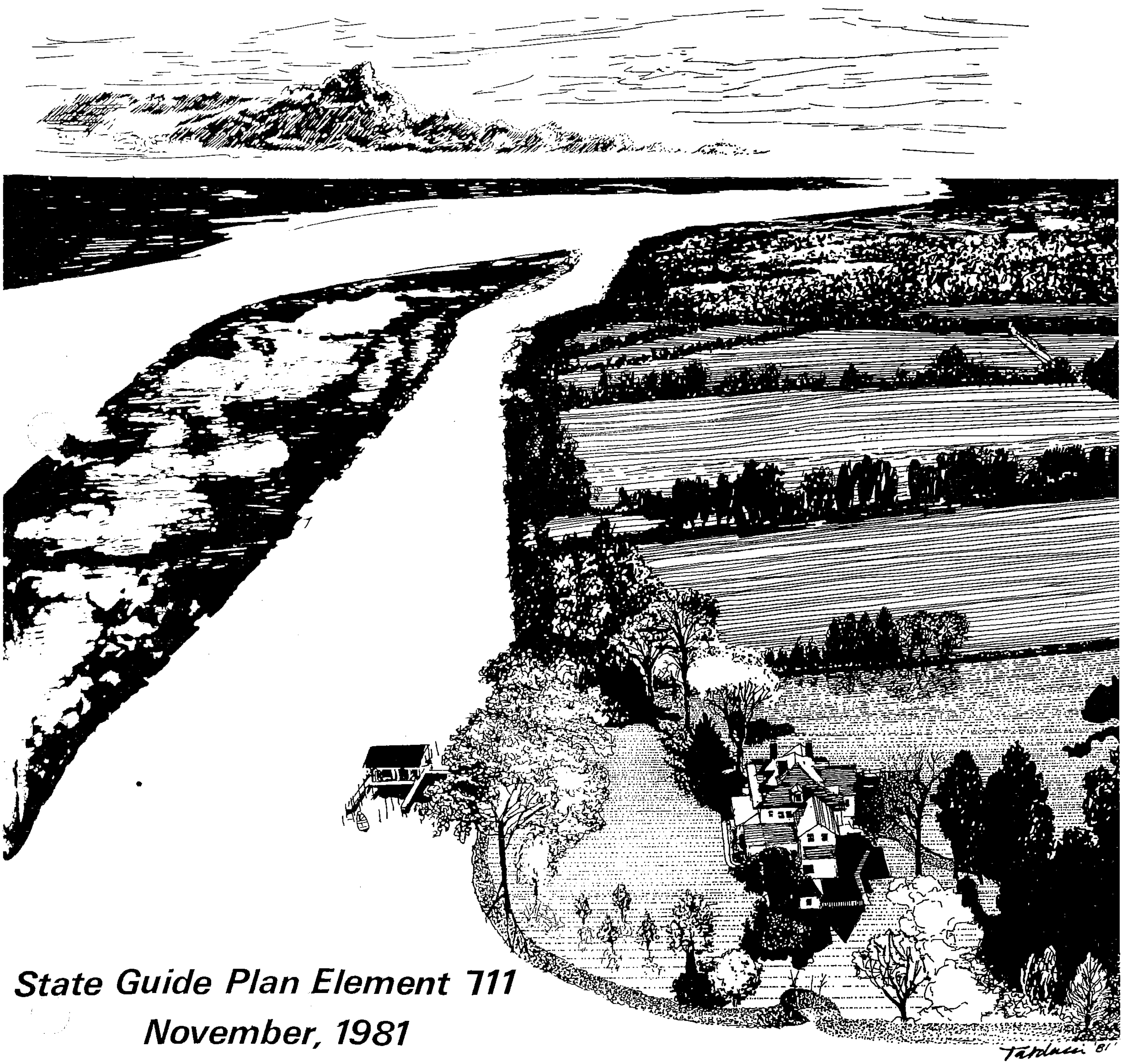
EXHIBIT I

State of Rhode Island

Report № 42

THE BLACKSTONE REGION WATER RESOURCES MANAGEMENT PLAN



State Guide Plan Element 711

November, 1981

The Rhode Island Statewide Planning Program is established by Chapter 42-11 of the General Laws as the central planning agency for state government. The work of the Program is guided by the State Planning Council, comprised of state, local, and public representatives and federal and other advisors. The Office of State Planning, a division of the Department of Administration, is the staff component of the Program.

The objectives of the Program are to plan for the physical, economic, and social development of the state; to coordinate the activities of governmental agencies and private individuals and groups within this framework of plans and programs; and to provide planning assistance to the Governor, the General Assembly, and the agencies of state government. The Program prepares and maintains the State Guide Plan as the principal means of accomplishing these objectives. The State Guide Plan is comprised of a series of functional elements which deal with physical development and environmental concerns, the economy, and human services.

Program activities are supported by state appropriations, federal grants through the Joint Funding Program, and direct grants. The contents of this report reflect the views of the Statewide Planning Program, which is responsible for the accuracy of the facts and data presented herein. The contents do not necessarily reflect the official views or policies of other sponsoring agencies.

OFFICE OF STATE PLANNING

RHODE ISLAND STATEWIDE PLANNING PROGRAM

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MEMORANDUM

To: All recipients of the Blackstone Region Water Resources Management Plan Report No. 42

Subject: Up-dating of the document

Date: August 5, 1982

The enclosed amendment represents the latest up-date of the document. The complete plan now consists of the original plan and Amendment No. 1.

This Memorandum should be filed in the front of the document, utilizing the recommended three ring binder. This is the easiest way to insure that you have the latest amendment to the Blackstone Water Resources Management Plan.

The necessary deletions and additions to the basic document should be accomplished in the order indicated on the instruction sheet.

Daniel W. Varin
Chief

BLACKSTONE WATER RESOURCES MANAGEMENT PLAN

Amendments No.1

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Report Number 42

Blackstone Region Water Resources Management Plan

June, 1982

State Guide Plan Element 711

Prepared by the

Rhode Island Office of State Planning

and the

Rhode Island Department of Environmental Management

THE STATE OF RHODE ISLAND

AND

PROVIDENCE PLANTATIONS

J. Joseph Garrahy, Governor

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(revised 6/30/82)

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PREFACE

This plan was prepared pursuant to Title III, Section 303(e) of the Federal Water Pollution Control Act Amendments of 1972 (PL92-500). Section 303(e) requires all states to prepare plans, in two phases, to identify water quality problems and propose a management program to mitigate those problems. The Phase I plans, commonly referred to as basin plans, since the planning area boundaries closely coincided with river drainage basin boundaries, were established as the fundamental planning document to guide water quality management decisions in the basin and establish the framework for future water quality planning in the state. These plans were prepared by the Statewide Planning Program in close cooperation with the Department of Environmental Management, Division of Water Resources. Plans were prepared for seven drainage basins in the state including the Woonasquatucket, Moshassuck, Blackstone, Pawcatuck, Pawtuxet and Moosup Rivers in addition to the Narragansett Bay drainage basin.

The basin plans were adopted by the State Planning Council and constitute the state water quality management element of the State Guide Plan. The most important functions of these plans were:

(1) To identify and rank point sources of pollution

(2) To divide the river into segments according to water quality standards and to classify the segments as "water quality" or "effluent limited" on the basis of the degree of treatment required to achieve those standards.

(3) To establish waste load allocations for water quality segments.

(4) To determine municipal facilities needs and to establish priorities for the award of construction grants.

(5) To indicate the need for additional water quality planning, such as facilities planning and "208" planning.

The Phase II basin plans, or water resources management plans, will substantially revise, augment, and replace the Phase I plans as the state water quality management plan. The Phase II water resources management plans will revise the Phase I basin plans in the following areas:

(1) Water Quality Standards and Classifications

Water quality standards and classifications will be updated to comply with the latest revisions adopted by the Department of Environmental Management. The possibility of meeting the 1983 goals of fishable-swimmable waters will be of prime consideration.

(2) Segment classifications

Segment classifications will be reviewed and revised, if necessary, in light of possible revisions to water quality standards and classifications. Changes in wastewater discharges will also be taken into consideration when revising these classifications.

(3) Sources of Pollution

Both point and non-point sources of pollution will be inventoried and ranked according to severity of pollution. The effects of non-point sources of pollution such as urban runoff, landfill leachate, sub-surface disposal systems, and erosion and sedimentation will be discussed in detail. Waste load allocations will be revised, if necessary, to allow for contributions from non-point sources. Methods for abatement of this pollution will also be described.

(4) Growth Potential and Treatment Facilities Requirements

The growth potential in each planning region will be discussed with particular emphasis on the effects of land use on water quality and on the need for municipal sewerage facilities.

Information regarding non-point sources of pollution, for the Phase II plans, was obtained primarily from the 208 Water Quality Management Plan for Rhode Island while additional updated information regarding both point and non-point sources of pollution was provided by the Department of Environmental Management. The Phase II planning regions were established through a combination of geographic and political factors instead of hydrological boundaries and reduced from seven to four planning regions. The four planning regions were established so that they would include entire communities wherever possible in order to facilitate the discussion of management needs and to eliminate the repetition which occurred in Phase I plans when a community was in more than one drainage basin. The four planning regions illustrated on Figure 711-00(1) are the Blackstone, Narragansett, Pawcatuck, and Pawtuxet.

The City of Providence is considered as part of both the Blackstone and Narragansett Regions due to its strong influence on both regions. The towns of Johnston and West Greenwich are the only communities that are divided into more than one planning region. The regional planning boundaries in these two communities were established according to the 1970 analysis zone boundaries, which are based on population density, nearest to the hydrologic boundaries of the planning regions.

This plan was adopted as Element 711 of the State Guide Plan by the State Planning Council in August 1982 following a public hearing on June 3, 1982.

Report Organization

This document has been organized to assure flexibility in revision while maintaining the integrity of the sections of the plan. Maintenance of the document itself can best be accomplished through the use of a loose leaf binder. All amendments or changes to the document will be transmitted with a dated cover letter to insure that the user has the most current edition.

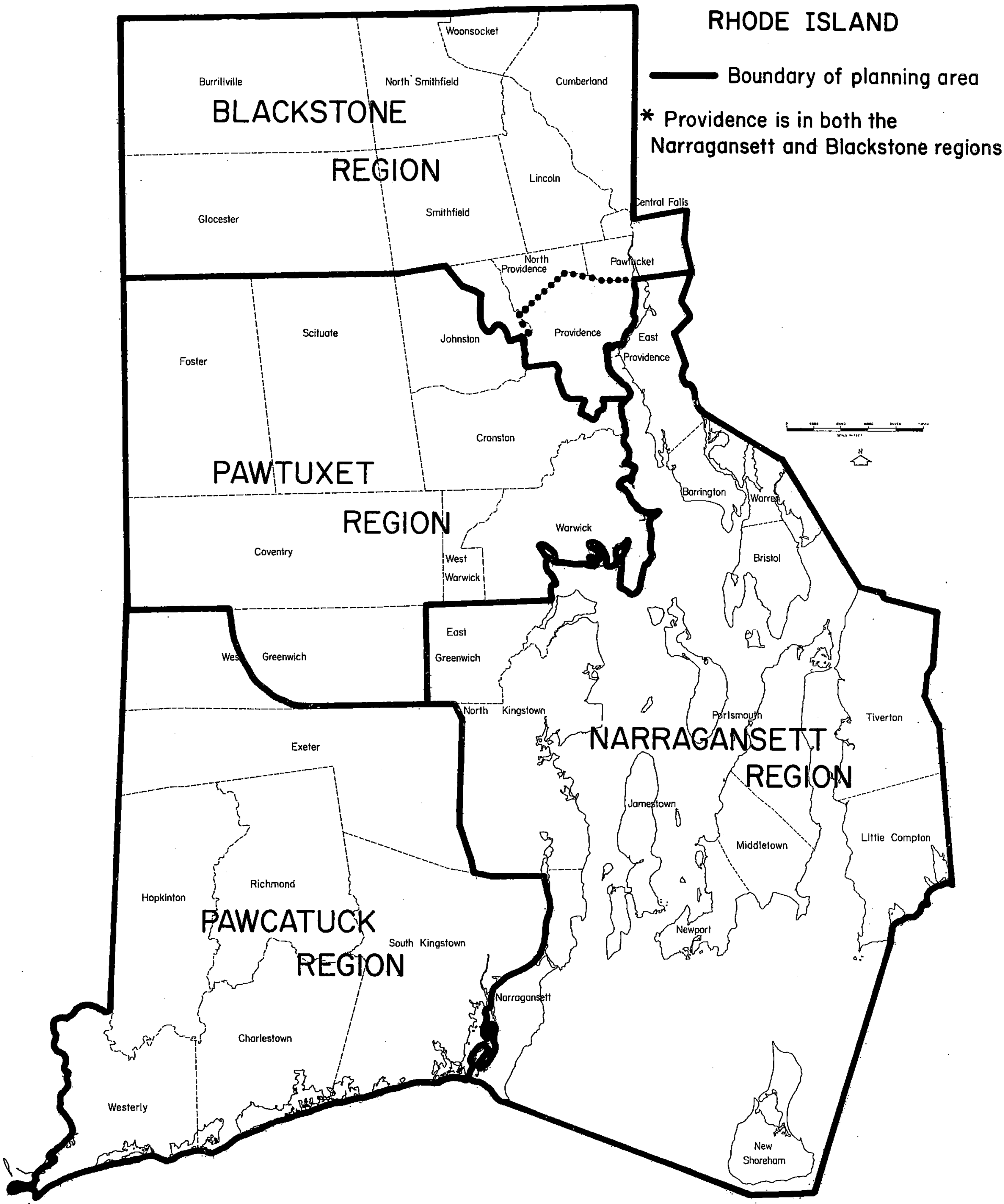
The plan is divided into Parts, Chapters, and Sections, each with a number designation. For example, Part 1, Chapter 2, Section 1 is headed: 01-02-01 Federal Goals and Objectives.

Each Part is page-numbered separately to make updating easier. Page numbers appear at the bottom of each page, the part number first, a decimal point, then the page number. For example, the second page of Part 1 is numbered 01.2

(revised 6/30/82)

Figure 711-00(1)

PLANNING REGIONS FOR PHASE II WATER QUALITY MANAGEMENT PLANS*



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The number that precedes each Part corresponds to elements of the State Guide Plan which are identified within major categories as follows:

100 Resources management and utilization
200 Economic Development
300 Environmental programs
400 Human services
500 (Reserved)
600 Transportation systems
700 Utility systems
800 (Reserved)
900 (Reserved)

The Water Resources Management Plans fall within the 700 utility systems category, and is thus numbered 711. This number appears before each Part number (e.g. 711-01), and as part of each Table and Figure number (e.g. Table 711-02(2) for the second Table in Part 02.

This document incorporates a system of referring to quoted sources which should relieve some of the congestion common to footnotes in this type of document. All references to quoted sources are keyed to the Bibliography. Bibliographical entries are numbered to facilitate these references. Narrative that relies on significant portions of one or more references but is not directly quoted, will be designated within double parentheses at the appropriate place, thus: ((9)), ((2)), with both numbers identifying reference documents.

Acknowledgements

This plan was prepared by Scott Millar, Environmental Planner and Michael Naughton, Planning Technician, under the general supervision of Victor Parmentier, Supervising Planner. Additional Office of State Planning staff members involved in the preparation of this plan are as follows:

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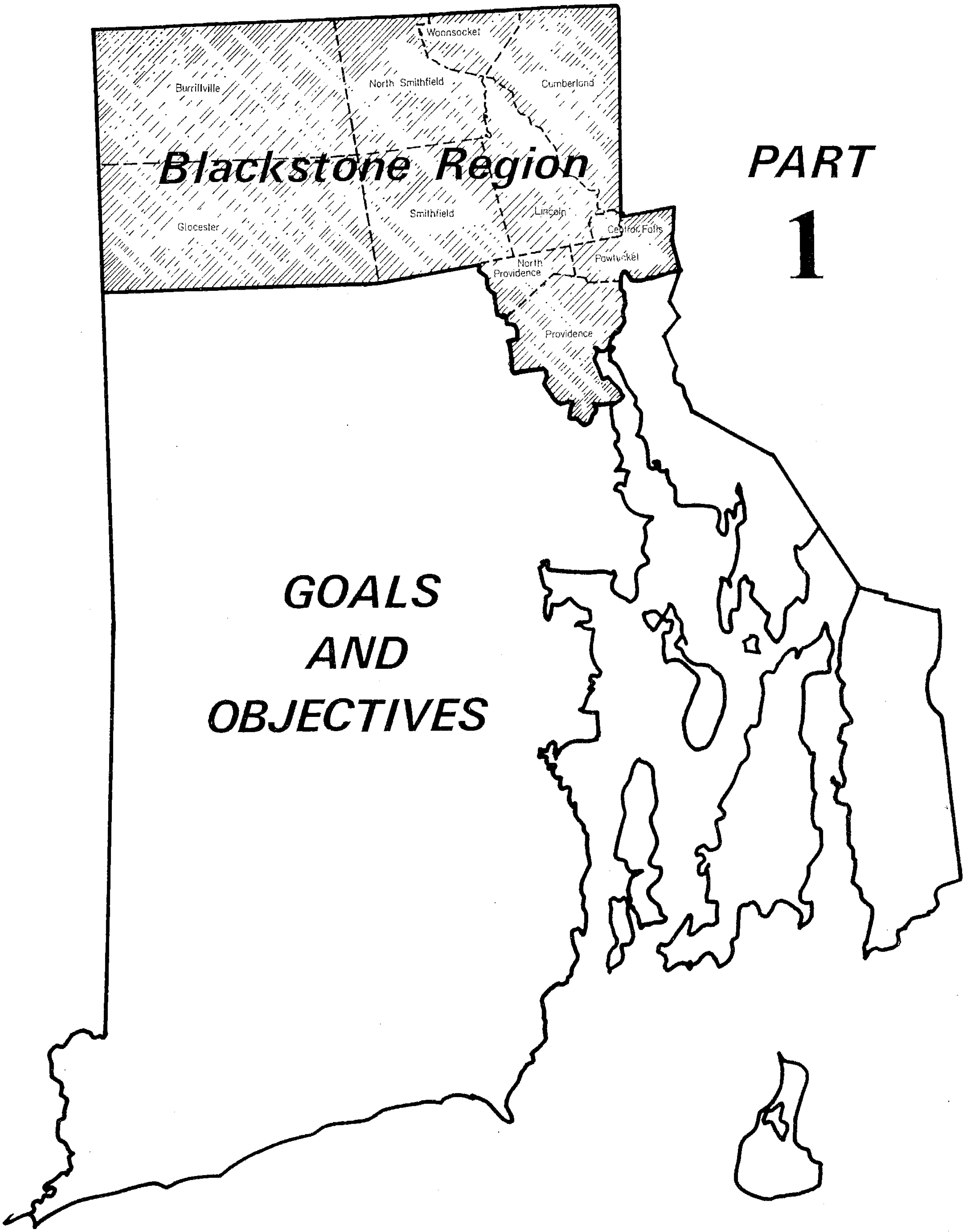
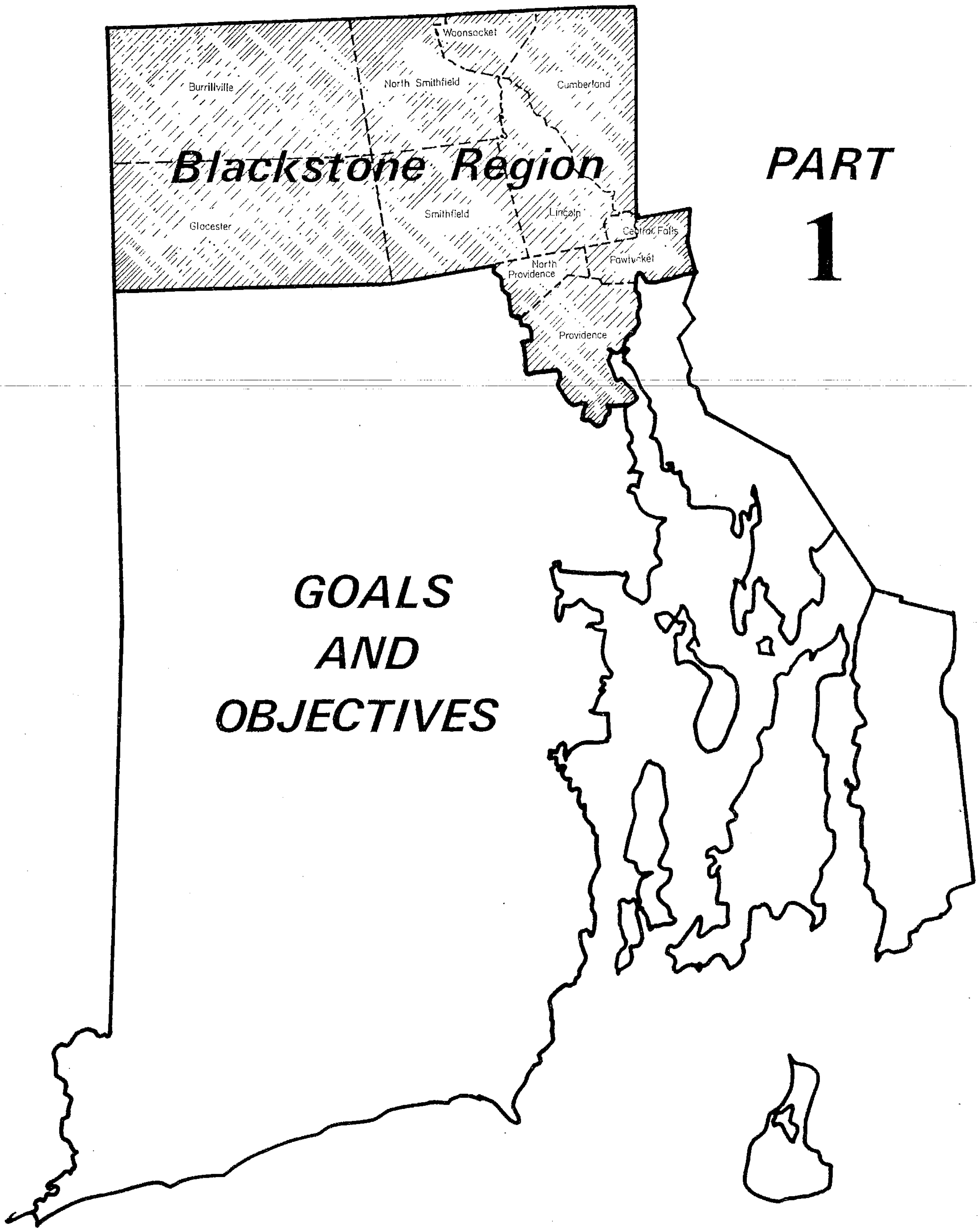


GOALS AND OBJECTIVES

PART 1

GOALS AND OBJECTIVES



711-01 GOALS AND OBJECTIVES

Rhode Island does not have an adopted or generally accepted statement of goals and objectives for the comprehensive management of its water resources. The eventual goals and objectives of this plan will encompass all major aspects of water resources: water quality, water supply, wetlands, flooding, navigation, recreation, fish and wildlife, hydropower and other related topics. The goals and objectives for water resources must be related on an integrated basis rather than a single purpose orientation. In addition, goals and objectives will be applied on a statewide and regional basis, specifically for natural drainage basins.

This plan has been prepared as a part of a broader plan which will eventually incorporate all major water resource issues. This phase of the plan will only address the water quality aspects of water resource planning.

01-01 WATER RESOURCE GOALS AND OBJECTIVES

One of the major goals of the Rhode Island Land Use Policies and Plan is to "make efficient use of available land and water, producing a visually pleasing coherent, and workable environment." In addition, this Plan recommends: reducing water pollution and protecting water resources which are presently unpolluted, maintaining high quality water bodies in their existing condition, and providing for adequate water supply.

Other objectives of the State Guide Plan to be incorporated into the water resources plan are as follows:

- Plan for and develop water resources in a coordinated and efficient manner, on a state and regional level.
- Secure or protect high-quality sources of ground and surface water adequate to meet future needs.
- Encourage the organization of combined regional water supply and water pollution control functions.
- Support measures which encourage more efficient use of water.
- Maintain and upgrade necessary natural resources for selected industries, such as tidal marshes for the commercial fishing industry.

These goals and objectives will be incorporated into the Water Resource Plan when topics such as water supply, wetlands, flooding, etc. are addressed at a future date.

01-02 WATER QUALITY GOALS AND OBJECTIVES

The water quality planning goals utilized in the Blackstone Region Water Resources Management Plan were based on federal and state water quality goals and objectives. The following goals and objectives are fully integrated with all related elements of the State Guide Plan, so that implementation of recommendations will be consistent with other activities.

01-02-01 Federal Goals and Objectives

The enactment of the Federal Water Pollution Control Act Amendments of 1972 initiated a long term commitment by the federal government to clean up and maintain the purity of the nation's waters. The goals and objectives of this Act, which was amended in 1977, were:

(A) By July 1, 1977, effluent limits applying the best practicable control technology by industry as defined by the Administrator (under section 304(b)) or treatment to meet pretreatment standards (under section 307).

(B) By July 1, 1977, effluent limits applying secondary treatment as defined by the Administrator (section 304(d)) ((1)) for publicly owned treatment works in existance on July 1, 1977 or approved prior to June 30, 1973 with four years allowed for completion.

(C) By July 1, 1977, any more stringent limitations including those necessary to meet water quality standards, treatment standards, or schedules of compliance.

These goals have been met wherever possible and extended wherever necessary. The water quality goals for 1983 are:

(A) By July 1, 1983, effluent limits applying the best available technology for industries which is economically achievable for that category of point source as defined by the Administrator (section 304((b)) ((2)), including the elimination of the discharge.

(B) By July 1, 1983, effluent limits applying the best practicable treatment for the publicly owned treatment works.

01-02-02 Rhode Island Goals and Objectives

The goals cited by the Rhode Island Water Quality Regulations for Water Pollution Control are "to upgrade the quality of the waters of the state and, where attainable, achieve swimmable/fishable waters by 1983". These goals are consistent with the Federal Water Pollution Control Act.

In addition to this goal, this plan will incorporate the water quality objectives cited in related elements of the State Guide Plan.

These objectives are as follows:

1. Improve the coordination of local water pollution control management plans and programs and seek regional solutions to the greatest extent possible.

2. Continue the close coordination of the state's water pollution control planning activities such as those concerned with water resource development and land use development.

3. Assure that all proposals for water pollution control management facilities and systems are fully analyzed and evaluated in terms of their impact on the social, economic and physical environment.

4. Limit intensive development to areas served by public sewer systems which can provide for the adequate collection and treatment of the liquid wastes generated.

5. Require pre-treatment of sewage by industrial operations where appropriate.

6. Upgrade treatment in municipal or other treatment plant facilities, where appropriate.

7. Support and encourage efforts to prevent and control oil spills of contaminants.

8. Encourage research to better determine potential effects of thermal pollution on the marine environment.

9. Support efforts to maintain and strengthen the state's regulatory activities for water pollution control.

10. Take necessary actions to reduce water pollution to levels set in the state's water quality classification plan.

    - provide public sewer systems and treatment facilities in all intensively developed areas, in ways that do not stimulate unnecessary or undersirable growth.

    - provide at least secondary-level treatment; provide tertiary-level treatment where required to bring water quality to the standards set forth in the state water quality plan.

    - regionalize treatment facilities.

    - limit intensive development to areas served by public sewer systems providing adequate treatment.

11. Identify water quality problems.

12. Assess the effects of point and nonpoint pollution

13. Determine where fishable-swimmable water quality can be attained.

14. Determine potential future sources of water pollution

15. Develop effective programs to mitigate pollution problems.

16. Develop management strategies and designate appropriate agencies to implement the plan.

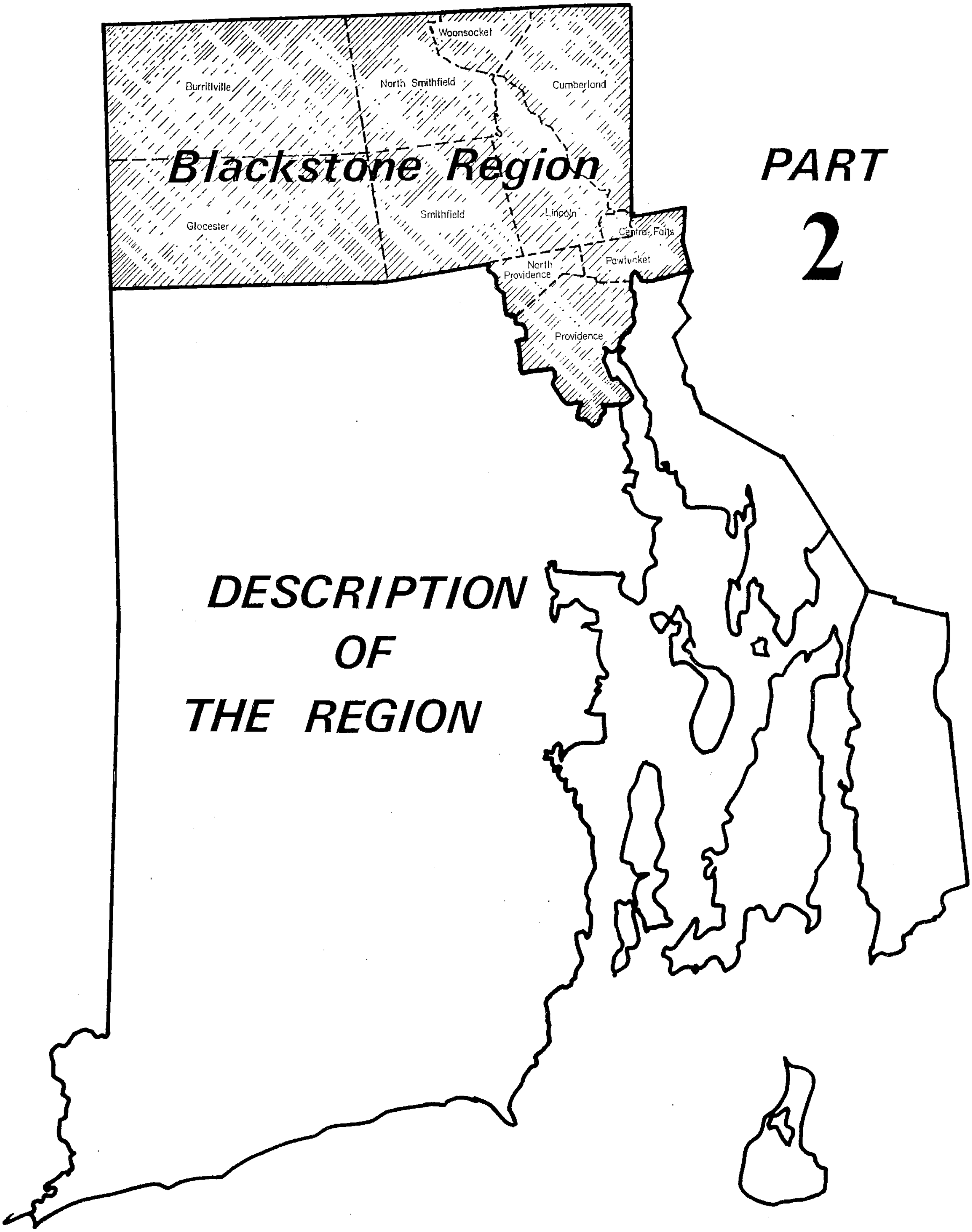
17. Require that:

    a) industrial development causing other than domestic waste discharges occur only in areas served by public sewer systems.

    b) recycling of industrial wastes be undertaken whenever possible to conserve resources and reduce treatment problems.

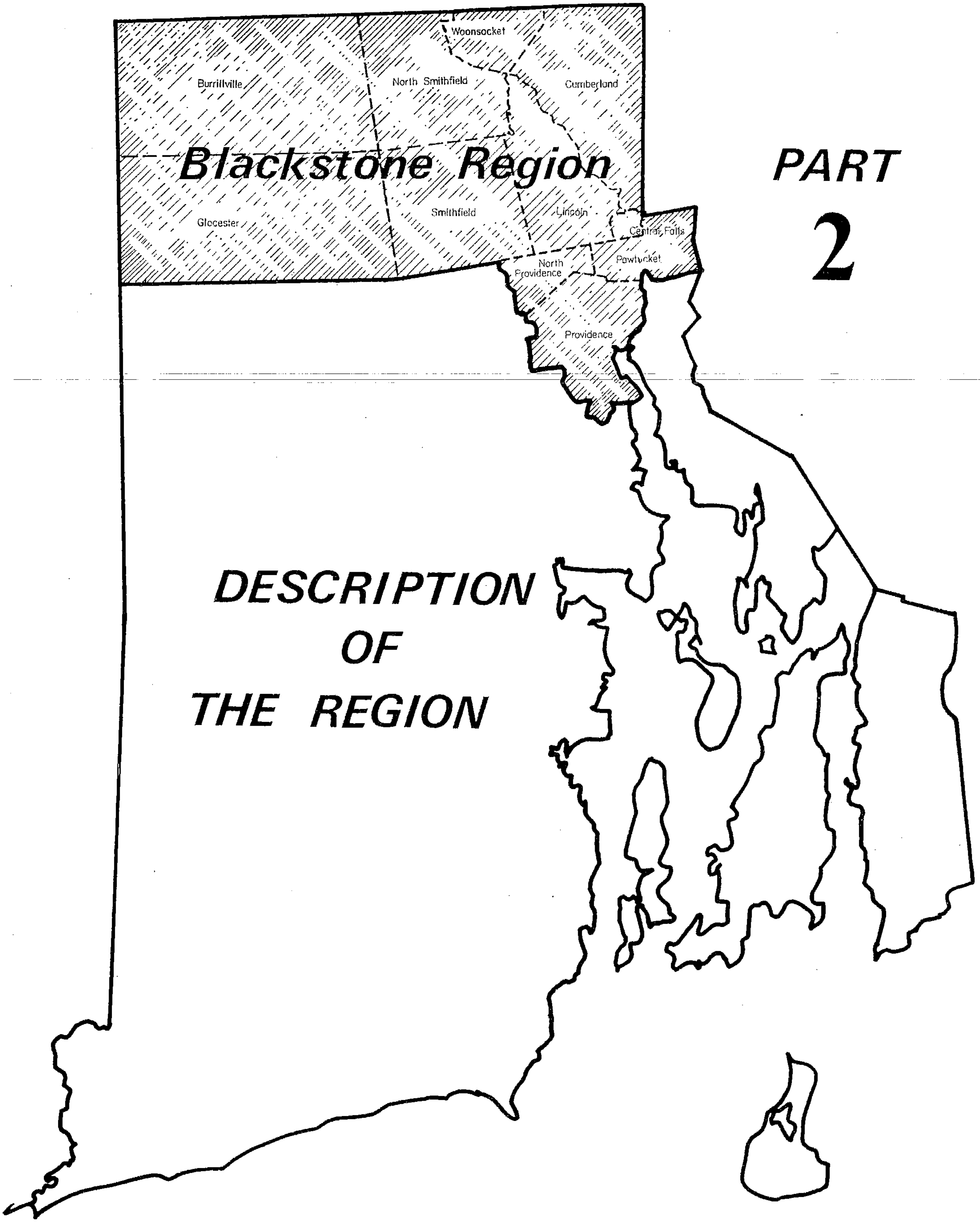
    c) pretreatment of industrial wastes be accomplished before discharge to a public system wherever necessary.

PART 2



DESCRIPTION OF THE REGION

PART 2



DESCRIPTION OF THE REGION

711-02 DESCRIPTION OF THE REGION

The Blackstone Region encompasses the northern part of the state and consists of the Woonasquatucket River Basin, the Moshassuck River Basin, the Rhode Island portion of the Blackstone River Basin, and small portions of the Pawtuxet, Moosup, and Narragansett Bay Basins (see Figure 711-02(1)). Three major rivers drain through the region: the Blackstone, Woonasquatucket, and the Moshassuck. The Blackstone River is by far the most commercialy important river in the region. The Blackstone originates in Worcester and flows in a southeasterly direction to its mouth in Pawtucket, where it becomes a tidal estuary known as the Seekonk River.

It was at the Pawtucket Falls in 1790 that Samuel Slater developed a mechanized system for spinning cotton yarn. This event was one of the most important in the history of early American industry and helped to transform the towns of the Blackstone Valley from a rural and agrarian character to one of urbanization and industrialization ((7)). By the 1820's the Blackstone was dotted with dams for the utilization of water power by textile mills. The character of the Blackstone Region in the 1980's closely reflects the history of its development. Much of the existing urbanization in the region is still clustered around the Blackstone River ((6)). In addition to Pawtucket, Central Falls, and Woonsocket, many old mill villages such as Manville, Albion, Lonsdale, Berkeley, and Ashton remain along the Blackstone. The region has remained relatively rural in character west of the Blackstone River.

