South Kingstown Residential Energy Usage and Cost

Fuel	Customers	Usage: Traditional Units	Trillion BTUs	Unit Cost	Total Cost
#2 Fuel Oil	4733* (75% of yr. round housing)	5,206,300	.7221	1.02/gal	5,310,426
Electricity	7737	48,570,212 KwH	.1657	.07 KwH	3,440,896
Natural Gas	268 (60% of total customers)	190,307 MCF	.196	5.39 MCF	1,025,755
Gasoline	13,458 (1979 figure)	8,468,580	1.0592	1.15	9,738,867
			2.1430		$ 19,515,944

* Approximately 1100 gallons of fuel oil is utilized per average housing unit according to the GEO

Source:
1. 1980 Census
2. Narragansett Electric Co.
3. Providence Gas Co.
4. SEDS 1977
5. AAA Fuel Guage Surveys
6. RI Fuel Allocation Office

The total cost of energy in South Kingstown in 1980 was approximately 20 million dollars which is about 2% of the state total of approximately 916 million dollars. In several respects 1980 energy patterns and costs in South Kingstown are in line with its populations and housing units. With approximately 2% of the state's population and 2.2% of the state's housing units South Kingstown used approximately 2% of total state residential consumption in 1980 (see Table V-15). In some areas such as gasoline consumption, the town used more than its proportional share of fuel whereas in others such as natural gas the town used a comparatively small percentage of total state consumption.

Table V-15

1980 Town Energy Consumption as Compared to State

Fuel	South Kingstown Trillion BTUs	State Trillion BTUs	South Kingstown as % of State
Fuel Oil #2	.7221	44.620	1.8%
Electricity	.1657	6.324	2.6%
Natural Gas	.196	13.865	1.4%
Gasoline	1.0592	44.	2.4%
TOTAL	2.143	108.807	2.0%

Sources: 1. RI Fuel Allocation Office
2. Narragansett Electric Co.
3. Providence Gas Co.
4. RI Division of Taxation and Registry of Motor Vehicles

Dividing total residential energy costs which include gasoline expenditures by total number of housing units in South Kingstown it appears that the average South Kingstown household spent approximately $ 2500.00 on energy. When total expenditures are divided by year round town housing this figure is substantially

higher -- over $ 3,000.00 per housing unit.

Trends in energy consumption since 1970 closely parallel state trends. There has been movement towards conservation in all the traditional fuels. Building permit information and other local observation indicate increasing popularity of wood and solar resources. These trends reveal that the town like the state responds to price increases but does not always sustain a consistent trend towards conservation.

Although similar to the state in its energy usage South Kingstown has particular energy problems. As a rural recreational area there is marked reliance on gasoline and transportation systems. As a growing community, town services and facilities are under increasing pressure at a time when residential sprawl is particularly costly. As South Kingstown's population grows, so does its use of all forms of energy. Many of the conservationist trends at the state level are not so evident in South Kingstown.

In some respects the town is in an enviable position. As a growing community the town's land use measures can still shape a more efficient energy future. New construction lends itself more readily than older housing to alternate energy installations. Over half the town is forested and coastal winds may yet prove an attractive energy resource. In sum, there is considerable potential for energy self-reliance in the town.

It is beyond the scope of this report to describe detailed energy patterns in all sectors. 1970 census information as well as data from federal, state, and local agencies have been analyzed to present a rough profile of energy usage trends in the town, primarily in the residential sector. 1980 census information dealing with energy usage will soon be available to help complete this picture.

Population - Housing and Transportation Characteristics

In the last decade South Kingstown has experienced a substantial increase in both population and housing units. While the state as a whole lost 3% of its

population from 1970-1980, South Kingstown grew by approximately 20% and is estimated to grow another 28% by the year 2000.

Table V-16

South Kingstown Population

	1960	1970	1980	% Change 70-80	2000	% Change 1980-2000
South Kingstown	11,950	16,916	20,414	20.7	26,200	28.3
State	859,500	949,723	947,154	- 3.0	1,005,600	6.2
South Kingstown as % of State	.013	.017	.0215			

Source 1. U.S. Census of Population 1960, 1970

2. U.S. Census of Population & Housing, 1980 Advance Report, Feb. 1981

3. R.I. Population Projections by County, City & Town, Technical Paper No. 83 Statewide Planning April 1979.

The increase in housing units has been even more substantial and indicates considerable immigration into the town. From 1970-1980 housing units increased approximately 35%. Seasonal housing has dropped to 22% of the total housing stock.

Table V-17

South Kingstown Housing: Total Units

	1960	1970	1980	% Change 1970-1980
South Kingstown	5,124	6,020	8,138	35.2
State	286,757	317,689	372,672	17.3
South Kingstown as % of state	1.8	1.9	2.2	

Housing - Seasonal Units

	1970	% Total	1980	% Total
South Kingstown	1,747	29	1,752	22

Source: 1. U.S. Census General Housing Characteristics 1960-1970

2. U.S. Census of Housing & Population 1980 Advance Report, Feb. 1981

Although 1980 home energy characteristics have not yet been released by the Census Bureau, general housing characteristics are known and serve as broad indications of town energy patterns. Housing in the town is overwhelmingly single family. 78% of the year-round homes are single family according to 1980 U.S. Census figures. From 1971 to 1980 99% of new starts were single family, with the addition of only 23 multi-family units. The 1980 census characterizes South Kingstown housing as rural with a median value of approximately $56,000. 70% of the housing is owner occupied and 30% renter occupied. In many of these categories South Kingstown resembles the South County region and the five towns in the larger CEIP study area.

Transportation and commuting information is as yet unavailable from the 1980 census. 1970 census information based on a 15% worker sample describes characteristics of workers by residence and place of work for part of Washington County. Only 21% appear to be employed outside the county. However, these figures include a large armed forces population which has been transferred out of state. Subtracting this population results in over 55% of the Washington County population working outside the county. The majority of these work in the Providence area.

Table V-18

Characteristics of Workers in Washington County

Residents in Washington Co.	Work In Kent County	%	Work In Providence County	%	Work In Washington County*	%	Other Counties	%
SMSA 11143*	1,015	9.1	1,317	1.8	8,772	78.7	39	.4
SMSA without armed forces 5331	1,015	19	1,317	24.7	2,960	55.5	39	.7

* includes 5812 Armed Forces

SOURCE: 1970 U.S. Census of Population: Journey to Work

These rough estimates serve to confirm what is generally understood. Most South County workers including those in South Kingstown have a considerable commute to their place of work.

Equipment and structural characteristics of South Kingstown housing stock are reported by the 1970 census. In 1970, 75% of South Kingstown's housing used fuel oil to heat while 9% used electricity and 11% used some kind of bottled, tank or LPGas. 42% used fuel oil to heat water while 37% used electricity and 14% used bottled, tank or LPGas. Not unexpectedly electricity provided most of the cooking fuel -65%, while bottled gas also accounted for 28%. There was no reported usage of coal or alternate energy sources other than wood which represented less than 1% of home heating.

Table V-19

South Kingstown 1970 Residential Fuel Use

Utility	Home Heating		Water Heating		Cooking Fuel	
Gas	208	5%	216	5.3%	241	6%
Fuel Oil, Kerosene, etc.	3,028	75%	1,693	42.0%	46	1%
Electricity	343	8.5%	1,472	37%	2,605	65%
Bottled, Tank, LPGas	429	10.6%	581	14%	1,139	28%
Coal	--		--		--	
Wood	23	.4%				
None			69	2%		
	4,031					

Source: 1970 Census General Housing Characteristics

Electricity: Trends in South Kingstown 1970-1980

Town electrical consumption is broken down into both a residential trend and a combined commercial and industrial trend. An examination of consumption in these two sectors reveals that the commercial and industrial sectors responded to

price increases in 1973 to a far greater degree than did the residential sector. From 1974 to the present both sectors have maintained a very slow rate of growth in consumption (see Figure V-4).

According to 1970 and 1980 census population figures South Kingstown has consistently used slightly more than its statewide share of electricity. With approximately 1.8% of the state's population and 1.9% of the state's housing units in 1970, South Kingstown used 2% of the state's electricity in the residential sector. In 1980, with 2.1% of the state's population and 2.1% of the housing units, South Kingstown new represents 2.6% of the state's residential usage (see Table V-20).

The 163% increase in residential electric rates from 1970 to 1980 and a 28.4% increase in usage caused the average customer's yearly bill to increase from $ 131.97 in 1970 to approximately $ 445.71 in 1980 (see TableV-21). In spite of actual reductions in usage during the mid-seventies, electric bills have consistently climbed and show no sign of abating.

Table V-20

South Kingstown Residential Electric Usage as Compared to State

(in trillion BTUs)

	Rhode Island Statewide	South Kingstown	
Year	Residential Sales	Residential Sales	Residential Sales as % of State
1970	4.742	.098361	2.00 %
1971	5.143	.10894	2.10 %
1972	5.475	.11892	2.10%
1973	5.876	.12878	2.20%
1974	5.691	.12972	2.20%
1975	5.747	.13452	2.30%
1976	6.214	.15489	2.40%
1977	6.061	.15100	2.49%
1978	6.210	.15403	2.48%
1979	6.249	.15858	2.50%
1980	6.324	.16572	2.60%

Source: [1]Narragansett Electric Co.
[2]SEDS Report 1979
[3]Governor's Energy Office Report 1981

FIGURE V-4

SOUTH KINGSTOWN ELECTRICITY CONSUMPTION
(TRILLION BTU'S)