The Blackstone Region encompasses 278 square miles with 59 percent or 163 square miles covered by forest ((14)). The terrain in the region is generally hilly or rolling with the highest elevations located in the western portion of the region. The elevations vary from a maximum of 750 feet in western Glocester to mean sea level in the southeast corner of the region. The population of the region, based on the 1980 census, was 441,602 people.

02-01 COMMUNITY PROFILES

The Blackstone Region consists of twelve cities and towns. They are Burrillville, Central Falls, Cumberland, Glocester, Lincoln, North Providence, North Smithfield, Pawtucket, Providence, Smithfield, Woonsocket, and the northeast section of Johnston. A brief summary of the major characteristics of each city and town follows.

02-01-01 Town of Burrillville

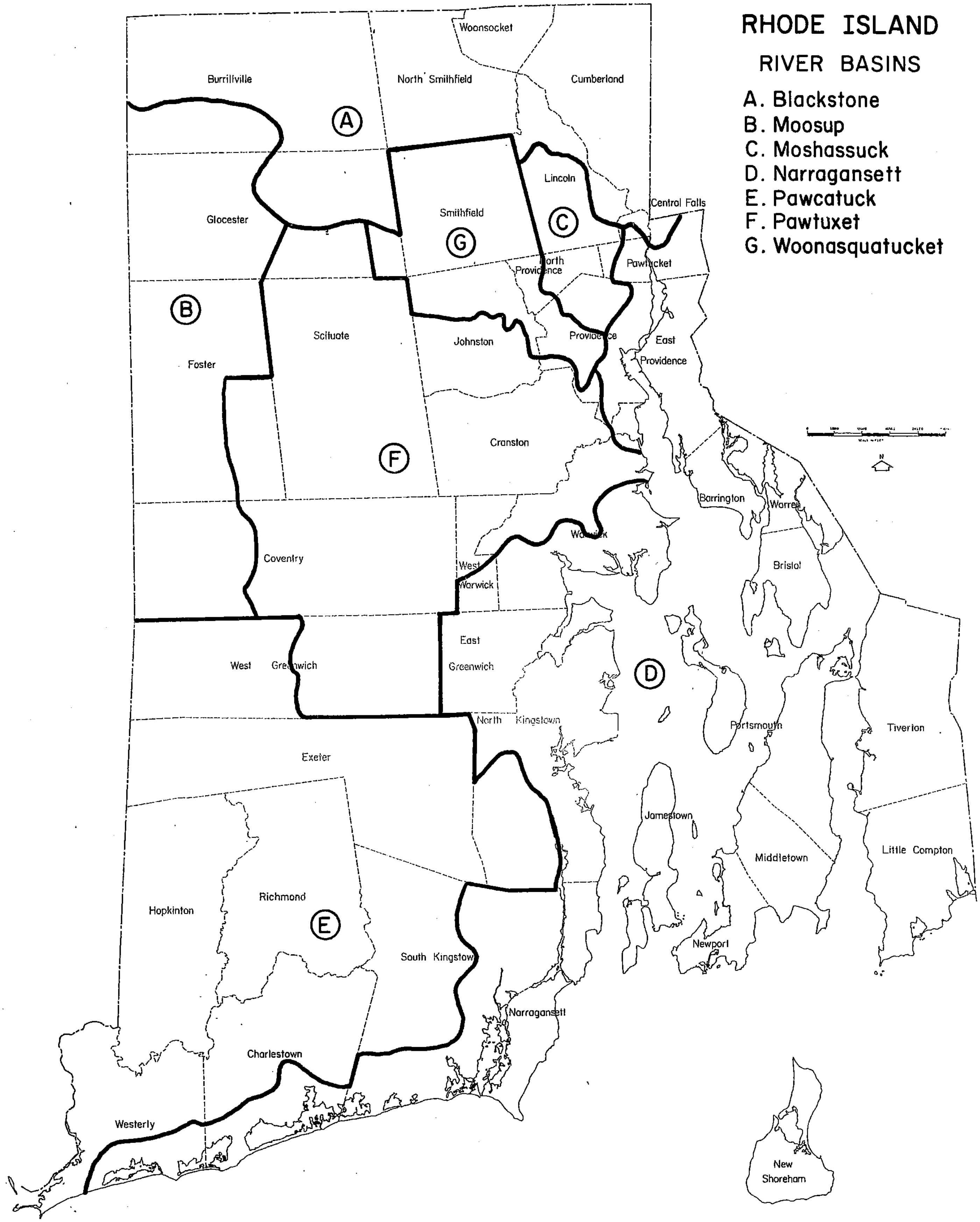
With the exception of numerous mill villages that were established during Rhode Island's 19th Century textile era, this community is rural in character. Important demographic and economic statistics are as follows:

a) Population:

1970 Census - 10,087
1980 Census - 13,164

Figure 711-02 (1)

PLANNING REGIONS FOR PHASE I WATER QUALITY MANAGEMENT PLANS



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b) Area ((15)):

Total	57.3 sq. mi.
Land	55.8 sq. mi.
Inland Water	1.5 sq. mi.

c) Density ((15)):
234 inhabitants per square mile of land area (1981)

d) Total Employment ((15)):

Employees of Private Business and Industry (1975)		957
- Construction	48	
- All manufacturing	331	
- Trade	285	
- Service Industries	237	
- Other	56	
- Self-employed Proprietors of Unincorporated Business (1972)		96
- Professions (1976)		20
- Government (1976)		821
Total		1,894

There are two public water supply systems in Burrillville. The Pascoag Fire District and the Harrisville Fire District both obtain supplies from wells within their district. These two systems serve the Pascoag-Harrisville area. There is also a water supply system serving the Zambarano Memorial Hospital which is located in the northwestern corner of Burrillville.

The predominant means of sewage disposal is through individual subsurface disposal systems. However, because soil conditions is many areas make subsurface disposal impossible, the direct discharge on inadequately treated wastewater into rivers has been an expedient means of sewage disposal. Houses, industries, and business establishments have discharged improperly treated wastes in the Clear, Pascoag, and Chepachet Rivers, particularly in the vilages of Harrisville, Mapleville, Pascoag and Glendale.

The Rhode Island Department of Environmental Management has determined that municipal sewers are needed to eliminate these discharges. A facilities plan (section 201) for the Town of Burrillville was prepared by the engineering firm of Metcalf and Eddy in 1975. This report proposed three sewer service areas for the town. These areas are the Pascoag/Harrisville service area, the Spring Lake service area and the Glendale/Nasonville service area. A secondary wastewater treatment plant was recently completed near Harrisville to treat the wastes of the two service areas and an additional facilities plan will be prepared to determine the most feasible alternative for treating the wastes of the Glendale/Nasonville service area.

02-01-02 City of Central Falls

Central Falls is the smallest municipality in the state and one of the most densely populated cities in the country. Central Falls' economy is primarily sustained by a diversified manufacturing industry ((16)). Important demograhic and economic statistics are as follows:

a) Population

1970 Census - 18,716
1980 Census - 16,995

b) Area ((16)):

Total	1.3 sq. mi.
Land	1.2 sq. mi.
Inland Water	0.1 sq. mi.

c) Density ((16)):

14,084 inhabitants per squre mile of land area (1980).

d) Total Employment ((16)).

- Employees of Private Business and Industry (1976)		6,589
- Construction	52	
- All manufacturing	4,944	
- Trans., Comm., & Util.	86	
- Trade	863	
- Fin., Ins., and R.E.	74	
- Service Industries	570	
- Self-Employed Proprietors of Unincorporated Business (1972)		226
- Professions (approx. 1976)		15
- Government (1976)		522
Total		7,352

The entire City of Central Falls is served by municipal sewers which tie into the Blackstone Valley District Commission treatment plant in East Providence. The City of Central Falls, like the cities of Pawtucket and Providence, combine their sanitary sewage with stormwater runoff during periods of heavy rainfall. It has been determined that there are approximately 125 storm events per year that cause the discharge of untreated sanitary sewage and stormwater runoff directly into the Blackstone, Moshassuck, and Seekonk Rivers, in addition to the extreme upper end of Narragansett Bay ((5)). There are 30 combined sewer overflows (CSO's) in the Cities of Pawtucket and Central Falls, which have adjoining sewerage systems. There are 8 CSO's in Central Falls. A facilities plan, prepared for the City of Central Falls recommended that the 8 CSO's be treated at two separate satellite treatment facilities ((5)). Treatment at each facility will consist of primary treatment and disinfection prior to discharge. Similar recommendations have been made for the Cities of Pawtucket and Providence. The implementation of satellite treatment facilities in the City of Central Falls is subject to the availability of funds.

The entire city is served by a public water system supplied by the City of Pawtucket. Pawtucket receives its water supply from the Diamond Hill and Arnold Mills Reservoirs in Cumberland, in addition to small amounts supplied by wells in Pawtucket and Cumberland.

02-01-03 Town of Cumberland

The Town of Cumberland is located in northeastern Rhode Island and is bordered on the north and east by the Commonwealth of Masssachusetts. The northern portion of the town is predominantly rural in character while the southern portion is generally urbanized. Important demographic and economic data are as follows:

a) Population:

1970 Census - 26,605
1980 Census - 27,069

b) Area((17)):

Total	28.4 sq. mi.
Land Area	27.1 sq. mi.
Inland Water Area	1.3 sq. mi.

c) Density ((17)):
997 inhabitants per square mile of land area (1980)

d) Total Employment ((17)):

- Employees of Private Business and Industry (1974)		5,765
- Agr., Fish., Min.	52	
- Construction	164	
- All Manufacturing	2,503	
- Trans., Comm., Util.	351	
- Whol. & Retail Trade	1,574	
- Fin., Ins., & R.E.	53	
- Service Industry	1,068	
- Self-Employed Proprietors of Unincorporated Business (1972)		224
- Professions (1975)		28
- Government (1975)		758
	Total	6,775

The Town of Cumberland utilizes three different water supply systems. The entire area south of Marshall Avenue (Lonsdale and Valley Falls) is served by the

City of Pawtucket; a small area adjacent to the Woonsocket city line at Diamond Hill Road is served by the City of Woonsocket Water Department; and the remainder of the public water is supplied by the Town of Cumberland Water Department. Areas served by this Department include: the Mendon Road (RI-122) Area, the Diamond Hill Road (RI-114) Area, the Abbott Run Valley Road Area, and the Angell Road (RI-116) Area, the Bear Hill Road Area, and the Sneech Pond Road (RI-120) Area. The sources for this supply are Sneech Pond and three wells. Two of these wells have been contaminated by an aerosol manufacturing firm, Peterson-Puritan. Refer to Sub-Section (05-01-03)B for additional information.

Parts of the Valley Falls, Cumberland Hill, Lonsdale and Ashton sections of Cumberland are sewered. As of 1975, 7,700 or 28 percent of Cumberland's population of 28,300 were served by sewers, and the average daily flow was 0.9 MGD. The Ashton system, which serves an old mill housing complex, discharges into the Blackstone River. Raw sewage is also discharged into the ground or into surface waters in part of Valley Falls. Cumberland has a municipally owned and operated wastewater collection system that connects to the Blackstone Valley District Commission (BVDC) wastewater treatment facility. A facilities plan for the Town of Cumberland is currently being prepared to establish a priority system for the construction of new lateral sewers by the town and interceptor sewers by the BVDC.

(revised 6/30/82)

02-01-04 Town of Glocester

This community is generally rural in character, with a small urban center at Chepachet. Important demographic and economic statistics are as follows:

a) Population

1970 Census - 5,160
1980 Census - 7,550

b) Area ((18)):

Total	57.2 sq. mi.
Land Area	55.3 sq. mi.
Inland Water Area	1.9 sq. mi.

c) Density ((18)):

135 inhabitants per square mile of land area (1980).

d) Total Employment ((18)):

- Employees of Private Business and Industry (1976)		385
- Construction	25	
- All Manufacturing	7	
- Trans., Comm., & Util.	59	
- Whol. & Retail Trade	224	
- Fin., Ins., & R.E.	10	
- Service Industries	60	
- Proprietors & Professionals (1976)		25
- Government (1976)		171
Total		581

(revised 6/30/82)

There are no public water supply systems in the Town of Glocester. However, the Brandy Acres subdivision in the northwestern corner of the town is served by a privately owned water system which is supplied by a well in the vicinity.

There are no municipal sewer systems within the town, and wastewater disposal is by individual subsurface disposal systems. However, there are approximately 2,000 people that live in the vicinity of Chepachet that could be served by the Burrillville wastewater treatment facility.

02-01-05 Town of Johnston

The area west of Route I-295 is generally rural in character, while development is occurring rapidly in the easterly portion of the community from I-295 to the Woonasquatucket River. The population figures are for the entire town of Johnston, not just the portion within the Blackstone Region. Important demographic and economic statistics are as follows:

a) Population:

1970 Census	22,037
1980 Census	29,907

b) Area ((19)):

Total	24.4 sq. mi.
Land area	23.7 sq. mi.
Inland Water	0.7 sq. mi.

c) Density ((19)):

1,048 persons per square mile of land area (1980).

d) Total Employment ((19)):

- Employees of Private Business and Industry (1974)		3,767
- Agr., Fish., Min.	98	
- Construction	319	
- All Manufacturing	1,452	
- Trans., Comm., & Util.	73	
- Wholesale & Retail	1,319	
- Fin., Ins., & R.I.	55	
- Service Industries	432	
- Self-Employed Proprietors of Unincorporated Business (1972)		261
- Professions (1975)		46
- Government (1975)		750
Total		4,824

The urbanized areas of Johnston east of RI-5 are served by a public water system which is supplied by the Providence water system. The remainder of the town is dependent on individual wells.

An estimated 70 percent of the town's total population of 22 thousand people is presently served by a separate sanitary sewer system which discharges into the City of Providence sewer system at four locations. This sewer system serves the eastern area of the town along the Woonasquatucket River, where the majority of the population is located. The average daily flow in 1980 was 2.21 MGD.

The Johnston sewerage system is subject to surcharging, possibly because of excessive infiltration and inflow. A facilities plan is being prepared to determine the most feasible means of eliminating surcharging in the system.

02-01-06 Town of Lincoln

This community is located south of Woonsocket and west of the Blackstone River. The town has been developing rapidly, particularly in the southern portion. Important demographic and economic statistics are as follows:

a) Population:

1970 Census	16,182
1980 Census	16,949

b) Area ((20)):

Total	19.0 sq. mi.
Land Area	18.6 sq. mi.
Inland Water	0.4 sq. mi.

c) Density ((20)):

909 persons per square mile of land area (1980).

d) Total Employment ((20)):

- Employees of Private Business and Industry (1974)		5,349
- Agr., For., and Fish.	132	
- Construction	283	
- All Manufacturing	2,927	
- Trans., Comm., & Util.	296	
- Trade	620	
- Fin., Ins., & R.E.	24	
- Service Industries	1,067	
- Self-Employed Proprietors of Unincorporated Business (1972)		157
- Professions (1975)		17
- Government (1975)		482
	Total	6,005

Six areas of the town are served by sewers. They are: Albion, Manville, Lonsdale, the Lincoln Downs-Davies School Area, the North Central Industrial Air Park, and the Saylesville Area.

a) The Albion sewerage system was constructed by private interests but is now in town ownership. It serves most of the developed area of Albion and is tied into the Blackstone Valley District Commission (BVDC).

b) Most of the developed areas of Manville are served by a sewerage system which is tied into the BVDC interceptor.

c) The Lonsdale sewerage system serves approximately 600 residents of that area. Sewage from the Lonsdale system discharges into the BVDC interceptor.

d) Lincoln Downs, Rhode Island Junior College, and the Davies School are served by a system that extends from the North Providence sewerage system. The system was initially installed to serve the race track and was later extended to serve the Davies School. The state, which constructed the system beyond Lincoln Downs to serve the school, has permitted only a limited number of abutters to tie into the system because of its limited capacity.

e) The Saylesville system was constructed before the turn of the century to serve the Sayles Finishing Plants, Inc. complex and the company owned houses. The system is now operated by the Town of Lincoln and serves about 160 houses and a dozen industries. The wastewater from this system is pumped into the Moshassuck Valley interceptor which is part of the BVDC sewerage system.

The areas most in need of sewers were determined by a 1971 engineering report for the town and were designated in the report as Phase I sewers ((45)). The recommended projects will extend the service areas in Manville, Albion and Lonsdale, and separate combined sewers in Manville. As of January 1978, the sewer extensions in Albion had been installed and the extension of sewers and separation of combined sewers in Manville were initiated. Approximately 2,000 people were served by sewers and the average daily flow was 2.23 MGD.

The developed sections in the Town of Lincoln, including Manville, Albion, Quinnville, Lonsdale, Saylesville, and North Central Airport, are served by a public water supply system. Prior to 1979, Lincoln obtained its water supply solely from wells. In October 1979, three of the eight wells were found to be contaminated and were closed. This reduced the water supply for the Town of Lincoln by 45 percent. To supplement their water needs, the town purchases water from the cities of Woonsocket and Pawtucket on an as needed basis. Lincoln is currently searching for new well sites within the town. Industries within the town are required to cut back their water needs by 20 percent and when possible, recycle their water.

02-01-07 Town of North Providence

This suburban community, with over two-thirds of its resident labor force employed outside the town, has experienced a significant rate of residential growth in the last few years. Important demographic and economic statistics are as follows:

a) Population:

1970 Census	24,337
1980 Census	29,188

b) Area ((21)):

Total	5.8 sq. mi.
Land Area	5.7 sq. mi.
Inland Water	0.1 sq. mi.

c) Density ((21)):

5,125 inhabitants per square mile of land area (1980).

d) Total Employment ((21)):

- Employees of Private Business and Industry (1974)		4,893
- Agr., Fish., Min.	33	
- Construction	331	
- All Manufacturing	2,235	
- Trans., Comm., Util.	122	
- Whol. & Retail Trade	1,191	
- Fin., Ins., & R.E.	107	
- Service Industry	874	
- Self-Employed Proprietors of Unincorporated Business (1972)		600
- Professions (1975)		30
- Government (1975)		669
	Total	6,192

The Town of North Providence is served by a public water system supplied by the Providence water system.

In 1977, 90 percent of the town's population was served by the municipal sewer system which is about 50 years old, and has groundwater infiltration and inflow from drains. The wastewater from North Providence has an average daily flow of 9.39 MGD and discharges into the Providence sewerage system. Treatment is provided at the Providence treatment facility.

02-01-08 Town of North Smithfield

Although this community is predominantly rural, there are areas of concentrated development such as Slatersville and Forestdale. Important demographic and economic statistics are given below:

a) Population:

1970 Census	9,300
1980 Census	9,972

b) Area ((22)):

Total	25.1 sq. mi.
Land Area	24.5 sq. mi.
Inland Water	0.6 sq. mi.

c) Density ((22)):

416 inhabitants per square mile of land area (1980).

d) Total Employment ((22)):

- Employees of Private Business and Industry (1976)		3,593
- Agr., Fish., Farm. & Misc.	86	
- Construction	80	
- All Manufacturing	1,885	
- Trans., Comm., & Util.	6	
- Whol. & Retail Trade	693	
- Fin., Ins., & R.E.	7	
- Service Industries	836	
- Self-Employed Proprietors of Unincorporated Business (1972)		78
- Professions (1976)		7
- Government (1976)		240
	Total	3,918

The Union Village area of North Smithfield is supplied with water from the Woonsocket system. The Slatersville area of North Smithfield also has a public water system, supplied by the Town of North Smithfield.

Some municipal sewers have been constructed in North Smithfield. Currently Union Village, Park Square and a small portion of Slatersville have been completed. The remainder of Slatersville and Forestdale will be sewered subject to the availability of funding. The collected sewage will be conveyed via the Cherry Brook Interceptor to the Woonsocket wastewater treatment plant.

02-01-09 City of Pawtucket

Pawtucket is known as the "city of diversified industries;" because of its 300 manufacturers, including textile, machinery, tools, electrical machinery, chemicals, foundries, glass and jewelry ((23)). Some important poulation and economic statistics are given below:

a) Population:

1970 Census	76,984
1980 Census	71,204

b) Area ((23)):

Total 8.9 sq. mi.
Land Area 8.8 sq. mi.

c) Density ((23)):

8,072 inhabitants per square mile of land area (1980).

d) Total Employment ((23)):

- Employees of Private Business and Industry (1974)		30,039
- Agr., Fish., Min.	57	
- Construction	751	
- All Manufacturing	17,747	
- Trans., Comm., Util.	1,035	
- Who. & Retail Trade	6,014	
- Fin., Ins., & R.E.	601	
- Service Industry	3,834	
- Self-Employed Proprietors of Unincorporated Business (1972)		858
- Professions (1975)		175
- Government (1975)		2,035
	Total	33,107

Almost all non-residential land uses and more than 95 percent of the dwelling units in Pawtucket are served by municipal sewers. In most sections of the city the sewers are combined with stormwater runoff, as is the case in Central Falls and Providence, and during periods of heavy rainfall, stormwater and untreated sewage are discharged directly to the Blackstone, Moshassuck and Seekonk Rivers, in addition to the extreme upper end of Narragansett Bay. There are 22 combined sewer overflows (CSO's) in Pawtucket that are activated by approximately 125 storm events per year ((3)). A facilities plan prepared for the City of Pawtucket recommended that the 22 CSO's be treated at four separate satelite treatment facilities ((3)). Treatment at each facilty will consist of primary treatment and disinfection prior to discharge. Similar recommendations have been made for the cities of Central Falls and Providence for the treatment of their CSO's. The implementation of satellite treatment facilities in the City of Pawtucket is subject to the availability of funds. The sewage generated in Pawtucket is conveyed to the Blackstone Valley District Commission treatment facility in East Providence.

The entire city is served by a public water supply system which obtains most of its water supply from surface water and a small amount from wells. The surface water supply is the Abbott Run watershed in Cumberland which, after impoundment in Diamond Hill and Arnold Mills Reservoirs, flows to Happy Hollow Pond through Abbott Run. The groundwater supplement is from ten wells located in Pawtucket and Cumberland.

02-01-10 City of Providence

Providence is the state capitol as well as its industrial center. Important demographic and economic statistics are given below:

a) Population:

1970 Census	179,116
1980 Census	156,804

b) Area ((24)):

Total	20.0 sq. mi.
Land Area	18.1 sq. mi.
Inland Water	1.9 sq. mi.

c) Density ((24)):

8,642 persons per squre mile of land area (1980).

d) Total Employment ((24)):

- Employees of Private Business and Industry (1975)		105,686
- Agr., Fish., Min.	46	
- Construction	1,658	
- All Manufacturing	36,079	
- Trans., Comm., Util.	7,757	
- Whol. & Retail Trade	17,334	
- Fin., Ins., & R.E.	13,719	
- Service Industry	29,093	
- Self-Employed Proprietors of Unincorporated Business (1972)		2,681
- Professions (1975)		1,617
- Government (1975)		11,889
Total		121,873

The entire city is served by a public water supply system. The source of this supply is the Scituate Reservoir, located in the Town of Scituate.

The entire City of Providence, in addition to Johnston, North Providence, parts of Lincoln, and the Narragansett Brewery in Cranston are served by the Providence wastewater treatment facility located at Field's Point. Like Central Falls and Pawtucket, the Providence sewerage system combines stormwater runoff with sanitary sewage. There are 65 combined sewer overflow (CSO's) locations within Providence. These CSO's discharge directly into the Woonasquatucket, West, Seekonk, Moshassuck, and Providence Rivers. A facilities plan prepared for the City of Providence in 1979, recommended the construction of 9 satellite treatment facilities within the city for primary treatment and disinfection of the CSO's ((4)). In addition, the Providence sewage treatment facility, at Field's Point, will be upgraded to comply with secondary treatment. For more details regarding the past problems at the Providence plant and the measures that have been taken to rectify these problems, refer to Chapter 07-02.

02-01-11 Town of Smithfield

Much of the Town of Smithfield is rural in character; with concentrations of population in the Georgiaville, Esmond, and Greenville areas, all of which are located in the southerly portion of the town. As can be seen in the population figures, the town experienced a rapid growth rate from 1970 to 1980.Important demographic and economic statistics are listed below:

a) Population:

1970 Census	13,468
1980 Census	16,886

b) Area ((25)):

Total	27.8 sq. mi.
Land Area	26.7 sq. mi.
Inland Water	1.1 sq. mi.

c) Density ((25)):

632 persons per square mile of land area (1980).

d) Total Employment ((25)):

- Employees of Private Business and Industry (1974)		3,481
- Agr., Fish., Mining	15	
- Construction	188	
- All Manufacturing	1,787	
- Trans., Comm., & Util.	95	
- Whol. & Retail	608	
- Fin., Ins., & R.E.	21	
- Service Industry	768	
- Self-Employed Proprietors of Unincorporated Business (1972)		127
- Professions (1975)		8
- Government		367
	Total	3,990

There are three public water systems in the town. The East Smithfield Water District serves the villages of Esmond and Georgiaville and obtains the supply from the Providence water system. The Greenville Water District serves much of the southwestern corner of the town in and around the village of Greenville. The source of supply for this system is also the Providence system. Four gravel packed wells, two near the southern end of Slack Reservoir and two near the southern end of the Woonasquatucket Reservoir, are available as an emergency source of supply. The third system is the Town of Smithfield Water Supply Board System. This system serves the Douglas Pike (RI-7) Area, from Bryant College south to Mineral Spring Avenue (RI-15), and the George Washington Highway (RI-116), from Douglas Pike east to the town line. The water supply source is from the Providence system.

A Facilities Plan (Section 201) which was completed in 1973 outlines the service area of the Smithfield sewerage system. The system serves the Esmond, Georgiaville, Greenville and Spragueville sections of the town and includes a wastewater treatment facility in Esmond. A small section of northeastern Smithfield, the Smithfield Industrial Park, is served by the Blackstone Valley District Commission (BVDC), via the Washington Highway Interceptor.

02-01-12 City of Woonsocket

Woonsocket is the sixth largest municipality in Rhode Island and it includes many diversified industries. Important demographic and economic statistics are as follows:

a) Population:

1970 Census	46,820
1980 Census	45,914

b) Area ((26)):

Total	7.9 sq. mi.
Land Area	7.9 sq. mi.

c) Density ((26)):

5807 inhabitants per square mile of land area (1980).

d) Total Employment ((26)):

- Employees of Private Business and Industry (1974)		11,411
- Agr., Fish., & Min.	8	
- Construction	438	
- All Manufacturing	4,003	
- Trans., Comm., & Util.	235	
- Whol. & Retail Trade	4,097	
- Fin., Ins., & R.E.	535	
- Service Industries	2,095	
- Self-employed Proprietors of Unincorporated Business (1972)		498
- Professions		68
- Government		1,122
	Total	13,099

The Woonsocket water supply system serves the entire City of Woonsocket and parts of North Smithfield and Cumberland. Water is obtained from three surface reservoirs (Harris Pond, Reservoir Number 1 and Reservoir Number 3). Water flows from Reservoir Number 3, located on the Smithfield-North Smithfield town line, through Crookfall Brook to Reservoir Number 1 and then to the treatment plant.

The city is almost completely served by a municipal sewerage system and treatment of the sewage is provided by a secondary treatment plant. The system is in good condition. Major improvements were made to the Low Level and Cherry Brook interceptors and to the treatment plant to accommodate future flows and eliminate industrial discharges to the Blackstone River. These improvements were completed in 1978. As of 1980, 48,500 people were served by the Woonsocket regional sewerage system and the average daily flow was 9.03 MGD. In addition to the City of Woonsocket, the regional sewerage system serves the Town of North Smithfield, Rhode Island and the Towns of Blackstone and Bellingham, Massachusetts.

02-02 HYDROLOGICAL DATA

02-02-01 Hydrological Data for the Region

Hydrological data for the Blackstone Region exists for those rivers where there are United States Geological Survey gaging stations. Available data is summarized below for each river basin in the Blackstone Region.

A. The Blackstone River Basin

There are five USGS gaging stations in the Rhode Island portion of the Blackstone River Basin. The data from these gaging stations are given in Table 711-02(1).

B. The Woonasquatucket River Basin

There is one U.S. Geological Survey (USGS) gaging station located in Centerdale at river mile 6.5 which has historic low flow analysis data available. This gage receives the drainage of 38.3 square miles with a period of record from 1943 to 1979. The average flow at this gage from the period of record is 70.6 cubic feet per second (cfs). The one in ten year average seven day low flow for the Woonasquatucket River at the Centerdale gage is 8.230 (9.16 cfs).

C. Moshassuck River Basin

Although the United States Geological Survey (USGS) has a gaging station on the Moshassuck River at river mile 0.5, it has not been in operation long enough to obtain sufficient data for historic low flow analysis.

The average discharge over the twelve year period from 1965 to 1979 was 39.0 cubic feet per second (cfs). The one in ten year average seven day low flow for the Moshassuck River is 3.57 cfs.

TABLE 711-02(1)

U.S.G.S. GAGING STATION DATA

Location of Gage	Drainage Area (sq. mi.)	Period of Record	Average Discharge cfs**	1 yr. in 10 yr. 7 Day Low Flow* cfs
Nipmuc River near Harrisville, R.I.	16.0	1966 to 1979	27.9	0.47
Chepachet River at Chepachet, R.I.	17.4	1964 to 1971	28.9	N/A
Branch River at Forestdale, R.I.	91.2	1942 to 1979	166.6	12.96
Blackstone River at Woonsocket, R.I.	4.6	1931 to 1979	729.0	101.01
Mill River at Woonsocket, R.I.	2.3	1967 to 1974	3.0	N/A

* The average seven day low flow period which can be expected to occur once in ten years is the critical low flow period upon which water quality standards and waste load allocations are determined.

** Cubic ft. per second.

02-03 SURFACE WATER

02-03-01 The Blackstone River Basin

This basin is generally hilly or rolling, the higher elevation and narrower valleys being in the western portions. Elevations vary from a maximum of 1,345 feet above sea level near Worcester, Massachusetts to near sea level in Pawtucket. A number of natural falls exist along the course of the main rivers and most have been developed for waterpower or process water, usually in connection with textile plants.

The Blackstone River has a drainage area of 478 square miles, at the head of tidewater, comprised of 373 square miles in Massachusetts and 105 square miles in Rhode Island. The basin is 46 miles long, stretching from its headwaters in the vicinity of Worcester southeasterly to tidewater in the Providence-Pawtucket area.

The Blackstone River has its origin at the junction of Middle River and Mill Brook in the southeastern section of the City of Worcester. The river flows generally southward through the towns of Millbury, Sutton, Grafton, Northbridge, Uxbridge, Millville and Blackstone, all in Massachusetts. It continues to flow southeasterly in Rhode Island through the City of Woonsocket, forms the boundaries of the towns of Lincoln and Cumberland, and passes through the cities of Central Falls and Pawtucket.

The main tributaries of the Blackstone, in downstream order, are Kettle Brook, Quinsigamond, Mumford, West, Mill, Peters and Branch Rivers. The Branch, Peters and Mill Rivers are the only tributaries in Rhode Island.

The Branch River is by far the largest tributary in the basin, having a total drainage area of 93 square miles, of which 11.7 square miles are in Massachusetts and the remainder in Rhode Island. The Branch River is formed at the confluence of the Clear and Chepachet Rivers and flows in an easterly direction to join the Blackstone River in Rhode Island, about one-quarter mile below the Massachusetts-Rhode Island state line.

In Rhode Island, the Blackstone River Basin encompasses all of Woonsocket and Cumberland, most of North Smithfield, and portions of Burrillville, Glocester, Lincoln, Central Falls, Pawtucket and Smithfield.

02-03-02 The Woonasquatucket River Basin

The Woonasquatucket River Basin is located in the north-central part of the State and encompasses parts of six communities (see Figure 711-02(1). The Woonasquatucket River rises in the towns of North Smithfield, Smithfield and Glocester and follows a general southeasterly direction through numerous reservoirs, lakes, and old mill ponds, and is joined by several smaller tributaries along the way to its mouth. The river has a drainage area of approximately 51 square miles and is about 19 miles in length.

The northern half of the basin is primarily rural in character with scattered concentrations of development. The southerly portion of the basin is generally urbanized with the highest density development occuring in the City of Providence, followed by the towns of North Providence and Johnston.

In Providence, the Woonasquatucket River joins the Moshassuck River to form the Providence River, which is tidally influenced. The Woonasquatucket River is normally tidal up to Eagle Street, a distance of about 1.4 miles from the confluence with the Moshassuck River.

02-03-03 The Moshassuck River Basin

The Moshassuck River Basin, located in the northeastern part of the state, encompasses portions of Central Falls, Lincoln, Smithfield, North Providence, Pawtucket and Providence (see Figure 711-02(1)). The basin has a total drainage area of 24 square miles, 11 of which are drained by the West River, which is the major tributary of the Moshassuck River.

The Moshassuck River originates in the Town of Lincoln and flows approximately ten miles in a southerly direction through the cities of Pawtucket and ~~Providence, where it joins the Woonasquatucket River to form the Providence~~ River. The West River, which is approximately seven miles long, originates in Smithfield and flows easterly through North Providence and Providence, to join the Moshassuck about one mile north of the confluence of the Woonasquatucket and Moshassuck Rivers.

The northern half of the basin is primarily rural in character with scattered concentrations of development, while the southerly portion of the basin is generally urbanized with high density development occuring in Providence, Central Falls, Pawtucket and North Providence.

02-03-04 Moosup River Basin

The Mossup River Basin is a minor sub-basin of the Thames River Basin. The Thames River Basin covers 1,474 square miles and lies principally in the eastern third of Connecticut, with small portions extending into Massachusetts and Rhode Island. The portion of the Moosup River Basin which is included in the Blackstone Region in this plan is located in the far western sections of Burrillville and Glocester. The water bodies in the Burrillville portion of the Moosup River Basin consist of Wakefield Pond, Peck Pond and a tributary of the Quaddick Reservoir. The water bodies in the Glocester portion of the Moosup River Basin are Bowdish Reservoir, Mowry Meadow Brook, and Killingly Pond.

02-03-05 Pawtuxet River Basin

The northern portion of the Pawtuxet River Basin is included in the Blackstone Region planning area. All the major water bodies of the Pawtuxet River Basin in the Blackstone Region are tributaries of the Scituate Reservoir.