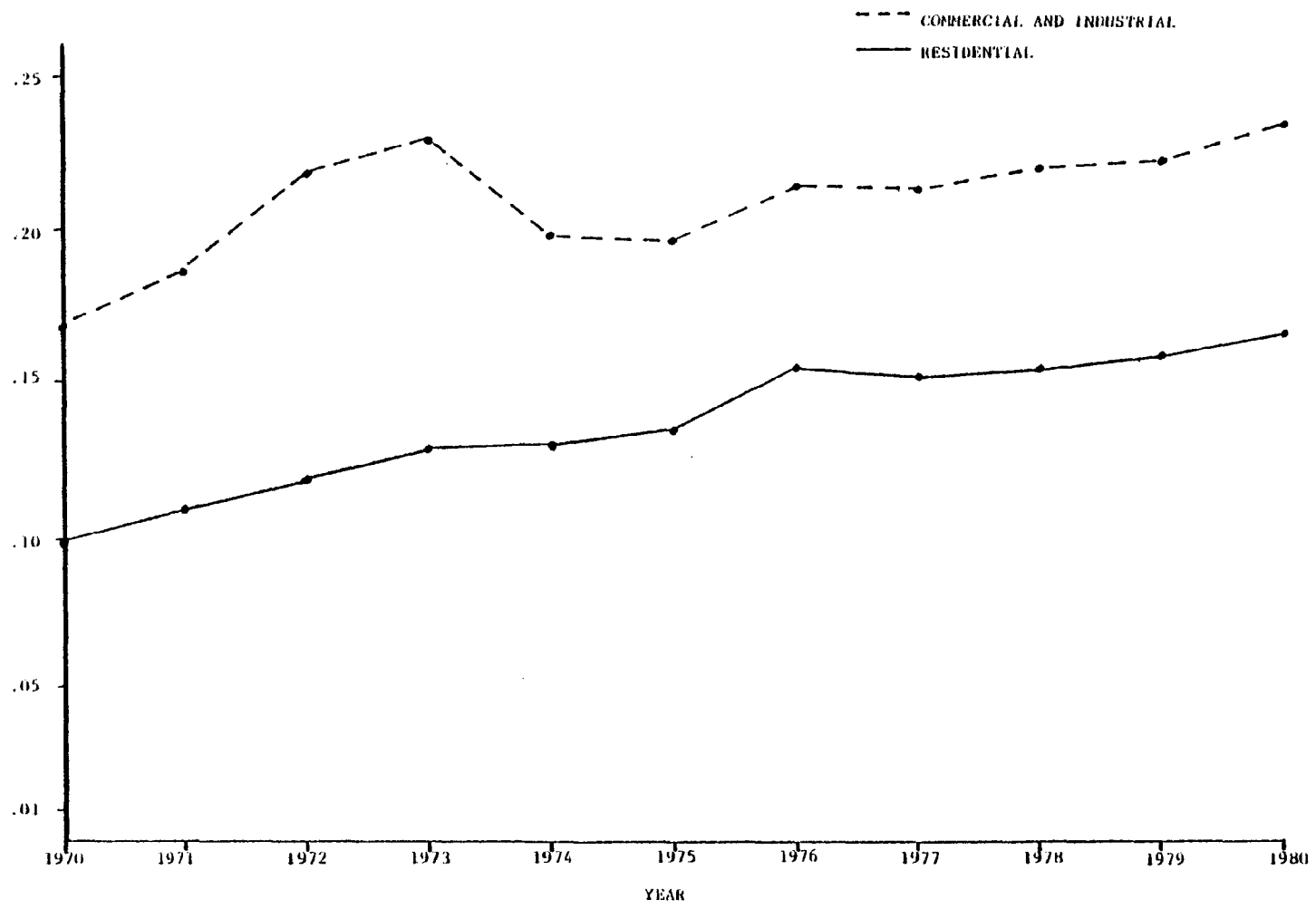


Table V-21

South Kingstown Residential Sales

Year	KWH Sold/Monthly Cust.	x	KWH Price That Year	=	$ Spent Per Customer
1970	4887.75		.027		131.97
1971	5333.74		.028		149.34
1972	5669.99		.031		175.77
1973	5930.76		.033		195.72
1974	5826.74		.046		268.03
1975	5954.66		.048		285.82
1976	6635.66		.048		318.51
1977	6271.19		.054		338.64
1978	6257.05		.055		344.14
1979	6281.63		.062		389.46
1980	6277.65		.071		445.71

Source: 1. Narragansett Electric Co.
2. Edison Electric Institute

#2 Fuel Oil: Trends in South Kingstown 1970 - 1980

The sale of fuel oil is unregulated and community specific information on price and usage is difficult to collect. In spite of repeated attempts to solicit information from local fuel oil dealers, the project succeeded in obtaining only an insignificant sampling of dealer information. The dealers who responded to the project survey agreed that the basic trend in South Kingstown was one of conservation. One dealer reported substantial drops in sales to residential, commercial and industrial customers over the last five years. Another had increased sales by 12% in the last 10 years but had more than doubled the number of customers. Installation of wood and coal stoves and other conservation measures were noted by the dealers.

According to census figures South Kingstown relied heavily on fuel oil as a source of heat and hot water in 1970. However the price of fuel oil has increased more than six times its 17¢ a gallon price in 1970. 1980 census information should establish that South Kingstown like the state has reduced its reliance on

fuel oil. The Governor's Energy Office estimates that in 1980 a statewide average of 69% of housing units used approximately 1100 gallons of fuel oil per year per unit. Using these figures a total of approximately 5,600 households in South Kingstown x 1100 gallons used is 6.2 million gallons. However these figures should be reduced somewhat to reflect seasonal units.

Natural Gas: Trends in South Kingstown 1970-1980

According to figures of the Providence Gas Company, use of natural gas has been increasing in South Kingstown although it still represents only about 1% of total gas usage in the state. Over the last 10 years there has been a doubling in the numberof South Kingstown customers and more than a 150% increase in usage. 1970 census figures which indicated that approximately 5% of cooking, home and water heating were provided by natural gas in South Kingstown should indicate a higher percentage today.

Since Gas Company records do not separate community usage into residential, commercial and industrial sectors, it is difficult to follow specific trends. According to conversations with Gas Company officials approximately 60% of South Kingstown customers are estimated to be residential consumers. In South Kingstown combined usage has followed a familiar pattern, dropping in 1973 and again in the late seventies. there has been similar fluctuation in state usage which increased a total of 16% over the ten year period.

Prices of natural gas which are regulated, have been rising steadily but not as quickly or unpredictably as other forms of fuel. In the last few years,however, these prices have risen substantially and are beginning to compare to fuel oil prices. (Table V-23)

Table V-22

Natural Gas -- South Kingstown -- Providence Gas Company

Year	South Kingstown MCF	% increase	South Kingstown Customers	Revenues	State Totals	% increase	South Kingstown % of State
1970	123,781		206	144,062.00	22769932		.5
1971	153,843.	+24	258	193,109.12	22868932	+.9	.7
1972	222,219	+44	314	282,444.83	22265139	-.3	1
1973	165,406.	-26	334	258,213.08	20311650	-9	.8
1974	134,935	-19	327	284,693.15	21713592	+7	.6
1975	140,290	+ 3	342	395,379.57	22871844	+5	.6
1976	215,059	+53	374	673,370.45	19835922	-14	1
1977	237,125	+10	392	757,467.71	23460652	+18	.9
1978	220,928	-7	408	682,574.	23560576	+.4	.9
1979	289,430	+31	421	888,198.	27648977	+17	1
1980	317,179.	+9	446	1,482,304.	26416741	-5	1.2

Source (1) Providence Gas Company

(2) SEDS Report 1979

(3) GEO Report

Table V-23

Natural Gas - Prices

Year	Residential	Commercial	Industrial
1970	1.775	1.428	0.839
1971	1.872	1.569	0.928
1972	1.989	1.766	1.112
1973	2.299	1.827	1.296
1974	2.471	2.064	1.676
1975	2.989	2.661	2.063
1976	3.256	3.282	2.220
1977	4.097	3.354	2.856
1978	4.050	3.178	2.713
1979	3.554	2.993	2.586
1980	5.39		
1981	6.01		
1982	7.50		

Source: [1][2]SEDS Report 1979
Providence Gas Company

Gasoline: Trends in South Kingstown 1970-1980

Insofar as information is available, it is possible to distinguish South Kingstown from state averages in both gasoline price and consumption. From the AAA fuel guage survey one can compare the Narragansett and North Kingstown test station figures with state averages. It appears that southern Rhode Islanders pay consistently more for gasoline than average - by as much as .07 extra for one gallon of regular gas in 1979.

Table V-24

Gasoline Prices

Year	Narragansett $/gal. reg.	North Kingstown $/gal.reg.	State Average $/gal.reg.
1977	65.9	64.9	63.23
1978	66.9	65.9	64.14
1979	95.22	84.92	88.0
1980	120.88	122.0	115.0
1981	135.56	138.3	132.9

Source: AAA Fuel guage surveys

In addition to experiencing higher gasoline prices, South Kingstown is increasing its consumption of gas at the same time that state consumption is dropping. From 1973-1979 South Kingstown increased consumption by 8% while the state consumption dropped 8%.

1973-1979

Area	Gal. of Gas Consumption	Car Registrations	Population 1970-1980
State	- 8%	+ 12%	- 4%
South Kingstown	+ 8%	+ 32%	+ 21%

Consumption figures were obtained by using car registration figures. In large measure the state and local trends reflect population trends. South Kingstown with a growing population is using proportionally more gasoline each year. As a rural recreational area, commuting patterns also place South Kingstown in a particularly susceptible position with regard to gasoline pricing and policies.

Taking statewide gasoline consumption and car registration figures one can calculate the average amount of fuel the Rhode Island individual has used and what it has cost him over the years.

Table V-25 Monthly Gas Expenditures

Year	Gallons Per Month	$ Regular	$ Premium	Monthly $ Regular	Monthly $ Premium
1973	63.3	x .39	x .43	24.68	27.21
1974	59.4	x .50	x .545	29.70	32.37
1975	63.25	x .58	x .63	36.68	39.84
1976	62.0	x .6012	x .6467	37.32	40.06
1977	60.2	x .6326	x .6862	38.08	41.31
1978	55.1	x .6414	x .7057	35.34	36.68
1979	52.3	x .87	x .942	46.02	49.27
1980	50.0*	x 1.15	x 1.24	57.50	62.10
1981	48.0*	x 1.329	x 1.399	63.79	67.15

*1980 and 1981 figures were unavailable. These are estimates based on state trends.

In 1979 the average Rhode Islander used 52.3 gallons of gasoline, .11 fewer gallons per month than in 1973. This drop reflects a steady yearly decline in consumption. To some extent conservation has offset price increases. From 1977 to 1978 when prices had leveled off, conservation actually caused a slight reduction in the average Rhode Islander's gas budget. However, conservation has not been able to keep pace with price increases and in 1979 the average yearly gas budget was approximately $552., almost twice the $296 spent on gas in 1973.

South Kingstown: Potential for Alternate Fuels

Wood, Solar, Wind and Hydropower

South Kingstown is uniquely endowed with alternate energy resources. 20,000 acres or over 50% of the town is forested. The majority of South Kingstown's forest is hardwood. Some mixed forest is also suitable for fuel. Forested wetlands which are numerous in the town are primarily maple, a good firewood, and have the advantage of being unsuitable for residential use thus holding greater potential as long term managed wood lots.

There is ample evidence that wood is becoming increasingly popular for home heating in South Kingstown. Building permit records from October 1980 to October 1981 contain 160 wood stove permits and 12 coal stove permits. In the same period the records revealed only 4 permits for solar applications. In both cases permits reflect only a portion of actual applications in the town. Wood and solar installations in new construction for example are contained in blue prints rather than the permits reviewed by REP. Figures from the tax division on solar sales tax refunds for the same one year period show 36 refund requests from South Kingstown out of a state total of 321. Refund figures only represent one quarter of actual solar installations according to figures from the Governor's Energy Office. They do show that 11% of total state requests were from South Kingstown, a high percentage probably reflecting the amount of new construction in the town.

PART II - Town Facilities - Energy Usage and Cost

Energy consumption information for town and school facilities is available in energy audit reports compiled as phase 1 of the Title III program by the town energy coordinator. This material provides approximately six years of consumption data. Consumption trends in town buildings are difficult to follow because of the addition of new facilities, incomplete information, and a change in the report period from a January -December year to a June-July year in 1979.

An examination of usage in town facilities shows no increase in either electrical or fuel oil consumption from peak use periods in the mid-seventies (see TableV-25). Although some individual facilities show energy usage declines, there is no consistent conservationist trend. Town buildings for which audit material is available include the Town Hall built in 1877, the Town Annex converted to use in 1977, three town libraries added to the accounts in 1976, the highway and landfill garages, the all electric police station and the sewer treatment plant. Recently several small conservation measures were undertaken in the Town Hall such as storm windows and insulation on the third floor. The town energy audit committee is measuring the results of these improvements but it is too early to assess their success.

Energy Patterns in South Kingstown Schools

There are nine public schools serving South Kingstown: six elementary, one junior high, and one senior high school. Many of the school buildings are old, dating from the first half of the century. The town's senior high, its largest facility, was built in 1954. The town has two new elementary schools, built in 1975, and along with South Road Elementary, built in 1964, these are only three facilities which have the potential for future expansion. The school system also includes an administration building, built in 1910, and a maintenance shop built in 1900.

Table V-26

Electrical Consumption KWH
In Town Facilities

Building	1975	1976	1977	1978	1979	1980	1981
Town Hall & Annex (added in 1977)	72688	60793	88560	129,840	118,560	112,440	104,400
Libraries *incomplete		23345*	15058*	41,387	41,897	20,497*	19,928*
Highway Garage	59877	64577	61395	64,800	62,640	60,670	62,880
Landfill Garage	47455	40441	42006	37,827	21,442	47,094	39,305
Police	237,012	238,246	256,345	252,624	249,353	236,429	244,189
TOTAL KWH	417,032	427,348	463,364	526,478	493,892	477,130	470,702
Schools	843,459	1,460,398	1,409,675	1,436,254	1,382,922	1980-1981 1,539,057	

Fuel Oil Consumption Gallons

Town Hall	4,855	4,688	5,151	4,496	4,248	3,466	4,541
Annex			2,349	2,331	2,127	2,099	2,513
Highway Garage	8,097	9,345	9,197	10,977	6,846	6,288	7,967
Libraries (* incomplete)		3,108	10,924	10,274	9,413	3,773*	8,019
Sewer Treatment Plant		58,006	38,523	20,190	40,042	36,897	34,475
TOTAL	12,952	75,147	66,144	48,268	62,676	52,522	57,515
Schools	190,052	173,531	162,541	176,237	162,933	1980-1981 151,767	

Source: Town Energy Audit Reports

Consumption of fuel in the schools increased somewhat from 1973 to 1975 but since then has actually decreased (see Figure V-5). Audit information reveals a significant drop in the use of electrical power in 1974. The addition of two new electric schools in 1975 accounts for increased electricity usage in recent years. Usage of fuel oil also peaked in 1975 decreasing in the following years in response to replacement of fuel oil facilities by electric-powered schools. The total consumption of energy in the schools has neither risen nor declined dramatically over the years. Audit information reveals no major conservation measures undertaken during this time so that reductions in usage such as the drop in electrical consumption in 1974 are largely due to self-imposed conservation. It is unlikely that consumption of energy will be reduced in future years without more strenous conservation measures.

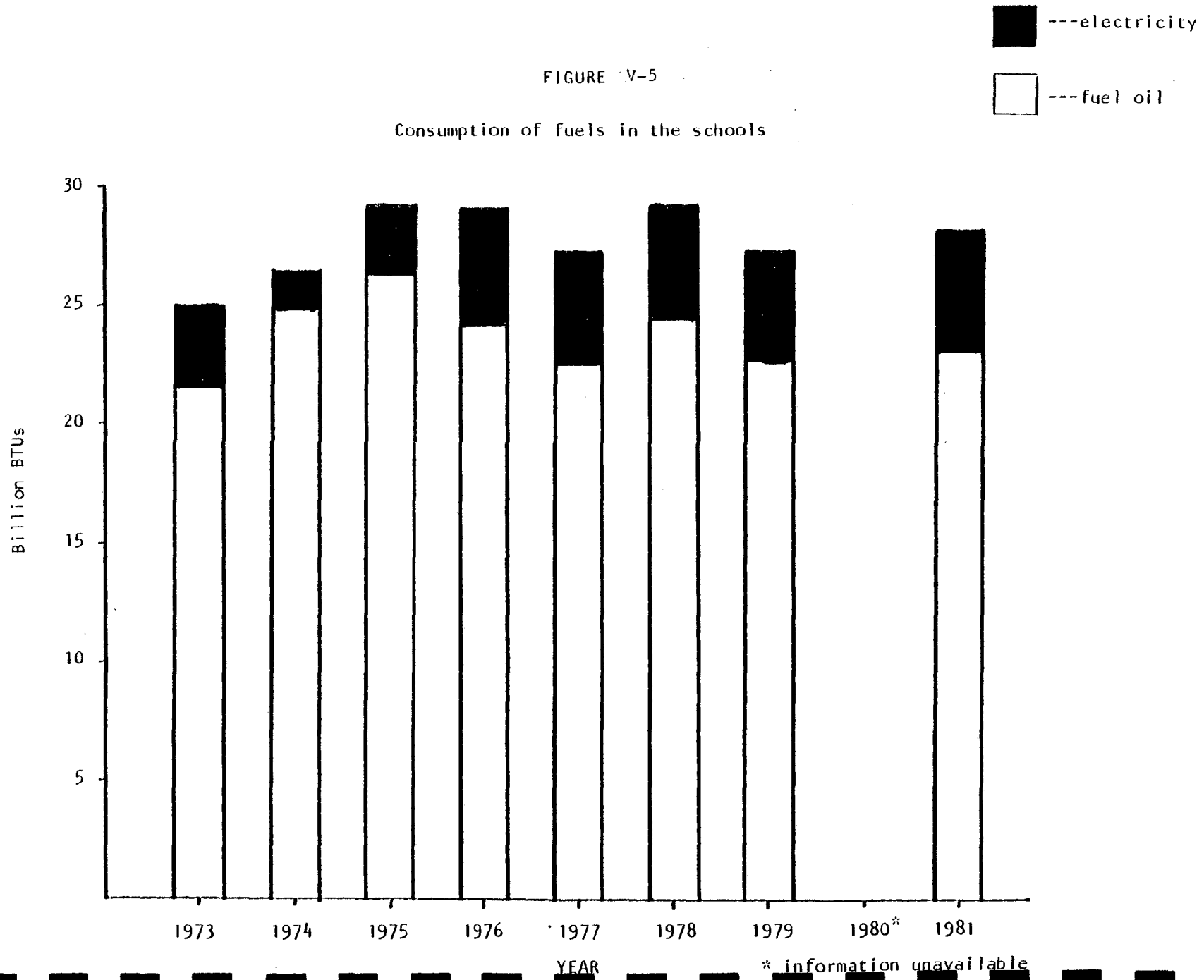
Information on individual schools derived from energy audits conducted by the GEO prompt several general observations. Not unexpectedly, the older buildings use more energy per square foot whereas the new electric schools are the most energy efficient. With few exceptions, only minor conservation measures, such as turning down the thermostat and turning off lights, have been undertaken. However, in the one instance of additional insulation and storm windows at the Stepping Stones Kindergarten, consusmption dropped dramatically in the following years.

Town Budget - Energy Expenditures

As one would expect, energy expenditures have risen consistently and sometimes dramatically over the ten-year period from 1971-1980 in South Kingstown. An examination of the town accounts reveals that energy costs have risen across the board in the three categories of electricity, fuel oil and fuel and lubricants. The accounts examined include electricity and oil accounts for the town hall, police, highway and library buildings as well as the street lighting account and fuel lubricant costs for police, highway and landfill (see TableV-27).

FIGURE V-5

Consumption of fuels in the schools



In 1980, the town spent approximately $ 35,000 on electricity, $ 38,000 on streetlighting, $ 20,000 on fuel oil and $ 117,405 on fuel and lubricants. Whereas streetlighting costs have risen slowly and consistently over the years from approximately $33,800 in 1972 to $ 38,600 in 1980,* other combined electrical bills more than tripled from approximately $ 8,800 in 1971 to $ 35,000 in 1980. There are several reasons for rising expenditures including addition of the town Annex and addition of the accounts for libraries, forest fire and recreation. Fuel oil, the smallest spending category exhibited the most dramatic increases costing the town only $1,440 in 1972 and $ 20,300 in 1980. The addition of new building accounts also affected these figures.

By far, the largest spending category, fuel and lubricant expenditures, have also increased substantially through the years from approximately $22,600 in 1972 to $ 117,400 in 1980.