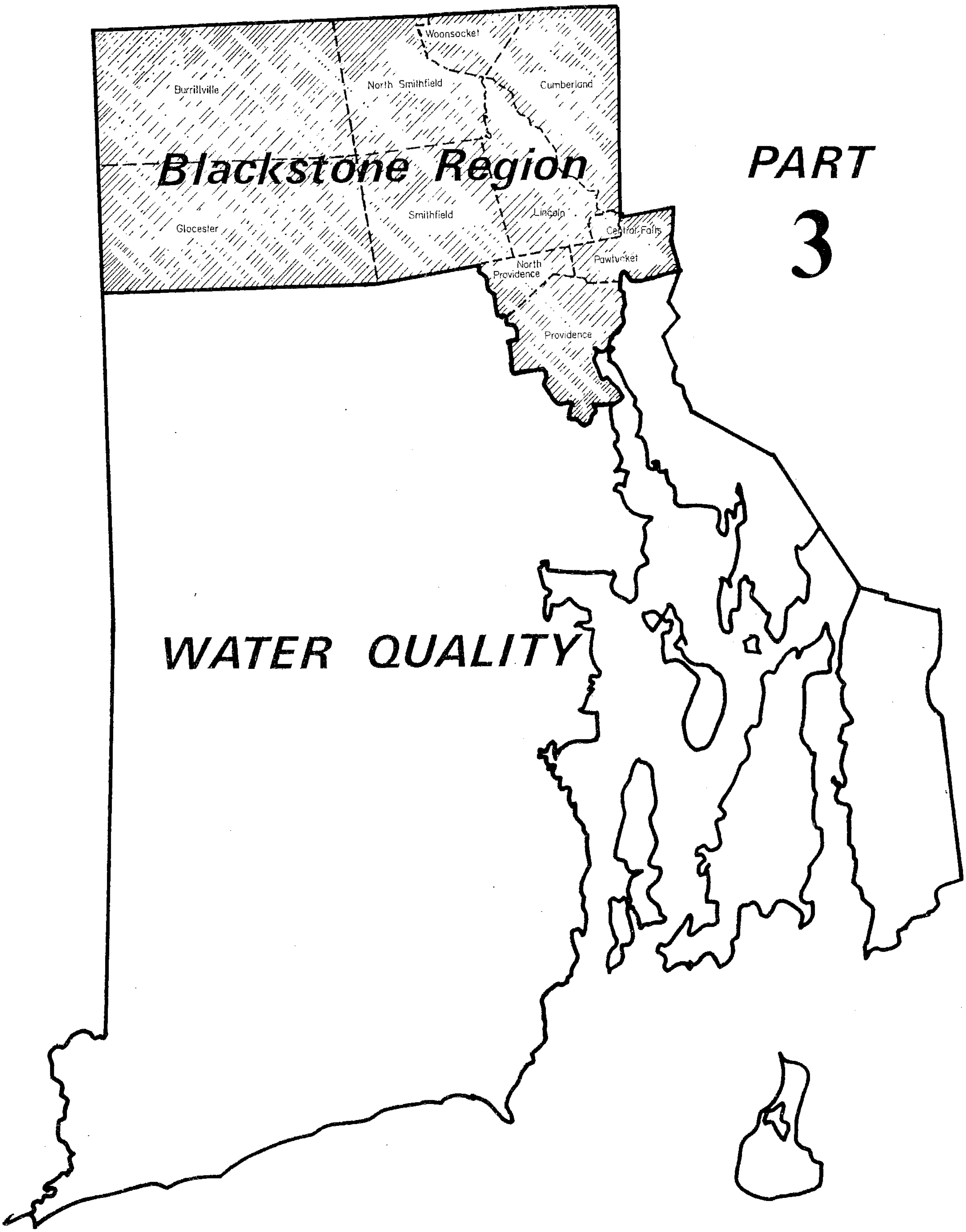
02-03-06 Narragansett Bay Basin

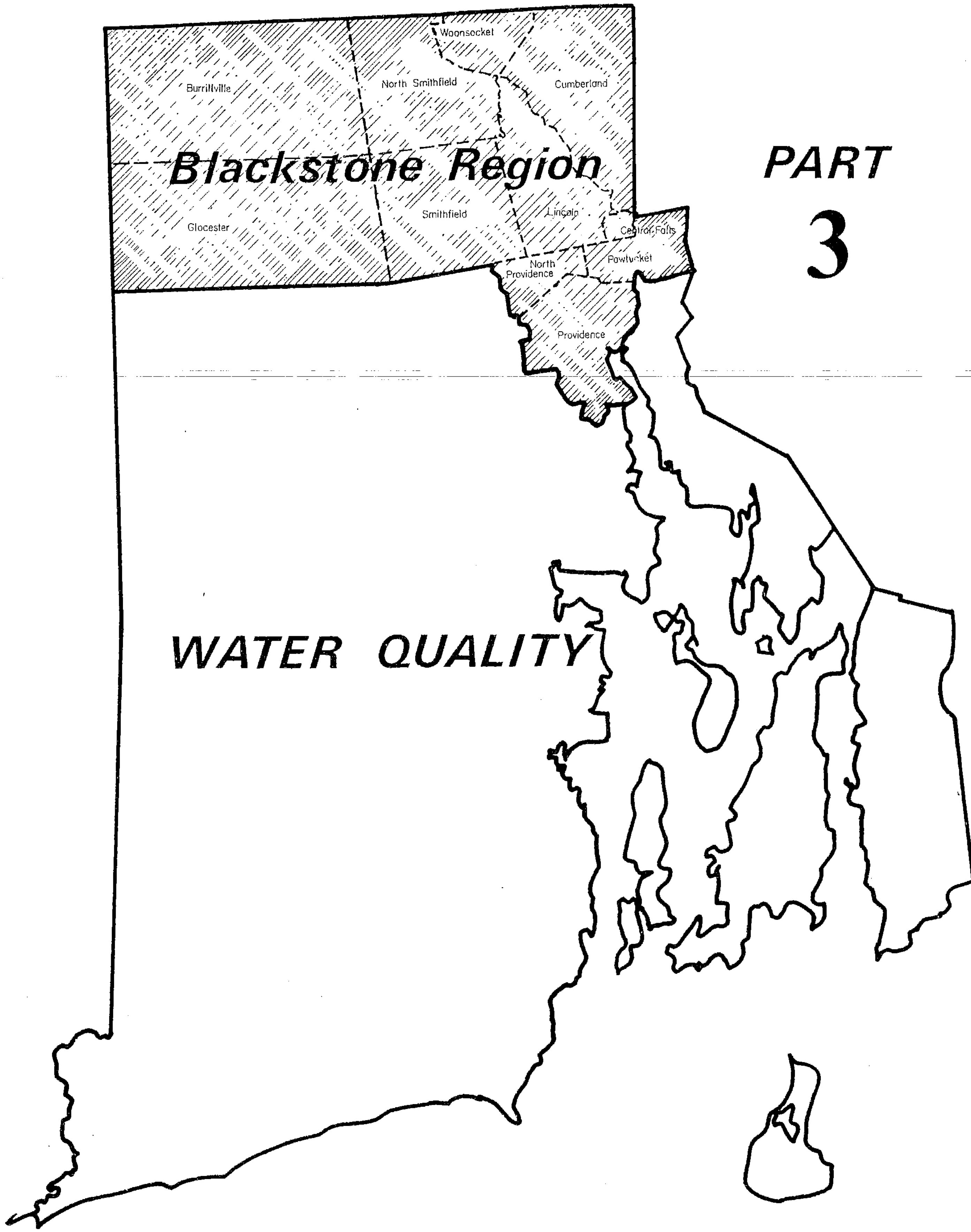
The northern portion of the Narragansett Bay Basin is also included in the Blackstone Region. This area includes the very eastern section of Providence, a small south-central section of Central Falls and the southwestern section of Pawtucket. The Seekonk River and the Providence River flow through this northern portion of the Narragansett Basin.

PART 3

WATER QUALITY

Blackstone Region





PART 3

WATER QUALITY

711-03 WATER QUALITY

03-01 WATER QUALITY STANDARDS

Standards of water quality for the waters of the State of Rhode Island were first adopted in 1967 with revisions in 1973, 1975, and 1980. There are presently five classes of water quality designating the suitability for use of the state's fresh water. Each water classification has specific water quality standards associated with it that must be met if the water body is to be considered in compliance with its classification. These classifications are:

Class A - Suitable for water supply and all other water uses; character uniformly excellent.

Class B - Suitable for bathing, other recreational purposes; agricultural uses; industrial processes and cooling; excellent fish and wildlife habitat; good aesthetic value; acceptable for public water supply with appropriate treatment.

Class C - Suitable for fish and wildlife habitat, recreational boating, and industrial processes and cooling, good aesthetic value.

Class D - Suitable for navigation, power, certain industrial processes and cooling, and migration of fish; good aesthetic value.

Class E - Nuisance conditions

Classifications of saline waters are designated as SA, SB, or SC. The suitability of use of these waters are:

Class SA - Suitable for all sea water uses including shellfish harvesting for direct human consumption (approved shellfish areas), bathing and other water contact sports.

Class SB - Suitable for bathing, other recreational purposes, industrial cooling and shellfish harvesting for human consumption after depuration (restricted shellfish areas) excellent fish and wildlife habitat, good aesthetic value.

Class SC - Suitable fish, shellfish and wildlife habitat, suitable for recreational boating, and industrial cooling, good aesthetic value.

All states have the option of classifying certain waters as "Outstanding State or Natural Resources". According to the EPA, these waters could be selected according to the following criteria, which are meant to be suggestive rather than all encompassing:

1) Waters within national and state parks and wildlife refuges;

2) Waters that provide a unique habitat for identifiable threatened or endangered species;

(revised 6/30/82)

3) Rivers designated under the National or State Wild and Scenic Rivers Act;

4) Waters flowing through designated state or national wilderness areas;

5) Certain waters within state or National Forests; including roadless areas and management areas II, III, and IV (respectively, intensive, extensive, and back country recreation.);

6) Class A (protected) water supplies;

7) Areas proposed for designation as "preservation or restoration" in the preliminary state coastal resources management programs; or

8) Other waters within the state that are of unique recreational or ecological significance.

If a water body is selected as an "Outstanding State or National Resource", then no discharges are allowed to that body of water. At the present time, however, Rhode Island has not classified any water body an "Outstanding State or National Resource".

The Division of Water Resources, Department of Environmental Management, is responsible for the review and revision of water quality standards. When the water quality standards were reviewed and revised in fiscal year 1977, one of the major changes was the revision of the anti-degradation policy. Under the former anti-degradation policy, all new discharges to Class A, SA, B and SB waters were prohibited. The present anti-degradation policy has two thrusts. The first applies to A, SA, B and SB waters and permits new discharges to these waters only when the applicant can demonstrate to the state that the discharge will not impair any usages specifically assigned to the water class and that the waters will not be degraded below existing classifications under most adverse conditions. The most adverse conditions are those cases where there is minimum dilution of the pollutant and complete disruption of the treatment system. In essence, the above policy restricts new discharges in all A, SA, B and SB waters to non-contact cooling waters. The need for the elimination of old discharges in A, SA, B and SB segments, other than non-contact cooling water, is based on an evaluation of the effects that each discharge has on the uses specifically assigned to the receiving water classification. Specifically, if the Division of Water Resources determines that a certain discharge does not impair the uses assigned to the receiving waters, then the discharge is allowed to continue and the water body is considered in compliance with its classification.

The second thrust of the new policy is directed at Class B, SB, C, SC, and D waters. This section states that waters whose existing quality is better than established standards will be maintained at such high quality unless it can be demonstrated to the Director of Environmental Management, after a public hearing, that the change is a result of necessary economic or social development and will not result in a significant loss of a use presently possible in such waters. Also, any new source or increased source of pollution will be required to provide the best practicable means of waste treatment to maintain high water quality.

03-02 MONITORING PROGRAM IN THE BLACKSTONE REGION

The Rhode Island Department of Environmental Management, Division of Water Resources, with the assistance of the Department of the Interior, U.S. Geological Survey is responsible for the water quality monitoring program in the state. This program consists of two types of monitoring:

1) ambient monitoring - instream water quality monitoring;

2) effluent monitoring - wastewater discharge monitoring.

03-02-01 Ambient Monitoring

Instream water quality is monitored by both trend sampling and by intensive sampling. Trend sampling is performed several times a year at the same location. Its purpose is to record water quality conditions in the river on a continuing basis throughout the year. It may also determine the need for a more intensive sampling of the river.

The Division of Water Resources has contracted with the U.S. Geological Survey to conduct the riverine trend monitoring in Rhode Island. Samples are collected at three locations within the Blackstone Region as follows:

1) Blackstone River above Manville Dam;

2) Branch River at Forestdale gage;

3) Branch River at inlet to upper Slatersville Reservoir.*

The parameters measured and results monitored at these stations are listed in the State of the State's Waters 305b Report which is available from the Division of Water Resources.

Intensive river sampling is usually conducted for a specific purpose, rather than as a routine procedure. Intensive sampling is done over a twenty-four hour time period at a number of sequential locations in the river. The purpose of this sampling is to identify variation in water quality for the entire river length during a short time period.

Samples are collected during a 24 hour time period when the water flow is low. Intensive sampling is conducted to determine the following:

1) To obtain additional data to establish waste load allocations;

2) To determine a change in water quality caused by a change in a wastewater discharge;

3) To measure a change in water quality indicated by a shoreline survey;

4) To measure a change in water quality indicated by trend monitoring.

---

* Samples collected by R.I. Division of Water Resources

Intensive surveys were conducted on the Branch and Blackstone Rivers in August and September of 1978. The Woonasquatucket and Ten Mile Rivers were surveyed in the summer of 1979. Parameters monitored in these surveys are listed in the State of the State's Waters 305b Report.

03-02-02 Effluent Monitoring

Effluent monitoring consists of the sampling and analysis of municipal and industrial wastewater discharges. Major municipal wastewater treatment facilities are sampled on a monthly basis for the following parameters:

1) pH;

2) Suspended solids;

3) Settleable solids;

4) Chlorides;

5) Detergents;

6) Turbidity;

7) BOD_5;

8) Total and fecal coliform.

Municipal treatment plants with significant industrial process waste in their influent, such as Blackstone Valley, Providence, and Woonsocket are sampled quarterly for zinc, copper, chromium, nickel, and cadmium. The above treatment plants, in addition to Smithfield, have semi-annual sludge analyses for metals and an annual analysis for lead and mercury. The Blackstone Valley plant is spot checked weekly while the Providence plant is sampled bi-weekly for chlorination treatment, since their discharges can impact shellfish beds.

Major industrial discharges, such as Nife (a manufacturer of batteries) are sampled bi-monthly; smaller discharges are inspected annually. Industrial discharge analyses are dependent upon the nature of the effluent being discharged.

03-02-03 Biological Monitoring

Biological monitoring has been utilized to supplement physical and chemical water quality sampling since 1974. The major objectives of biological monitoring are to determine the effects of pollutants to macroinvertebrate aquatic communities, specifically impacts to the population of organisms, species composition, diversity, and their physiological condition. Stations selected for biological monitoring are identical to ambient trend stations in order to correlate the results of each survey.

03-02-04 Groundwater Monitoring

Because of the increasing threat to the quality of groundwater posed by some waste management practices and a general lack of comprehensive information on the origins, scope, and nature of existing groundwater pollution problems, it is important that groundwater monitoring programs be established and maintained. Objectives of groundwater monitoring include:

1) Determining baseline conditions;

2) Early detection of groundwater pollution or contamination;

3) Surveying impacts of potential and existing groundwater pollution sources; and

4) Providing data upon which decisions can be made concerning disposal of wastes.

03-03 SURFACE WATER QUALITY

All the waters in the state have been classified by the Division of Water Resources based on the suitable use of that water body. Table 711-03(1) defines each class for fresh and sea water. The criteria correlated with each classification are defined by a number of physical and chemical water quality parameters. If it is determined that a certain body of water does not meet the water quality criteria for its classification, that body of water is then considered to be out of compliance with its classification.

Pursuant to the Rhode Island Water Quality Regulations for Water Pollution Control, no new discharges, other than non-contact cooling water, are permitted into Class A, SA, B, and SB waters. This policy does not apply to normal stormwater drainage. If a new discharge occurs in either a Class A, SA, B, or SB water, then that particular segment is out of compliance with its designated classification.

The greatest water pollution problem in the Blackstone Region is from the 96 combined sewer overflows that periodically discharge into the region's rivers. These combined sewer overflows are located in the Central Falls, Pawtucket, Blackstone Valley, and Providence sewerage systems. During wet weather the combined sanitary/stormwater flows can exceed the sewerage system's capacity and are discharged at designated overflow points in the region's rivers. There are 65 combined sewer overflows in Providence, 7 in Central Falls, 20 in Pawtucket, and the Blackstone Valley District Commission is responsible for 4 within the Blackstone Region and 3 that discharge in the Narragansett Bay Region.

The following sections describe existing water quality in the Blackstone Region. Figure 711-03(1) illustrates the water quality classification for each water body in the Blackstone Region and also depicts those segments that are out of compliance with their designated classification.

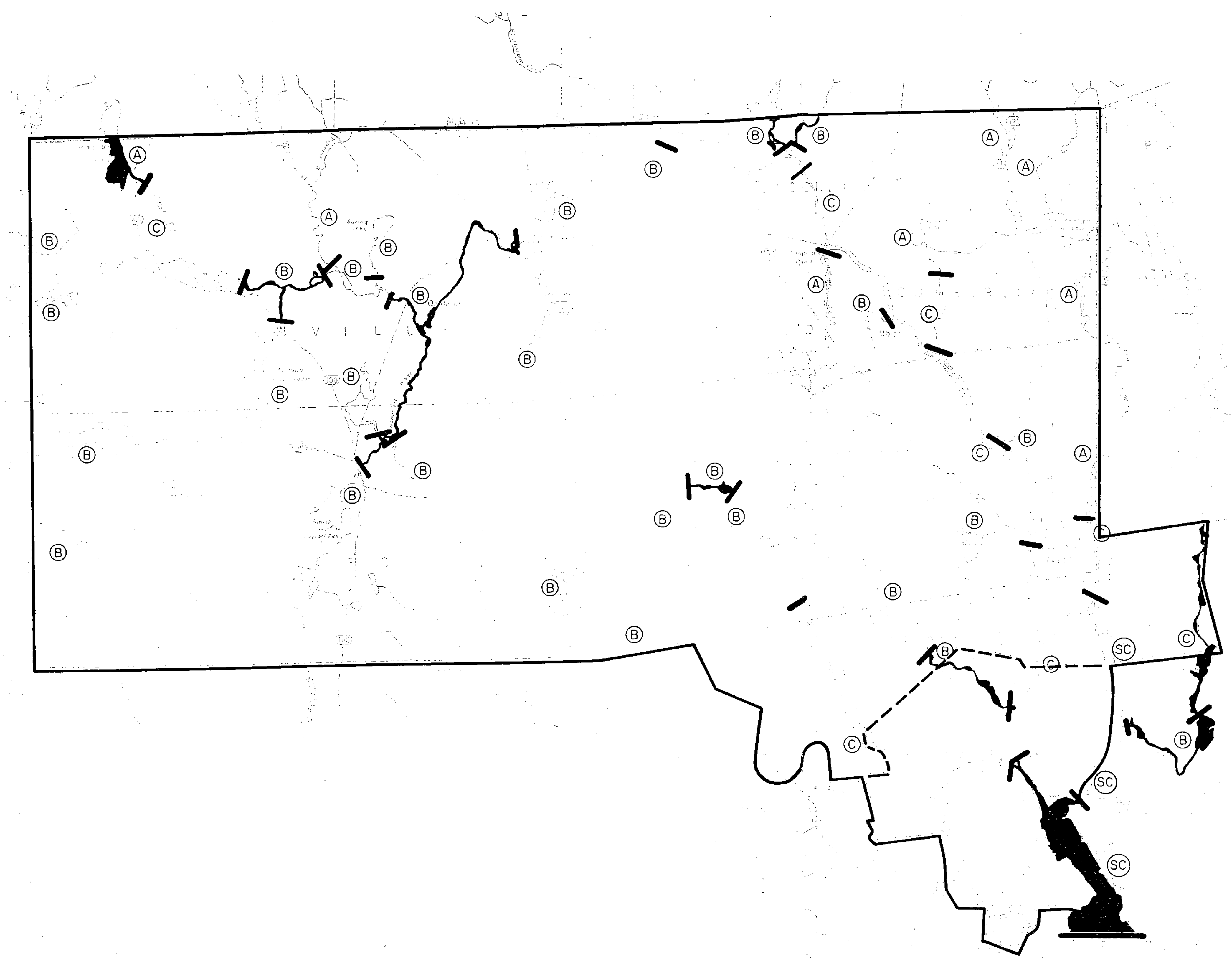
03-03-01 Clear, Pascoag and Chepachet Rivers

The Clear River from the Wilson Reservoir to one mile upstream from its confluence with the Chepachet River and the Pascoag River downstream from the Pascoag Reservoir are out of compliance with their Class B water quality classification due to industrial and individual sewage disposal system discharges. This segment will be brought into compliance when the Burrillville sewerage system is completed.

Direct discharges from individual sewage disposal systems cause the Chepachet River to be out of compliance with its Class B classification. Since only the northern portion of the Chepachet River is scheduled to be sewered by the Burrillville treatment facility, this segment will probably remain out of compliance even after the Burrillville facility is completed in 1981.

Wallum Lake has a Class A water quality classification and serves as a water supply source for Zambarano Hospital. Recreational use of this lake in Massachusetts causes it to be out of compliance with its designated A classification.

Figure 711-03(1)



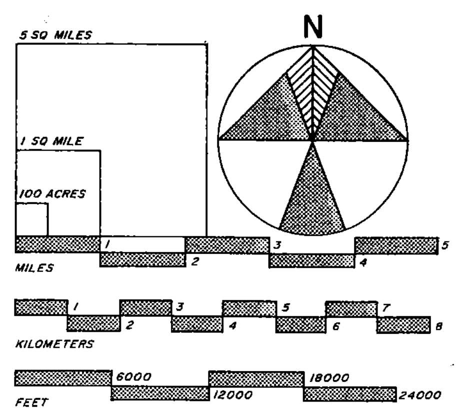
State of Rhode Island

Water Quality Classifications in the Blackstone Region

Legend:

- Region Boundary
- (A) Classification of Water Quality
- Change in Water Quality Classification
- Segment Not In Compliance With Classification

Note: Providence is in both the Narragansett and Blackstone Regions



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Recreation is not a compatible use for a public water supply source according to Rhode Island water quality regulations.

In addition to the pollution sources mentioned above, non-point sources that have the potential to adversely impact the Clear, Pascoag, and Chepachet Rivers include:

1) Erosion and sedimentation from agricultural areas;

2) Landfills;

3) Salt storage areas; and,

4) Urban runoff from roads, shopping centers, and developed areas.

The impact of non-point sources cannot be substantiated at this time due to the lack of sampling data.

03-03-02 Branch River

The Branch River from its origin to the inlet of the Upper Slatersville Reservoir is out of compliance with its Class B Classification due to discharges from the Glendale individual sewers. The Class B segments, from the inlet of the Upper Slatersville Reservoir to the Lower Slatersville Dam, and from the Upper Slatersville Dam to the confluence with the Blackstone River, meet their water quality criteria for physical, chemical, and biological parameters.

To date, there are no data to substantiate the potential impacts from non-point sources of pollution on the Branch River.

03-03-03 Blackstone River

The water quality of the Blackstone River has improved since the Worcester, Massachusetts and Woonsocket wastewater treatment facilities were upgraded to secondary treatment in 1976 and 1978, respectively. As of April 1980, 92 percent of the Blackstone River's 88.8 miles were in compliance with Class C water quality standards and 54 percent were in compliance with Class B standards.

In Rhode Island, the Blackstone River flows from the confluence with the Branch River in North Smithfield to the Main Street Dam in Pawtucket, a distance of 17 miles. Currently, these 17 miles are in compliance with their Class C water quality designation. The Blackstone River within the State of Rhode Island is not expected to meet Class B standards by 1983, the deadline established by the Clean Water Act of 1972. The major sources of pollution to the Blackstone within Rhode Island, are the Woonsocket wastewater treatment facility, combined sewer overflows and urban runoff.

The lower Blackstone River has 20 combined sewer overflows from the City of Pawtucket, the City of Central Falls, and the Blackstone Valley District Commission. During wet weather, discharges from these sewer overflows can cause the water quality of the lower Blackstone River to be reduced.

The data that is available in the R.I. Department of Environmental Management's 305b report suggests that the Blackstone River has minor impacts from non-point pollution sources. However, additional research is needed to assess non-point impacts, particularly from urban runoff, on the water quality of the Blackstone, Moshassuck, Woonasquatucket, Seekonk, and Providence Rivers.

03-03-04 Mill River

The Mill River, which originates in Blackstone, Massachusetts, is a tributary of the Blackstone River. Discharges from the Hopedale, Massachusetts wastewater treatment facility and individual sewage disposal systems (ISDS) in Blackstone cause the Mill River to be out of compliance with its Class B designation. When the Town of Blackstone ties into the Woonsocket wastewater tretment facility in 1982 and the Hopedale treatment plant is upgraded, the Mill River will meet class B water quality standards.

Prior to its confluence with the Blackstone River, the Mill River flows through Woonsocket where the potential for pollution from urban runoff does exist. However, there are no data to substantiate pollution from urban runoff in the Mill River.

03-03-05 Peters River

The Peters River flows from Bellingham, Massachusetts, through Woonsocket to the Blackstone River. The Peters River is out of compliance with its Class B designation due to ISDS discharges from the Town of Bellingham. These discharges will be eliminated when Bellingham constructs municipal sewers that will tie into the Woonsocket sewerage system.

As is the case with the Mill River, the Peters River flows through northern Woonsocket prior to its confluence with the Blackstone River. There is the potential for pollution from urban runoff as the river passes through Woonsocket, although there are no data to substantiate urban runoff pollution in the Peters River.

03-03-06 Abbot Run Brook

Abbott Run Brook originates in Wrentham, Massachusetts, and flows through the Pawtucket Reservoir, Robin Hollow Pond, and Happy Hollow Pond, which are all public water suply impoundments for the City of Pawtucket. Although this brook is in compliance with its Class A standard, discharges from individual sewage disposal systems in Cumberland could be a potential pollution problem. Non-point sources of pollution which could have an impact on Abbott Run Brook include:

1) Erosion and sedimentation from agricultural and gravel mining operations;

2) Landfills;

3) Salt storage areas;

4) Urban runoff; and,

5) Discharges from individual sewage disposal systems.

03-03-07 Moshassuck River

The Moshassuck River is classified Class B from its origin to Bleachery Pond in Lincoln, and is classified Class C below Bleachery Pond to its confluence with the Woonasquatucket River because of industrial and sanitary discharges to this stretch of the river. The West River, the major tributary of the Moshassuck River, is classified Class B from its origin in Smithfield to its confluence with the

Moshassuck River. There are no monitoring data available for the Moshassuck or West Rivers.

The Moshassuck River, from its origin to Bleachery Pond, contains only one point source of pollution, an overflow from an evaporating lagoon for cooling water from Lincoln Dimensional Tube, Inc. This overflow also contains some rinse water from a metal precipitation system. Since it is felt that this discharge is not impairing the assigned uses of its receiving water's classification, this segment is considered to be in compliance with its classification. In 1982, a monitoring survey will be conducted in this area by the Department of Environmental Management to fully assess the impacts of this discharge.

The Moshassuck River, from Bleachery Pond to its confluence with the Woonasquatucket River, has fourteen combined sewer overflows from the cities of Providence, Central Falls, and Pawtucket, and the Blackstone Valley District Commission. These overflows have a great impact on the water quality of this river. However, additional studies are needed to better assess this impact.

The West River, from a quarter mile upstream of the Providence line to its confluence with the Moshassuck River, is out of compliance with its Class B classification because of three combined sewer overflows from the Providence sewerage system that impair the assigned standard of this segment.

Non-point sources of pollution which could affect the water quality of the Moshassuck River include:

1) Erosion and sedimentation from agricultural areas;

2) Discharges from subsurface disposal systems;

3) Landfills; and

4) Urban Runoff.

3-03-08 Upper Woonasquatucket River Basin: Waterman Reservoir to Georgiaville Pond

The upper basin from Waterman Reservoir to Georgiaville Pond is primarily a series of reservoirs and old mill ponds, which are classified as Class B water.

The Stillwater River, from the Waterman and Slack reservoirs to the Woonasquatucket Reservoir, was out of compliance with its Class B classification because of discharges from the Greenville Laundry and individual subsurface disposal systems. The Smithfield sewerage system, which began operation in 1978, eliminated both the Greenville Laundry discharge and the leachate problems.

The Stillwater Reservoir was out of compliance with its Class B classification because of two sanitary sewage discharges. These discharges were the Bryant College wastewater treatment facility and the Wionkheige Valley wastewater treatment facility, both of which are package wastewater treatment facilities. Both of these minor wastewater treatment plants were eliminated by tying into the Smithfield sewerage system.

03-03-09 Lower Woonasquatucket River Basin: Georgiaville Pond to Providence River

The Woonasquatucket River from Georgiaville Pond Dam to Greystone Dam Pond, 0.2 miles north of the Smithfield/North Providence line, is classified as Class B water, and the Woonasquatucket River from Greystone Dam Pond to the Providence River is classified as Class C water. The Woonasquatucket River from the Georgiaville Pond Dam to Greystone Dam Pond is out of compliance with its Class B classification due to a number of industrial and sanitary discharges. The effect of these discharges on the water quality is verified by the high total and fecal coliform bacteria readings at the Smith Street Bridge (Station 25) in the 1979 intensive survey on the Woonasquatucket River. Although this station is not in the stretch that is out of compliance, it is affected by the point source pollution upstream.

There are twenty combined sewer overflows from the Providence sewerage system on the Woonasquatucket River, downstream of the Manton Dam, that degrade the water quality of this segment.

A small portion of the Woonasquatucket River, downstream from Eagle Street to the Providence River, is out of compliance with its classification. The Providence wastewater treatment facility which discharges to the Providence River affects this portion of the Woonasquatucket River because of the influence of tidal waters. The effect of this influence can be verified by observing the below-standard readings of dissolved oxygen at the Gaspee Street Station (Station 33).

The potential non-point sources of pollution which could affect the Woonasquatucket River include:

1) Erosion and sedimentation from agricultural areas;

2) Landfills;

3) Salt storage areas;

4) Urban Runoff; and

5) Combined sewer overflow impacts.

03-03-10 Ten Mile River

The Ten Mile River from the Massachusetts-Rhode Island state line to the Central Pond Dam is out of compliance with its Class C standard due to discharges from the North Attleboro and Attleboro wastewater treatment plants and from the numerous jewelry and metal plating industrial discharges in the Massachusetts portion of this river. The Turner Reservoir and the Ten Mile River below Central Pond are also out of compliance with its Class B standard due to these same discharges.

Non-point sources of pollution which could affect the water quality of the Ten Mile River include:

1) Erosion and sedimentation from agricultural areas; and

2) Urban runoff.

03-03-11 Seekonk River

The Seekonk River from its origin at the Main Street Dam in Pawtucket to the Providence River is in compliance with its Class SC standard. The major discharges to the Seekonk are the Providence, Blackstone Valley District Commission, and Pawtucket combined sewer overflows, and the Blackstone Valley wastewater treatment plant.

Urban runoff and combined sewer overflow impacts are the sources of non-point pollution, although there is insufficient data to quantify these non-point water quality impacts.

03-04 GROUNDWATER QUALITY

Groundwater reservoirs and recharge areas for the Blackstone Region were mapped for the Rhode Island 208 Water Quality Management Plan. These groundwater areas are depicted in Figure 711-03(2). Groundwater quality in the Blackstone Region was assessed for the Blackstone and Branch River Basins by the United States Geological Survey in 1974. Tables 711-03(2) and (3) show the results of these surveys in the Blackstone and Branch River Basins.

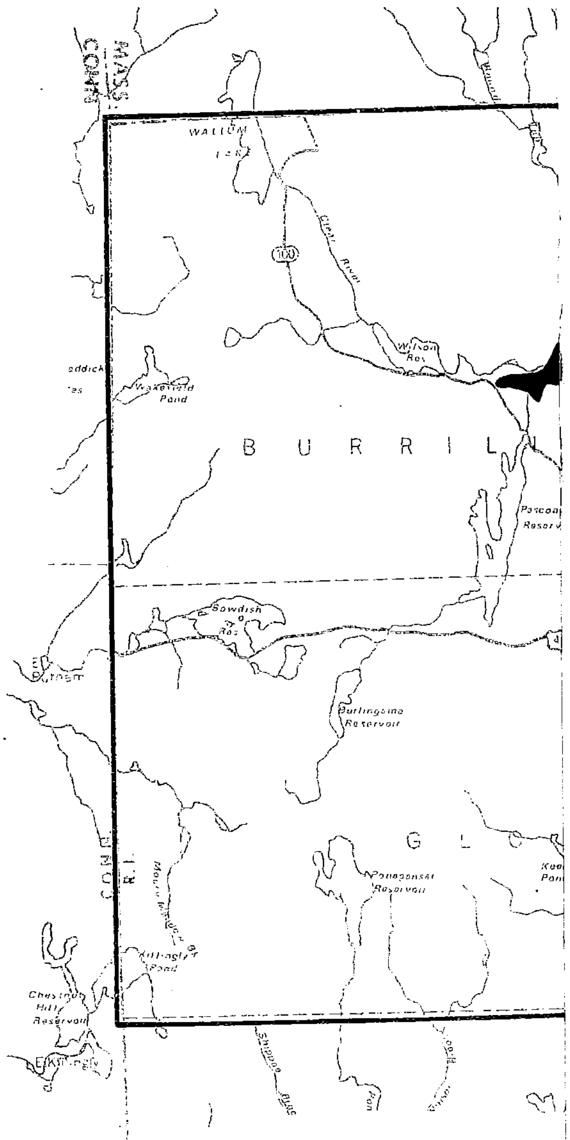
In general, with the exception of iron and manganese in some samples, the groundwater in the Blackstone Region complies with drinking water standards established by the United States Public Health Service. The chemical analyses of the groundwater indicate that it is suitable for most purposes, although Rhode Island does not have designated groundwater quality standards. The groundwater is soft and has a pH range of 5.5 to 7.0, and typically contains less than 100 mg dissolved solids ((10)).

It should be noted that very little data are available for some groundwater pollutants that are normally not assessed unless contamination is suspected. Potential groundwater pollution sources include: individual sewage disposal system leachate; fertilizers; salts to de-ice highways; landfill leachate and infiltration from chemically degraded surface water.

There are some data available regarding groundwater contamination from some landfills in the Blackstone Region. Table 711-03(4) depicts landfills with the potential to degrade groundwater. In addition, the Forestdale section of North Smithfield, the Quinville section of Lincoln, and the area across the Blackstone River from Quinville in Cumberland have contaminated groundwater from a chemical degreasing agent. However, the exact source of this contaminant is not known. The United States Geological Survey has estimated the amount of water potentially available for development and simulated pumping from model aquifers for the Blackstone River and Branch River Basins. Their results for the Blackstone River Basin indicate that as much as 45 million gallons per day (mgd) can be pumped continuously from the stratified-drift aquifer. This withdrawal rate includes 31 mgd from the Blackstone River Valley, 4 mgd from the Moshassuck River Valley, and 10 mgd from the Ten Mile River Valley ((10)). Large quantities of groundwater cannot be pumped from coastal areas without causing saline water to be induced into the aquifer from the Providence and Seekonk Rivers.

The potential groundwater yield in the Branch River Basin is approximately 12 mgd ((11)). This estimate was obtained from models simulating withdrawals in the Slatersville, Oakland, Harrisville, and Chepachet areas with continuous yields of 5.5, 3.4, 1.6, and 1.3 mgd respectively obtained from these areas ((11)). Groundwater resources found to be potentially available for development in the Branch River Basin are considered to be four times the estimated public supply requirement of 3 mgd by the year 2020 ((11)). In addition, greater amounts of groundwater may be available from areas within this basin that were not modeled.

Figure 711-03(2)



State of Rhode Island

Groundwater Reservoirs and Recharge Areas Blackstone Region

Legend:

Region Boundary

Stratified-Drift Aquifer
Major aquifer and principal recharge area.
(Hatched area in Providence area where only limited data available)

Ground-Water Reservoir
That part of the stratified-drift aquifer where there is the greatest potential for water-supply development.