Tablve V-27

1970-1980 Energy Expenditures in South Kingstown (Dollars)

Year	Elec.	Fuel Oil	Fuel & Lubs.	Street Lights	Town Total	Schools*	Energy Total
71-72	8777	1440	22681	33885.02	66783.02		
72-73	9790	1767	22380	34435.	68372.		
73-74	13155	2539	32391	34937	83022.	63079	146101.
74-75	19241	6420	45138	35794	106593	94222	200815
75-76	23580	6488	55058	36876	122002	109160	231162
76-77	22579	7096	63825	38152	131652	131208	262860
77-78	27844	12569	54218	37448	104235	143193	247428
78-79	30764	8203	49829	44944	133740	145984	279724
79-80	35434	20346	117405	38659	211844	178153	389997

Source: 1. Town Accounts
2. Town Energy Audits

*Because of rate increases, streetlighting costs have increased substantially in the last 2 yrs. to a projected $56,000 in 1983. See Chapter on town initiatives.

Town accounts do not include energy expenditures on school building or busses. School energy expenditures from energy audit material also show sharp increases in expenditures from 1974-1980. The cost of electricity and fuel oil combined have tripled from approximately $ 63,079 in 1973-1974 to $ 178,153 in 1979-1980. School energy expenditures have been rising consistently and in 1977-1978 and 1979 cost more than other town energy expenditures combined.

Information on school busses and gasoline budgets was not collected for the ten-year period. However records for 1980-1981 show a fuel expenditure of approximately $17,500 for the schools' busses and other vehicles.

Energy Initiatives

Introduction

Town departments and boards have taken several steps to conserve energy in their facilities and equipment. The Public Works Department keeps detailed equipment records for all departments. New vehicle purchases are determined in light of their gas mileage potential as well as other factors. School and town buildings are maintained with energy efficiency in mind. According to conversations with the Maintenance Department, attitude is a major factor in cutting energy costs in the school system. A memo urging conservation sent to all schools* had measurable impact on energy usage. Unfortunately, maintaining the conservation ethic throughout school and town buildings is not a simple task.

An energy audit committee was appointed by the Town Council in 1978. Their efforts have included proposals for an energy awareness campaign in the schools and auditing of energy usage in the town buildings. Currently, they are reassessing their role. In fact, there is a real need for coordination of town energy efforts and promotion of conservation goals. Although town departments practice good management as a matter of course, there is little consideration given to potential alternate energy applications or large scale weatherization and conservation projects. One important function of the energy commission is that of an energy efficiency lobby which can assist long term planning for reducing town energy expenditures. In this and other efforts the town's energy committee requires good communication with and support from other town departments. Most town boards make decisions which have impact on energy usage and expenditures in the town. In addition to the energy audit committee, the planning board, conservation commission, building inspector, tax and public works department all deal with important energy issues.

With renewed commitment by the energy committee, the town could adopt an energy program to bring down energy costs in town facilities and the community at large.

The Farmers Market

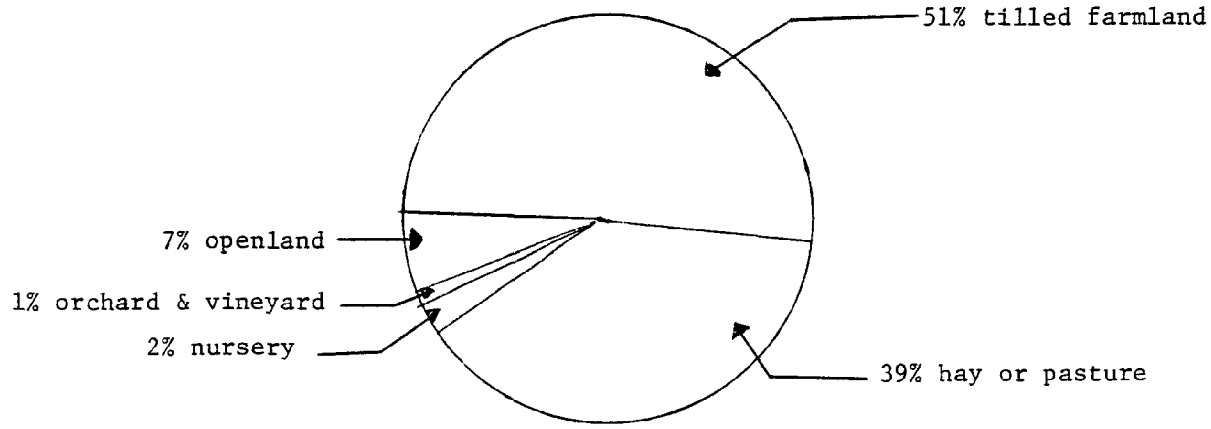
As an important adjunct to its informational function, R E P has worked closely with the town's Conservation Commission to promote a community farmers market to

*in 1976

be located at the Washington County Government Center parking lot. Although a farmers market serves a number of other town goals, it also promotes energy self-sufficiency in the region. Importation of out-of-state food is an increasingly expensive proposition in Rhode Island. By providing a local center for growers to market produce and crafts, the farmers market avoids fuel and transportation costs. Farmers markets also serve as a possible outlet for alternate energy fuels such as wood. Perhaps most importantly, a farmers market serves as a meeting place for the community. A related community project is the possibility of an energy exposition to be located as a special event at the farmers market. Such an exposition could engage the public's attention, promote local energy businesses, and provide informational services a forum to discuss energy-saving opportunities to the public.

South Kingstown has the most acreage of tilled farmland in the state with 1,889 tilled acres, according to the 1979 Soil Conservation Study. Only two other Rhode Island communities have over 1,000 tilled acres; Richmond, with 1,166 acres and Portsmouth with 1,224. In addition to its tilled lands, South Kingstown has 1,434 acres of hay and pasture, 95 acres of nursery, 39 acres of orchard or vineyard and 276 acres of open land. This represents ten (10) percent of the state's total farmland acreage.

South Kingstown Acreage



source: U.S. Dept. of Agriculture
Soil Conservation Service

Although only 3,733 acres of South Kingstown are being farmed, according to 1979 figures there are over 11,000 acres of prime farmland in the town. Prime farmland is the land best suited for farming as well as still available for farm use. South Kingstown leads the state in area potential for prime farm use, although nearly two-thirds (2/3) of this potential area is not now cultivated (See Fig. V-7). Unfortunately, this same land is often the most desirable for residential development, and South Kingstown is one of the fastest developing communities in the state.

Rhode Island currently have five farmers markets of varying size and success. The Department of Environmental Management has formed a direct marketing group to promote locally-grown produce and assist in organizing and advertising markets. Other states have significantly more direct market activity. Maryland recently reported 454 direct farm outlets, including nineteen (19) farmers markets*; Vermont has a reported thirteen (13) farmers markets; and Massachusetts, twelve (12).

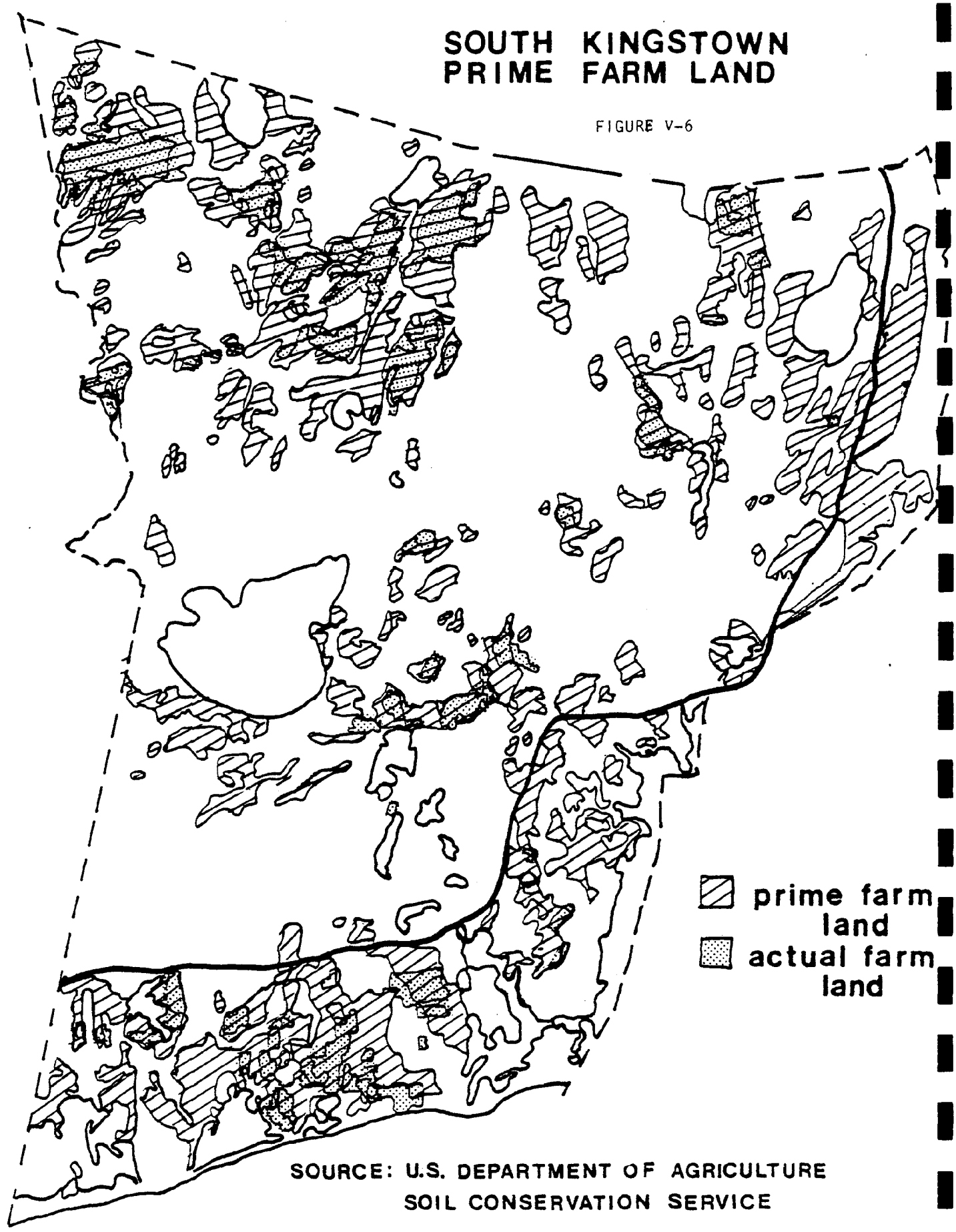
Rhode Island is just in the beginning stages of promoting state grown produce. Lack of actual market experience as well as past low priority placed on agriculture in Rhode Island combine to make the organization of farmers markets a difficult task. Good publicity and a campaign to reach the growing community has been necessary to get adequate participation and commitment. As examples of successful markets become more common, recruitment of growers will be more a matter of course. Farmers too busy to participate may well consider hiring people to sell; smaller part-time growers may consider combining their produce to sell at one booth.