Note: Providence is in both the Narragansett and Blackstone Regions

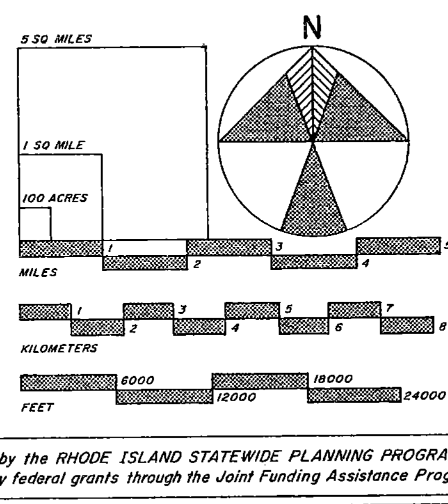


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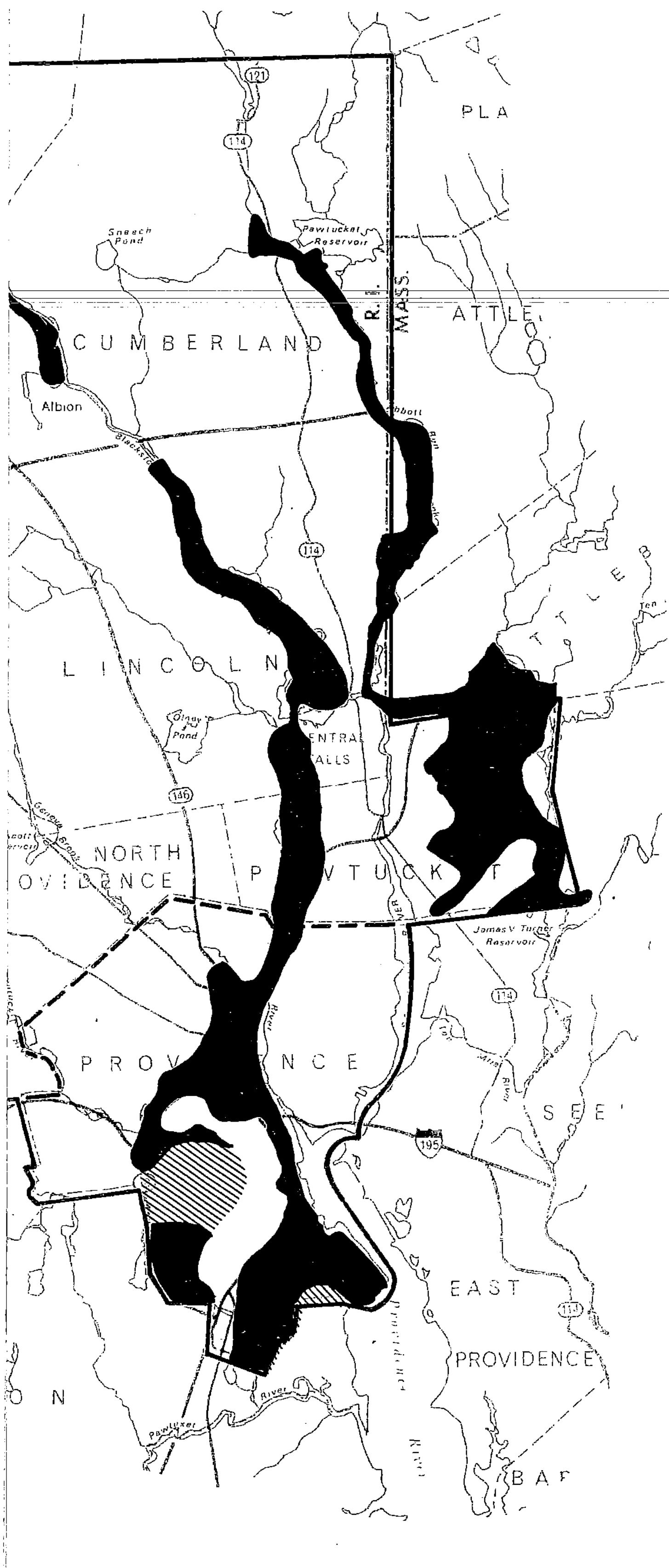
Figure 711-03(2)



State of Rhode Island

Groundwater Reservoirs and Recharge Areas Blackstone Region

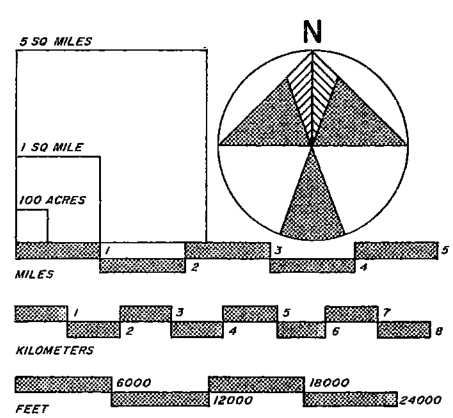
Legend:

Region Boundary

Stratified-Drift Aquifer
Major aquifer and principal recharge area. (Hatched area in Providence area where only limited data available)

Ground-Water Reservoir
That part of the stratified-drift aquifer where there is the greatest potential for water-supply development.

Note: Providence is in both the Narragansett and Blackstone Regions



Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM assisted by federal grants through the Joint Funding Assistance Program

Table 711-03(2)

SUMMARY OF CHEMICAL CHARACTERISTICS OF WATER FROM THE BLACKSTONE RIVER BASIN STRATIFIED-DRIFT AQUIFER
(Concentrations in milligrams per liter, except color, pH, and specific conductance)

Constituent or Property	Wells sampled	Groundwater[1] Range	Median	Limit recommended for drinking water by the U.S. EPA
Silica (SiO_2)	15	2 - 17	11.0	--
Iron (Fe)	60	.00 - 22	0.10	0.3
Manganese (Mn)	51	.00 - 6.4	0.30	.05
Calcium (Ca)	31	8.6 - 52	17.0	--
Magnesium (Mg)	31	1.0 - 24	4.4	--
Sodium (Na)	25	5.6 - 31	18.0	--
Potassium (K)	25	.5 - 4.2	1.4	--
Bicarbonate (HCO_3)	17	6 - 138	30.0	--
Sulfate (SO_4)	30	6.2 - 109	19.0	250
Chloride (CL)	62	4.0 - 57	22.0	250
Fluoride (F)	31	.0 - .5	0.1	1.3[2]
Nitrate (NO_3)	47	.0 - 41	3.1	45
Dissolved solids (Residue on evaporation)	35	60 - 319	140.0	500
Specific conductance (Micromhos at 25°C)	11	85 - 464	212.0	--
Clacium-magnesium hardness (as $CaCO_3$)	62	26 - 210	68.0	--
pH	52	5.6 - 7.6	6.2	--
Color	39	0 - 15	5.0	15

1 Most recent analysis used if more than one available.

2 Upper limit where annual average maximum daily air temperature is 14.6 to 17.7°C (Average is 15.5°C at Providence, Rhode Island).

Source: Johnston & Dickerman 1974 Water Resources Investigations 4 - 74

Table 711-03(3)

SUMMARY OF CHEMICAL CHARACTERISTICS OF WATER FROM THE BRANCH RIVER BASIN STRATIFIED DRIFT AQUIFER

Local well number	Temp. °C	Iron (Fe)	Nitrate (NO_3)	Dissolved solids (Residue on evaporation at 180°C)	Hardness as $CaCO_3$		pH
					Calcium Magnesium	Noncarbonate	
Bur 9	10	.25	10	105	37	22	6.4
Bur 54	11	.01	.2	48	14	6	6.4
Bur 69	12	.01	.4	84	36	0	7.0
Bur 124	8	.02	.3	25	4	2	5.5
Bur 149	9	.01	.1	46	16	6	6.4
Bur 284	12	.03	0	42	16	14	5.8
Glo 28	11	.05	.0	60	23	13	6.4
Glo 293	9	.05	.0	34	14	6	6.6
Glo 298	20	.19	.0	34	8	0	6.6
Nsm 183	11	.00	14	117	58	18	6.9
Nsm 310	10	.03	1.6	46	14	1	6.6

(Chemical analyses in milligrams per liter)

Source: Johnston & Dickerman 1974 Water Resources Investigations 18-74

Table 711-03(4)

POTENTIAL GROUNDWATER CONTAMINATION FROM LANDFILLS IN THE BLACKSTONE REGION

Site	Town	Owner	Waste Type	Impact	Remarks
Burrillville Landfill - Active	Burrillville	Municipal	Solid Waste	Minor	Potential Impact to Clear River
Burrillville Landfill - Closed	Burrillville	Municipal	Solid Waste	Minor	Leachate enters Clear River
Davis Liquid Waste Site	Smithfield	Private	Hazardous Waste	Major	In litigation to remedy
Glocester/Smithfield Regional Landfill	Glocester	Private	Solid Waste	Minor	Leachate causes surface water degradation
Glocester State Highway Garage	Glocester	State	Deicing Salt	Minor	
Landfill and Resource Recovery, Inc.	North Smithfield	Private	Solid and Hazardous Waste	Minor	Groundwater monitoring wells show negative results
Lincoln Dimensional Tube, Inc.	Lincoln	Industrial	Industrial Waste	Minor	
Narragansett Grey Iron Foundry	Smithfield	Industrial	Industrial Waste	Minor	Surface water discharge
North Providence Landfill	North Providence	Municipal	Solid Waste	Minor	Leachate causes surface water degradation

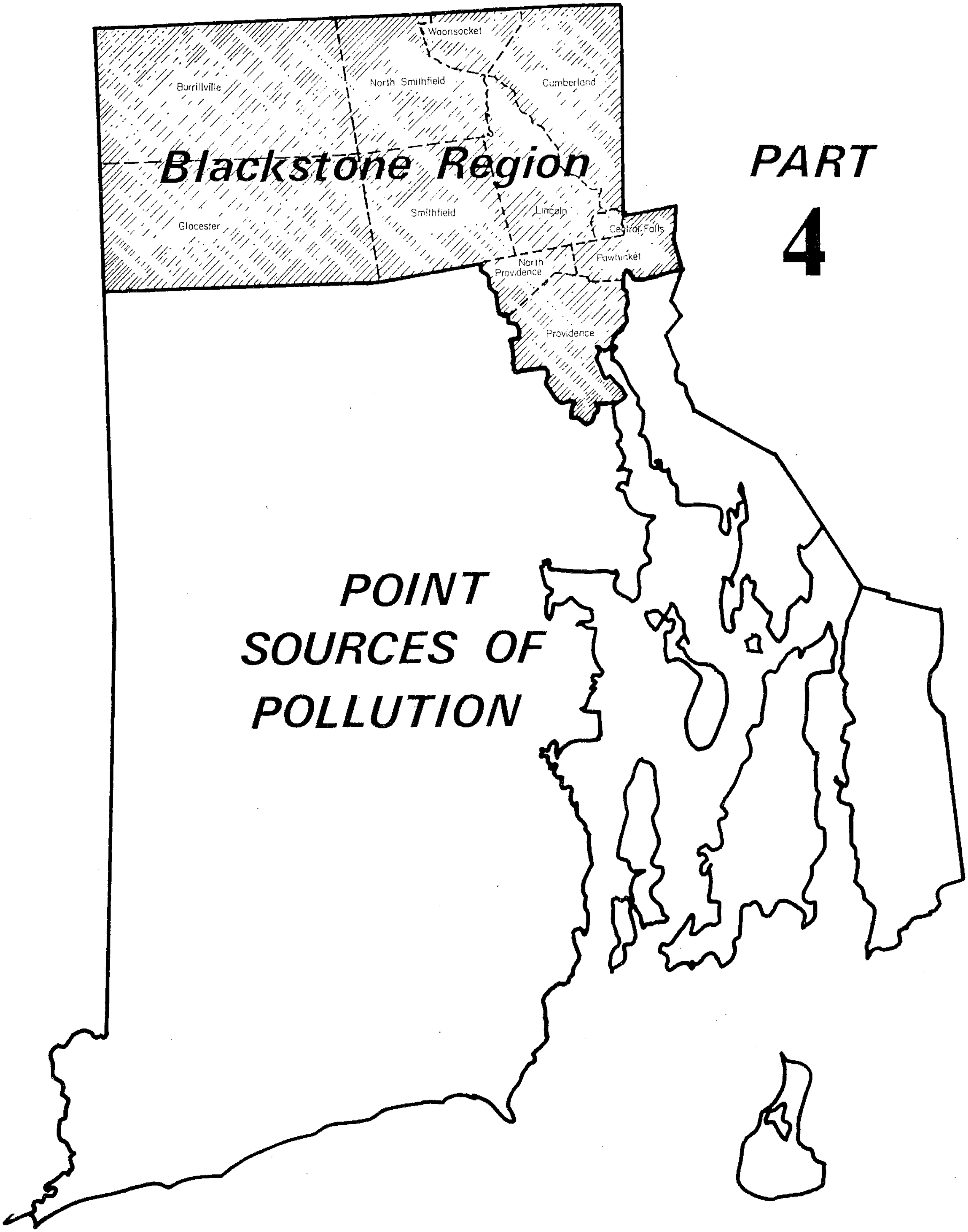
Table 711-03(4) Continued

Refinement International Co.	Burrillville	Industrial	Industrial Waste	Minor	Surface water discharge
Silvestri Brothers	Johnston	Private	Solid and Hazardous Waste	Minor	Former erosion problem now being corrected
Stamina Mills	North Smithfield	Industrial	Hazardous Waste	Major	Possible contamination source for Forestdale wells
Western Sand and Gravel	North Smithfield	Private	Hazardous Waste & Sewage Sludge	Major	Hazardous waste is now being removed

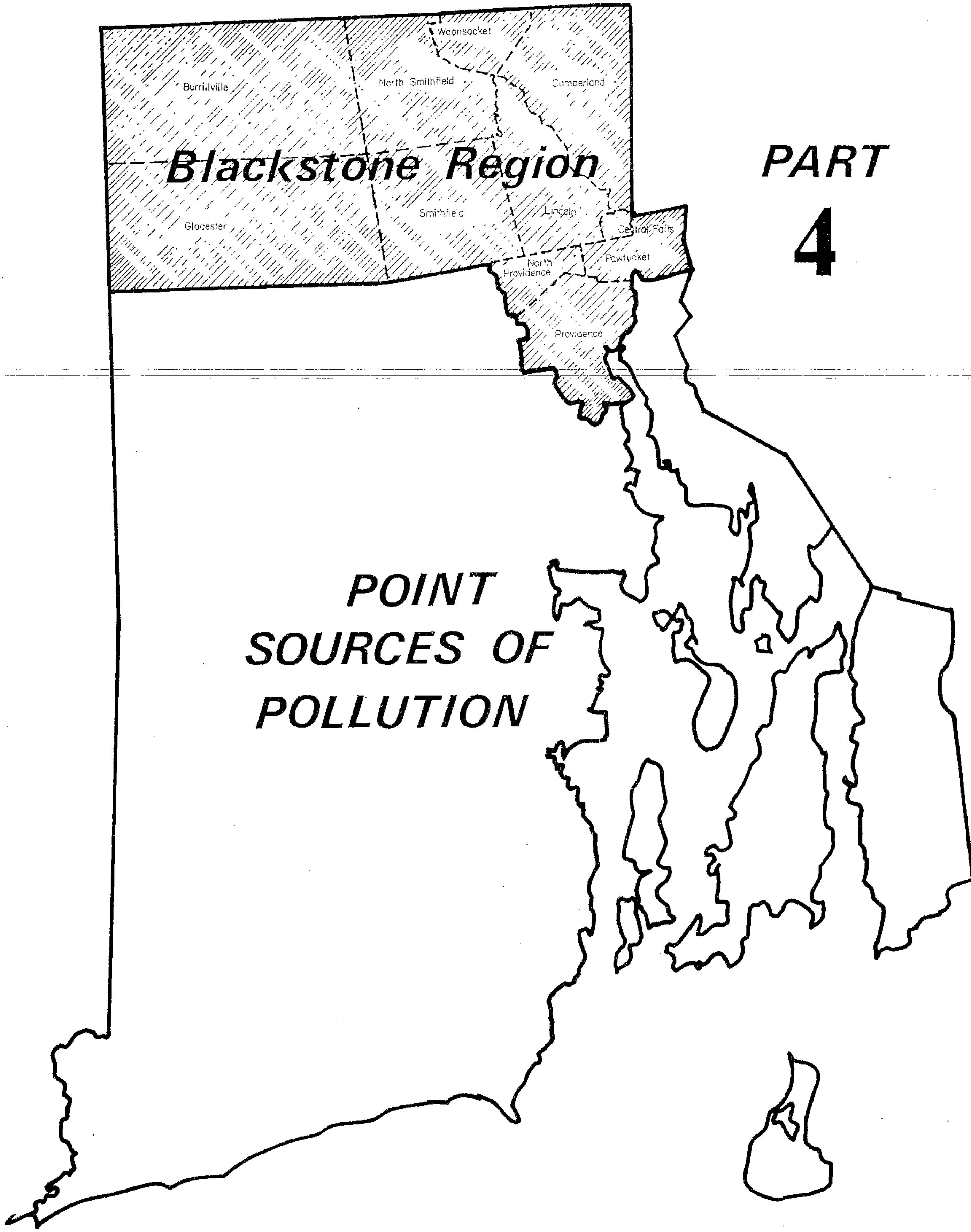
Source: R.I. Division of Water Resources 1980 305(b) Report.

PART 4

POINT SOURCES OF POLLUTION



PART 4



Blackstone Region
Woonsocket
Burrillville
North Smithfield
Cumberland
Glocester
Smithfield
Lincoln
Central Falls
North Providence
Pawtucket
Providence
POINT SOURCES OF POLLUTION

711-04 POINT SOURCES OF POLLUTION

Point source pollution is that which is discharged from a pipe or conduit directly into a waterway with or without some treatment. For example, discharges from municipal wastewater treatment plants and industries are considered point source discharges. All point source discharges in Rhode Island are regulated by discharge permits. The EPA has established effluent limitations for all dischargers. An effluent limitation is the maximum amount of pollutant that may be discharged into any waterbody. These limitations formally establish performance criteria for wastewater treatment facilities. In Rhode Island, the State Division of Water Resources assists the EPA in the issuance of permits.

There are 47 wastewater discharges in the Blackstone Region, not including 95 combined sewer overflows. The discharges are listed in Table 711-04(1) and their locations are illustrated on Figure 711-04(1). A description of the classification code format and a categorization of the Blackstone Region point source discharges is presented below.

04-01 CLASSIFICATION CODE FORMAT

Discharges are tabulated according to the "208" Program system with respect to location and discharge type in the following format:

XXOO (m), where:

- XX is the planning region, that is:

  B - Blackstone
  N - Narragansett
  P - Pawcatuck
  PT - Pawtuxet

- 00 is the number which identifies a discharge within a region

- (m) is one of eight letters which categorizes the type of discharge.

04-01-01 Location - River Basin Planning Region

In the Phase II 303 (e) Water Quality Management Plans, Providence is found both in the Blackstone and the Narragansett Regions. Since the discharges originating in Providence can only be given one discharge code, these discharges were assigned either a Blackstone (B) code if they discharge to the Moshassuck or Woonasquatucket rivers, or a Narragansett (N) code if they discharge to the Seekonk or Providence rivers.

(revised 6/30/82)

Table 711-04(1)

POINT SOURCE DISCHARGES - BLACKSTONE REGION

Discharge Number[1]	Discharger[2]	Watercourse	Location	Waste Type	Severity of Pollution Ranking[3]
B1(A)	Zambarano Hospital	Clear River	Wallum Lake (Burrillville)	Sanitary	12
B2(M)	Burrillville Sewage Treatment Plant	Clear River	Harrisville (Burrillville)	Sanitary	10
B3(S)	Glendale Individual Sewers	Branch River	Glendale (Burrillville)	Sanitary	9
B4(C)	Consolidated Thermoplastics (Turex, Inc.)	Branch River	Masonville (Burrillville)	Cooling Water	30
B5(C)	Service Color Corporation	Branch River	Forestdale (N. Smithfield)	Cooling Water	30
B6(S)	Tupperware Co. (Laboratory)	Branch River	N. Smithfield	Sanitary	18
B7(S)	Tupperware Co.	Blackstone River	N. Smithfield	Sanitary	17
B8(M)	Woonsocket Wastewater Treatment Facility	Blackstone	Woonsocket	Municipal	4
B9(W)	Woonsocket Water Treatment Plant	Blackstone	Woonsocket	Filter Backwash Water	26
B10(A)	Cumberland High School	Unnamed Brook	Cumberland	Sanitary	16
B11(C)	A.T. Cross Co.	Crookfall Brook	Lincoln	Cooling Water	30

Table 711-04(1) Continued

B12(C)	Mossberg Hubbard	Abbot Run Brook	Cumberland	Cooling Water	30
B13(C)	H. and H. Screw Product Manufacturing	Blackstone River	Ashton (Cumberland)	Cooling Water	30
B14(S)	Ashton Septic Tank Overflow	Blackstone River	Ashton (Cumberland)	Municipal	11
B15(I)	Nife	Blackstone River	Ashton (Cumberland)	Industrial	20
B16(C)	Owens Corning Fiberglass Corp.	Blackstone River	Ashton (Cumberland)	Cooling Water	30
B17(C)	Universal Chemical Corp. (Lonza)	Blackstone River	Ashton (Cumberland)	Cooling Water	30
B18(W)	Cumberland Water Treatment Plant	Blackstone River	Berkely (Cumberland	Backwash Water	28
B19(C)	Okonite Co.	Blackstone River	Berkely (Cumberland)	Cooling Water	30
B20(S)	Valley Falls Individual Sewers	Blackstone River	Valley Falls (Cumberland	Sanitary	12
B21(W)	Pawtucket Water Treatment Plant	Blackstone River	Cumberland	Backwash Water	25
B22(I)	Corning Glass Works	Blackstone River	Central Falls	Industrial	14
B23(O)	Central Falls C.S.O.	Blackstone River	Central Falls	Sanitary and Stormwater	7
B24(O)	Pawtucket C.S.O.	Blackstone River	Pawtucket	Sanitary and Stormwater	5
B25(C)	Lincoln Dimensional Tube	Moshassuck River	Lincoln	Cooling Water	19
B26(C)	Collyer Insulated Wire Co.	Moshassuck River	Lincoln	Cooling Water	30

Table 711-04(1) Continued

B27(C)	Rubber Covered Products Inc.	Moshassuck River	Pawtucket	Cooling Water	30
B28(O)	Providence C.S.O.	Moshassuck, West, and Woonasquatucket Rivers	Providence	Sanitary and Stormwater	2
B29(C)	R.I. Tool	West River	Providence	Cooling Water	30
B30(C)	Philip A. Hunt Chemical Co.	Moshassuck	Lincoln	Cooling Water	30
B31(C)	Industrial Machine	Woonasquatucket River	Georgiaville (Smithfield)	Cooling Water	30
B32(C)	Narragansett Grey Iron Foundary, Inc.	Woonasquatucket River	Smithfield	Cooling Water	30
B33(C)	Mine Safety	Woonasquatucket River	Esmond (Smithfield)	Cooling Water	30
B34(M)	Smithfield Wastewater Treatment Facility	Woonasquatucket River	Esmond (Smithfield)	Municipal	8
B35(C)	Worcester Textile	Woonasquatucket River	Centredale (N. Providence)	Cooling Water	30
B36(C)	Brown and Sharpe Mfg.	Woonasquatucket River	Centredale (N. Providence)	Cooling Water	30
B37(C)	Cowan's Plastics Products Corp.	Woonasquatucket River	Providence	Cooling Water	30
B38(C)	Electronic Precision Circuitry	Woonasquatucket River	Providence	Cooling Water	30
B39(C)	Uncas Mfg. Co.	Woonasquatucket River	Providence	Cooling Water	30
B40(C)	Merchants Cold Storage	Woonasquatucket River	Providence	Cooling Water	30
N1(O)	Pawtucket C.S.O.	Seekonk River	Pawtucket	Sanitary and Stormwater	5

Table 711-04(1) Continued

N2(M)[3]	BVDC Wastewater Treatment Facility	Seekonk River	East Providence	Municipal	3
N3(O)[4]	BVDC C.S.O.	Seekonk River	East Providence	Sanitary and Stormwater	6
N6(S)[3]	Okonite	Seekonk River	East Providence	Sanitary and Cooling Water	30
N9(R)	Texaco, Inc.	Providence River	Providence	Surface Runoff	22
N13(O)	Providence C.S.O.	Providence River	Providence	Sanitary and Stormwater	2
N14(C)	Narragansett Electric	Providence River	Providence	Cooling Water	15
N15(C)	C.H. Sprague and Sons	Providence River	Providence	Cooling Water	23
N16(I)	Lehigh Portland Cement	Providence River	Providence	Process Water	21
N17(R)	Sun Oil Co.	Providence River	Providence	Surface Runoff	24
N18(C)	Field's Point Mfg. Corp.	Providence River	Providence	Surface Runoff	30
N19(M)	Providence Wastewater Treatment Facility	Providence River	Providence	Municipal	1
N20(R)[3]	Gulf Oil Co.	Providence River	Providence	Surface Runoff	30

1. The letter within the parenthesis refers to the type of discharge. The discharge types have been classified into nine categories:

(A) Small and package wastewater treatment facilities
(C) Cooling water discharges
(I) Industrial discharges
(M) Municipal wastewater discharges
(O) Bypass/Overflow discharges
(R) Surface water runoff from petroleum products storage areas

Table 711-04(1) Continued

(S) Sanitary wastewater discharges
(W) Water treatment facilities

2. The location of the discharges is given on Figure 03-01(1).

3. Although these discharges are not located in the Blackstone Region, they are presented here because they discharge into segments that are discussed in this section of the report.

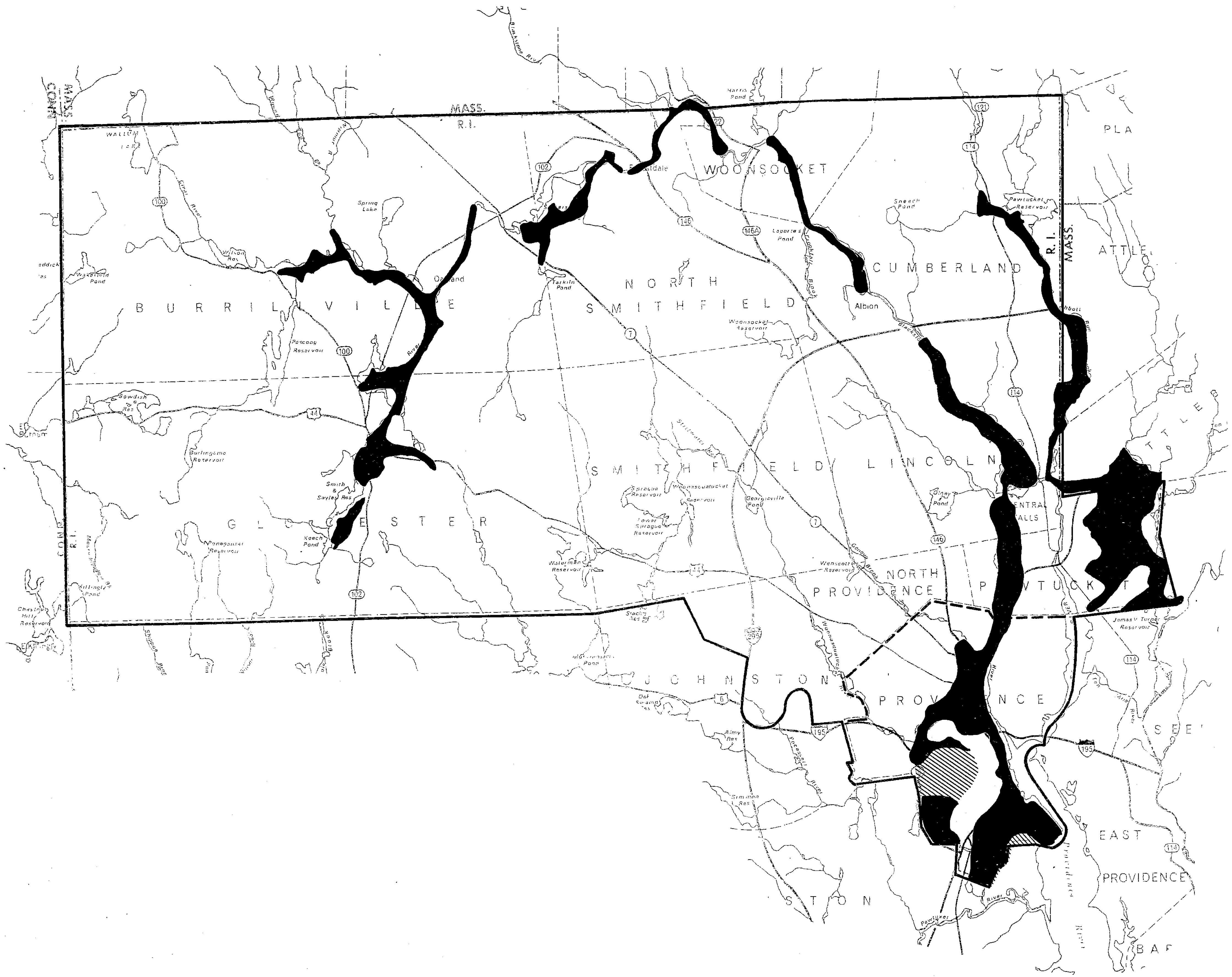
4. N3(O) has three discharges to this segment originating in the Narragansett Region and one discharge to this segment originating in the Blackstone Region.

5. Severity of pollution ranking is a ranking among all point source discharges in the basin according to the strength and/or toxicity of the wastewater discharge. The discharge with the greatest strength and/or toxicity has a ranking of one, and so forth. Most cooling water discharges were assigned the same rank (30).

Figure 711-03(2)

State of Rhode Island

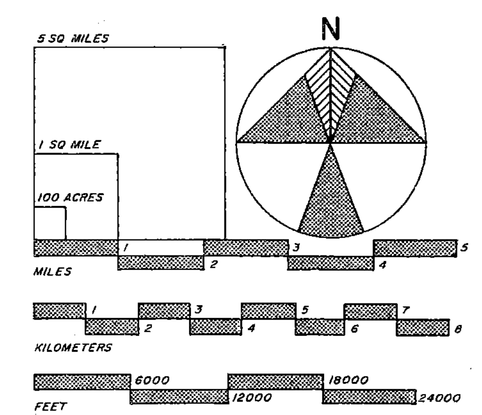
Groundwater Reservoirs and Recharge Areas Blackstone Region



Legend:

- Region Boundary
- Stratified-Drift Aquifer: Major aquifer and principal recharge area. (Hatched area in Providence area where only limited data available)
- Ground-Water Reservoir: That part of the stratified-drift aquifer where there is the greatest potential for water-supply development.

Note: Providence is in both the Narragansett and Blackstone Regions

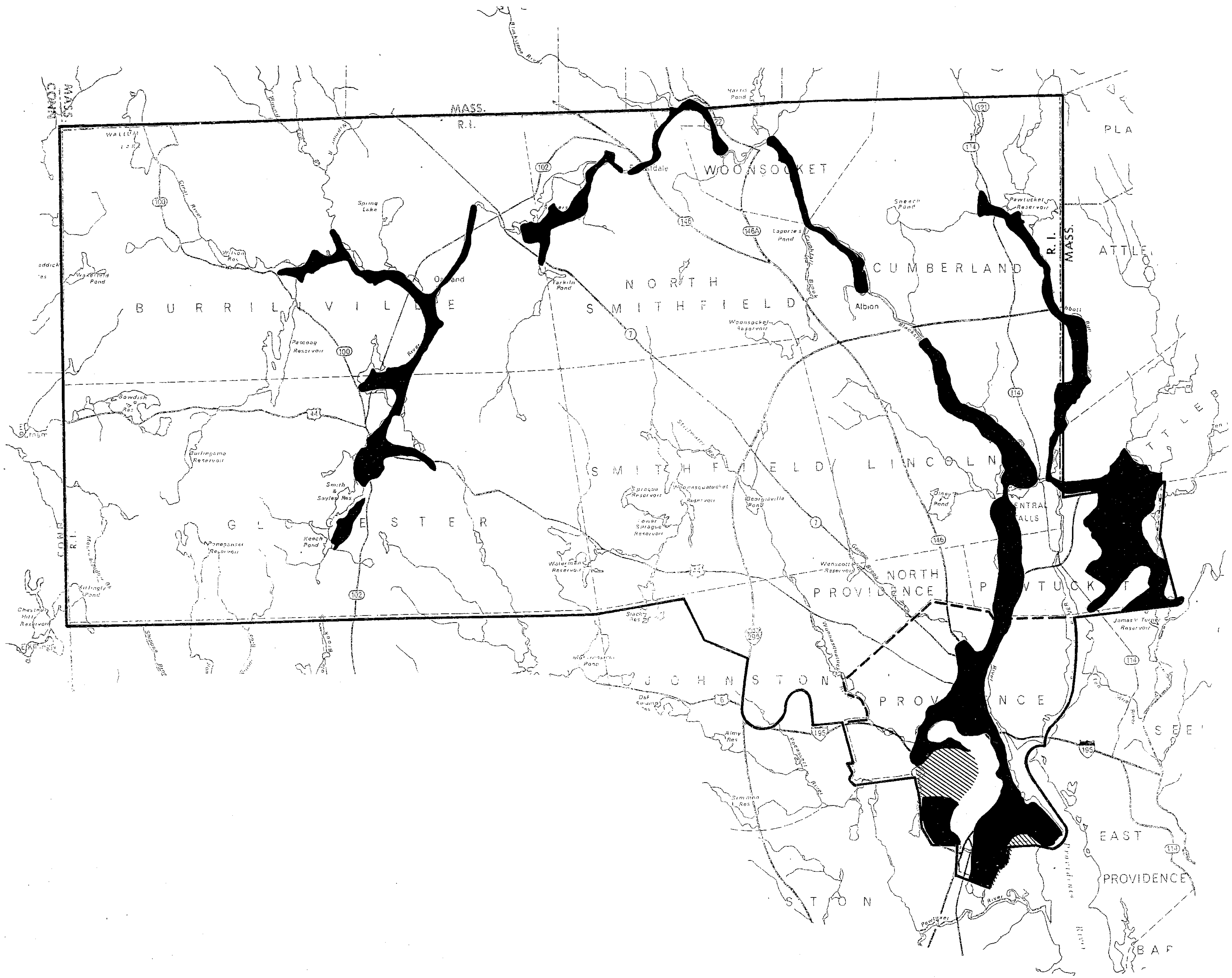


Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM assisted by federal grants through the Joint Funding Assistance Program

Figure 711-03(2)

State of Rhode Island

Groundwater Reservoirs and Recharge Areas Blackstone Region



Legend:

Region Boundary

Stratified-Drift Aquifer
Major aquifer and principal recharge area. (Hatched area in Providence area where only limited data available)

Ground-Water Reservoir
That part of the stratified-drift aquifer where there is the greatest potential for water-supply development.

Note: Providence is in both the Narragansett and Blackstone Regions

5 SQ MILES
1 SQ MILE
100 ACRES

MILES 1 2 3 4 5

KILOMETERS 1 2 3 4 5 6 7 8

FEET 6000 12000 18000 24000

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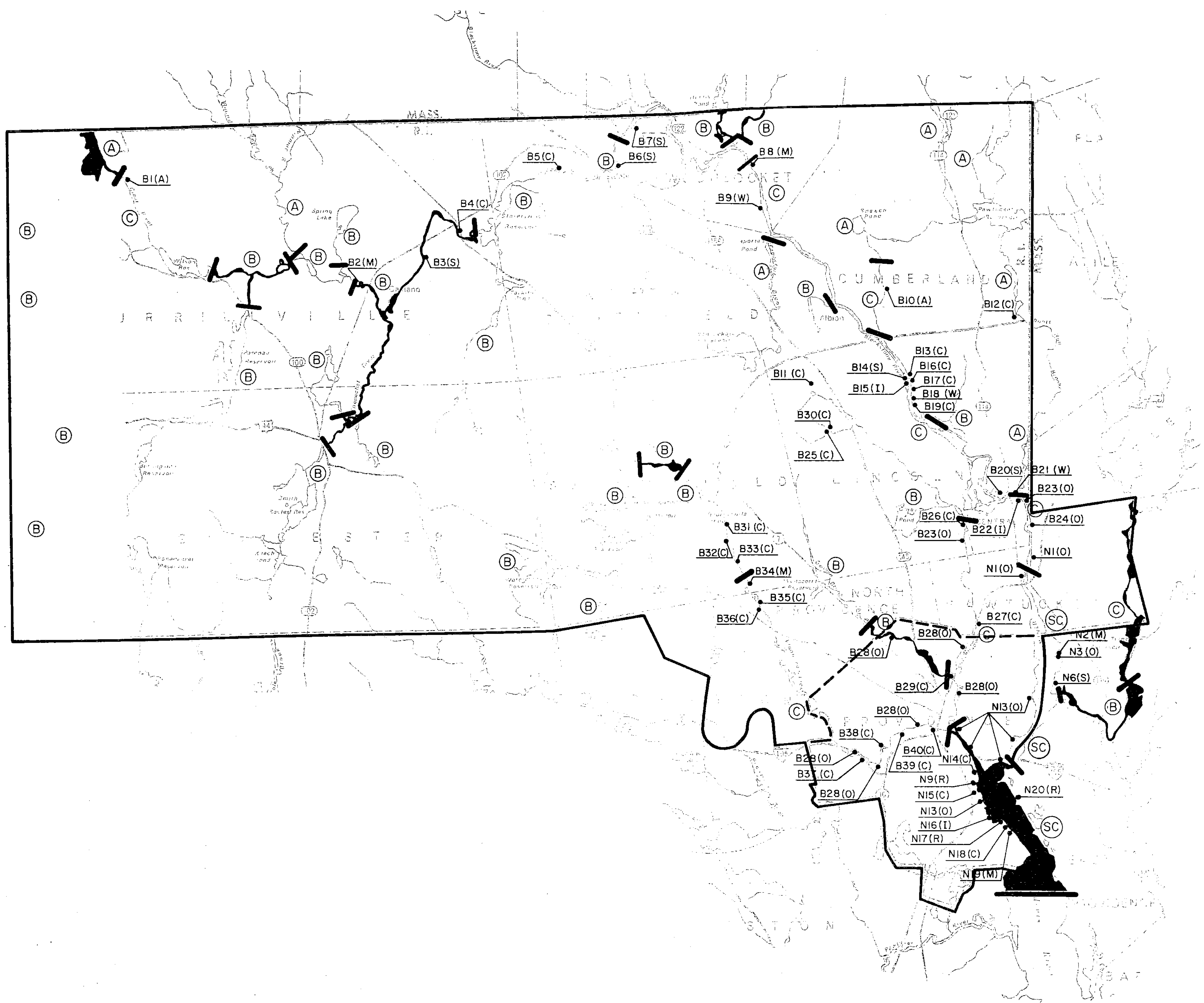
Figure 711-04 (1)



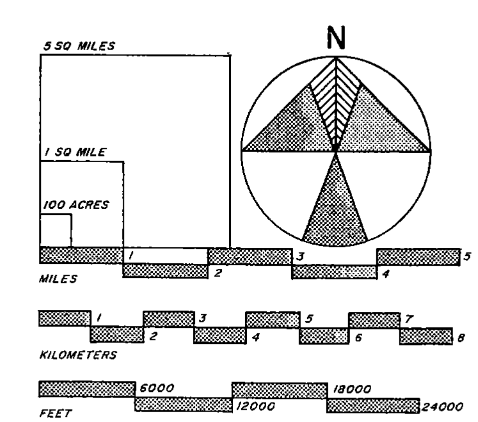
State of Rhode Island

Point Source Discharges in the Blackstone Region

Legend :

- Region Boundary
- (A) Classification of Water Quality
- Change in Water Quality Classification
- Segment Not In Compliance With Classification
- XXOO (X) Point Source Discharge
- XX Planning Region, B, Blackstone - N, Narragansett
- OO Discharge Number
- (X) Discharge Type
- A Small Wastewater Treatment Facilities
- C Cooling Water Discharges
- I Industrial Discharges
- M Municipal Wastewater Discharges
- O Combined Sewer Overflows
- R Runoff from Petroleum Products Storage Areas
- S Raw Sanitary Wastewater Discharges
- W Water Treatment Facilities

Note: Providence is in both the Narragansett and Blackstone Regions



Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM assisted by federal grants through the Joint Funding Assistance Program

Table 711-04(2)

DISCHARGE LIMITATIONS FOR POINT SOURCES OF POLLUTION[a]
BLACKSTONE REGION

Discharge Number	Discharger-Outfall Number	Flow[b]	Biological Oxygen Demand[b]	Total Suspended Solids[b]	Other[b]
B1(A)	Zambarano Hospital	MA 120 mgd	MA 30 mg/l	MA 30 mg/l	Settleable Solids (WA) .1 ml/l Fecal Coliform Bacteria (MA) 200/100ml
B2(M)	Burrillville Sewage Treatment Plant	MA 1.5 mgd	MA 30 mg/l	MA 30 mg/l	Settleable Solids MA 0.1ml/l Fecal Coliform MA 200/100ml Phosphorous MA 1.0 mg/l
B3(S)	Glendale Individual Sewers	----	----	No NPDES Permit	----
B4(C)	Consolidated Thermoplastics (Turex, Inc.)	-001 MA .190mgd -003 MA .110mgd -004 MA .050mgd	---- ---- ----	---- ---- ----	Max. Temp. 100°F Max. Temp. 87°F Max. Temp. 80°F
B5(C)	Service Color Corp.	DA .140 mgd	----	----	Temperature (DA) 50°F Temperature (DM) 70°F
B6(S)	Tupperware Co. (Laboratory)	----	DM 50 mg/l MA 30 mg/l	DM 50 mg/l MA 30 mg/l	Settleable Solids DM .3ml/l Chlorine Residual DM 1.0mg/l Fecal Coliform DM 400/100ml MA 200/100ml Temperature DM 83°F
B7(S)	Tupperware Co. Permit No. 001	DA .01 mgd DM .012 mgd	---- ----	---- ----	Temperature DA 85°F Total Phosphorous DM 0.2 lbs/day

Table 711-04(2)Continued

	Tupperware Co. Permit No. 485	-----	MA 30/mg/l DM 50 mg/l	MA 30 mg/l DM 50 mg/l	Settleable Solids DM .3ml/l Chlorine DM 1.0mg/l Fecal Coliform MA 200/100ml DM 400/100ml Temperature DM 83°F
B8(M)	Woonsocket Wastewater Treatment Facility	WA 16 mgd	MA 30 mg/l DM 50 mg/l	MA 30 mg/l DM 50 mg/l	Settleable Solids WA .1ml/l DM .3ml/l Fecal Coliform DM 400/100ml MA 200/100ml
B9(W)	Woonsocket Water Treatment Facility	----	----	DA 180 lbs/day DM 307 lbs/day	----
B10(A)	Cumberland High School Wastewater Treatment Plant	MA .032 mgd	MA 30 mg/l	MA 30 mg/l	Settleable Solids WA .1ml/l Fecal Coliform Bacteria MA 200/100ml WA 400/100ml DM 400/100ml
B11(C)	A.T. Cross Permit No. 001 Permit No. 002 Permit No. 003	 DA .07 mgd DA .036 mgd DA .001 mgd	 ---- ---- ----	 ---- ---- ----	 Temperature DA 75°F DM 90°F
B12(C)	Mossberg Hubbard	DA .062 mgd	----	----	Temperature - no change over stream ambient
B13(C)	H & H Screw	DM .005 mgd	----	----	Temperature DM 100°F
B14(S)	Ashton Septic Tank Overflow	----	----	No NPDES Permit	----
B15(I)	Nife, Inc.	DA .045 mgd	----	----	Sodium Sulfate DA 7,500 lbs/day Nickel DA .1mg/l

Table 711-04(2)Continued

B16(C)	Owens Corning Fiberglass Corp.				
	Permit No. 001	DA .3 mgd	----	----	Temperature DM 67°F
	Permit No. 007	DA .011 mgd	----	----	Temperature DM 82°F
B17(C)	Lonza Corp.	DA .005 mgd	----	----	Temperature DA 78°F
		DM .008	----	----	Temperature DM 90°F
B18(W)	Cumberland Water (Backwash Water)	DA .009 mgd	----	----	pH shall not be less than 6 Treatment Facilityor greater than 8.5
B19(C)	Okonite Co.	DA .30816	----	----	Copper DA .3mg/l DM .5mg/l Oil and Grease DM 10mg/l Temperature DA 75°F DM 79°F
B20(S)	Valley Falls Individual Sewers	----	----	No NPDES Permit	----
B21(W)	Pawtucket Water Treatment Plant	DA 0.42 mgd	----	DA 50 mg/l	----
B22(I)	Corning Glass Works	----	----	DA 159 lbs/day	Flouride DA 50 lbs/day Oil and Grease DA 72 lbs/day Chromium DA .05 mg/l Silver DA .05 mg/l Lead DA .05 mg/l
B23(O)	Central Falls Combined Sewer Overflows	Until August 1, 1983, the permittee is authorized to discharge untreated combined sanitary sewage and stormwater for combined sewer overflows 011-077 during periods of excess flow.			
B24(O)	Pawtucket Combined Sewer Overflows - 001 through 020	Until August 1, 1983, the permittee is authorized to discharge untreated combined sanitary sewage and stormwater for combined sewer overflows 001 through 020 during periods of excess flow.			

Table 711-04(2)Continued

B25(C)	Lincoln Dimensional Tube, Inc.	----	----	----	Total Copper DA .1mg/l DM .5mg/l Total Chromium DA .05mg/l Hexavalent Chromium DA .05mg/l DM .1mg/l DM .2mg/l Temperature DM 86°F
B26(C)	Collyer Insulated Wire, co.				
	Permit No. 002	DA .11 mgd	----	----	Temperature DM 70°F
	Permit No. 003	DA .14 mgd	----	----	Temperature DM 70°F
	Permit No. 004	DA .11 mgd	----	----	Temperature DM 70°F
	Permit No. 005	DA .22 mgd	----	----	Temperature 70°F
B27(C)	Rubber Covered Products	DM .001 mgd	----	----	Temperature DM 83°F
B28(O)	Providence S.C.O.	Treat overflows 002-065 according to best practical control technology currently available by July 1, 1977. (Extension of this deadline pending completion of the Providence Facility Plan (S. 201) in May, 1978			
B29(C)	R.I. Tool Co.	DM .001 mgd	----	----	Temperature DM 83°F
B30(C)	Philip A. Hunt Chemical Co.	DM .003 mgd	----	----	Temperature DM 83°F
B31(C)	Industrial Machine Corp.	DA .003 mgd	----	----	Temperature DM 70°F
B32(C)	Narragansett Grey Iron Foundry, Inc.	DM .0049 mgd	----	----	Temperature DM 74°F Zinc DM .07 mg/l Total Chromium DM .05mg/l
B33(C)	Mine Safety Appliances	DM 0.35 mgd	no change from intake	DA 1 mg/l DM 3 mg/l	Temperature DM 90°F
B34(M)	Smithfield Wastewater Treatment Facility	MA 3.5 mgd	MA 440 lbs/day	MA 440 lbs/day	Settleable Solids WA .1ml/l Fecal Coliform WA 200/100ml
B35(C)	Worcester Textile	DM .0001 mgd	----	----	Temperature DM 83°F
B36(C)	Brown & Sharp Mfg.	DA .034 mgd	----	----	Temperature DA 83°F

Table 711-04(2)Continued

B37(C)	Cowan's Plastics Products Corp.	DA .78 mgd	----	----	Temperature DA 60°F DM 90°F
B38(C)	Electronic Precision Circuitry	----	----	----	Iron DA 1.0mg/l DM 2mg/l Copper DA .5mg/l DM lmg/l Total Chromium DA .5mg/l DM .1mg/l Lead DA 1.0mg/l DM .2mg/l Tin DA 1.0mg/l DM 2.0mg/l Chromium (+6) DA .05 mg/l DM .1 mg/l
B39(C)	Uncas Mfg. Co.	DM .004 mgd	----	----	Temperature DA 68°F DM 90°F
B40(C)	Merchants Cold Storage	DA .47 mgd	----	----	Temperature DA 85°F
N1(O)	Pawtucket C.S.O.	----	See B24(O)	----	----
N2(M)	Blackstone Valley[e] District Commission Wastewater Treatment Facility	MA 31 mgd	MA 30 mg/l	MA 30 mg/l	Settleable DM .3ml/l Solids WA .1mg/l Fecal Coliform Bacteria WA 400/100ml MA 200/100ml
N3(0)[d]	Blacksone Valley District Commission		See B24		
N9(R)	Texaco, Inc.	----	----	----	Oil and Grease DA 30mg/l
N13(O)	Providence C.S.O.	----	See B44(O)	----	----
N14(C)	Narragansett Elec. Co.[g] A. 496 Eddy St. Permit No. 001	DA 237.2 mgd	----	Chlorine & Temp. 002	Free available Chlorine DM same for 001 &.5mg/l DA .2mg/l Temperature IM 27°F over intake temperature; or 110°F
	Permit No. 002 Permit 004	DA 118.6 mgd DA 1.0 mgd			

Table 711-04(2)Continued

	Permit No. 005 & 006	DM 2.0 mgd DM .020 mgd DA .015 mgd		DM 100 mg/l DA 30 mg/l	Oil and Grease DA 15mg/l DM 20 mg/l
	Permit No. 008	----	----	DA 30 mg/l DM 100 mg/l	Oil & Grease DA 15mg/l DM 20 mg/l
	<u>B. 360 Eddy St.</u> Permit No. 001	DA 150 mgd	----	----	Free Available Chlorine DA DM 150 mgd---------.2mg/l DM .5mg/l Temperature IM 27°F over intake temperature; or 110°F
	Permit No. 004	DA .063 mgd	----	----	----
N14C	Permit No. 007	DA .015 mgd	----	DM 50 mg/l	Oil and Grease DA 15mg/l DM 20mg/l
N15(C)	C.H. Sprague & Sons (Atlantic Terminal Corp.) Permit No. 003	----	DA 22 mg/l	DA 10 mg/l	Phenols DA .3mg/l Oil and Grease DM 15mg/l
N16(I)	Lehigh Portland Cement Co.	----	----	DA 17 lbs DA 35 mg/l DM 25 lbs/day	Settleable Solids DM .3ml/l
N17(R)	Sun Oil Co.	---	---	---	Oil and Grease DM 30mg/l
N18(C)	Field's Point Mfg. Co.	DA .36 mgd	----	----	DM 72°F
N19(M)	Providence Wastewater Treatment Facility	MA 64 mgd	MA 30 mg/l	MA 30 mg/l	Settleable Solids WA .1ml/l Fecal Coliform Bacteria WA 400/100ml MA 200/100ml
N20(R)[e]	Gulf Oil Co.	----	----	----	Oil and Grease DM 15mg/l

Table 711-04(2)Continued

a. The information in this table is from the National Pollutant Discharge Elimination System (NPDES) permits, issued by the EPA.

b. Abbreviations:

IM - Instantaneous Maximum
DM - Daily Maximum
DA - Daily Average
WA - Weekly Average
MA - Monthly Average

c. Enterprise Dye Co. is tied into the Woonsocket Sewerage System. However, siphon surcharges on the Woonsocket sewerage system cause wastewater from Enterprise Dye Co. to flow through an old outfall. No permit is required by the EPA for this discharge.

d. N3(O), BVDC combined sewer overflows, discharges three of its overflows in the Narragansett Region.

e. This treatment facility discharges out of the Blackstone Region, but is included in this section because most of its service area is in the Blackstone Region.

f. The Narragansett Electric Company's outfalls are for the following types of cooling water discharges:

<u>496 Eddy Street</u>

001 and 002 - condensor cooling water and boiler blowdown
005 and 006 - oil tank heater water
008 - storm water runoff

<u>360 Eddy Street</u>

001 - condensor cooling water
004 - jet washing
007 - surface runoff

Table 711-04(3)

COMBINED SEWER OVERFLOWS IN THE BLACKSTONE REGION

B28 PROVIDENCE (2)[1]

B28 Moshassuck River Discharges

1 Smith Street
2 Canal Street north of Smith Street
3 Charles Street
4 Charles Street south of Stevens Street
5 Stevens Street
6 Northwest of Randall Street
7 Livingston Street
8 At Rte. 95 from Northup and Silver Spring Streets
9 Cemetery Street

B-33 West River Discharges

10 Southeast of Charles Street at Silver Spring Street
11 South of Hawkins Street at Rte. 146
12 Vandewater Street at Branch Avenue

B-33 Woonasquatucket Discharges

13 Gaspee Street at Promenade Street
14 Park Street at Promenade Street
15 Harris Avenue at Kinsley Street
16 Holden Street at Promenade Street
17 Leland Street at Promenade Street
18 Bath Street at Promenade Street
19 Rathbone Street at Promenade Street (2 overflows)[3]
20 South of Walcott Street
21 Eagle Street at Kinsley Street (2 overflows)
22 Southwest of Rill Street at Valley Street
23 Atwells Avenue
24 Valley Street near Tippecanoe Street
25 Delaine Street
26 Northeast of Plainfield Street at Manton Avenue
27 Manton Avenue
28 Hartford Avenue near Edna Street
29 Sheridan Street
30 Glenbridge Avenue
31 Springfield Street overflow to unnamed tributary of the Woonasquatucket (from Johnston Sanitary District, not a CSO)

N13 PROVIDENCE (2)

Seekonk River Discharges

N13 PROVIDENCE (Cont.)

31 East of India Street at Gano Street
32 Tockwotton Street at Gano Street
33 Pitman Street
34 River Drive southwest of Angell Street
35 River Drive south of Irving Avenue
36 Irving Avenue at River Drive
37 At Butler Hospital

Providence River Discharges

38 Westminster Street
39 Market Square
40 College Street
~~41 Hutchinson Street~~
42 Crawford Street
43 Pike Street at South Water Street
44 South Water Street near Tockwotton Street[2]
45 India Street at South Main Street
46 India Street at Brook Street
47 India Street at Ives Street
48 Dyer Street
49 Thurbers Avenue
50 Harborside Blvd.
51 Harborside Blvd. at Fields Point Drive
52 Originates at Huntington Avenue and Chambers Street than passes beneath the treatment facility to the river
53 Ernst Street Pumping Station
54 Public Street
55 Blackstone Street Extension
56 Dudley Street
57 Henderson Street
58 Point Street east of Eddy Street
59 Elm Street[2]
60 Ship Street[2]
61 East of Dorrence Street at Dyer Street (2 overflows)

B24, N1 PAWTUCKET (5)[1]

B24 Blackstone River Discharges

1 East Street, west of Roosevelt
2 Roosevelt at Japonica Street
3 Carnation Street
4 Central Avenue (2 CSO's)
5 Blackstone Avenue (2 CSO's)
6 Exchange Street (2 CSO's)
7 Main Street (3 CSO's)

B24 Moschassuck River Discharges

8 Esten Avenue

9 Moshassuck Street
10 Moshassuck River Siphon[2]

N1 Seekonk River Discharges

11 East Avenue at Pleasant Street
12 Roosevelt Avenue Ext.
13 Division Street
14 School Street at Woodlawn Avenue
15 Seekonk River Siphon[2]
16 Bucklin Brook at School Street
17 Mercury Street at Thronton Street

B23 CENTRAL FALLS (7)

Blackstone River Discharges

1 River Street at Samoset Street
2 New Haven Avenue at Samoset Street
3 High Street at Aigan Street right of way
4 Sacred Heart Avenue
5 Cross Street at Roosevelt Avenue
6 Richmond Street
7 Roosevelt Avenue south of Sacred Heart Avenue

Moshassuck River Discharges

8 Higginson Avenue

N3 BLACKSTONE VALLEY DISTRICT COMMISSION (6)

Seekonk River Discharges

1 Bucklin Point - BVDC Interceptor
2 Bucklin Point - East Providence Interceptor

1. Numbers in parentheses indicate severity of pollution rankings.
2. These overflows are for emergency purposes only and do not operate during normal storm events.
3. One of these CSO's is a relief CSO which is manually operated for maintenance.

flow-through treatment facilities be utilized in Providence, and six in Pawtucket and Central Falls to mitigate the impacts from combined sewer overflows. Construction of these fifteen overflow treatment facilities is subject to the availability of funding.

The Governor's Sewerage Facilities Task Force on the Providence Sewage Treatment Plant, published in February 1980, determined that primary treatment of combined sewer overflows could reduce settleable solids loadings discharged to the Providence River by an estimated 90 percent. An estimated 87 percent of the total annual load of settleable solids discharged to the Providence River is from combined sewer overflows, according to the Governor's Task Force report.

04-02-03 Sanitary Wastewater Discharges "S"

Sanitary wastewater discharges are those that are not publicly owned ~~wastewater treatment facilities, such as individual subsurface disposal systems,~~ and industrial sanitary discharges. There are only two industrial sanitary discharges, Tupperware Laboratory (B6) and Tupperware Co. (B7). Discharges from individual subsurface disposal systems include: Ashton, Glendale, and Valley Falls individual sewers.

04-02-04 Petroleum Runoff Discharges "R"

Petroleum runoff dischargers are discharges to storm drains that carry spilled oil from gas and oil truck loading terminals. There are only three petroleum runoff dischargers, Texaco (N6), Atlantic Terminal Corp. (N15), and Sun Oil Co. (N17), in the Blackstone Region. All three have low severity of pollution rankings of 24, 25, and 26 respectively.

04-02-05 Water Treatment Plant Discharges "W"

These discharges contain contaminants filtered from drinking water. The three water treatment plants in the region (Woonsocket (B9), Cumberland (B18), and Pawtucket (B21)) have very low severity of pollution rankings.

04-02-06 Cooling Water Discharges "C"

Uncontaminated cooling water is generally not considered a significant source of pollution. However, this type of discharge, if not properly regulated in conjunction with other cooling water discharges, could have a serious impact on a receiving water, because warmer temperatures can reduce levels of dissolved oxygen. Most of the cooling water discharges in the region were given the lowest severity of pollution ranking of 31. Three cooling water discharges, Narragansett Electric (N14), Lincoln Dimensional Tube (B25), and C.H. Sprague and Sons (N15), were given severity of pollution ratings of 15, 19, and 23 respectively due to the discharge of heavy metals, phenols, oil, and grease in their cooling water. See Table 711-04(2) for permit requirements for each of these dischargers.

04-02-07 Industrial Dischargers "I"

These are the wastewaters from industrial processes including rinsewaters, leakages, spillages, overflows, and spent reactants. There are only three industrial discharges in the Blackstone Region: Corning Glass Works (B22), Nife (B15), and Lehigh Portland Cement (N16), with severity of pollution rankings of 14, 20, and 21 respectively.

04-02-08 Municipal Wastewater Treatment Facilities "M"

There are five municipal wastewater treatment facilities in the Blackstone Region: Burrillville (B2), Woonsocket (B8), Smithfield (B34), Blackstone Valley District Commission (N2) and Providence (N19). All facilities with the exception of the Providence and occasionally BVDC plants are in compliance with effluent limitations based upon secondary treatment as defined by the EPA. The existing treatment at the Providence plant is less than secondary. However, funds were approved in a state general election November 4, 1980, for upgrading the Providence plant to comply with secondary treatment effluent limitations. The Blackstone Valley plant will also be modified in the future to enhance its efficiency for compliance with effluent limitations. Although the Blackstone Valley facility is located within the Narragansett Region, it was included in this plan since most of its service area, which includes: Central Falls, Cumberland, Lincoln, Pawtucket, and the Rumford section of East Providence, is in the Blackstone Region.

Discharges from municipal wastewater treatment facilities have some of the highest severity of pollution rankings in the region. Providence is ranked number 1, BVDC number 3, Woonsocket number 4, Smithfield number 8, and Burrillville number 10.

04-02-09 Hydroelectric Facilities

Hydroelectric power involves the conversion of the potential energy of water into mechanical energy by causing it to flow through a hydraulic turbine, and then into electrical energy by means of a generator which is connected to the turbine. Hydroelectric facilities have not been included with the other eight categories of point source discharges, since the water discharged does not contain any contaminants.

Although the water that passes through a hydroelectric facility does not contain any contaminants, there are potential water quality problems associated with these facilities.

Some of the short term impacts on water quality can occur during construction of the facility. At this time, erosion, sedimentation, and turbidity can temporarily degrade water quality. These impacts can, however, be mitigated through the utilization of appropriate construction techniques.

The primary long term impact of hydroelectric facilities involves the reduction of flow in the river, such that too little water is provided for the river to assimilate wastes discharged to it downstream. Each hydroelectric facility must provide an adequate flow to maintain water quality standards, in addition to preserving fishery resources, recreational use, and aesthetic values. Moreover, the creation of new or enlarged impoundments can cause stratification, or the separation of waters of different temperature into layers. Oxygen content can be reduced by the warming of shallow waters in new or enlarged impoundments, and by the increased accumulation of organic nutrients. The depletion of oxygen can also occur if a segment of rapids which causes natural aeration is replaced by an impoundment or by-passed by a diversion structure.

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Properly designed hydroelectric facilities can reduce or eliminate these long term impacts. For example, stratification can be prevented by the proper placement of the headrace intake within the dam. Turbines equipped with venting devices or other aeration features may offset losses of natural aeration, as can, maintaining some spillage over the dam. The maintenance of adequate flow releases can prevent problems with waste assimilation downstream ((13a)).

There are currently two hydroelectic facilities in the Blackstone Region, the Tupperware facility on the Blackstone River in the Town of North Smithfield, and Thundermist Hydro located on the Blackstone River, above the Woonsocket Falls Dam in the City of Woonsocket. In addition, the Blackstone Valley Electric Company has a facility under construction on the Blackstone at the Main Street Dam in Pawtucket. There are six other hydro facilities that have been proposed for the Blackstone Region:

1. ~~Forte Brothers - Blackstone River - Manville Dam in Cumberland~~

2. Stamina Mills - Branch River - Forestdale Pond Dam in North Smithfield

3. Blackstone River - Valley Falls Dam in Central Falls

4. Owings Corning - Blackstone River - Ashton Dam in Cumberland

5. Elizabeth Webbing - Blackstone River - Pantex Dam in Pawtucket

6. Blackstone River - Albion Dam in Lincoln

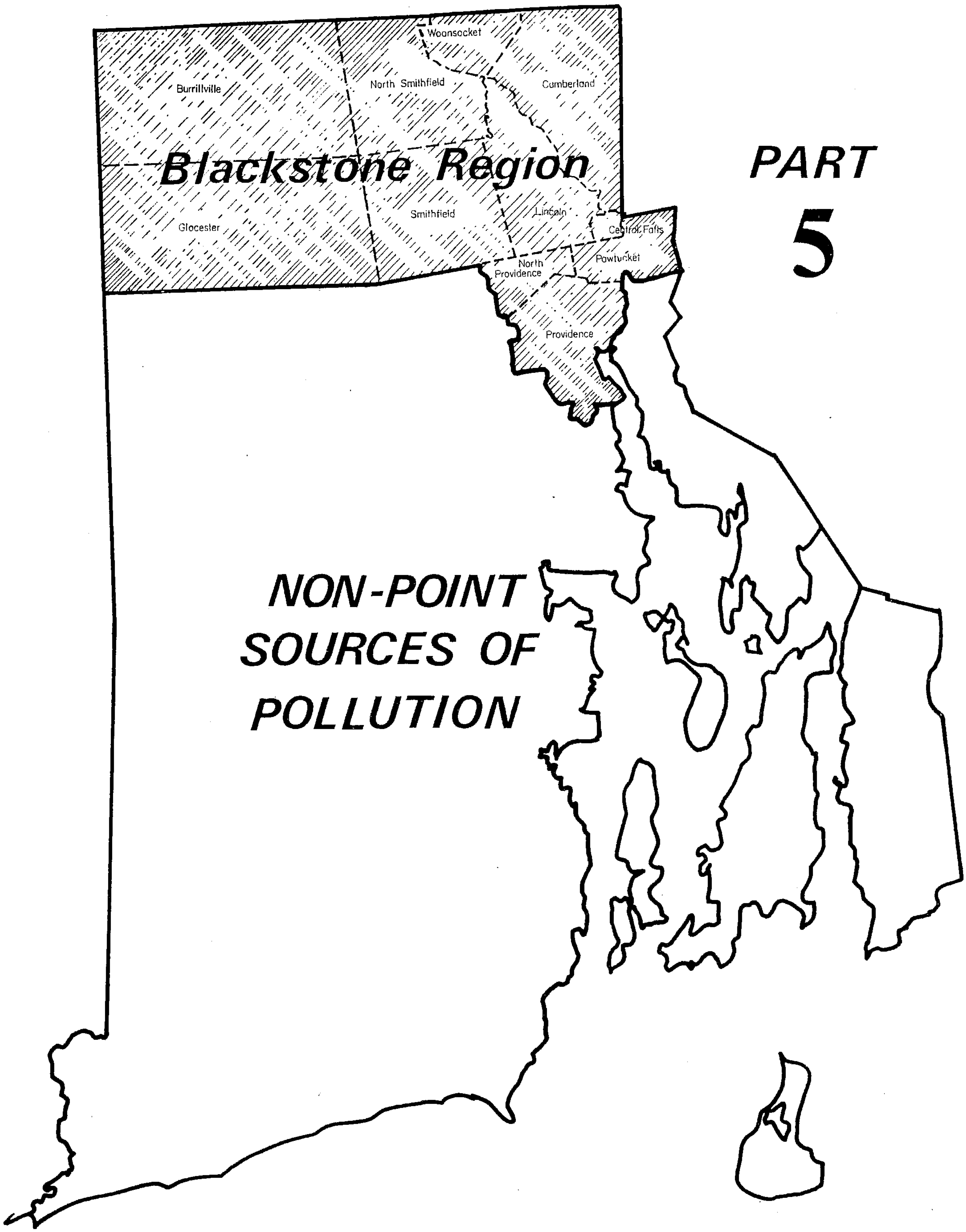
The Department of Environmental Management (DEM) issued Water Quality Certifications for the existing hydroelectric facilities in the Blackstone Region and determined that there would be no significant long term water quality impacts from these facilities. The New England River Basins Commission determined that the retrofitting of existing dams on the Blackstone River for hydroelectric facilities could be accomplished without a significant conflict to water quality ((13a)).

It is recommended that the Department of Environmental Management continue to assess the potential water quality impacts of all proposed hydroelectric facilities to insure the maintenance of existing or proposed water quality standards. A Water Quality Certification should not be issued by DEM if the proposed facility has the potential to degrade water quality.

(revised 6/30/82)

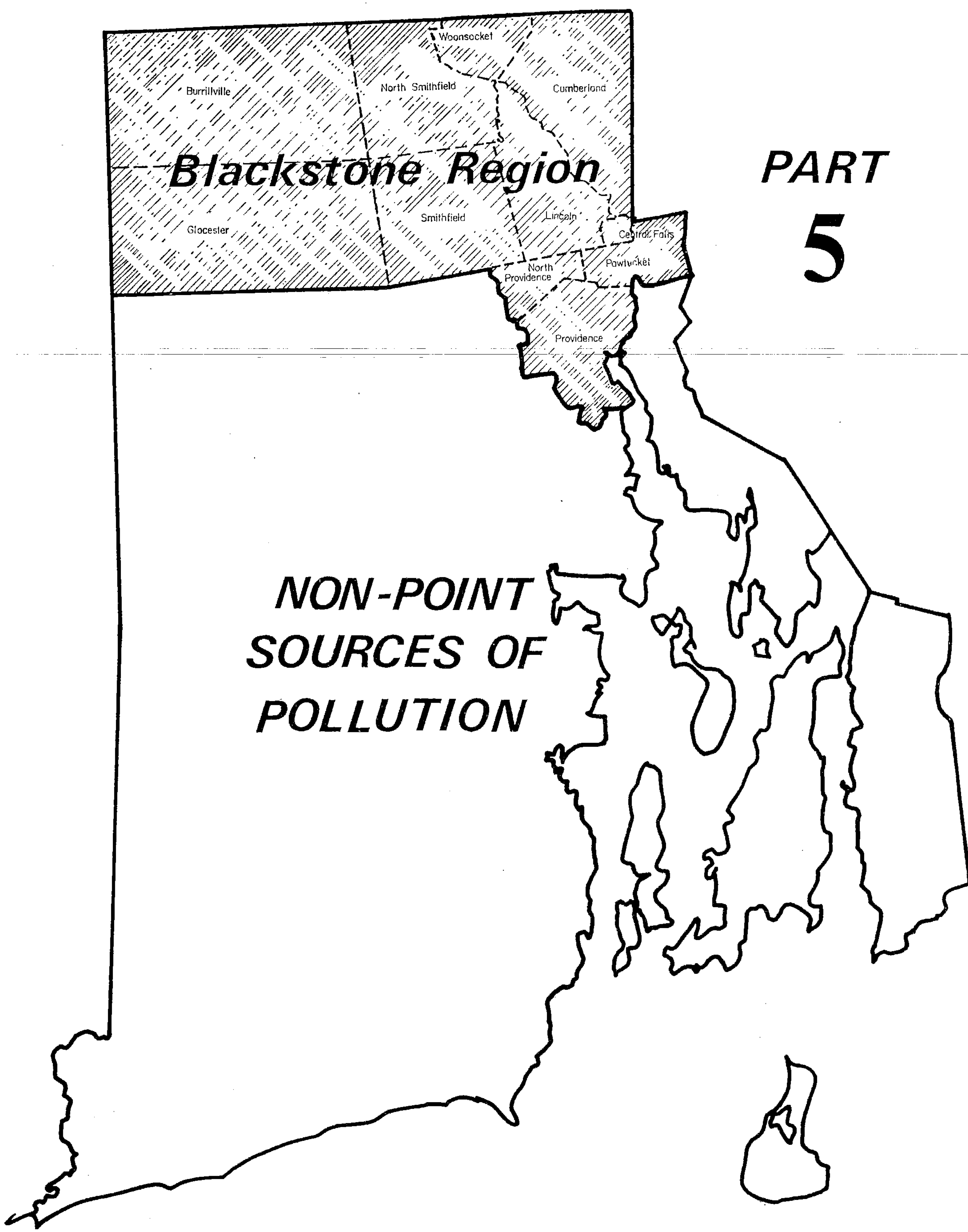
PART 5

NON-POINT SOURCES OF POLLUTION



PART 5

NON-POINT SOURCES OF POLLUTION



711-05 NON-POINT POLLUTION SOURCES

Non-point pollution is that which is not discharged through a pipe or conduit. Typical non-point pollution sources include: urban and rural runoff, leachates from landfills, erosion and sedimentation, failing septic systems and excessive application of fertilizers or pesticides.

Non-point pollution sources within the Blackstone Region are as follows:

Landfills
Urban Runoff
Erosion and Sedimentation
Road Salt
Individual Subsurface Disposal Systems

05-01 LANDFILLS

When solid wastes are deposited in a land disposal facility (landfill), the wastes degrade as a result of various chemical and biological reactions, producing solid, liquid and gaseous by-products. Ferrous and other metals are oxidized; organic and inorganic wastes are consumed by microorganisms through aerobic and anaerobic digestion. Liquid waste products of microbial degradation, such as organic acids, increase chemical activity within the fill.

Surface water and in many cases groundwater infiltrating through the landfill will collect contaminants contained within and produced by the solid waste. This contaminated liquid is called "leachate" and may be produced by both active and inactive landfills. As the leachate migrates from the landfill, it can directly contaminate ground and surface water. The generation and migration of leachate from a landfill is illustrated on Figure 711-05(1). Surface water also may be contaminated indirectly by polluted groundwater.

The impact of leachate on water quality is dependent upon many natural conditions of the site, along with physical conditions of the landfill. As leachate migrates from the landfill, it undergoes certain physical, chemical, and biological reactions which may bring about a temporary or permanent decrease in contaminant levels of the leachate. This overall natural reaction process which tends to improve the quality of leachate as it migrates from the landfill is termed "attenuation." The major attenuation mechanisms in the soil-water system are illustrated on Figure 711-05(2). The characteristics of the leachate produced (e.g. composition, quantity, rate of generation) in relation to the attenuation capacity of the site are primary determinants of the degree of water quality impact. The actual attenuation capacities at landfill sites vary considerably. However, some groundwater sampling has been done in Rhode Island to determine the distance required to attenuate leachate contaminants to concentrations below detectable levels. ((12a)).