South Kingstown has both the need and potential for a good farmers market. Attracting buyers in South Kingstown, particularly during the summer and fall months, presents no problem. However, getting enough growers to grow crops specifically for the market in its first year is key to the success of the operation. The Conservation Commission has been successful in providing a good site for the market and an association of interested growers has been formed to pursue market operation.

* "Direct Marketing of Fruits and Vegetables in Maryland," James L. Cain, Professor of Agriculture and Resource Economics, University of Maryland, College Park, Maryland, April, 1980.

SOUTH KINGSTOWN
PRIME FARM LAND

FIGURE V-6



SOURCE: U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Land Use Planning

There are many examples of towns regulating development patterns and the siting of buildings to encourage energy efficiency in land use and building design. In some areas of the country such as California, financing from utilities has facilitated the implementation of stringent conservation measures. Federal funding has also eased the transition to community energy efficiency. In Rhode Island there are few direct funding mechanisms now available to a community for promoting conservation. Fortunately, simple modifications in planning and regulatory practices to include energy considerations do not require large investments by either the town or the individual developer.

A publication by the Rhode Island League of Cities and Towns, Energy Planning and Management suggests several common sense measures for a community to effect development patterns. These measures include consideration of energy as a factor in subdivision review. In South Kingstown, which is a growing community, there is ample opportunity to influence the future development of the town through subdivision regulation.

There are two approaches to energy efficiency review. One is to provide the developer with an energy efficiency checklist, listing energy considerations he should bear in mind in planning the development. Second is to require an energy impact statement asking the applicant to figure and, where possible, minimize the energy costs of his development. Site selection , site design and orientation all influence energy usage. An energy efficient subdivision minimizes road, sewer and utility runs, maximizes the potential of solar gain, and optimizes environmental conditions.

Subdivision review in South Kingstown already includes analysis of environmental and ecomomic factors. An energy review would require a finer analysis of the site and subdivision design. Subdivision review does not regulate building design or orientation. Suggestions regarding energy efficient design might be distributed from the building inspector's office.

South Kingstown's current land use practices and policies include cluster ordinances and ongoing efforts to encourage preservation of open space. Encouraging energy efficiency factors will further these established growth management practices.

Residential Weatherization

In Rhode Island a free residential energy audit service, funded through utility surcharge, is available through Rhode Islanders Saving Energy (R.I.S.E.) a nonprofit corporation. R.I.S.E.auditors assess the efficiency of the home heating system, recommend needed work, suggest qualified contractors and estimate costs and benefits for the homeowner. Over the last two years, R.I.S.E. has conducted over 20,000 audits; of these approximately 300 or 1.5% have been conducted in South Kingstown.

A recent survey of homes weatherized by community action agencies for the Department of Community Affairs found that there was an annual energy savings of 18.5% in weatherized homes. The average savings per home was $82 during the survey period from October 1980 to March 1981. The payback time for the cost of materials was 4.5 years. Weatherization programs can thus effectively reduce energy consumption and expenditures in South Kingstown homes.

Like most coastal areas, South Kingstown has been evolving from a seasonal to a year-round community. Thirty percent of town residences were summer homes in 1970, dropping to 22% in 1980 according to census figures. Because a substantial number of South Kingstown homes were built for summer use and many of these are now being converted to year-round use, weatherization programs are particularly valuable in the town.

Although R.I.S.E. is a well publicized service, the town could take several steps to encourage residents to participate in the program. With 2.2% of the state's housing units, the town should target at least its representative share of audits. A U.R.I. survey of the R.I.S.E. program showed that residents taking advantage of R.I.S.E. are overwhelmingly upper income, 70% making over $20,000 and 40% over

$30,000 income. There is a particular need to reach the lower income families with weatherization information.

There has been a dramatic drop off of audits in South Kingstown. Only 44 of 310 audits were performed in 1982 and most of these were in January. R.I.S.E. has had good success marketing audits through direct mailings and is willing to coordinate with town promotional efforts. Other towns have included R.I.S.E. brochures in water bill mailings. The town energy committee could also contact local lending institutions and encourage their cooperation in promoting R.I.S.E. audits for home improvement loan customers. Information on R.I.S.E. audits could also be available in the building inspector's office. One goal of town energy initiatives should be to increase the percentage of R.I.S.E. audits in the town over the next several years.

Public Transportation: Carpooling & Ridesharing

Today, mass transit alternatives are available to commuters and residents in South Kingstown. However, there are no plans to extend or expand these services. Amtrak makes stops in the morning and evening at West Kingstown but was recently forced to eliminate a commuter local between Westerly and Boston due to lack of riders. The primary passenger carrier in Rhode Island is the Rhode Island Public Transit Authority (R.I.P.T.A.). Over the past decade, R.I.P.T.A. has increased its ridership by updating its equipment, by increasing the number of communities served, and by providing an alternative to the high cost of automobile travel. Bus transit links now exist between the urban centers of the West Bay communities and with the major employment centers (Quonset Point-Davisville and the University of Rhode Island (U.R.I.)) in the region. Bus routes joining Kingston and U.R.I. with Wakefield, Narragansett Pier, Galilee, Jamestown and Newport provide connections to routes to the Providence Metropolitan area.

While bus routes in the region are running at capacity levels or at least within respectable levels of ridership, there are no plans to expand service by increasing the number of buses in the region or by increasing the number of communities

served. Expected federal cuts in operating funds makes future service cut-backs more likely than service expansion.

Carpooling provides an important alternative to the high cost of automobile travel. Presently the Rhode Island Department of Transportation maintains a commuter lot at the intersection of Routes 138 and 1A and has plans for another lot at the Washington County Government Center.

The University of Rhode Island has made some effort to encourage carpooling to the main campus. One, sixty-five-space lot located behind the Memorial Union, and central to most facilities, has been reserved for carpools of at least three persons. While the lot is identified by signs, a lack of funding for additional personnel to monitor the lot hampers its success.

R.I.D.O.T. serves as a funnel agency for federal dollars for ridesharing programs. Early activities included the computer matching of commuters. Since 1978 R.I.D.O.T. has been promoting the Rhode Island Revitalized Ridesharing Program. Surveys are being conducted to identify major employers in the state that are most likely to participate in a ridesharing project. Informational meetings are conducted by R.I.D.O.T. staff. R.I.D.O.T. serves as the link between the employer and the federal government who will loan 75% of the cost of a van, interest free. The employer purchases the van and provides it at a nominal fee to employees for vanpooling.

R.I.D.O.T. officials point out that while the program requires both the outlay by the employer of some monies and, more importantly, company initiative, the employer reaps the benefits of tax credits as well as employee satisfaction. Administrators of the program note that they are studying the feasibility of state employee involvement in the program as well as identifying other large firms as potential participants in the project.

Energy projects in other communities have included efforts to promote carpooling. Simple measures such as maintaining a commutor information box at the town hall assist individuals in matching up rides. The town's energy committee could

also serve as a contact for R.I.D.O.T. and encourage the regions larger employers to participate in a ridesharing project.

In South Kingstown reliance on automobile travel could be reduced by increased bicycle use. A study of biking in South Kingstown was done in 1981 by Brian Dixon. Safety and secure storage facilities were identified as the major concerns of bikers. Secure bikeways would be a major boost to bicycle travel. However, the state has a policy of not encouraging biking on state roads and will not undertake "stiping" or other relatively low-cost measures.

The town is now considering the opportunity of a separate bike path on the old rail bed from Kingston Station to Wakefield. In addition to an important recreational bikeway, the path connects the U.R.I. area to Wakefield and connects many of the town schools. As cyclists become acclimated to recreational biking, regular use of bicycles would become more common in the town.

Strategies suggested by Mr. Dixon's study include providing storage facilities conducting an educational and promotional program, and distributing bicycle suitability maps. The zoning ordinance could require bike facilities, in addition to parking in commercial areas. The study emphasized the need to encourage public involvement in biking noting that perception of dangerous biking conditions is a greater impediment than any actual danger on the roadways.

Streetlighting

In November, 1981, the cost of streetlighting rose dramatically when the utility was allowed to establish a streetlight fuel surcharge which is now multiplied per KWH of consumption. At the present time, South Kinsgtown has 1,454 streetlights and a projected 1982 streetlighting budget of approximately $56,000. There are ten different categories of streetlights classified by type, lumin output, yearly KW usage, and annual charges from the utility (see tableV28). The majority of the town's streetlights (over 1,000) are incandescent, low lumen output lights with a low annual utility charge and low KWHR consumption. This type of light, referred to as a "bug light," is no longer available and the town is slowly

converting to larger, more expensive lights. The two choices now available are mercury vapor lights and sodium vapor lights. The mercury vapor lights are more energy efficient but have a higher annual utility cost. On balance, the town has calculated that it is more economical to install the mercury vapor light, although it uses more KWH per year to operate.

Streetlighting costs are a major part of the town's energy budget and the Town Traffic Commission employs a conservative policy in determining the need for new lights. Requests for new streetlights must meet at least one of four requirements by being located 1) at a street corner, 2) in a high crime area, 3) on a major traffic artery, or 4) at a place of public gathering.

Utility policy and rate setting are responsible for lack of cost effectiveness of the newer, more efficient lights. The town should encourage rate and policy changes to promote better cost-effectiveness. A new, lower lumens bulb to help replace eventually the "bug light" would also be desirable for towns like South Kingstown in which many areas use and enjoy low intensity lights. Although the town already has a conservative policy on streetlights, it might be possible to propose cutting back the number of streetlights. Lincoln, Rhode Island, is reducing lights substantially in response to high electric rates.