From a management standpoint, the seriousness of leachate impact on water quality in large part depends on the present or projected future use of the affected

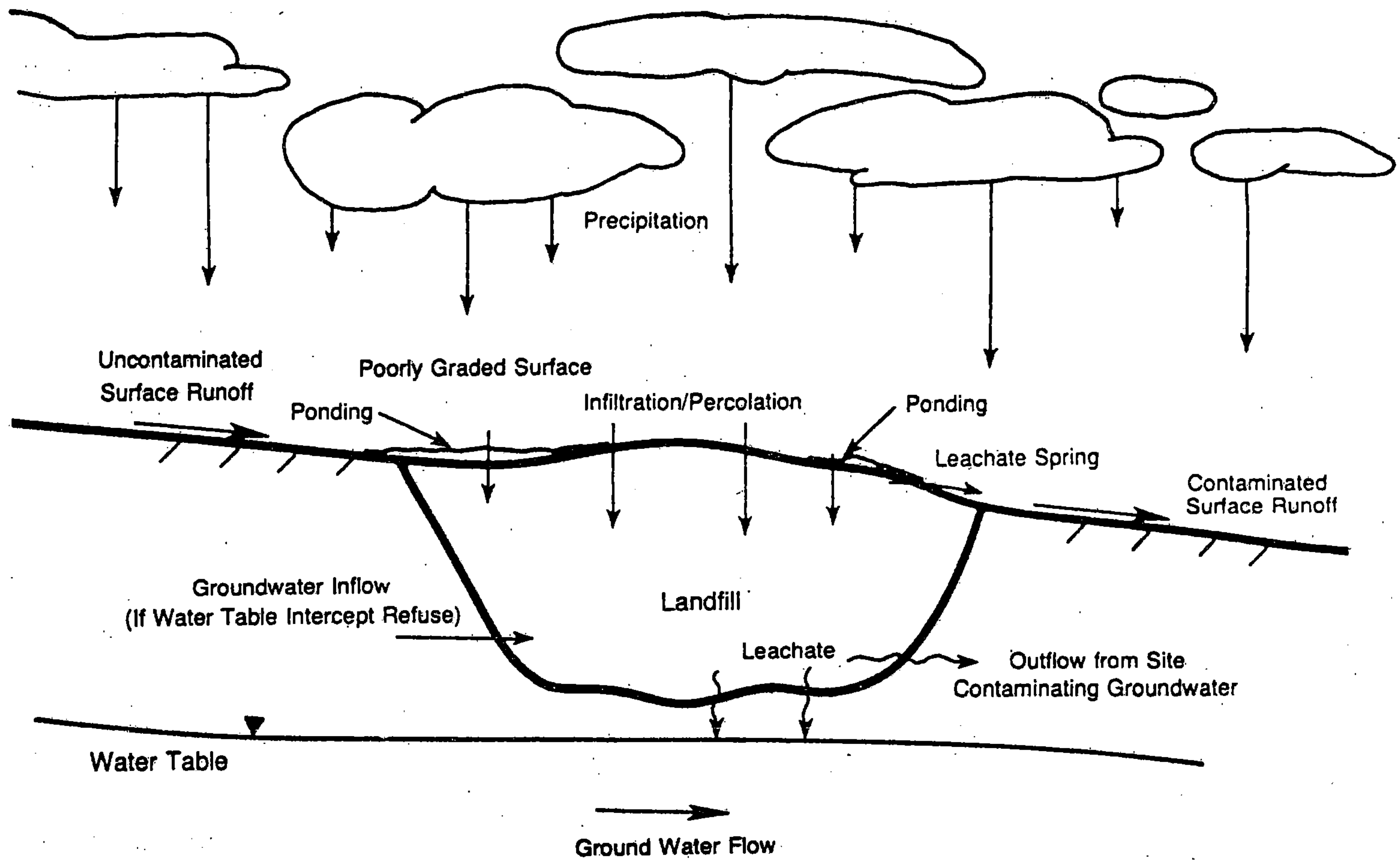


Figure 711-05 (1)

LANDFILL LEACHATE MIGRATION

Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM
assisted by federal grants through the Joint Funding Assistance Program

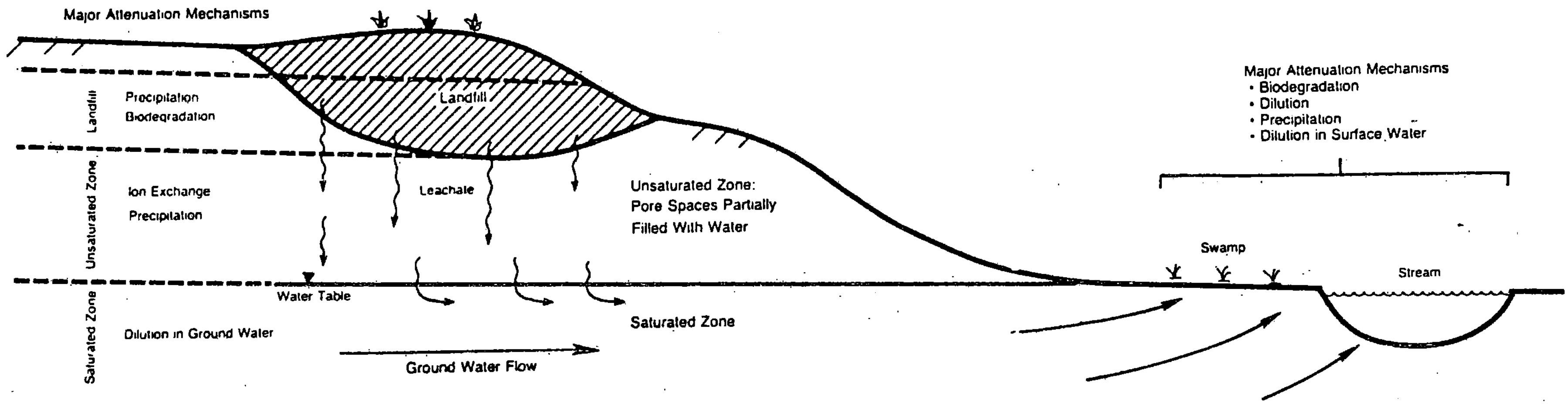


Figure 711-05(2)

MAJOR ATTENUATION MECHANISMS IN THE SOIL-WATER SYSTEM

Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM
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ground or surface water body. Landfill-generated pollution is most serious where it is affecting or potentially could affect groundwater aquifers, surface water supply reservoirs, and/or otherwise pristine streams. However, once the extension of an unacceptable impact on water quality has been determined, simply closing the landfill will not solve the pollution problem. Leachate will continue to be generated from the site for as long as 20 to 30 years or more. Even if the leachate is collected and treated, polluted groundwater aquifers require many years to purify themselves. Thus, the siting of a new landfill constitutes a major land use decision, involving a commitment of both land and water resources to the absorption of wastes in the area of the fill, unless measures other than natural attenuation are provided to control leachate.

05-01-01 Water Quality Impacts from Landfills

An inventory of the 22 landfills in the Blackstone Region is given in Table 711-05(1) and their locations illustrated in Figure 711-05(3). Six of the 22 landfills, Burrillville - active and closed, Cumberland - Albion Road, Glocester - Chestnut - Hill, Landfill and Resource Recovery, and Pawtucket - Canal Street were selected for a more detailed assessment of their potential ground and surface water impact ((44)). Despite some limitations such as denial of access to privately owned sites and insufficient sampling to determine annual fluctuations in leachate concentration, this study indicated the relative severity of ground and surface water contamination associated with the six landfills. It was determined that each of the six sites did generate leachate that impacted water quality in the immediate vicinity of the landfill. However, from the limited analyses conducted, none of the sites were considered to have a major impact on water quality ((44)). It should be noted that the Department of Environmental Management monitors all active landfills in the state on a quarterly basis to determine potential impacts to water quality.

The groundwater analyses showed the most contaminated leachate from the Cumberland, Burrillville (active), and Glocester landfills. Samples from these sites had high test results for chemical oxygen demand, total dissolved solids, chloride, iron, manganese, mercury, and phenols ((34)).

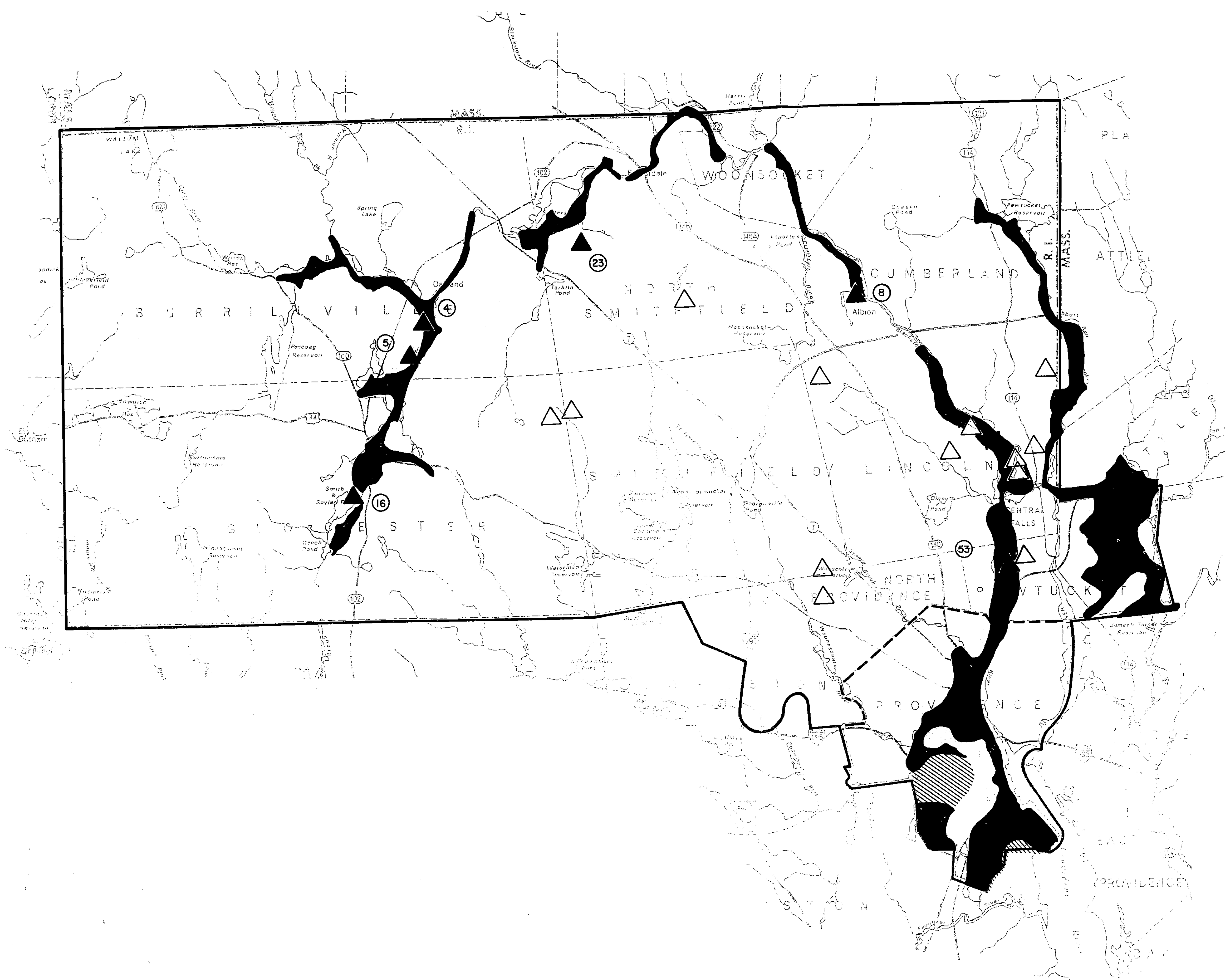
Surface water generally affords greater dilution of pollutants than groundwater. Many of the leachate parameters sampled were below detectable limits. However, mercury, cadmium, copper, and chlorinated hydrocarbons can affect aquatic life even in minute concentrations which are below acceptable drinking water concentrations ((34)).

Since the implementation of the Rhode Island Hazardous Waste Management Act in September 1979, there are no landfills in the state authorized to receive hazardous wastes. This act mandates that a permit be granted prior to the disposal of hazardous wastes at any site in the state; to date none have been granted. The Rhode Island Department of Environmental Management (DEM) is currently conducting a sampling program to assess the degree to which active landfills in the state contribute to the pollution of ground and surface water. The sampling program is conducted on a quarterly basis at each site.

05-01-02 Recommendations for Landfills

A detailed evaluation of the alternatives to alleviate pollution from landfills is given in the 208 Water Quality Management Plan for Rhode Island. A summary of the general recommendations from this plan are as follows:

Figure 711-05(3)



State of Rhode Island

Landfill Locations Blackstone Region

Legend:

- Region Boundary
- ⑤▲ Landfills Selected for Detailed Study
- △ Landfill Location
- Stratified-Drift Aquifer
  Major aquifer and principal recharge area. (Hatched area in Providence area where only limited data available)
- Ground-Water Reservoir
  That part of the stratified-drift aquifer where there is the greatest potential for water-supply development.

Note: Providence is in both the Narragansett and Blackstone Regions

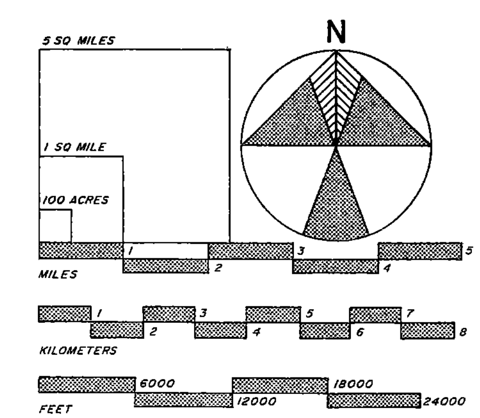


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Table 711-05(1) Continued

67	Davis/Smithfield	No	9	H, SW	3	High
72	Woonsocket-Transfer Sta./ Davis Rd.	No	-	A	1	Moderate
—	Western Sand and Gravel/ Douglas Pike, N. Smithfield	No	-	H	-	High

* Waste Type

H - Hazardous Waste

SW - Solid Waste

A - Ash

** Proximity to Groundwater

1 In Groundwater Reservoir

2 Near Groundwater Reservoir

3 Indirect Affects to Groundwater Reservoir

a. Possible Hazardous Waste

Source: Preliminary Evaluation of Pollution Potential from Landfills - Roy F. Weston, Inc. 1978.

(revised 6/30/82)

A. Reduction of Solid Waste

Because landfills all generate leachate and are possible sources of pollution, it is recommended that recycling be practiced as much as possible, in order to reduce the quantity of wastes and the need for new landfills. The following measures would serve to maximize attainment of this objective:

- passing mandatory deposit legislation ("bottle bill") in Rhode Island

- recycling oil, flat papers, bottles, and cans by source separation

- burning as fuel those materials that cannot be recycled and that are combustible. The Solid Waste Management Corporation's proposed resource recovery facility will recover this energy potential of solid waste.

B. Monitoring Program

It is recommended that DEM undertake a monitoring program at four or five landfill sites representative of different hydrogeologic conditions in the State. This sampling program should consist of the installation of monitoring wells at varying distances from the landfills to measure the attenuation of leachate. Based on costs for well installation, sampling, and analyses carried out for the 208 Program, the estimated cost of this sampling program would be $30,000 - 45,000 per year. Currently, sufficient funds are not available to initiate this recommendation.

C. Changes to Existing Regulations

DEM should continue to administer the program for licensing landfill operators. Existing regulations should be strengthened as follows:

* - A 200-foot buffer between landfills and surface water may not be sufficient to preclude leachate contamination, as attenuation capacity varies from site to site. DEM should be given discretion to require a greater setback from surface water bodies on a site-specific basis. This is especially important for protection of existing high quality (Class A and B) waters. Similarly, DEM should have discretionary authority to require a buffer greater than 200 feet between a landfill and any water supply wells. The direction of groundwater flow from the landfill is an essential consideration in determining a safe distance for location of wells.

* - Given the porous nature of Rhode Island soils, the required 4 foot depth to water table may not be adequate to protect groundwater from serious leachate pollution. The U.S. Environmental Protection Agency recommends a 5-foot depth to water table and greater depth should be required by DEM on a site-specific basis.

* - In addition to the groundwater standard, there should be a required minimum depth to bedrock. Such a standard is needed

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because the leachate will tend to spread over a larger area in shallow soils than in deep soils, causing an increased risk of pollution of nearby surface waters. A 6-foot minimum depth to bedrock is recommended, with DEM given discretion to require greater distances on a site-specific basis.

- Impervious final cover, preferably clay or silt, should be required in order to minimize infiltration into the landfill. Application of two feet of top soil over the impervious material should be required as a base for vegetating the site. The use of impervious cover necessitates proper venting of the methane produced by decomposition of the landfilled waste. Methane extraction from closed landfills should be investigated as a potential energy source.

- The establishment of vegetation is important for controlling erosion, increasing evapotranspiration, and aesthetics. Vegetation has been found lacking, however, at almost every Rhode Island landfill site evaluated. The landfill operation regulations should require vegetation of all completed and intermediate slopes and surfaces.

- Temporary sediment control measures are needed to mitigate impacts of erosion from active areas of landfills where establishment of vegetation is not practicable. State regulations should require landfill operations (both private and municipal) to meet the same erosion and sediment control standards as other earth-moving activities.

- The landfill operation regulations should specify required grades to reduce infiltration while not encouraging erosion. Slopes of not less than 2 percent and not more than 15 percent are recommended.

* - The landfill licensing regulations should prohibit the siting of any new landfill in water-related, environmentally sensitive areas, particularly recharge areas for groundwater reservoirs with water supply potential, surface water supply watersheds, and near coastal ponds.

* Denotes those recommendations that have been incorporated in the latest revised solid waste management regulations. These regulations will go into effect by the end of 1982.

D. Groundwater Legislation

- Groundwater protection legislation that will prohibit the siting of landfills, hazardous waste disposal facilities, and other specified uses (e.g. road salt storage) in groundwater reservoir recharge areas should be enacted.

A groundwater advisory committee was formed to study the use of land in areas critical to groundwater and, to draft legislation. Three bills were drafted for introduction in the 1981 General Assembly session:

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S 974 - An Act relating to the protection of groundwater aquifers. The State Planning Council would be authorized to adopt guidelines for designation of groundwater aquifers, or portions thereof, as existing or potential public water supply sources, and to designate these. The Department of Environmental Management would be required to modify its existing regulations in five areas to include protection of groundwater, and apply these to designated areas.

S 990 - An Act relating to planning and management of groundwater aquifers. Enabling legislation authorizing cities and towns to include protection of groundwater resources in community plans and zoning ordinances.

S 1013 - An Act relating to hazardous waste management. Owners and operators of hazardous waste facilities would be held strictly liable for damages to public or private drinking water supplies.

No hearings were held on these bills during the 1981 regular session. An act similar to S-990 from the 1981 session was reintroduced to the 1982 General Assembly as H-7766, an act relating to zoning. H-7766 would have authorized cities and towns to adopt zoning regualtions to protect public and private drinking water sources. Cities and towns would first be required to prepare an element of their comprehensive plan to deal with water resources. This bill was referred to the House Committee on Corporations but no action was taken.

An act relating to the disposal of solid waste over drinking water sources, S-2335, was introduced in 1982. This bill would allow groundwater reservoirs and recharge areas identified in the 208 plan to be designated as existing, planned, or potential public drinking water sources. Public hearings must be held by both the city or town concerned, and the Department of Environmental Management. Solid waste may not be disposed of in areas designatd as groundwater aquifers or recharge areas that serve or have the potential to serve as public drinking water supplies. This bill was passed by the General Assembly and signed into law by Governor Garrahy.

In addition, H-7039, an act relating to water pollution, was introduced in 1982. H-7039 would extend the definition of "waters" in the State Water Pollution Act to include groundwater. This amendment to the State Water Pollution Act would allow the Department of Environmental Management to protect the quality of the state's groundwater. This bill was approved by the House, but was not acted upon by the Senate.

E. Hazardous Wastes

A 208 recommendation for strict state hazardous waste regulations has been implemented. Currently, there are no sites in Rhode Island permitted to receive hazardous wastes. Disposal, storage and/or treatment of hazardous wastes will be allowed only at a completely secure site, with a dual impermeable liner and leachate collection and treatment system, or with other appropriate safeguards. Such a facility will be strictly prohibited from being sited in water-related, environmentally sensitive areas. Stringent siting, design and operating requirements are incorporated in the state's hazardous waste regulations.

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F. Groundwater Protection

- The State Planning Council should delineate groundwater reservoir and associated recharge areas which constitute existing or potential public water supply sources.

- DEM should adopt regulations which prohibit new sanitary landfills in the groundwater reservoir and recharge areas designated by the State Planning Council.

- Existing landfills located in these groundwater reservoir and recharge areas should be closely monitored by DEM to determine if the landfills are polluting the reservoirs. If there is evidence of leachate contamination, then the offending landfill should be closed in such a manner that infiltration will be minimized.

- The landfills listed below are located in groundwater reservoir recharge areas in the Blackstone Region. Those indicated with an asterisk (*) are located in recharge areas for groundwater reservoirs recommended by the 208 study for delineation as existing or potential public water supply sources.

208 Inventory Map No.		OPEN LANDFILLS
No. 5	*	Burrillville
No. 16	*	Glocester
No. 23	*	North Smithfield, Landfill & Resource Recovery, Inc.
No. 24		Pawtucket Incinerator
		CLOSED LANDFILLS
No. 4	*	Burrillville
No. 8	*	Cumberland Albion Rd.
No. 9	*	Cumberland, J.M. Mills
No. 37		Central Falls, Arrow St.
No. 38		Central Falls, Lincoln Almond Field
No. 39		Central Falls, Brook St.
No. 41	*	Cumberland, Curran Rd.
No. 45		Lincoln, Dupraw
No. 46		Lincoln, Elm Tree
No. 53		Pawtucket, Grotto Ave.
No. 54		Pawtucket, Canal St.
No. 58		Providence Dump
No. 59		Providence Dump
——	*	Western Sand and Gravel

(revised 6/30/82)

- DEM should adopt regulations which prohibit both new and existing hazardous waste disposal facilities in groundwater reservoir and recharge areas delineated by the State Planning Council. The sites listed below have been used for disposal of hazardous wastes. Those indicated with an asterisk (*) are located in recharge areas for groundwater reservoirs recommended by the 208 study for delineation as existing or potential public water supply sources.

MAJOR SITES

* Cumberland, J.M. Mills
* North Smithfield, Landfill & Resource Recovery, Inc.
* North Smithfield, Western Sand and Gravel
  Smithfield, Davis Liquid Waste Site

As previously mentioned, S-2335, an act relating to the diposal of solid waste over drinking water sources, was passed by the 1982 General Assembly and will serve to implement the recommendations for groundwater protection.

05-01-03 Community Recommendations for Landfills

The following general recommendations are applicable to more than one community:

All municipalities should act to reduce the volume of solid waste to be landfilled (or otherwise disposed of) by providing for source separation and recycling of recyclable materials (paper, glass, metal, waste oil) to the fullest extent possible. Appropriate best management practices (described in Recommended Leachate Control Alternatives for Landfills) ((42)) should be implemented in the design, operation, and/or closure of all active and inactive landfills in Rhode Island, as required by DEM.

Approximately 20 of the 76 sites listed in the landfill inventory were operated as open dumps ((41)). Exposed wastes at these sites should be compacted, graded, covered with soil, and vegetated in accordance with best management practices for landfill closure.

Recommendations for major landfills and hazardous waste sites, as well as their status, are discussed below on a community-by-community basis.

A. Burrillville

There are no landfill sites in the Town of Burrillville that are considered to be a major threat to water quality, although there is an identified hazardous waste site at the Refinement International Company located in Mapleville. Refinement International in the past disposed of heavy metal plating wastes via an on-site individual subsurface disposal system. This company currently disposes of their wastes at an approved off-site location. In addition, there is another hazardous waste site, Western Sand and Gravel, located on the Burrillville-North Smithfield town line. Refer to subsection E. North Smithfield, for a description of this site.

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The Department of Health will test private wells for contaminants, free of charge, if a well is within a half mile of any identified hazardous waste site. The Department of Health should continue this policy to insure that private drinking water supplies are not contaminated.

B. Cumberland

Cumberland has one active landfill site, J.M. Mills, which will close by July 1, 1982, and two closed sites, Albion Road and Curran Road. All three are located within the recharge area of a groundwater reservoir used as a public water supply source.

The Albion Road landfill, located adjacent to the Blackstone River, was analyzed in detail as part of the 208 landfill study. As indicated by groundwater samples, the leachate generated from this site is among the most highly contaminated of the 16 landfills studied ((44)). The following control measures, recommended by the landfill study, have been implemented by DEM:

- placement of additional final cover (2-foot depth)
- provision of proper grading and drainage
- establishment of vegetative cover
- control of off-site surface water
- construction of berms at the toe of the slope to prevent direct overland flow to the Blackstone River
- implementation of other erosion control measures, as needed

Surface water runoff from this site has been sampled by DEM and determined to be free of harmful contaminants. However, since this site is over a groundwater reservoir that is utilized as a public drinking water supply, groundwater monitoring should be conducted to assess any groundwater contamination that may occur.

(revised 6/30/82)

The J.M. Mills landfill on Mendon Road is a recognized hazardous waste site. The operating license for this site expired in 1979 and a new license has been denied. It was determined from the installation of groundwater monitoring wells that large quantities of arsenic and a variety of other wastes that were stored at this site have contaminated groundwater.

In addition to these landfill sites, the Peterson-Puritan Co. of Cumberland, an aerosol manufacturer, has been linked to the contamination of municipal wells in the towns of Cumberland and Lincoln. Three wells in Quinnville and two wells in Cumberland have been contaminated by seven different chemicals, four of which are suspected to cause cancer. The seven chemicals found in the groundwater, by the EPA, that have been linked to Peterson-Puritan are as follows:

Freon 11, a mild irritant whose long term health effects are unknown;
1,1 Dichloroethylene, a suspected carcinogen;
~~1,1 Dichloroethane, which causes liver injury in laboratory animals;~~
~~Trans 1,2 Dichloroethylene, whose effects are unknown;~~
1,1,1 Trichloroethane, whose long term effects are unknown;
Trichloroethylene, a suspected carcinogen and;
Tetrachloroethylene, a suspected carcinogen.

In June 1982, the EPA ordered Peterson-Puritan to clean up the groundwater aquifer that they were responsible for contaminating.

C. Glocester

There are two landfills (Number 16, Glocester; Number 26, Glocester-Smithfield Regional) located in Glocester that are identified in the landfill inventory ((41)). The portions of the Glocester landfill that are presently licensed and operating are the minimum required distance above the groundwater; however, several previously filled acres were unlicensed and are in low-lying areas. These filled areas are of particular concern, because the landfill is situated in the recharge area of a groundwater reservoir. The detailed evaluation of this site indicated the presence of numerous leachate seeps at the toe of the landfill because of its location in a swamp, yet surface water samples did not indicate that a significant impact was occurring as a result of the leachate discharge ((44)). This site is currently being monitored by DEM to determine any groundwater pollution which may occur.

The Glocester-Smithfield Regional Landfill (on the Glocester-Smithfield town line) was not investigated in detail as part of the landfill study because of difficulties encountered in gaining access to the site. However, 21 acres of the 50-acre landfill were identified in the rural runoff study as a severe erosion problem area, requiring ground cover and a sediment basin at an estimated total cost of $5,050. ((28)). In addition, this site has been the center of considerable controversy due to the acceptance of hazardous wastes on a watershed. Such indiscriminate dumping of hazardous wastes is prohibited by the Rhode Island Hazardous Waste Management Act.

Due to operating deficiencies at the landfill (unrelated to hazardous wastes), DEM has denied renewal of its operating license. This landfill is now closed.

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D. Lincoln

The Lincoln-Dupraw landfill on Dexter Road, in addition to Hunt Chemical Corp. in the North Central Industrial Park and Majestic Motors on Route 146 are all hazardous waste sites.

The Hunt Chemical site is still being investigated by DEM. Several problems have been identified including groundwater contamination by septic tank additives and a leaking pretreatment system that allowed chemicals to leach into the groundwater. The pretreatment system has been repaired and Hunt Chemical contributed $175,000 to extend a public water supply system to serve adjacent homes. DEM is planning to install groundwater monitoring wells to assess the extent of groundwater contamination.

The spilling of a cleaning agent utilized to clean car engines at Majestic Motors is suspected of contaminating wells adjacent to the site. The Department of Health is currently investigating the contamination potential of this spill. It is recommended that potential impacts on the adjacent Woonsocket Reservoir watershed be assessed.

The Lincoln-Dupraw landfill is an abandoned gravel pit where commercial and industrial wastes were dumped. This site is now closed to further dumping and some groundwater monitoring wells have been installed to assess contamination. Additional monitoring is recommended to assess the impacts on groundwater quality from this site.

E. North Smithfield

Disposal of hazardous wastes did occur, until 1979, at two sites in North Smithfield - Western Sand and Gravel, and Landfill and Resource Recovery, Inc. Both sites are located in the recharge area of a groundwater reservoir which, according to the U.S. Geological Survey, has potential for municipal water supply development, with an estimated pumping capacity of 5 million gallons per day. Although the present direction of groundwater flow at the Landfill and Resource Recovery site is away from the potential pumping center, there is a possibility that withdrawal of water from a future well could change the direction of flow, causing leachate to contaminate the water supply ((44)).

The Western Sand and Gravel site has been ranked by the EPA as being among the worst 114 chemical dumps in the United States. The EPA has allocated $292,079 in Superfund money to assess the problems, develop disposal plans, and inititate the clean up of this hazardous waste site. It is not known when this effort will begin.

The Landfill and Resource Recovery (L&RR) site was investigated as part of the detailed evaluation of landfills, and sampling data showed that hydrocarbon contamination and higher than normal chemical oxygen demand values were present in the groundwater ((44)).

After several months of hearings, the Department of Environmental Management in October, 1981, refused to renew the license for L&RR and the site was ordered to be closed. This decision was successfully appealed by the landfill owners to the Superior Court and remains open pending further court action. In June 1982, the Town of North Smithfield proposed a zoning amendment designed to

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close L&RR pursuant to S-2335, an act relating to solid waste disposal over drinking water sources, which prohibits solid waste dumping over drinking water sources. L&RR is above the Slatersville aquifer, a major underground drinking water supply source. However, this new law also provides the owners of Landfill and Resource Recovery with the legal right to appeal the town's zoning amendment. Whether or not to close this landfill will be decided by the courts.

F. Pawtucket

Pawtucket has one open landfill (Number 24, Pawtucket Incinerator) and two closed landfills (Number 53, which is utilized only for the disposal of incinerator residue, Grotto Ave.; Number 54, Canal St.) identified in the landfill inventory ((41)). All three landfills are located within the groundwater reservoir recharge area. The Canal St. site was investigated in detail as part of the landfill study ((44)). Implementation of the following controls is recommended at this site:

- placement of additional final cover (2-foot depth)
- provision of grading and drainage improvements
- establishment of vegetative cover.

Currently DEM encourages but does not require the implementation of these recommendations for open landfills, only closed sites.

G. Smithfield

There are three closed landfills (Number 26, Glocester-Smithfield Regional), (Number 66, Ridge Road), and (Number 67, Davis Liquid Waste Site) in Smithfield identified in the landfill inventory ((41)). Adverse impacts have been associated with all three sites, particularly Number 26 and Number 67.

The Glocester-Smithfield Regional landfill had 21 acres identified in the rural runoff study as a severe erosion problem area, requiring ground cover and a sediment basin, at an estimated cost of $5,050. ((28)). DEM has refused to issue an operating license for the landfill because of repeated violations of the landfill regulations.

The Davis Liquid Waste Site was determined to have a high potential to pollute water quality. Surface water samples of a nearby swamp and Latham Brook indicated the presence of organic chemicals in the surface water ((38)). In addition, consultants under contract to DEM discovered severe groundwater contamination. The EPA has allocated $336,182 of Superfund money for the clean up of this site. It is not known when this clean up effort will be initiated.

There is another hazardous waste site in Smithfield located at the New England Container Company on George Washington Highway. New England Container disposed of wastewater, which contained contaminants considered to be hazardous by DEM, via land treatment. In addition, the wastewater was being disposed of within the watershed of the Woonsocket Reservoir. This company currently pretreats their wastewater prior to discharging to the Blackstone Valley District Commission's sewerage system. DEM is installing groundwater monitoring wells around the site to assess the impacts to the groundwater.

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05-02 URBAN RUNOFF

Rain that falls on impervious surfaces in an urban area can not penetrate the soil and must be conveyed to nearby water courses to minimize the impacts from flooding. Pollutants that have accumulated on impervious surfaces are either dissolved or physically transmitted with the flowing stormwater. Within the last decade, stormwater runoff studies conducted throughout the nation have clearly established that urban runoff can transmit substances, with significant polluting potential, to adjacent water bodies. Substances that are generally carried by urban runoff include: toxicants, nutrients, and sediments.

Although the characteristics of urban stormwater runoff have been well described, there has been little work done to assess its impact on receiving waters. Comparisons between stormwater runoff and treated wastewater discharges (in terms of concentrations or loadings during the duration of typical storms, average annual loadings and the like) have led to concern that stormwater runoff may ultimately influence the attainment of water quality objectives ((34)). However, such comparisons are not particularly meaningful in most cases given the differences in the intermittent nature of stormwater runoff. Sound methods of assessing the effects of highly intermittent stormwater runoff on water quality objectives must be established.

There is not much information regarding the impacts of urban runoff to water quality in the Blackstone Region. However, the <u>208 Water Quality Management Plan for Rhode Island</u> established acceptable concentrations of urban runoff pollutants for various water uses within Rhode Island. Stormwater runoff parameters of concern for each of five water uses are given in Table 711-05(2). Maximum federal and state allowable concentrations of these pollutants in drinking water suplies are listed in Table 711-05(3) and water quality criteria for aquatic life are depicted in Table 711-05(4).

In addition, the 208 Plan correlated stormwater pollutant loadings with broad land use categories, since land use characteristics can exert an influence upon the quantity and quality of stormwater runoff in a drainage basin. The land use categories established by the 208 plan are as follows:

Residential - High Density (7.5 dwelling units/acre)

Residential - Low Density (1 dwelling unit/acre)

Commercial - (includes commercial, transportation and public uses)

Industrial

Open (includes agricultural, forest, recreation, wetlands, mining and waste disposal)

Tables 711-05(5) and 711-05(6a) list the pollutant concentration and loadings for each land use category. Since there is a limited amount of data regarding pollution from urban runoff in Rhode Island, the values cited in Tables 711-05(5) and 711-05(6a) are assumed values based upon a review of existing literature ((34)). A detailed sampling program would be required to assess the actual impacts to water quality from urban runoff in the Blackstone Region.

Table 711-05(2)

STORMWATER RUNOFF PARAMETERS OF CONCERN
FOR VARIOUS WATER USES

	WATER USE				
PARAMETER	Public Water Supply	Shellfish Harvesting	Aesthetic & Recreational Values	Aquatic Life (1)	Agricultural Uses
<u>Physical Parameters</u>					
Dissolved Oxygen (BOD)			X	X	
~~Turbidity & Color~~			~~X~~	~~X~~	
Total Dissolved Solids				F	
Suspended & Settleable Solids	X		X	X	
<u>Inorganic Chemicals</u>					
Ammonia				X	
Cadmium		X		F	
Chromium	X	X		X	
Copper		X		X	
Iron	X			X	
Lead	X	X		X	X
Manganese	X	X		M	
Mercury	X	X		X	
Nickel		X		M	
Zinc		X		X	
<u>Organic Chemicals</u>					
Polychlorinated Biphenyls (PCB's)		X		X	
Pesticides		X		X	
Oil & Grease		X	X	X	

Table 711-05(2) Continued

<u>Nutrients</u>					
Phosphorus	X		X	X	X
Nitrogen		X		X	
<u>Bacterial Indicators</u>					
Total Coliform	X	X	X		X
Fecal Coliform	X	X	X		X

Notes: (1) F denotes parameter of concern for freshwater aquatic life only, M for marine life only. X denotes parameters of concern for both freshwater and marine life.

Source: <u>208 Water Quality Plan for Rhode Island</u>

Table 711-05(3)

WATER SUPPLY SOURCE AND
DRINKING WATER STANDARDS

Parameter and Units (mg/l unless otherwise indicated)	Maximum Contaminant Level: Rhode Island Standards (1)	EPA Secondary
Arsenic	0.05	--
Total Coliform Bacteria (No./100ml)	Not to exceed median of 100	--
Barium	1.0	--
Cadmium	0.010	--
Chloride	--	250
Chromium	0.05	--
Color (units)	--	15
Copper	--	1.0
Detergents (MBAS)	--	0.5
Fluoride	2.0	--
Iron	--	0.3
Lead	0.05	--
Manganese	--	0.05
Mercury	0.002	--
Nitrate-Nitrogen	10.0	--
Pesticides	--	--
Endrin	0.0002	--
Lindane	0.004	--
Methoxychlor	0.1	--
Toxaphene	0.005	--
2, 4-D	0.1	--

Table 711-05(3) Continued

2,4, 5-TP (Silvex)	0.01	--
pH (units)	--	6.5-8.5
Phenolic Compounds	--	0.001
Radioactivity	--	--
Radium-226, 228 (pCi/L)	5	--
Alpha (pCi/L)	15	--
Beta & Photon Dose Equivalent (MREM/yr)	4	--
Selenium	0.01	--
Silver	0.05	--
Sulfates	--	250
Sulfides (as H_2S)	--	0.05
Total Dissolved Solids	--	500
Turbidity (units)	--	--
Zinc	--	5.0

NOTES: (1) The Rhode Island Standards are identical to those of the EPA interim primary regulations, except for fluoride for which the two differ only slightly.

Source: 208 Water Quality Management Plan for Rhode Island

Table 711-05(4)

WATER QUALITY CRITERIA FOR
AQUATIC LIFE (CONTINUOUS EXPOSURE)

(1) Parameter and Units	Limiting Level (2) Protection and Propagation of Freshwater Aquatic Life	(3) Protection and Propagation of Marine Life
Physical Parameters		
Dissolved Oxygen, mg/L	5.0 Minimum (3)	5.0-6.0 Minimum (5)
Total Dissolved Gas Pressure	110 Percent of Existing Atmospheric Pressure	110 Percent of Existing Atmospheric Pressure
Turbidity and Color	JTU Standards and Narrative Criteria	Narrative Criteria
Total Dissolved Solids	Bloassays and Field Studies plus 1,500 mg/L Upper Limit	---
Suspended and Settleable Solids	Varies with fishery 25 mg/L to 400 mg/l	Varies with fishery 25 mg/L to 400 mg/L
Inorganic Chemicals (1)		
Ammonia, mg/L	0.02 Unionized Ammonia	0.4 Unionized Ammonia
Cadmium, mg/L	0.0004	0.005
Chromium, mg/L	0.1	0.1
Copper, mg/L	0.026	0.01
Iron, mg/L	1.0	0.3
Lead, mg/L	0.03	0.01

Table 711-05(4) Continued

Manganese, mg/L	--	0.1
Mercury, mg/L	0.00005	0.00010
Nickel, mg/L	0.026	0.01
Zinc, mg/L	0.039	0.02
Organic Chemicals		
Polychlorinated Biphenyls (PCB's), ug/L (2)	0.001	0.001
Pesticides, ug/L		
Aldrin - Dieldrin	0.003	0.003
Chlordane	0.01	0.004
DDT	0.001	0.001
Demeton	0.1	0.1
Endosulfan	0.003	0.001
Endrin	0.004	0.004
Guthion	0.01	0.01
Heptachlor	0.001	0.001
Lindane	0.01	0.004
Malathion	0.1	0.1
Methoxychlor	0.03	0.03
Mirex	0.001	0.001

Table 711-05(4) Continued

Parathion	0.04	0.04
Toxaphene	0.005	0.005
Oil & Grease	0.01 Times 96-Hour LC50 (4) plus Narrative Criteria Given in Text	0.01 Times 96-Hour LC50 (4) plus Narrative Criteria Given in Text

Notes:

1. For metals, the following recommendation of the NAS/NAE should be incorporated: Since forms or species of metals in water may change with shifts in water quality and since the toxicity to aquatic life may concurrently change in as yet unpredictable ways, it is recommended that water quality criteria for a given metal be based on the total amount of it in the water, regardless of the chemical state or form of the metal, except that settleable solids should be excluded from the analysis.
2. ug/L = 10^{-3} mg/L
3. Based on Rhode Island's Water Quality Criteria for Class A and B waters. Lower standards may be allowed for Class C and D waters.
4. Based on lowest of the continuous flow values for several important freshwater or marine species, each having a demonstrated high susceptibility to oils and petrochemicals.
5. Based on Rhode Island's Water Quality Criteria for Class SA and SB waters. Lower values may be allowed for Class SC waters.

Source: 208 Water Quality Management Plan for Rhode Island

Table 711-05(5)

ASSUMED AVERAGE CONCENTRATIONS

OF URBAN RUNOFF POLLUTANTS

BY LAND USE (LB/ACRE-INCH)[1]

Pollutant	Concentration by Land Use: Residential High Density	Residential Low Density	Commercial	Industrial	Other Developed Areas
SS, lb/acre-in.	39.5	32.4	29.6	43.1	2.55
TS, lb/acre-in.	138	113	72.6	148	5.27
BOD_5, lb/acre-in.	1.935	1.586	4.27	1.79	0.107
COD, lb/acre-in.	11.3	9.27	19.5	13.0	0.901
Oil & Grease, lb/acre-in.	53	53	27	53	0.11
TKN, lb/acre-in.	0.339	0.278	0.730	0.759	0.0382
NO_3-N, lb/acre-in.	0.0759	0.0622	0.115	0.0364	0.0843
NH_3-N, lb/acre-in.	0.0911	0.0746	0.263	0.118	--
Total Phosphorus, lb/acre-in.	0.249	0.205	0.309	0.318	0.0287
OPO_4-P, lb/acre-in.	0.117	0.0961	0.163	0.185	0.00896
Cu, lb/acre-in.	0.0128	0.0105	0.00966	0.0158	--
Cd, lb/acre-in.	4.14×10^{-4}	3.39×10^{-4}	3.05×10^{-4}	5.77×10^{-4}	--
Cr, lb/acre-in.	0.0265	0.0217	0.0163	0.0411	--
Fe, lb/acre-in.	2.84	2.33	1.69	4.23	--
Hg, lb/acre-in.	8.70×10^{-4}	8.70×10^{-4}	4.74×10^{-4}	3.35×10^{-4}	--
Mn, lb/acre-in.	0.0541	0.0443	0.0288	0.0844	--
Ni, lb/acre-in.	0.00386	0.00316	0.00348	0.00548	--

Table 711-05(5) Continued

Pb, lb/acre-in.	0.197	0.162	0.250	0.172	--
Sr, lb/acre-in.	0.00290	0.00237	0.00131	0.00340	--
Zn, lb/acre-in.	0.0483	0.0396	0.0378	0.0469	--
Total Coliform(2)	107,000	87,200	59,300	55,100	383
Fecal Coliform(2)	10,000	8,210	6,260	12,100	17

1. Multiply by 4.413 to obtain concentrations in mg/L.

2. Coliform in million organisms per acre-inch. Multiply by 0.973 to obtain organisms per 100 ml.

Source: 208 Water Quality Management Plan for Rhode Island

Table 711-05(6a)

ASSUMED AVERAGE CONCENTRATIONS OF CHLORINATED HYDROCARBONS IN URBAN RUNOFF

	Concentration by Land Use				
Pollutant	Residential High Density	Residential Low Density	Commercial	Industrial	Other Developed Areas
TS, lb/acre-in	138	113	72.6	148	5.27
PCB/s, ug/L	0.469	0.384	0.247	0.503	0.0179
Dieldrin, ug/L	0.0171	0.0140	0.00897	0.0183	0.000651
DDT, ug/L	0.0463	0.0379	0.0244	0.0496	0.00177
DDD, ug/L	0.0499	0.0409	0.0263	0.0536	0.00191
Endrin, ug/L	0.000122	0.0000997	0.0000641	0.000131	0.00000465
Lindane, ug/L	0.00177	0.00145	0.000929	0.00189	0.0000674
Methoxychlor, ug/L	0.305	0.249	0.160	0.327	0.0116
Methyl parathion ug/L	0.00122	0.000997	0.000641	0.00131	0.0000465

Source: 208 Water Quality Management Plan for Rhode Island

Even though there have not been many research efforts regarding the impacts of runoff in the Blackstone Region, it seems reasonable to suggest that urban runoff does contribute a significant amount of contaminants to surface waters due to the intensely developed characteristics of this region. The exact quantities of contaminants entering urban surface waters are not known. It is known, however, that some of the average concentrations of urban runoff pollutants depicted in Tables 711-05(5) and 711-05(6a&b) are contaminating certain surface waters within the Blackstone Region. Those rivers that have the most severe urban runoff impacts are:

Blackstone River;
Moshassuck River;
Woonasquatucket River;
Seekonk River
Ten Mile River; and
Providence River

Refer to Part 6, Table 711-06(5) for those segments within the rivers cited above that have urban runoff problems.

The cities of Central Falls, Pawtucket, and Providence all have municipal sewerage systems that combine residential, industrial, and commercial wastewater with stormwater runoff. When these systems were originally installed, circa 1900, treatment could be provided to both the wastewater and stormwater flow. However, as these cities expanded, the size of their treatment facilities did not keep pace with the increased volumes of wastewater generated. Overflows were installed in the system to discharge untreated excess volumes of wastewater, that occur during approximately 125 storm events each year, directly into the Blackstone, Seekonk, West, Moshassuck, Woonasquatucket, and Providence Rivers (see Table 711-04(3) for locations of these overflows.). This was deemed necessary since the treatment plant could not handle the increased storm induced volumes and to keep water from backing up onto the city streets. There were 95 sewer overflows installed with 8 in the City of Central Falls, 22 in the City of Pawtucket, and 65 in the City of Providence. These combined sewer overflows (CSO's) are heavily polluted with untreated sewage, and stormwater runoff comprised of gasoline, oil, grease, pesticides, fertilizers, trash, animal wastes, and other substances washed from impervious surfaces. The Rhode Island Department of Environmental Management (DEM) has determined that storm induced coliform loadings to Upper Narragansett Bay cause coliform concentrations in the Upper Bay to be in excess of acceptable limits for swimming and shellfishing, as stated in Rhode Island's Water Quality Criteria. As a result, DEM closes the Upper Bay to shellfishing for seven days when it rains more than one-half inch in Providence. Moreover, recent research concluded that CSO's in Central Falls, Pawtucket, and Providence carry 617 tons of oil a year into the Upper Bay during dry weather ((96)). The dry weather discharges are due to the malfunctioning CSO sewerage systems.

Facilities plans prepared for the cities of Central Falls, Pawtucket, and Providence recommend treating combined sewer overflows by removing solids (primary treatment) and disinfection with satellite treatment plants to be located adjacent to those rivers currently receiving CSO discharges. Two CSO treatment facilities that would serve the largest of nine drainage areas in the City of

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Providence were selected for the earliest possible construction. Currently, engineering studies are in progress to assess the impacts and develop alternatives for CSO discharges in the Woonasquatucket (CSO Number 2) and Providence Rivers (CSO Number 9). The U.S. Environmental Protection Agency estimated that these two facilities could eliminate 30 to 40 percent of the CSO pollution from Providence's 65 CSO's. However, DEM should monitor those rivers receiving CSO discharges to determine their water quality impacts. In addition, more complete water quality data is necessary in order to establish goals and priorities for the attenuation of stormwater runoff impacts.

There is research currently being conducted by Dr. Eva Hoffman and Dr. James Quinn, from the University of Rhode Island Graduate School of Oceanography, regarding the impacts of petroleum hydrocarbons and heavy metals to the coastal environment via stormwater runoff. Stormwater sampling was performed at four different land use types in the Providence metropolitan area. The results of this work for hydrocarbons in those cities and towns sampled in the Blackstone Region are depicted in Table 711-05(6b). The results regarding heavy metal inputs to the Bay are not yet available. As can be seen from Table 711-05(6b), the industrial land use type contributes the largest percentage (77.56%) of petroleum hydrocarbons to upper Narragansett Bay, followed by the highway (14.04%), residential (4.24%) and commercial (4.15%) land use types ((96)). The large percentage of hydrocarbons from the industrial land use was attributed to the sloppy handling of fuel oil. A greater public participation in the program sponsored by the Department of Environmental Management and the Ocean State Service Station Dealers Association for recycling used crank case oil could help to reduce petroleum hydrocarbon loadings to waterbodies.

Table 711-05(6b)

HYDROCARBON URBAN RUNOFF LOADINGS THAT IMPACT NARRAGANSETT BAY

	Residential*	Commercial	Industrial	Highway	Total
Central Falls	0.31	0.36	6.00	—	6.67
Cumberland	2.36	1.38	26.04	2.39	32.17
Lincoln	1.34	0.87	41.55	9.71	53.47
North Providence	1.45	0.79	5.49	—	7.73
Pawtucket	1.69	2.38	40.53	5.87	50.47
Providence	3.51	4.65	78.17	17.28	100.61
Total	10.66	10.43	194.78	35.25	251.12
Percent	4.24%	4.15%	77.56%	14.04%	100%

* Estimated Annual Hydrocarbon Loadings - Metric Tons/Year

Source: Hoffman et al. 1981. Annual fluxes of petroleum hydrocarbons to the coastal environment via urban runoff. Can J. Fish. Aquat. Sci.

The 208 Plan suggested that urban stormwater runoff could severely limit the

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water quality attainable in certain rivers, even with advanced treatment to remove pollutants from point source discharges. Examples of these rivers within the Blackstone Region are the Providence, Seekonk, and those segments of the Moshassuck and Woonasquatucket Rivers within the City of Providence. It is apparent that additional research is necessary prior to developing definitive alternatives for the mitigation of urban runoff impacts. Current research is assessing the impacts of CSO's and oil runoff on water quality in the Providence metropolitan area. These studies will be helpful in establishing goals and priorities to abate urban runoff impacts in the future.

Even though more research is needed to study urban runoff impacts, the 208 Plan has made some recommendations that can help to mitigate the impacts of urban runoff. The following is a summary of these impacts which were based on the Final Urban Stormwater Report ((9a)).

- Provide adequate treatment of water withdrawn for public water supply to remove metals, toxics, and taste and odors. The Department of Health should continue to monitor for these pollutants and if present removals are not adequate, pilot studies should be conducted to determine process changes, such as treatment by granular activated carbon, that may be required to achieve drinking water standards. If standards cannot be met with process changes, then new sources of supply should be utilized.

- Implement best management practices during construction of buildings and highways to control erosion. A uniform erosion and sediment control ordinance should be adopted by the state.

- Aeration of lakes and rivers should be considered as a possible means of reducing storm runoff-induced dissolved oxygen problems.

- Chemicals, such as fertilizers, pesticides and road salts should be carefully and sparingly applied.

- The federal government should undertake an effort to have lead compounds removed from gasoline and to control other motor vehicle toxicants.

- Illegal discharges and wastewater overflows to sewers should be eliminated. A public education program should be carried out to reduce the disposal of leaves, garden clippings, used crankcase oil, and the like, in stormwater inlets.

- To encourage and provide for proper disposal of waste oil, the state should adopt a used oil recycling act. DEM has initiated a waste oil recycling program. For more information, contact the Division of Water Resources.

- Measures should be adopted which restrict land uses in sensitive areas. These "non-structural" controls would include land use planning (including open space and conservation planning) and restrictive zoning. Considering available technology for abating stormwater pollution, such measures may represent the only means of preventing water quality degradation in some areas. Most of the present urban region in the

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state lies at the downstream ends of rivers and near coastal waters, where some dilution of urban runoff can be provided. As a general policy, future land use planning in Rhode Island should direct growth to existing urban and coastal areas and away from upstream areas.

In order to better asses the impacts from urban runoff and to implement an effective control program, the following should be initiated:

- Delineate the water quality impacts that urban runoff create.

- Develop a stormwater monitoring program to refine the scope of urban runoff impacts.

The initial delineation of the impacts from urban runoff initiated in the 208 Plan should be completed with specific studies in the Blackstone Region. All water supply reservoirs under existing and future (e.g. year 2000) land use conditions should be monitored to assess potential impacts from urban runoff to drinking water supplies utilizing the methods described in the Final Urban Stormwater Report ((9a)).

Impacts to aquatic life from urban runoff should be assessed to determine the nature of the problem for major water bodies in the Blackstone Region. The abatement of stormwater induced combined sewer overflows in Providence, Pawtucket, and Central Falls, that affect shellfishing in the Upper Bay, is currently being addressed by these cities in 201 Facilities Plans. The implementation of the recommendations in these plans will depend upon the availability of funding.

A stormwater monitoring program should be designed and implemented to serve the following two technical functions:

The assumed average concentrations of uban runoff pollutants by land use estimated by the 208 Plan should be revised.

More accurate data regarding areas assumed to be problem areas by the 208 Plan should be obtained.

The methods described in the 208 Plan should be utilized to initiate the development of a stormwater monitoring program.

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05-03 EROSION AND SEDIMENTATION

Erosion and resulting sedimentation will generally occur where vegetation or the ground cover has been removed to expose soil to precipitation. When the ground cover is removed, surface water runoff increases, causing soil to be washed away and discharged into adjacent water bodies causing an increase in turbidity (suspended soil particles) and sedimentation (settled soil particles). Erosion and sedimentation can degrade water quality by the following:

increased turbidity

increased sediment load

increased nutrient load

increased water temperature

change in bottom substrate

Erosion and sedimentation is regarded as the major pollution problem to water quality in terms of volume in the United States, according to the Environmental Protection Agency ((27)). An inventory of erosion and sedimentation sites conducted in the Blackstone Region identified 45 sites covering 449.5 acres as potential problem areas ((28)). The inventory did not include the urban areas within the Blackstone Region, (Providence, Pawtucket, Central Falls, North Providence, and Woonsocket,) since they were inventoried for urban runoff problems.

Table 711-05(7) summarizes potential erosion and sedimentation problem areas within the Blackstone Region. As can be seen from this table, there are 8,099 tons of soil lost via erosion per year with 1,182 tons of sediments entering water bodies within the region annually. The most serious problems identified in the Blackstone Region are nonagricultural, and relate to construction sites, roadside ditches, and landfills. The most serious agricultural problem sites deal with animal waste treatment areas. Communities in the region were inventoried for sites with potential erosion and sedimentation problems with recommendations for the best management practices (BMP's) and estimated costs for BMP's for each site.

05-03-01 City and Town Recommendations

A. Burrillville

There were only 3 sites identified in Burrillville as problem areas that contribute to water pollution. Two of the sites are cornfields totalling 10 acres and the remaining site is a 2,400 foot long roadside ditch. These sites contribute 39 tons of sediment to water each year. Table 711-05(8) gives complete details of each site.

B. Cumberland

Cumberland had seven sites totalling 112 acres identified as potential water pollution sources. These sites have been estimated to cause 798 tons of sediments to degrade water quality each year. Details regarding these sites are given in Table 711-05(9).

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Table 711-05(7)

EROSION AND SEDIMENT INVENTORY — BLACKSTONE REGION

TOWN	AGRICULTURAL AREAS					NON-AGRICULTURAL AREAS					SEDIMENT TOTALS		COST
	CORN LAND ACRES	MARKET GARDEN ACRES	NURSERY LAND ACRES	PIG PAST. ACRES	ANIMAL WASTE ACRES	CONSTRUCTION SITES ACRES	LAND FILLS ACRES	SURFACE MINING ACRES	ROAD BANKS ACRES	ROADSIDE DITCHES FEET	SOIL LOSS IN TONS PER YEAR	TONS SED. ENTERING WATER	ESTIMATED COST TO IMPLEMENT CONTROLS
BURRILLVILLE	10	--	--	--	--	--	--	--	--	2,400	181	39	$ 15,250.00
CUMBERLAND	60	--	--	--	7	6	--	38	--	--	3,398	798	53,100.00
GLOCESTER	65	12	--	--	--	--	21	--	0.1	1,000	758	125	17,475.00
JOHNSTON		9	--	--	--	--		--	--	--	57		225.00
LINCOLN	46	--	--	--	--	--	--	--	--	--	400	60	1,450.00
NORTH SMITHFIELD	7	8	--	--	0.5	--	--	1.25	--	--	55	12	10,625.00
SMITHFIELD	6	5	--	--	4	--	--	75	--	--	336	148	31,275.00
TOTALS	194	34	0	0	11.5	6	21	114.25	0.1	3,400	8,099	1,182	$ 14,765.00

*Only includes the portion of Johnston within the Blackstone Region

NOTE: Estimated cost figures shown here are preliminary estimates only. Detailed surveys and engineering designs for each job would be needed before more accurate cost estimates can be provided.

Source: Rural Runoff Task Erosion and Sedimentation Preliminary and Detailed Evaluation

Table 711-05(8)

EROSION AND SEDIMENT INVENTORY

TOWN BURRILLVILLE

SITE NO.	OWNERSHIP	LOCATION	WATERBODY AFFECTED OR WATERSHED	SEVERITY * OF PROBLEM	LAND USE OR CROP	ACRES	PERCENT SLOPE	SOIL LOSS TONS 1/	SOIL LOSS AV./ACRE	MGT. PRACTICES NEEDED 2/	ESTIMATED COST BMP
1	Town	East Wallum Rd.	Clear River	Severe	Road ditch	0.5	(2400')	81	162.0	Riprap	$ 12,000.00
2	Private	Rt. 102, Mapleville	Chepachet River	Slight	Corn	7.0	4	47	6.7	Cc. Cf.	175.00
3	Private	Ironstone Mine Rd.	Ironstone Reservoir	Moderate	Corn	3.0	8	53	17.7	Cc. Cf. Mt.	75.00
			BURRILLVILLE TOTALS			10.5		181			$ 12,250.00
											3,000.00**
										Total Cost	$15,250.00

* SEVERITY of problem is based on annual soil loss in tons per acre
SLIGHT = less than 10 tons per acre
MODERATE = 10 to 20 tons per acre
SEVERE = more than 20 tons per acre

**Estimated cost of Technical and Administrative Services

Source: Rural Runoff Task Erosion and Sedimentation Preliminary and Detailed Evaluation

1/ Estimated SOIL LOSS in TONS per year using the "UNIVERSAL SOIL LOSS EQUATION" A = R K L S C P

2/ MANAGEMENT PRACTICES NEEDED: Cc = Cover Crops; Cf = Contour farming; Sc = Strip Cropping; Cr = Crop rotations; Mt = Minimum tillage
Dt = Diversion terrace or Cropland terrace; Wc = Waterway Outlet.

Table 711-05(9)

EROSION AND SEDIMENT INVENTORY

TOWN CUMBERLAND

SITE NO.	OWNERSHIP	LOCATION	WATERBODY AFFECTED OR WATERSHED	SEVERITY* OF PROBLEM	LAND USE OR CROP	ACRES	PERCENT SLOPE	SOIL LOSS TONS 1/	SOIL LOSS AV./ACRE	MGT. PRACTICES NEEDED 2/	ESTIMATED COST BMP
1	Private	Manville	Blackstone River	Severe	Sand & gravel	30	20	2,417	80.5	Diversion(1000') Outlet (500') Sediment basin	$ 2,500.00 1,250.00 2,000.00
2	Private	Cumberland Hill	Sneech Pond Brook	Severe	Construction	6	4	240	40.0	Diversion (600') Sediment basin	1,500.00 2,000.00
3	Private	Abbott Run Valley Rd.	Rawson Pond	Slight	Corn	10	4	65	6.5	Cc. Cf. Cr.	250.00
4	Private	Off Diamond Hill Rd.	Millers River	Moderate	Corn	50	4	518	10.4	Cc. Cf. Cr. Mt.	1,250.00
5	Private	Curran Rd.	Robin Hollow Pond	Moderate	Feed Lot	2				Animal waste Mgt. System	10,000.00
6	Private	West Wrentham Rd.	Bungay Swamp	Moderate	Barn yard	5				Animal Waste Mgt. System	18,000.00
7	Private	Curran Road	Robin Hollow Brook	Moderate	Gravel pit	8	8	158	19.7	Diversion (900') Sediment basin	2,250.00 2,000.00
			CUMBERLAND TOTALS			111		3,398			$ 43,000.00 10,000.00
										Total Cost	$53,000.00**

*SEVERITY of problem is based on annual soil loss in tons per acre.
SLIGHT = less than 10 tons per acre
MODERATE = 10 to 20 tons per acre
SEVERE = 20 or more tons per acre

**Estimated cost of Technical and Administrative Services

Source: Rural Runoff Task Erosion and Sedimentation Preliminary and Detailed Evaluation

1/ Estimated SOIL LOSS in TONS per year using the "UNIVERSAL SOIL LOSS EQUATION" A = R K L S C P

2/ MANAGEMENT PRACTICES NEEDED: Cc = Cover Crops; Cf = Contour farming; Sc = Strip Cropping; Cr = Crop rotations; Mt = Minimum tillage
Dt = Diversion terrace or Cropland terrace; Wo = Waterway Outlet.

The 208 erosion and sedimentation task identified 53 high priority watersheds within the state with agricultural related erosion and sedimentation problems. The priority ranking of these watershed areas was based primarily on the amount of sediment delivered to adjacent water bodies and the use of the receiving water (e.g. water supply, recreation, etc.). Cumberland has two sites within the top ten priority watershed areas in the state. The combined impacts from sites 5 and 7, from Table 711-05(9), to Robin Hollow Brook watershed were given a priority ranking of 3 due to the impact from these sites to a drinking water supply source for the City of Pawtucket. The other site, Bungay Swamp, has a priority ranking of 10 ((28)). This site has an animal waste management problem with a large herd located in a restricted area close to the water.

C. Glocester

There were seven sites with a total of 92 acres identified as sources of pollution to the town's watercourses. Approximately 125 tons of sediments erode into water bodies in Glocester annually. Detailed information regarding these sites is given in Table 711-05(10). Site 5 (Peep Toad Brook) and sites 2 and 3 (Chepachet River) have priority rankings of 43 and 44 respectively ((28)).

D. Johnston

There were ten sites identified in Johnston. However, only one of these sites is located within the Blackstone Region. The other nine sites are within the Pawtuxet Region since Johnston is divided into two regions. The site delineated in Johnston is a privately-owned 9 acre market garden located on Greenville Avenue and has a slight impact on the Woonasquatucket River. This site has a 4 percent slope and loses 57 tons of soil per year. It was estimated that it would cost approximately 225 dollars to implement recommended management practices to control erosion such as cover crops and contour farming ((28)).

E. Lincoln

Lincoln only had 2 problem sites identified. Both sites are part of a single agricultural operation with 46 acres used for growing corn. It was estimated that 60 tons per year are eroded from the rolling topography of these sites ((28)). Additional information regarding these sites is given in Table 711-05(11).

F. North Smithfield

Only four sites totalling 16.75 acres were identified as problem areas having the potential to pollute the water courses in North Smithfield. It was estimated that these sites contribute approximately 12 tons of sediment per year that degrades water quality ((28)). Table 711-05(12) provides more detailed information regarding these sites. Site 2 (Cherry Brook) has a statewide priority ranking of 11 due to an animal waste problem.

G. Smithfield

Four problem sites covering 90 acres were identified as potential pollution sources to the town's waters. Approximately 148 tons of sediment per year are eroded into water bodies in Smithfield. The complete details for each site are given in Table 711-05-(13).)

Table 711-05(10)

EROSION AND SEDIMENT INVENTORY

TOWN GLOCESTER

SITE NO.	OWNERSHIP	LOCATION	WATERBODY AFFECTED OR WATERSHED	SEVERITY * OF PROBLEM	LAND USE OR CROP	ACRES	PERCENT SLOPE	SOIL LOSS TONS 1 /	SOIL LOSS AV./ACRE	MGT. PRACTICES NEEDED 2 /	ESTIMATED COST BMP
1	State	Sheldon Rd.	Shady Oak Brook	Severe	Roadbank	0.1	30	10	100.0	Critical Area Treatment	1,000.00
2	Private	Victory Highway	Chepachet River	Moderate	Corn	11.	4	114	10.4	Cc. Cf. Mt.	275.00
3	Private	Snake Hill Rd.	Chepachet River	Slight	Corn	22	2	117	5.3	Cc. Cf. Cr.	550.00
4	Town	Paris Irons Rd.	Mosquitohawk Brook	Severe	Road ditch	0.1	(1,000')	25	250.0	Riprap	5,000.00
5	Private	Tucker Road	Peep Toad Brook	Moderate	Corn	26.	7	289	11.1	Cc. Cf. Mt.	650.00
6	Private	Whites Hill Rd.	Shady Oak Brook	Slight	Mkt. Garden	9	3	27	3.0	Cc. Cf.	225.00
6	Private	Whites Hill Rd.	Shady Oak Brook	Slight	Corn	3	2	10	3.3	Cc. Cf.	75.00
7	Private	Tarkiln Road	Nine Foot Brook	Slight	Land Fill	21	3	160	7.6	Ground Cover Sediment basin	1,050.00 5,000.00
	Land adequately treated - all private				Corn	3	1	3	1.0	Cc.	75.00
	" " " " "				Mkt. Garden	3	1	3	1.0	Cc.	75.00
				GLOCESTER	TOTALS	98.2			758		$ 13,975.00
											3,500.00
										Total Cost	$17,475.00

* SEVERITY of problem is based on annual soil loss in tons per acre.
SLIGHT = less than 10 tons per acre
MODERATE = 10 to 20 tons per acre
SEVERE = more than 20 tons/acre

** Estimated cost of technical and administrative services

Source: Rural Runoff Task Erosion and Sedimentation Preliminary and Detailed Evaluation

1 / Estimated SOIL LOSS in TONS per year using the "UNIVERSAL SOIL LOSS EQUATION" A = R K L S C P

2 / MANAGEMENT PRACTICES NEEDED: Cc = Cover Crops; Cf = Contour farming; Sc = Strip Cropping; Cr = Crop rotations; Mt = Minimum tillage
Dt = Diversion terrace or Cropland terrace; Wc = Waterway Outlet.

Table 711-05(11)

EROSION AND SEDIMENT INVENTORY

TOWN LINCOLN

SITE NO.	OWNERSHIP	LOCATION	WATERBODY AFFECTED OR WATERSHED	SEVERITY * OF PROBLEM	LAND USE OR CROP	ACRES	PERCENT SLOPE	SOIL LOSS TONS 1/	SOIL LOSS AV./ACRE	MGT. PRACTICES NEEDED 2/	ESTIMATED COST BMP
1	Private	Dexter Rock Road	Blackstone River	Moderate	Corn	11	6	118	10.7	Cc. Cf. Mt.	$ 275.00
2	Private	Breakneck Hill Rd.	Moshassuck River	Slight	Corn	35	5	282	8.0	Cc. Cf. Mt.	875.00
				LINCOLN TOTALS		46		400			$ 1,150.00
											300.00**
											1,450.00

*SEVERITY of problem is based on soil loss in tons per acre annually

SLIGHT = less than 10 tons per acre.
MODERATE = 10 to 20 tons per acre.
SEVERE = more than 20 tons per acre.

** Estimated cost of technical and administrative services

Source: Rural Runoff Task Erosion and Sedimentation Preliminary and Detailed Evaluation

1/ Estimated SOIL LOSS in TONS per year using the "UNIVERSAL SOIL LOSS EQUATION" A = R K L S C P

2/ MANAGEMENT PRACTICES NEEDED: Cc = Cover Crops; Cf = Contour farming; Sc = Strip Cropping; Cr = Crop rotations; Mt = Minimum tillage
Dt = Diversion terrace or Cropland terrace; Wo = Waterway Outlet.

Table 711-05(12)

EROSION AND SEDIMENT INVENTORY

TOWN NORTH SMITHFIELD

SITE NO.	OWNERSHIP	LOCATION	WATERBODY AFFECTED OR WATERSHED	SEVERITY* OF PROBLEM	LAND USE OR CROP	ACRES	PERCENT SLOPE	SOIL LOSS TONS 1/	SOIL LOSS AV./ACRE	MGT. PRACTICES NEEDED 2/	ESTIMATED COST BMP
1	Private	Slatersville	Slatersville Reservoir	Moderate	Sand bank	1.25	20	15	12.0	Buffer Strip (1250 Red Pine)	$ 250.00
2	Private	Woonsocket Hill Rd.	Cherry Brook	Moderate	Barn yard	0.5	3	5	10.0	Animal waste Mgt. System	8,000.00
3	Private	Primrose	Woonasquatucket River	Slight	Corn	7.0	2	23	3.3	Cc. Cf.	175.00
4	Private	Primrose	Woonasquatucket River	Slight	Mkt. Garden	8.0	2	12	1.5	Cc.	200.00
				NORTH SMITHFIELD TOTALS		16.75		55			$ 8,625.00
										Total Cost	2,000.00**
											$10,625.00

* SEVERITY of problem is based on soil loss in tons per acre annually.

SLIGHT = less than 10 tons per acre.
MODERATE = 10 to 20 tons per acre.
SEVERE = more than 30 tons per acre.

** Estimated cost of technical and administrative services

Source: Rural Runoff Task Erosion and Sedimentation Preliminary and Detailed Evaluation

1/ Estimated SOIL LOSS in TONS per year using the "UNIVERSAL SOIL LOSS EQUATION" A = R K L S C P

2/ MANAGEMENT PRACTICES NEEDED: Cc = Cover Crops; Cf = Contour farming; Sc = Strip Cropping; Cr = Crop rotations; Mt = Minimum tillage
Dt = Diversion terrace or Cropland terrace; Wo = Waterway Outlet.

Table 711-05(13)

EROSION AND SEDIMENT INVENTORY

TOWN SMITHFIELD

SITE NO.	OWNERSHIP	LOCATION	WATERBODY AFFECTED OR WATERSHED	SEVERITY * OF PROBLEM	LAND USE OR CROP	ACRES	PERCENT SLOPE	SOIL LOSS TONS 1/	SOIL LOSS AV./ACRE	MGT. PRACTICES NEEDED 2/	ESTIMATED COST BMP
1	Private	Spragueville	Woonasquatucket River	Moderate	Sand bank	75	varies	265	3.5	Diversions(900') Outlets (2000') Sediment basins	2,250.00 5,000.00 5,000.00
2	Private	Swan Road	Lower Sprague Reservoir	Moderate	Mkt. Garden	5	4	50	10.0	Cc. Cf.	125.00
2	Private	Swan Road	Lower Sprague Reserv.	Slight	Corn	6	2	15	2.5	Cc. Cf.	150.00
3	Private	Brayton Road	Woonasquatucket River	Slight	Barn yard	3	8	5	1.6	Animal waste Mgt. System	7,500.00
4	Private	Limerock Road	Woonasquatucket River	Slight	Barn yard	1	3	1	1.0	Animal waste Mgt. System	5,000.00
				SMITHFIELD	TOTALS	90		336			$25,025.00 $ 2,300.00**

* SEVERITY of problem is based on soil loss in tons per acre annually.

SLIGHT = less than 10 tons per acre.
MODERATE = 10 to 20 tons per acre.
SEVERE = more than 20 tons per acre.

** Estimated cost of technical and administrative services

Source: Rural Runoff Task Erosion and Sedimentation Preliminary and Detailed Evaluation

1/ Estimated SOIL LOSS in TONS per year using the "UNIVERSAL SOIL LOSS EQUATION" A = R K L S C P

2/ MANAGEMENT PRACTICES NEEDED: Cc = Cover Crops; Cf = Contour farming; Sc = Strip Cropping; Cr = Crop rotations; Mt = Minimum tillage
Dt = Diversion terrace or Cropland terrace; Wo = Waterway Outlet.

05-03-02 Best Management Practices for Erosion and Sedimentation Control

Best management practices (BMP's) are the most effective practicable means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals (40 CFR Part 130). The BMP's recommended for Rhode Island will control erosion and sedimentation accompanying pollution problems. These practices will also reduce soil losses within tolerable limits of 3 tons per acre annually ((28)). Table 711-05(14) lists BMP's recommended for control of erosion, sedimentation, and agricultural related pollution problems identified in the erosion and sedimentation inventory ((27)). For a detailed description of each BMP refer to the 208 publication entitled: Rural Runoff Task Erosion and Sedimentation, Preliminary and Detailed Evaluation. Additional mitigative measures for the control of erosion and sedimentation are given in the following publications:

1. Technical specifications for determining erosion potential and applying particular vegetative or structural control measures are provided in Rhode Island: Erosion and Sediment Control Handbook, U.S. Soil Conservation Service, West Warwick, R.I., 1980.

2. Recommendations for Erosion and Sediment Control During Land Use Change, the Southern New England Chapter, Soil Conservation Society of America, January, 1978 (available from the Rhode Island Statewide Planning Program, 265 Melrose Street, Providence, R.I. 02907);

3. Nonpoint Source Control Guidance: Construction Activities, U.S. Environmental Protection Agency, Office of Water Planning & Standards, Washington, D.C. 20460, December, 1976.

05-03-03 Legislation to Control Erosion and Sedimentation

There is no specific state legislation to control soil erosion and sedimentation or to authorize cities and towns to deal with this problem. The existing state legislation is inadequate to implement the best management practices previously cited. The 208 Water Quality Management Plan for Rhode Island has recommended that legislation be adopted that would establish minimum standards for controlling erosion and sedimentation. Legislation was drafted that would have implemented the recommended BMP's. This legislation was submitted to the Rhode Island General Assembly in 1981, but was not acted upon.

Table 711-05(14)

BEST MANAGEMENT PRACTICES COST SUMMARY

	Practice	Description	unit	Estimated* Cost
1.	Conservation Cropping System	Combination of crop rotation and conservation practices designed to limit soil loss	Acre	$ --
2.	Contour Farming	Conducting farming operations on sloping cultivated land in such a way that plowing, land preparation, planting, and cultivation are done on the contour	Acre	--
3.	Cover and Green Manure Crops	Using close-growing grasses, legumes, or small grains primarily for summer or winter protection and/or soil improvement	Acre	25.00
4.	Critical Area Planting (Grass)	Stabilizing sediment-producing and severely eroded areas by establishing permanent grass and legume cover or by sodding	Acre	2,100.00
5.	Critical Area Planting (Sodding)		Acre	8,000.00
6.	Diversion	Constructing a channel across a slope with a supporting ridge on the lower side. The channel must have capacity to carry the peak runoff from the contributing watershed for a 10-year storm	Lin.Ft.	2.50
7.	Erosion Check (Baled Hay)	Temporary system of anchored bales of hay or straw strategically located to check erosion	Lin.Ft.	1.50
8.	Erosion Check (Log and Hay)	Temporary structure built of baled hay or straw, native logs and stone and constructed across a natural or manmade watercourse	Lin.Ft.	1.75
9.	Field Border (Filter Strip)	A natural, shaped or graded area established in perennial vegetation to provide a filtering medium for contaminated runoff.	Acre	200.00
10.	Waterway or Outlet (Grassed)	A natural or constructed waterway or outlet shaped or	Lin.Ft.	2.50

Table 711-05(14) Continued

10.	Continued	graded and established in suitable vegetation as needed for the safe disposal of runoff from a field, diversion, terrace, or other structure.		
	(Stone Lined)	A waterway or outlet having an erosion-resistant lining of concrete, stone, or other permanent material	Lin.Ft.	4.00
11.	Minimum Tillage	Limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage	Acre	--
12.	Sediment Basin	Construction of a barrier or dam across a drainageway or excavating a basin, or a combination of both, to trap and store sediment from erodible areas in order to protect properties and stream channels below the installation from excessive siltation. This practice applies primarily to areas where land grading operations are planned or are underway. It is used as a temporary measure until areas above the installations are permanently protected against erosion by vegetative or mechanical means.	Each	Varies
13.	Streambank Protection	Stabilizing and protecting banks of streams or excavated channels against scour and erosion by vegetative or structural means.	Sq.Yd.	10.00
14.	Contour Stripcropping	Growing crops in a systematic arrangement of strips or bands on the contour to reduce water erosion. The crops are arranged so that a strip of grass or close-growing crop is alternated with a strip of clean-tilled crop or fallow.	Acre	--
15.	Field Stripcropping	Growing crops in a systematic arrangement of strips or bands across the general slope (but not on the contour) to reduce water erosion. The crops are arranged so that a strip of grass or close-growing crop is alternated with a clean-tilled crop or fallow.	Acre	--
16.	Terrace	An earth embankment, channel, or a combination ridge and channel constructed across the slope.	Lin.Ft.	2.50

Table 711-05(14) Continued

17.	Waste Management System	Planned system to nanage liquid and solid waste, including runoff from concentrated waste areas, with ultimate disposal in a manner which does not degrade air, soil, or water resources.	Each	Varies
18.	Waste Storage Structure	Fabricated structure for temporary storage of animal or other agricultural waste.	Each	Varies
19.	Waste Treatment Lagoon	Impoundment made by excavation or earthfill for biological treatment of animal or other agricultural waste.	Each	Varies

* Costs are expressed in 1979 dollars

Source: <u>208 Water Quality Plan for Rhode Island</u>

05-04 ROAD SALT

The use of road salt (both sodium chloride and calcium chloride) to accelerate the melting of ice and snow has become more prevalent since the early 1960's. From 1972 to 1978, road salt useage by the Rhode Island Department of Transportation averaged 50,587 tons annually for snow removal on state and interstate roads ((8)). The use and storage of road salt can have adverse impacts to surface and groundwater quality. In addition, road salt can cause a decline in roadside vegetation, reduce soil permeability, enhance corrosion of automobiles, damage highways, and underground utilities such as water mains, electric lines, and telephone cables ((13)).