Conclusion

There are dozens of small energy saving projects of immediate benefit to the town which require only interest and commitment to energy saving goals. The withdrawal of federal funds has meant the collapse of many energy programs. We are now in a period of transition in which towns and individual consumers must determine their own priorities. Energy costs will continue to use and become increasingly burdensome. In many respects the individual consumer has already pointed the way by reducing statewide residential consumption by 13% from 1976-1980. Towns should set their sites on reducing energy consumption in the 1980s.

Appendix

Regional Onshore Impact Issues

Regional Onshore Impact Issues

This section consists primarily of a composit of findings of onshore impacts from other OCS support regions in North America and Great Britain. Onshore impacts and issues found in the United States in general, oil support regions of the states of Louisiana, Alaska, the Mid-Atlantic, North Atlantic, and Scotland are presented on the charts in pages 265-279.

This study does not attempt to quantifiably project regional impacts from OCS support facility development in Rhode Island. The reasons for this, as stated in Chapter One, are parimarily due to the numerous unknowns existing as far as future offshore oil and gas resources in the North and Mid-Atlantic OCS, unknown support base plans of the oil and gas companies and limited quantitative methods available for a regional or secondary impact assessment of this scale. A far more realistic as well as valuable approach was to assess the region's existing problems which could be further exacerbated by large and rapid development of OCS support facilities.

However, there are valuable lessons to be learned from onshore impacts which have occurred in other regions. Perhaps the broadest overview of onshore impacts is provided in the 1977 Council of Environmental Quality Report on Oil and Gas in Coastal Lands and Waters. A major conclusion of CEQ on the impacts onshore is that every place is different:

> Common sense, a modicum of experience with oil development in new places, and projective studies made for the Council and others agree on this point: every place where offshore drilling may occur is different -- humanly, climatically, geophysically, and ecologically -- and the planning to protect both human communities and marine ecosystems affected by offshore oil must rest upon detailed studies of those particular places. Further, the people who care most about those plces -- that is, the people who live there -- must be intimately involved in the planning.

Furthermore, a CEQ finding on projected impacts in the Mid-Atlantic region may be uncannily applicable to Rhode Island:

> In contrast, the Mid-Atlantic OCS region is not only milder climatically than the Gulf of Alaska, but the presence of large, urban industrial centers onshore makes it possible to absorb many kinds of development without undue strain. Possible but not certain. The impact of new people, additional jobs and collars, and

> extra demands for housing and community services would be little noticed in northern New Jersey or the Delaware estuary, where there are a large economic base and extensive infrastructure already in place (although, as we shall see, the cumulative impacts on air and water quality of clustering industrial plants together may create some problems). In southern New Jersey, however, oil-related development could distinctly affect or even transform the pastoral and recreational character of Cumberland and Cape May Counties.

These findings -- that the problems and solutions differ for each particular area; that successful planning requires a detailed and intimate familiarity with the area, and that urban areas can absorb and get more early benefit from the impacts than rural areas are critically important to Rhode Island's future management of OCS impacts.

The examination of other region's onshore impacts is provided parimarily for educational purposes. Common themes, however, are detectable and summaried on Table A-1.

Small rural coastal communities, or villages, have witnessed the greatest affect from onshore support development for offshore oil and gas drilling. It must be remembered that the chief criteria for selecting the support site is proximity to the offshore well fields as well as the availability or potential for development of the necessary facilities. Small, native fishing villages such as Yakutat, Alaska, or Peterhead, Scotland, or previously isolated communities such as Morgan City, Louisiana, or Port O'Connor, Texas, underwent rapid population and economic growth. The population centers for these regions, such as Juneau, Alaska, Corpus Christi, Texas, and Aberdeen, Scotland, received impacts but were more capable of assimilating with minimum community disruption and infrastructure demand. Rhode Island can almost be considered a microcosm for these larger OCS onshore impact scenarios. Rhode Island, however, is unique in that a made-for OCS support base exists in the heart of the West Bay Region. Dense population areas exist only a few miles from the rural but already rapidly growing West Bay Region. Secondary regional impacts

from population and commercial development can be more easily assimilated into the more urbanized communities at the head of Narragansett Bay than the rural downstream communities. Vacancy rates in temporary, i.e. rental, units are higher in these communities and growth can stimulate urban revitalization. Yet, as the experiences in other OCS support regions and other major energy development areas of the world indicate, undeveloped land areas are more attractive for the new growth demands.

Offshore oil and gas drilling is a relatively new phenomenon. The boom and bust cycle, typical of other major energy developments throughout history such as western gold or Appalachian coal mining, has not reached its duration in most frontier offshore support areas. In the oldest OCS support region in the Country, East St. May Parish, Louisiana, the support activity is only slowly declining due to continued offshore drilling in the Gulf of Mexico. Migration to the county had dropped from a rate of 40.7% in the 1950s to 5.3% in the 1970s and population is declining in some parts of the parish as drilling support activity moves westward towards Texas and more proximate locations to the offshore well sites (p.276). In certain OCS support regions in Alaska, according to the Council on Environmental Quality, there were declines in OCS jobs by over 50% in a two year period.

A boom and bust occurrence is also possible on a shorter time scale. This occurs when the activity attracts large numbers of unemployed to the region in excess of the number of jobs created. This would be especially true in areas where there is already an existing high unemployment rate. In 1978 the federal government predicted a slight rise in unemployment in the New England region from Georges Bank Lease Sale No. 42 and ensuing development.

Other population effects on the community may be less noticeable but nonetheless important to the community character. Major new employment opportunities are created and income levels of oil and gas ancillary support jobs are high. Other communities hosting OCS support activities have witnessed varying degrees of com-

munity segmentation created by a large influx of new population which may differ from the traditional community demographic characteristics. The new workers tend to be young, skilled, mobile, and many single workers on offshore rigs are on 14 or 21 day on/off shifts. In more isolated communities a noticeable occurrence was a change in existing or traditional professions to new jobs created by the offshore industry. For example, fisherman in Scotland or middle class professionals such as school teachers in Morgan City, Louisiana, left their positions for the higher paying OCS industrial work.

The local governments of OCS support or OCS support impacted communities have had the greatest challenge. Almost all of the federal, state and regional studies cited in the charts on pages 265-279 warn of the negative fiscal impact on the community's public services. These various problems are listed under the local economy column of these charts.

In Rhode Island the local economies vary from community to community. The state did attempt to predict fiscal impacts on surrounding communities for the development of OCS support facilities at Quonset Point-Davisville.* Three factors have or will play an important role on the effect of the activity on local economies in Rhode Island. First, the federal government has provided assistance to local governments to mitigate onshore impacts through the Federal Coastal Energy Impact Program. This has been especially beneficial to the host community, the town of North Kingstown, where the most impacts are expected to occur.

The second factor is tax income from the infusion of jobs and OCS ancillary support development. Because of the ownership of Quonset Point-Davisville by the State of Rhode Island Port Authority and Rhode Island Tax Exempt Laws for oil and gas companies' local revenue from property taxes if not derived directly from the industry currently, but through an agreement between the state and the town of North Kingstown.

* Tischler, Marcox, and Ass. Inc. Fiscal Impact Studies Prepared for the Governor State of Rhode Island, May, 1978.

The third factor dictating effects on local economies is an occurrence experienced worldwide from major energy developments. The host community will receive most of the local revenue but surrounding communities may experience impacts on public services and insufficient revenue to meet the new demands. Regional solutions are then required. In its second year study entitled Outer Continental Shelves Impact Study Implementation Plan, the Coalition of Coastal Communities will address these and other local and regional policy solutions to potential negative impacts on the coastal communities from the future development of this major energy activity.

Table A-1

Regional Onshore Impact Issues

Population

Greatest Effect on Small, Rural Communities
Rapid Growth Rate Greater Than 15% Causes Breakdown
Community Segmentation
Immigration of Unemployed
End of OCS, Population Loss (especially young)

Employment

Increase in Jobs, Income, and Standard of Living
Unemployment May Rise
Workers are Young, Skilled, Mobile, many Unmarried
Offshore Workers: 14 Day On/Off Shifts
Changes in Professions

Local Economies

Communities Need 25 Years to Balance Costs and Revenues
Communities Net Benefit One-Sixth of State's
Negative Fiscal Impacts with a High Rate of Growth
Service Demand Before Tax Revenue
Strain on Public Services
Neighboring Towns Receive Impacts of OCS, No Revenues

Housing

Lack of Housing Causes Worst Land-Use Problems
Price Increases and Competition with High Paying Oil Jobs
Real Need to Meet Temporary Housing Demands

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
FEDERAL STUDIES							
Rapid Growth From Energy Projects (1976)	Annual Rate of Growth 10% Strain " " " " 15% Breakdown Temporary Nature- What Follows Predictions vs. Actual Small and Remote Communities affected the most: Congestion and Overcrowding. Impact hard, expecially on elderly and wives. Const. Phase: 50-75% w/Familes; Fam. size: 3.5-3.9; More Workers Oper. Phase: 80-90% w/ Families	Multilier: Const. 2 Secondary Employment .3-.9	Lack of housing causes worst land-use problems. Workers alone in early stages dictates kind of housing, hotels, apartments, vacant homes. Impact on housing prices (doubles) and rents (double/ triple)	Medical Services heavily affected. Access and community roads affected	Cities take up to 25 yrs. to balance costs & revenues from energy dev. impacts. Cities net benefit 1/6 of state's (33 yrs.)	Traditional outdoor rec. change to urban/ park.	
FEIS Lease Sale 42 (1976)	Rapid Pop. Increase has greatest effect. Maximum Regional Pop. Increase 39,000-6,000	Slight Rise in Unemployment. May Workers highly skilled, young, mobile, unmarried.			Burden of Govt. Expenditures in early yrs. before tax revenue. No impact on oil prices - substantial impact on gas prices. Drop in Annual Per Capita Income		Major population increase would require 19,500 acres
FEIS Lease Sale 59 (1981)	Cumulative Pop. Increase 44,600 by 1990. 35.3% for Washington County, 16,743,800.				Major Impact on Local Economies.	Moderate	Major Impact

Continued...

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
FEDERAL STUDIES (Contd.)							
Coastal Effects of Offshore Energy Systems (1976)					Net Adverse Budgetary Effects Possible. Facility provides revenus in only one community but support population in other communities as well. If extraordinary expenditures for public facilities such as roads required to support OCS.		
OCS Oil and Gas Activities in the Mid-Atlantic & their onshore Impacts (1979).		OCS relieved unemployment caused by Navy pull-out. Transient work force comprised 250 out of 670. Work 14-day shifts and stay in hotels, commute to home state.	Adequate Housing readily available within commuting distance to Quonset.	OCS wastes brought to Davisville trucked out of state. Most significant: traffic problems.			
Effects on Coastal Communities' Environmental Planning for Offshore Oil & Gas (1978)	Family Size Multiplier 3.0-3.7; Nat, 1970: 3.58; 1976: 3.39	Dir. Employ. greatest during field dev. Indir. employ. job # small compared to Direct (supliers) Few products required for OCS mfgd. in study area. Induced jobs: .8 induc./ Dir. & Indir.; less in smaller areas.	Existing conditions and vacancy rate (av. 5%). Demand is function of (1) income, (2) total # of units demanded, (3) price.	Water: 100-180 gal./day Sewage: 100-120 gal./day Solid Waste: 3-6 lbs./person/ day. Power: 750 KWH/mo.		Playground: .00125 ac./person Park (neighborhood): .001 ac./person Major Park: .0025 ac./person Playground: 4,000-8,000 people size	

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION TOURISM	LAND USE
FEDERAL STUDIES (Contd.)							
Effects on Coastal Communities' Environmental Planning for Offshore Oil & Gas (1978) (contd.)	Total Pop.: 1,000 dir → 2,879	Multipliers smaller in: Limited ind. dev. areas. Limited source & skills. Surrounding region offers skills. New Resident Employees: Create demand for new services. New Resident Employees: % New-residents: Explor. 31-85 Dev. 35-57 Prod. 6-20					
Regional Status Reports Vol.: V, New England (1978)	Immigration of skilled & unskilled unemployed into area.	Cost well drilling 1976. New England 47% of jobs. (RI residents) Availability of skilled laborers determines # of locals hired.		Municipal Service costs> property tax revenue: Year 5 Prop. Tax:907,000 Serv. Cst:1,286,000 Year 10 Prop. Tax:1,493,000 Serv. Cst:2,022,000 Year 15 Prop. Tax:3,006,000 Serv. Cst:3,834,000 Uncertainty whether OCS ind. taxable either as real estate or personal property.	Tourism value in RI $100 m. 1976. Oil spill cost $100 m.	

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	SERVICES	LOCAL ECONOMIES	RECREATION TOURISM	LAND USE
FEDERAL STUDIES (Contd.)							
Economic Study of Possible Impacts of a Georges Bank Sale (GB gas processed in NE, oil refined in Mid-Atlantic) (1976)	Boom-Bust Phenomena Possible; New Population Greater Than Jobs Created. Population Levels Will Also Depend Upon Expansion Of Mid-Atlantic Refinery Capacity. Max. Pop. > 12,700-25,500 Impact More Significant In Areas With Low Population Density And Limited Economic Base.	Employment Multiplier 2.9 Included Effects Local And Not Extensive.		Economic Impact On Regional Economy Minor.	Early Yrs. Per Capita Income Increase $1,200 Later Yrs Per Capita Income Increase $200 Expansion of Mid-Atlantic Refinery Capacity Would Benefit NE Coastal Region In Terms of Output Employ., and Income. Personal Income Raise $20 Million Govt. Expenditure Would Rise. Prod. of Goods Would Increase 1.3% ($115 million Private Invest. & construction activties, 3.5% Georges Bank Gas could stimulate new metal manufacturing in county.		
Anticipating and Planning for the Impacts of OCS Oil and Gas Development	No Reliable Analysis of Impacts of OCS Development Until Discovery of Economic, Recoverable Oil & Gas Resources. Most Impacts During Early Development phase. Higher Rates of Growth, Greater Demand for Housing and Public Services. Seventy depends on rate of growth and level of urbanization	30% Employment from NE Outside of Region for Southeastern New England. Large & Skilled Labor Pool Exists in NE.		Stress on Investment Protection Systems. Start-up Costs for new Services Greater in Small Towns on Per Capita Basis than Cost of Expanding Services.	During Dev. Phase: Fiscal Impacts Reg. If Dev. Accompanied By a High Rate of Growth During Dev. Phase. State & Local Revenues Do Not Cover Costs. Favorable Fiscal Impact Later During Production.	Potential Threat To Fishing & Tourism.	

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	SERVICES	LOCAL ECONOMIES	RECREATION TOURISM	LAND USE
Anticipating and Planning for the Impacts of OCS Oil and Gas Development (Contd.)				Fiscal Impacts: Taxes only in host Community Timing of Service Demands Before Revenues Recede. Magnitude & Duration of New Service Demands Depends on Ratio of Outside Employees.			
OTHER NEW ENGLAND STATES							
Offshore Oil Dev.: Implications for Mass. Communities.	Severity of Impact Dependent Upon Rate of Pop. Growth Accompanying Oil Dev. Smaller Com. Affected the Most. Regional Impacts: Adequate Com. No Tax Breaks.	Diversification of Employment Opportunities.	During Construction: 15% New Employees Purchase homes 60% Rent 25% Live in Mobile Homes or Trailers. Town Should Plan for Permanent Level of Housing Equal to Projected Pop. for when Oil Dev. Activities are Completed. Real Need is to Meet Temporary Housing Demands. Demand for Housing Increase Prices: Greatest Effect On Elderly & Poor.	Neighboring Town Receives Impacts No Revenue e.g. Ferndale, Wash. & Oil Refineries p.41 Lag Time Between Need for Revenue and when Revenue Begins can Place Com. in Severe Financial Position New Facilities Built to Meet Peak Pop. May be Underutilized & Cause Burdensome Carrying Charges to Communities.	Addition to Local Towns Assessed Valuation Taxes From Development May Lessen Amount of State Aid. Rise in Local Income & Standard of Living. Higher Land Values.	Improvement in Parks & Recreation	Congestion, Overcrowding, Increase in Urban Problems

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	Municipal Services	Local Economies	Recreation/ Tourism	Land Use
Impacts Upon Towns & Cities From Construction & Operation of Major Industry Pittson Oil Refinery, 1980	Municipality Must Determine What Proportion will Settle in Town Factors: Distance to already established homes Travel Time Housing Availability Accessibility: Work, Home, Services Attitude & Ability of community to accept new population	Service Jobs Filled by Local Residents	Method of Alleviating Shortage of Housing for Construction Phase is to Convert Single-Family homes to Rental. Need for Adequate Standards for Conversion Mobile Home & Rentals Less Valuation & Therefore Less Income, Higher Cost to Resident.	Municipal Service Shortages Affect Residents More Than Newcomers Solid Waste Towns Over 10,000- 4.5 lb./ /day Septage Sludge p. 13	Income Leakage: Payroll carred out of Host Community by Commuting Worker $ spent outside host com. where services or goods not available Little net increase from local residents who quit jobs outside of town to work in town paying off debts. Smaller Region; Lower Multiplier		
Petroleum Development In New England 1975		5,000-12,000 from Georges Bank Effect on Local Com. could be substantial			Low Impacts		

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
California Onshore Impacts (1976)		-Imported labor roughly is 27% of OCS employment in Southern California, important for estimating new local employment and projecting housing and public service needs. -Many OCS jobs exported to other regions, i.e. rig fabrication at existing facilities outside of region. -Exploratory OCS jobs estimates: 775 workers/yr. x 5 years. -Employment beyond exploratory phase inherently speculative Employment estimates by Fed. govt. and industry tied to unrealistically high resource levels; cause dissappointment and not useful for planning.		In California, OCS impacts have most direct effect on local industry, greatest planning needs by local industry, least direct leverage on Fed. govt. policy.		Santa Barbara oil spill: 5,000-160,000 barrels spilled. 5 barrels/day released currently from blowouts & chronic spills.	
Offshore Oil Impact on Texas Communities (1976)	Texas coastal communities immigrant population consists of urban migrants and OCS personnel; strong sense of families. Not significant OCS growth	Local employment increase		OCS support base dev. created physical changes; helicopter pads, crew boats, service docks, and 3 mud companies. Did not result in significant increase in school enrollment, crime, or environmental problems.			

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
Alaska Oil and Gas in Coastal Lands & Waters. 1977	15 year OCS cycle 1957-1972 1960 pop. 1,100 (villages) 6,245 (region) 1970 pop. 7,200 (villages) 14,483 (region) Native pop. decline 1960 - 13% 1970 - 7% "Natives benefitted less" Lease Sales in N. Gulf of Alaska could induce pop. growth of 40% by 1984. Valdez: April 1974 1,173 pop. July 1975 6,512 pop. 450% Pipeline growth impacts	OCS Jobs Total Jobs 103 -1960- -1965- 2510 2300 -1968- 5893 1000 -1970- Unemployment rise after '67-'68 from 9% to 16-17% Non-OCS employment rose 5% after '70 Gas jobs steady Govt, Transportation, trade steady	1960-70 84% increase 50% mobile homes 1971 lots price $400-800 1975 " " $10,000-12,000 Apt. rent increase 4-5 times in a few months Public subsidies for trailers Native evicted who were also subject to rent increases	1960 1969 3000 5000 School Pop. Overbuilt water utility lines Kept up with school growth School size tripled	1960 1970 104% increase income		Villages: No Zoning or Land Use Plan
OCS Oil and Gas Activities in the Gulf of Alaska & Their Onshore Impacts 1980		On/Off shift of 21-28 days due to high trasport cost for workers to homes Entry level personnel locally hired to gain goodwill and reduce travel costs Alaska residents = 33% of Exploratory employment			Seward disappointed that positive economic impacts not as great as anticipated Yakutat pop. 600; 75% Indians High value on maintaining traditional culture Wanted minimum growth impacts from OCS Changed land use plan to protect OCS industrial development in town		

Continued .

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
OCS Oil and Gas Activities in the Gulf of Alaska & Their Onshore Impacts 1980 (cont.)					OCS temporary dock & storage was 3.5 x assessed value of all real property in town Confined all OCS activity to 1 compound Vast increase in pop. and destruction of life style did not occur due to town control Most OCS employees never entered town Support facilities in Seward supply 40 jobs Land speculation prior to lease sale caused prices to quadruple (largest impact) Homer collected dockage & wharfage fees from storing OCS exploratory rigs ($41,000/yr)		
Oil and Gas in Coastal Lands and Waters, CEQ 1977 Louisiana	Morgan City: 13,530 jobs/ 40,000 Pop. Thousands of spin-off jobs	Lot costs: $10,000 for 60'x100' 3-4 hrs. commute			Service costs net $38 million in 1972 to Louisiana; add Fed. revenue and state experienced gain of $16 million		

Continued ...

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
Louisiana cont.					Not enough taxes collected by Morgan City Fed. contributed 1/8 of Morgan City annual budget of $3.2 million City spent $1.7 million for recreation complex for total (inc. OCS) population		
OCS Impacts on Morgan City, Louisiana 1977	Major Pop. growth (25%) Low out-migration of young Increase in white-black ratio Urban pop. increase from 1940-1970 was 240% 92% decline in farm rural Pop. Projections - 51% increase by yr. 2000 in host city 23% increase by yr. 2000 in parish Community becoming more segmented & diverse (rational or organic solidarity)	OCS responsible for 20-35% employ. Many jobs blue-collar Entice migrants who become permanent residents Middle class professionals (school teachers) leave essential jobs for higher paying OCS industrial work Parish mining sector increase during OCS 438.2% (Nationally 32%)	Acute shortage of single family dwelling (SFD) causing people to live outside of town Town tax base stabilized, Municipal services increased Most housing SFD, few MFD Large # of mobil homes in region 58% homes in Morgan City are owner occupied 6% rental vacancy 99% with municipal water, 99% sewer	Potential acute probs. in hospitals, & health care Benefit from increased investment in voc. & educ. services Great strains on community to provide adequate services Time lag Pop. increase caused water system growth Operating expenses & revenues incr. by factor of 10 over 25 yrs.	OCS responsible for income increase twice as rapid as as state City median income higher than parish or state Distribution of income more equitable Competition for dock space Decline in importance of commercial fisheries OCS support indust. of support to fisheries	Environmental Direct impact small & related to dredging & filling Indirect impacts from Pop. growth occur on considerable scale Should OCS activities decline major disruption of social & economic life of community	Shift from agricultural to urban, res., indus. Swampland conversion OCS req. for land Pop. growth requires land Parish did not loose farmland 1934-70 Land value increase substantialy over 25 yrs.

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
OCS Impacts on Morgan City, Louisiana, (Contd:)		Employ. advances due to region spread into mfg., trade, finance, insurance, real estate, & business 66 OCS firm's employed 8536 persons, 1976 total payroll $94.5 million p.86 Increased income due to occupation shifts	80% increase in Morgan City and Berwick 5 fold increase in housing value 50-70	Waterworks profit increase (exclusive of capital costs for improvements) Limited sewage treatment, new WWTP being constructed $9 million - financing from .75% sales tax $36.5 million expressway & bridge project spurring new dev. west of bridge, divert congestion out of Morgan City Major local st. improvements through bonds & state severance tax to communities Berwick - no WWTF Patterson - tertiary treatment Bajou Vista - no WWTF	Elimination of OCS obstructions to fishing Prior to OCS net regional growth of economy negative OCS Impact on parish is division into 2 competitive areas Establishment of 2 multi-functional port authorities Partially economic expansion or progress became prime consideration Budget surplus 21 yrs, recently deficit 1973 & 1975	Benefits to sport fisheries, platforms as reefs & navigation aids City has acquired additional recreation acreage & facilities 150 acres inadequate for pop. (1 ac/ 100 people) Rec. funds expenditure 1970- $190,917 Extent of impact depends on makeup & rec. facilities of each town	Assessment value increase 4 x 20 yrs.

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
OCS Impacts on Morgan City, Louisiana (contd.)	In-migration to area with increasing employment opportunity problematic for OCS impact area	Concurent increase in immediate area of OCS. Secondary & tertiary industry increase Occupational shifts, diversity in life style, loss of sense of community Increase in personal income		Direct and indirect impacts strain municipal services		Change in how leisure time is spent due to income changes causes indirect OCS impact i.e. parks & boat ramps	Demand arises for industrial and housing land Land-use switches Dredging and filling
East St. May Parish Economic Growth and Stabilization Strategies 1980	Migration rates to East St. May caused by energy activity 1950-60 40.7% 1960-70 23.6% 1970-77 5.3% Projection for host, Morgan City '70 16,586 people '80 16,122 " '90 15,687 " Decline After rapid pop. growth pop. is decreasing in some parts of parish. No employ. decline People not being pulled into area of high employment	412% increase in transportation, communication, public utilities jobs 1940-70 OCS dev. period Oil and gas field service employ decreased by 40% from 1967-1972 Trends in employ. in '70s same as '60s acceleration in mining sector and transportation and trade 62.3% of parish families made < $10,000 Shift to west (Texas) of energy activity will be detrimental to mining sector employment Increase in "commuter" labor	44.5% of housing constructed in 60s 35% of housing in Morgan City substandard 37% parish renter occupied 3.7% vacancy rate 17.8% of housing overcrowded 6.85% of land in Morgan City is vacant Parish total net demand of 1,338 units in 1970 Demand > supply 2794 units in 1980	Few recent planning studies Commuting traffic causes problems.	Diversified in '70s somewhat, entrenchment of energy activites makes diversification more difficult. Large # of taverns & pool halls due to nature of male laboring classes Half of eating establishments specialize in fast foods Crime rate is 2 to 3x higher than for cities of comparable size to Morgan City Family problems Large income flow out of parish	Tourism underdev. in parish	OCS indicated development aesthetically displeasing

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
Louisiana Coastal Resources Program, Impact of OCS Development on Louisiana 1976		OCS employment estimates range from 38,000 to 9,604 OCS direct employ 1970 124,400 Total OCS employ 390,990.			State revenue from OCS FY73 $401 million 74 566 million 75 724 million After 2 to 4 yrs. OCS dev. pays its own way *Public sector costs per* capita are higher for OCS than average of other economic activities Primary impacted parishes have had higher public service operating costs per capita than other parishes Level of costs per capita dependent upon level of OCS operations		
Onshore Planning For *Offshore* Oil: Lessons for Scotland Bolelum, 1975	Social assimilation difficulties	Employment highest during construction, i.e. rig fabrication, pipeline laying, followed by decline. Shifting in work force causing shortage in non-OCS industries and services Major employment increases and potential for rapid decline from rig fabrication	Both large city & small town chosen to support OCS dev. experienced housing shortage. New house builders cannot be brought into area because of lack of housing for them. Other service personnel restricted because of no housing (teachers, planners, etc.) New housing as high-rise apts. and not traditional row house or cottage	Offshore bases can be successfully *trans-* formed to other uses such as marinas, sewage treatment works, cargo terminals, fishing marinas, with advanced planning Dabbling in Air Traffic: expansion of airport facilities	Land price increase (industrial) 1969 31000/acre, 1974 100000/acre Land not taxes as property which aids farming Successful rig fabrication utilized existing industrial site. 2 other sites required dredging and filling of 250 acres of reclaimed land Many speculative OCS related plans Shetland's accommodation of OCS terminal due to unintimidated attitude of ocal planners		

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
FEDERAL STUDIES							
Onshore Planning for Offshore Oil: Lessons for Scotland Boleium, 1975 (contd.)			Nontraditional materials being used, i.e. prefabricated houses. 2 old ocean liners used to house 800 workers at rig fabrication site.				
Onshore Impacts of Scottish Offshore Oil: Planning Implications for the Mid-Atlantic States James Mitchell, AIP Journal, 1976		Scottish Rig Fabrication employs 2500-3200 workers 1600 unskilled workers trained Ripple effect of OCS employment left areas without workers in basic low-paying jobs 127,000 OCS jobs by 1980 Regional multiplier of 2 Localized in Coastal Areas		Demand for services outstripped supplies NE Scotland: improved infrastructure and housing North Scotland: Massive housing and infrastructure problems Increased local costs to utilities and waste treatment Local planning often deficient		Barrier Is. inlets & river mouths favored for pipe landings Spills from gas pipeline and storage tank explosions potential is acute Wetland and marsh development for OCS facilities Emerging linear pattern of coastal industrialization rather than concentrated growth	
Scotland CEQ 1977	Before OCS - After Aberdeen 180,000 185,500 Peterhead 14,000 16,000 Shetlands 18,500 25,500	-Major shifts to OCS -Not in Fishing -Many temporary construction pbs followed by few oper. pbs	Worst crunch was in housing Shortages and price tripling lots 1969 300/ac 1994 100,000/ac	Larger communitee can absorb more easily than smaller com. Shetlands; 74 arrests 1971 182 arrests 1974			
	4 yr. OCS period						
Mid-Atlantic Cumberland & Cape May Counties, N.J.	10% increase (18,000) in Cape May & Cumberland counties pop. growth from mid-OCS find (includes refineries) Dept. of Int. 10,000 person increase (no refineries)					Southern New Jersey; oil related dev. could affect or transform pastoral and recreational character of Cumberland and Cape May counties 100,000 ac of wetlands Substantial landuse impacts since no industrial land	

ONSHORE IMPACT ISSUES

TITLE	POPULATION	JOBS	HOUSING	MUNICIPAL SERVICES	LOCAL ECONOMIES	RECREATION/ TOURISM	LAND USE
FEDERAL STUDIES							
Northampton Co. Va.	1970 Town 2,000 County 14,442 1980 16,000 (projected) Return of pop. in mid 70s	1970 5,200 1971 6,240 Median rent $30/mo* 1980 7,500 (projected OCS) houses price $7,000 14% unemploy. 1975 Brownroot plant in Scotland projected 600 employees, Actual 30002 outstripping capacity of public services & housing			Farm crop value $10.7 M 1970 Serv. value $2.5-5.2 M " Median income $4,778 Community costs service 7 revenue Rate of growth key issue	50,000 ac. farmland 28,054 wetlands (10% of st No industrial zon. ord. or LUP	
Secondary Economic Impacts of Coastal Facilities, Field, 1976		Secondary, or indirect employment multiplier ..... 1.60 to 1.80 Income (wage) multiplier ..... 1.75 to 2.0 Peak onshore facilitie employment (including refinery) 14,000, .3% total N.E. Employment			Secondary economic impacts substantial; can be double initial, direct impacts.		

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