Road salt contamination of surface and groundwater can result from two sources: road salt storage and application to roads. Road salt storage has been responsible for some well contamination in Rhode Island; however, most salt contamination is from application to roads ((33)).

Groundwater, due to its relatively slow flushing rate, is more susceptible to high sodium and chloride levels from the use of road salt than surface waters. Once contaminated, a groundwater aquifer generally requires many years to cleanse itself ((13)).

A study regarding salt storage areas in Rhode Island determined that the most severe impacts from salt storage were on ground water, particularly domestic wells. However, there were no significant impacts to major groundwater aquifers in the Blackstone Region ((33)). Although this study found evidence that road salt storage sites owned by the Rhode Island Department of Transportation in the Blackstone Region are degrading groundwater in their immediate areas.

Road salt contamination is not considered a significant problem to surface water in Rhode Island. Rivers and streams are not adversely affected by road salt because the rate of flow is large relative to the amount of salt entering the water. In small streams salt levels declined rapidly from the source due to dilution and dispersion ((12b)).

There is not much information regarding the impacts of road salt on water quality in Rhode Island. However, Table 711-05-(15) lists the road salt storage areas in the Blackstone Region with their corresponding impacts to groundwater and surface water bodies. Figure 711-05(4) identifies the location of each site. It has been estimated that 3 to 4 percent of stockpiled road salts are lost to the environment through runoff or leaching each year ((8)).

As can be seen in Table 711-05(15) most towns in the Blackstone Region, in addition to the Rhode Island Department of Transportation, store their road salt in open stockpiles. The 208 plan and a report prepared by Kelley and Urish from the University of Rhode Island recommended that the impacts from open stockpiles of road salt be mitigated by enclosing the stockpiles in a closed storage structure. In addition, curbed paved areas should be utilized for storage and handling of salt. Curbed paved areas would make it easier to recover or divert salt runoff and recover spillage. The 208 plan has recommended that Burrillville (Union Avenue Site) and Cumberland (Kent Street site) by given a high priority for enclosing their salt stock piles. The Cumberland site is located in a water supply watershed and Burrillville in a groundwater reservoir recharge area. Table 711-05(16) describes

Figure 7II-05(4)

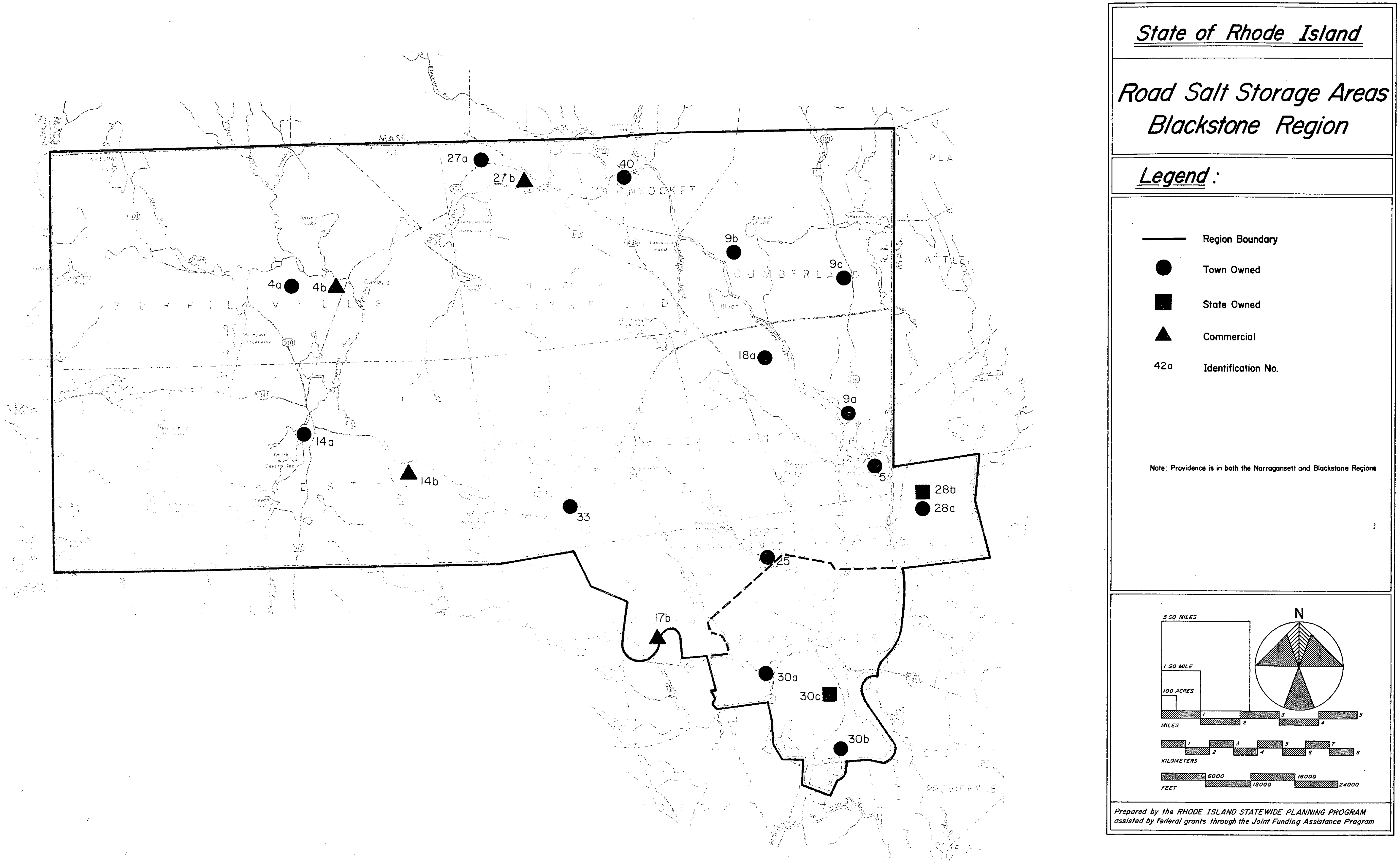


Table 711-05 (15)

SALT STORAGE IN THE BLACKSTONE REGION

City/Town	Map No.	Sand/Salt Storage Location	Ownership	Type of Storage	Location Relative to Ground Aquifers	Water Quality Impacts
Burrillville	4a	Union Ave. Public Works Garage	Town	INA*	In recharge area	Potential - Groundwater
	4b	Whipple St. storage area	State	Open**		
Central Falls	5	River St. Public Works Garage	City	INA	In recharge area	
Glocester	14a	Chestnut Hill Rd., Highway Garage	Town	Closed salt bin Open S/S pile	In recharge area	
	14b	Putnam Pike, Glocester Garage	State	Open**		Potential - Groundwater Definite - Surface water
Johnston	17b	Cherry Hill Garage	State	Open**		Definite - Surface water
Lincoln	18a	Old River Rd. & Washington Highway Garage	Town & State	Open**		Potential - Groundwater
North Providence	25	2 Mafalda St., Garage	Town			
North Smithfield	27a	Rte. 146A Slatersville	Town			
	27b	Carpenter's Corner, Rte. 7 & 5	State	Open**		Definite - Surface water Definite - Groundwater
Pawtucket	28a	Armastice Rd. Storage Area	City	Closed shed	In recharge area	
	28b	E. Pawtucket Indus. Hwy., Norton Salt Co.	Commercial			
Providence	30a	Olneyville Sq. storage area	City	Open	In recharge area	
	30b	Ernest St. Municipal Garage	City	Closed	In recharge area	
	30c	Allens Ave. near I-95	Commercial	Open		

* INA Information Not Available Towns did not specify the type of storage provided but most of these are probably open.

** All State Deptartment of Transportation stockpiles are covered with 6 inches of sand

From: 208 Water Quality Management Plan for Rhode Island

Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM
assisted by federal grants through the Joint Funding Assistance Program

Table 711-05(16)

EVALUATION OF ROAD SALT STORAGE ALTERNATIVES

Alternative	Advantages	Disadvantages
Permanent closed structure on impermeable surface	Complete isolation from ground and surface waters	High cost
	Increased efficiency in loading and unloading	
	Reduces caking problems and prevents salt loss	
Pile on impermeable surface with curb, covered with canvas (or similar material)	Effectively restricts runoff and leaching	Canvas must be replaced each year
	Lower initial cost than permanent structure	Pile must be partially uncovered to load up during storm
Sand covered salt pile on impermeable surface	Reduces leaching somewhat	Dissolved salts in runoff may cause contamination problem
		Moisture causes caking

Source: 208 Water Quality Management Plan for Rhode Island

alternatives for salt storage. For additional details regarding salt storage structures, see the 208 Water Quality Plan for Rhode Island.

Road salt contamination of water bodies from road application is not as easily mitigated as storage stockpiles. The reduction in road salt use will require changes in the attitudes and expectations from both snow plow operators and motorists. Advantages and disadvantages for road salt utilization are given in Table 711-05(17). The following recommendations taken from the 208 plan should be implemented in the Blackstone Region to reduce impacts from salt application to roads.

All town highway departments should act to minimize their use of road salts in winter road maintenance. For general use, the proportion of salt in the sand/salt mix should be no more than one part salt to six parts of sand (6:1 sand to salt mixture). The towns of Blackstone, and North Smithfield already use an even smaller portion of salt (9:1 or 10:1 sand to salt ratio), except for heavier applications in the case of particularly icy areas or severe storm conditions. Similarly, other municipalities should attempt to reduce further the proportion of salt in the sand/salt mixture applied to town roads, when and wherever feasible.

Environmentally sensitive areas associated with present or potential ground or surface water supplies should be considered water resource protection areas, and special restrictions should be applied to the use of road salts in such areas. Sand should be used exclusively as much as possible. If salt must be used, a 10:1 sand to salt ratio with a salt mixture of 3 parts sodium chloride to one part calcium chloride is recommended. Such a road salt "premix" has been used for several years in critical water supply areas in Connecticut to stem the rise in sodium concentrations in public water supply reservoirs.

The Rhode Island DOT should gradually reduce the proportion of salt in the sand/salt mixture applied to state-maintained roads, aiming for a 6:1 sand/salt mixture for general use. Efforts undertaken thus far to reduce road salt use by the department are commendable, but further reduction is still desirable from an environmental standpoint. DOT could increase the sand/salt mixture to 6:1 for one state road on a trial basis, to see how well this application rate works. Within water resource protection areas, the amount of sodium chloride applied to state roads should be reduced as recommended for town roads, unless the highways have drainage systems designed to divert road salt runoff from these sensitive areas.

In addition, the feasibility of utilizing calcium magnesium acetate (CMA) as a substitute to sodium chloride as a road deicer should be investigated. Studies have indicated that CMA has potential to be an effective deicing alternative to sodium chloride. CMA could be beneficial to most soils, unharmful to drinking water supplies and significantly less corrosive than sodium chloride ((38)).

Currently, the Department of Transportation utilizes a sand-salt ratio of 3 to 1 with greater proportions of salt used for severe storms. The Department of Transportation has stated that roads cannot be adequately deiced utilizing a sand-salt ratio of 6 to 1. However, they are currently investigating the feasibility of utilizing calcium magnesium acetate (CMA) which is a road salt substitute that does not adversely impact groundwater. Phase 1 of the DOT investigation determined that the use of CMA to deice roads in Rhode Island is feasible. Phase II of this study will investigate means of obtaining an economical source of this alternative deicing agent. It should be noted that CMA is more expensive than road salt.

(revised 6/30/82)

Table 711-05(17)

EVALUATION MATRIX FOR ROAD SALT APPLICATION ALTERNATIVES

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
Eliminate road salt use	(a) Protects the environment (b) Elminates salt damages to man-made goods (especially automobile corrosion) (c) Reduces materials costs (d) Provides traction on packed snow and ice	(a) Increased plowing frequency (apply only sand)and labor required for effective snow clearance (b) Decreased motorist convenience need for public education to change expectations (c) Sand must be reapplied frequently to prevent hazardous conditions on steep curves, sharp curves or major intersections (d) Increased sand sweeping cost in the spring
Use sand/salt mix on steep slopes, sharp curves or major intersections. Use only sand everywhere else.	(f) Provides traction and clears ice from hazardous areas (g) Reduces damages to man-made goods (h) (a), (c) and (e) above	(e) Supervisory problem in ensuring salt is used only where necessary (f) (a), (b) and (d) above
Reduce proportion of salt	(i) Reduces road salt usage and associated environmental damages (j) Provides traction and clear ice (k) No change in existing maintenance (l) Reduces materials costs, somewhat	(g) Salt-related deterioration of man-made goods may not be significantly reduced (h) Damages to matural resources may still occur (only more slowly)
Reduce or eliminate salt use in environmentally sensitive areas (e.g. public water supply watersheds, ground-water reservoir recharge areas)	(m) Provides some degree of protection of water resources	(i) No reduction in the likelihood of private well contamination outside of sensitive areas (j) Damages to other natural resources and man-made goods remain high (k) Supervisory problem in ensuring sensitive areas receive special treatment

Table 711-05(17) continued

No policy change	(n) No need to change motorist practices	(l) Excessive costs for damages expectations or maintenanceto natural resources and man-made goods
Design highways with drainage runoff to large rivers	(o) Diverts salt runoff to water bodies (p) Mitigates environmental impacts of road salts without requiring change	(m) High capital cost systems to systems to divert road saltwhere it will have little impact(n)Does not reduce damages to man-made goods (o) Increases surface water pol- in winter maintenance policieslution from other highway contaminants (e.g. solids, oil and grease, nutrients, coliforms)

Source: 208 Water Quality Management Plan for Rhode Island

05-05 INDIVIDUAL SUBSURFACE DISPOSAL SYSTEMS

In the Blackstone Region, approximately 20 percent of the population depends upon septic tanks or cesspools to dispose of household wastes. The components and layout of a typical septic tank and leaching field are shown in Figure 711-05(5). Although there is a potential for pollution of ground and surface waters by leachate from these systems, they are generally an inexpensive and efficient means of sewage disposal.

The typical septic system is composed of: septic tank, baffles, distribution box, and leach field, which is made of distribution lines surrounded by crushed stone. The leach field can be near the septic tank or some distance away.

Wastewater, or sewage, enters the septic tank and strikes a baffle, which prevents mixing of the contents and allows floating solids (such as grease) to separate. In cross-section, three layers accumulate or form in the septic tank: 1) scum, 2) liquid, and 3) sludge. The heavier solids in wastewater settle out to form the sludge. Micro-organisms, such as bacteria, breakdown the wastewater into simpler components and cause further settling of solids. This process takes place with little or no oxygen. The excess liquid, called "effluent", overflows the septic tank and travels to the distribution box. Distribution lines, or pipes, drain effluent from the distribution box into the leaching field. Effluent trickles down through perforations in the pipe, through the crushed stone, and into the soil. All distribution lines leave the box at the same level to insure that each line receives equal amounts of effluent. In Rhode Island, the leach field bottom must be a minimum of 3 feet above the seasonal high water table. This separation is thought to allow sufficient unsaturated (dry) soil to absorb and purify the effluent before it reaches the groundwater. Also, the leach field bottom must be 5 feet above bedrock or impermeable substratum (such as a clay layer).

The soil under the leach field must have enough absorption capacity to accept the daily volume of effluent without backing up or breaking out at the surface. Absorption capacity can be approximated by percolation tests (how rapidly water soaks into the soil). The percolation rate, combined with the number of bedrooms in the home (estimate of maximum occupancy and loading), will determine the size (in square feet) of the leach field. Soils vary considerably in absorption capacity and each lot may have several soil types. It is important to know the soil type and characteristics exactly where the leach field is to be built.

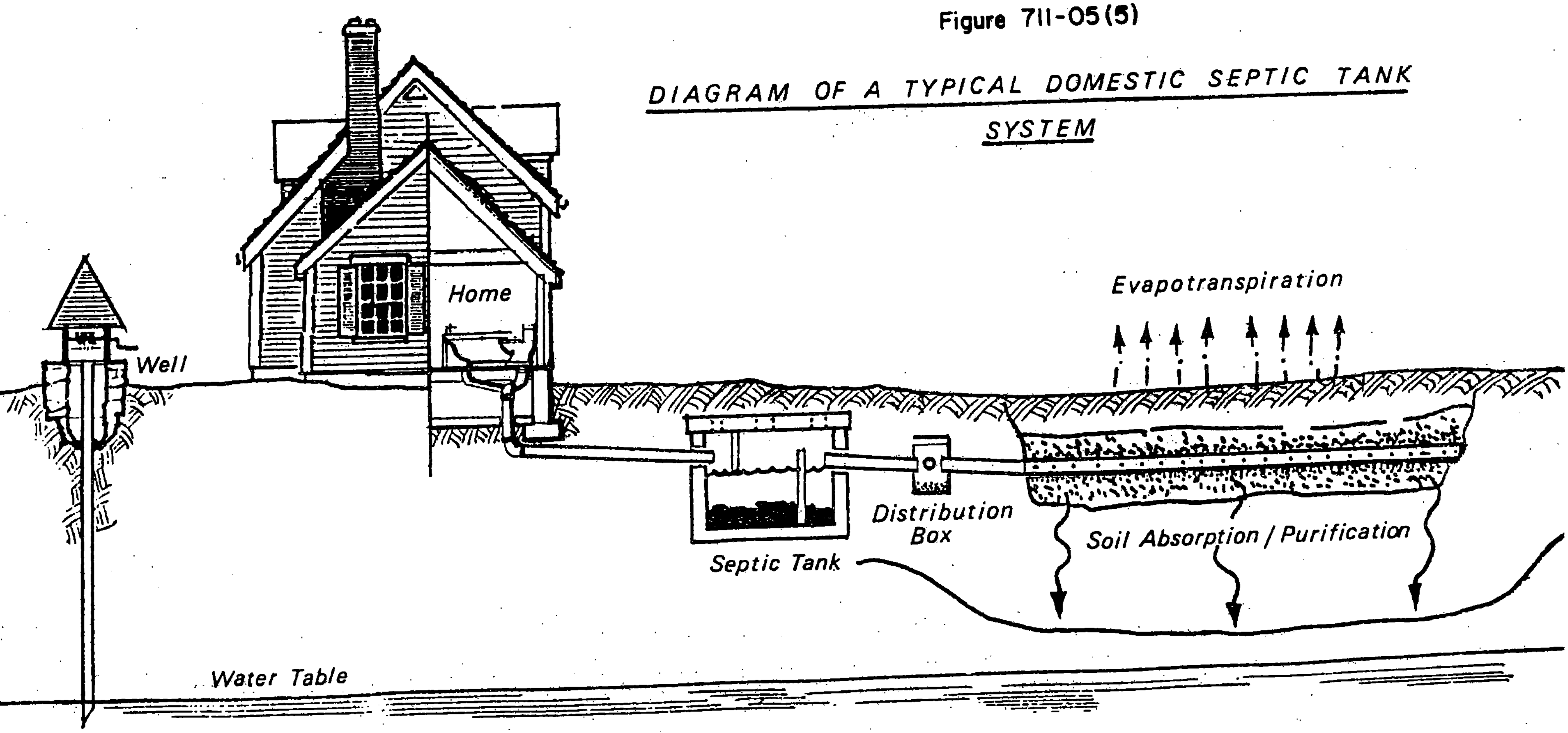
Size (capacity) of the septic tank is determined by the number of bedrooms in the home, figuring average occupancy and water use. For example, a four-bedroom home requires a minimum of a 1,000 gallon capacity septic tank.

The biggest drawback to individual subsurface disposal systems (ISDS) is that they sometimes fail to operate properly, creating a nuisance at best, and a health hazard at worst. There are several easily recognizable symptoms of septic system failure: the effluent may back up into the household plumbing fixtures; the leaching field may not absorb the sewage, causing the effluent to break through the ground and accumulate on the surface or there may be noxious odors.

Four factors affect the operation and expected life of subsurface disposal systems: location, design, installation, and maintenance. Each of these factors is discussed in more detail in the 208 Plan.

Figure 711-05(5)

DIAGRAM OF A TYPICAL DOMESTIC SEPTIC TANK SYSTEM



Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM assisted by federal grants through the Joint Funding Assistance Program

05-05-01 ISDS Effectiveness

Because soil is a good purifying medium, individual subsurface disposal systems can efficiently remove organic matter, pathogenic organisms, viruses, and most chemicals from sewage. The effectiveness of individual sewage disposal systems in removing pathogenic organisms, nitrogen, and phosphorus is discussed below.

A. Bacteria and Virus Removal

One of the most important functions of a subsurface disposal system is the destruction of disease-causing organisms. If subsurface disposal systems are properly designed and operated, they will remove efficiently both bacteria and viruses from sewage. Most of the bacteria and viruses are removed in the clogged zone which is at the leach field infiltrative surface. Because the clogged zone is the principal mechanism for these removals, bacteria and virus removals will be fairly uniform for various soil types; that is, systems installed in sandy soils should remove pathogenic organisms just as efficiently as those in loam, once the clogging layer has formed.

B. Nitrogen Removal

Nitrogen in the nitrate form is the pollutant of greatest concern in a properly operating septic system, because it is not taken up by the soil, and because it is readily soluble in groundwater. Nitrates in drinking water can be toxic to infants if present in high concentrations; high concentrations of nitrogen in marine waters can cause excessive plant and algae growth. At present, a generally acceptable limit for nitrogen in marine waters is 0.4 ppm.

EPA has established a maximum nitrate-nitrogen standard of 10 ppm for domestic water supplies, a standard which has been exceeded at various times in some groundwater aquifers in the Blackstone Region. Wells which have had high nitrate-nitrogen concentrations (greater than 10 ppm) since 1970 and the land uses in the vicinity of the wells are listed in Table 711-05(18). Based on this limited information, it appears that high nitrate concentrations in Rhode Island groundwater are associated with agricultural and residential land use.

C. Phosphorus Removal

Phosphorus is usually the major nutrient contributing to eutrophication of fresh waters. In most properly operating subsurface disposal systems, phosphorus will be removed by the soil within a short distance of the leaching field and will not be transported to the groundwater or nearby surface waters. Phosphorus may get into groundwater, however, where there is a high water table or coarse sand and gravel.

In summary, subsurface disposal systems can be effective in removing most pollutants from sewage within a relatively short distance of the leaching field (2-10 feet). Nitrates, however, are not readily removed from the effluent and can travel great distances to contaminate ground and surface waters.

D. Minimum Lot Sizes for Individual Subsurface Disposal Systems

There are constraints that determine minimum acceptable lot size for on-site sewage disposal. The primary concern is protection of drinking water supplies.

Table 711-05(18)

GROUNDWATER NITRATE CONCENTRATIONS IN THE BLACKSTONE REGION

Well Location	Date	Nitrate-Nitrogen (ppm)	1970 Land Use*	1975 Land Use*
Cumberland at New Pond	5-65	31.0	--	--
	9-72	13.0	RM	RM
Cumberland at Happy Hollow Pond	7-64	6.6	--	--
	2-71	16.0	M	M
~~Cumberland at Robin Hollow Pond~~	~~2-66~~	~~18.0~~	~~--~~	~~--~~
	~~9-71~~	~~4.4~~	~~W, A, RM~~	~~W, A, RM~~
Cumberland at Robin Hollow Pond	7-66	13.0	--	--
	9-71	6.6	W, A, RM	W, A, RM
Cumberland at Robin Hollow Pond	4-66	13.0	--	--
	9-71	4.4	I	O
Lincoln west of Central Falls	12-49	3.1	--	--
	1-73	16.0	M	M
Lincoln near Scott Pond	8-70	11.0	RM	RMH
	9-72	8.2	RM	RMH
	11-72	3.5	RM	RMH

* A - Agricultural
O - Open Land
W - Woodlands
RL - Residential - low density
RM - Residential - medium density
RMH - Residential - medium high density
I - Institutional
C - Commercial
M - Manufacturing

Source: 208 Water Quality Management Plan for Rhode Island

DEM regulations require that the leaching field be at least 100 feet from any well, to ensure that the well does not become contaminated. For lots which have both on-site sewage disposal and water supply, 100 feet must be maintained between the well and leaching field.

If public water is not available, DEM regulations also require an alternate site on the lot for a second leaching field at least 100 feet from any well. In addition, DEM regulations require a minimum setback from property lines and structures on the property.

If public water is available, there is no requirement for an alternate site for a leaching field or setback from the well, which substantially reduces the minimum lot size for on-site sewage disposal.

For areas with public water, 15,000 sq. ft. lot sizes are recommended to allow an alternative site for a second leaching field, should the original field fail. This recommendation is primarily to give the homeowner the ability to install a second field to prolong the life of the on-site system.

For areas dependent on private wells, a minimum lot size of 60,000 square feet is recommended, to assure 100-foot-setback from wells. Because most on-site sewage disposal systems will be built on soils with a percolation rate better than 40 minutes/inch,(the worst case condition) and because most wells probably will not be located on the property line, 60,000 square foot lots should prove adequate to accommodate on-site disposal. This lot size also should ensure that each property owner will be able to meet the minimum setback requirement for building a house. Table 711-05(19) depicts existing residential zoning in unsewered communities and suggests zoning changes to accommodate adequate on-site sewage disposal.

05-05-02 Towns with ISDS Pollution Problems

The only towns known to have failing septic systems that contaminate water quality in the Blackstone Region are Burrillville, Cumberland, and Glocester. Details regarding each town are as following:

A. Burrillville

Septic leachate from the villages of Pascoag and Harrisville have caused segment 22, which consists of the Clear River from the Wilson Reservoir Dam to one mile upstream from the confluence with the Chepachet River and the Pascoag River from the Pascoag Reservoir to the confluence with the Clear River (See Figure 711-06(1), to be out of compliance with its B classification. The ISDS leachate will be brought under control when this area ties into the Burrillville treatment plant.

B. Cumberland

The Valley Falls section of Cumberland contributes ISDS leachate to segment 3 which is comprised of the portion of Abbot Run Brook that includes Robin Hollow Pond and Happy Hollow Pond (See Figure 711-06(1). Lateral sewers which should attenuate ISDS leachate are currently under construction in Valley Falls. A facilities plan is currently being prepared for the Town of Cumberland that will assess other areas within the Town that may have ISDS that contaminate surface and/or groundwater quality.

Table 711-05(19)

EXISTING RESIDENTIAL ZONING IN UNSEWERED AREAS IN THE BLACKSTONE REGION

City/Town	Min. Lot Size (Sq. ft.)	Comments
Burrillville	43,560	Minimum lot size should be increased to 80,000 sq. ft. in Slatersville groundwater aquifer recharge area; 60,000 sq. ft. elsewhere.
	87,120	Adequate for subsurface disposal, environmental protection.
Cumberland	7,200	Minimum lot sizes should be increased to 15,000 sq. ft. where public water is to be provided; 60,000 sq. ft. elsewhere.
	12,000	Minimum lot size should be increased to 80,000 sq. ft. in watersheds of Sneech Pond, Pawtucket Reservoir, and Robin Hollow Pond; 15,000 sq. ft. where there is public water, 60,000 sq. ft. elsewhere.
Glocester	87,120 130,680	Adequate for subsurface disposal, environmental protection.
Johnston	10,000	Should be increased to 60,000 sq. ft., unless public water is to be provided; minimum lot sizes should be increased to 15,000 sq. ft. with public water.
Lincoln	20,000 40,000	Adequate, where public water is provided. Should be increased to 60,000 sq. ft.
Smithfield	30,000 80,000	Adequate in sewered areas. Adequate for subsurface disposal, environmental protection.
North Smithfield	40,000 65,000 120,000	Adequate, where sewers are available. Adequate for subsurface disposal, environmental protection.

Source: 208 Water Quality Plan for Rhode Island

C. Glocester

ISDS leachate and direct sewage discharges from homes cause segment 18, which is the Chepachet River from the dam in Chepachet to the Branch River to be out of compliance with its B classification. The proposed Burrillville sewerage system will not provide service to this area during the first phase of construction. It is not known when this area might tie into the Burrillville treatment plant.

05-05-03 ISDS Management Program

The following recommendations are from the 208 Water Quality Management Plan for Rhode Island.

A comprehensive sewer program is recommended which will determine where sewers will and will not be provided. In essence, this program would require communities to decide which areas of the community will have sewers and which areas will have individual disposal systems. If it is decided that an area will be served by individual systems, then every effort should be made to ensure that this means of sewage disposal will be adequate to accommodate future development. Necessary actions could include change in zoning, the establishment of maintenance programs, or more stringent siting requirements.

The comprehensive sewer program would consist of three elements:

1. planning for the future installation of sewers and identification of specific pollution problems

2. local review of on-site subsurface disposal system permits

3. maintenance of existing on-site systems to ensure their efficient operation.

The three elements of the program (planning, regulation, and maintenance) are not interdependent and need not all be mandatory.

A. Comprehensive Sewer Plan

The goal of the comprehensive sewer plan is to reduce future needs for sewers. As such, the local planning agency would be responsible for preparing a comprehensive sewer plan identifying those areas of the community which are suitable for subsurface disposal systems and those which will require the construction of sewers during the next 20 years. This determination is to be based on soil types in the community, development trends, past on-site system failures, and projected population growth and density. The plan would also set forth means by which development can be controlled through the community's zoning and subdivision controls, and its taxation policies.

Chapter 45-22 of the General Laws of Rhode Island requires cities and towns to establish planning boards or commissions which are required to prepare comprehensive plans. Plans must include, among other requirements, environmental protection programs and a recommended program of action of implementation. 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 not 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, anticipated commercial and industrial development, 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 areas.

This mandatory sewer planning requirement would only apply to those communities which are not heavily urbanized and already sewered; thus, cities such as Providence, Pawtucket, and Central Falls, would not be required to prepare these plans. Facilities (201) plans that have been prepared recently, or that are in the process of being prepared will generally contain the information necessary for the sewer element of the comprehensive plan.

Communities would be required to transmit the completed plans to the Statewide Planning Program and the Department of Environmental Management for review and approval. These local plans would be used by the Statewide Planning Program in preparing regional water quality management plans. A community without such a plan would not be eligible for construction grant monies. DEM also could use these plans in establishing the state's construction grants priority list, since they will reflect the local communities' assessment of their future needs for sewers, and in determining future waste loads to streams. In order to provide current information, local communities would be required to prepare updated sewer plans every five years and to review the success of these plans in channeling growth into those areas where sewers are planned. Recommendations for future sewer construction also could be linked to the communities' capital improvement budgets.

Closely related to the issue of where sewers will be provided is the question of where public water will be available. As mentioned earlier in this section, one of the most important concerns of individual subsurface disposal systems is their effect on groundwater quality. Once the comprehensive sewer plan identifies areas which will depend solely upon these systems, it may be desirable for DEM to establish more stringent siting requirements for areas that do not have public water. The most important criteria would include depth to groundwater, depth to bedrock and setback from the property line.

B. Local Review of ISDS Permits

This second element of the comprehensive sewer programs entails local review of individual subsurface disposal permits issued by DEM. The major advantage of this review would be the first-hand knowledge of local officials of the land capabilities of the area. Local officials also may be more responsive to the demands of their constituents, and have more of a personal stake in preserving the quality of life in their communities.

There is an existing statute which requires city or town engineers to be notified in writing of percolation tests seven days in advance. This procedure provides an opportunity for local communities to oversee percolation tests to ensure that they accurately reflect site conditions. There is no provision in this statute which allows cities and towns to enforce its provisions. Recent proposed revisions to DEM's ISDS regulations, however, will give communities, or any person, an oportunity to submit written complaints to DEM after the issuance of any permit. DEM will investigate the complaint with 72 hours of its receipt and, based on the outcome of the investigation, may suspend or revoke the original approval.

If this procedure does not prove satisfactory to local communities, then legislation should be introduced into the General Assembly which would allow local communities to review permits before they are issued by DEM.

C. Local Maintenance Programs

A third element of the comprehensive sewer program is a voluntary, locally implemented maintenance program. The traditional institutional arrangement for subsurface systems places all responsibility for maintenance with the homeowner. The major problem with this arrangement is that when large numbers of failures occur, they become a community-wide problem. Ultimately, sewers may have to be constructed, with responsibility for their maintenance shifting to the community. Therefore, local governments do have a stake in proper operation of subsurface systems.

The effectiveness of periodic maintenance programs in prolonging the life of subsurface systems has not been clearly demonstrated, nor is it likely to be for some time. However, because solids overloading of the septic tank is a possible cause of system failure, implementation of some form of maintenance program in communities that rely heavily on individual subsurface disposal systems would be prudent.

There are a number of management approaches for ISDS maintenance programs that could be implemented by local communities. Four possible approaches, which vary in the degree of participation by the community, are discussed below.

1. Community-Owned Subsurface Disposal Systems - Under this management approach, the community would own the subsurface disposal system and be responsible for its installation and operation. A user charge would be assessed each homeowner to finance the program. Legislation would be necessary to authorize cities and towns to purchase equipment and to install, inspect, and maintain individual subsurface disposal systems; assess the individuals served on a user-cost basis; and receive federal and state grants to pay for part of the purchase of necessary equipment. Since there also would be significant capital expenses associated with establishing this management alternative, legislation allowing local communities to pass bonds to pay for these costs would be required. This alternative also would require additional local personnel, and would have a significant economic effect on private firms which design and install subsurface disposal systems.

2. Community-Operated Maintenance Programs - This management alternative would establish a community-wide subsurface disposal maintenance program which would be financed through user fees assessed individual homeowners. Under this alternative, the community would require that subsurface disposal systems be pumped out on a periodic basis. The community would provide the service either directly or through private firms under contract to the city or town. Legislation would be necessary to authorize local communities to set up maintenance programs and to issue orders to owners of septic tank systems requiring participation in the maintenance program. If a community were to directly provide pumpout services to individual homeowners, legislation would be necessary to authorize the issuance of bonds to pay for the capital costs of the program. While this alternative would not be as expensive as the first management alternative (community-owned subsurface disposal systems), additional personnel would be necessary to ensure that individual homeowners complied with the requirements of the maintenance program.

3. Community Requirement for Periodic Maintenance - Under this alternative, local communities would require homeowners to provide periodic maintenance to their subsurface disposal systems, but would not provide the service directly. Homeowners would have their systems pumped out by private firms, and they would mail receipts from the firm to the city or town as proof of maintenance. The local community could then provide for reimbursement to homeowners who have had their systems pumped out. Legislation would be necessary to authorize local communities to require periodic maintenance of subsurface disposal systems and to establish a means of enforcing this requirement. Few additional personnel would be necessary to implement this alternative, since the community would not be directly providing maintenance services, but only administering the program's requirements.

4. Community Educational Program - This management alternative involves the mailing of reminders and educational materials by the local community explaining to homeowners the need for periodic maintenance of subsurface disposal systems. No new legislation would be required. The expense of implementing this alternative could be kept at a minimum by mailing this information along with the local property tax assessments.

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.

05-05-04 Septage Management

Septage is the solid and liquid material which is pumped out of a septic tank or cesspool. Although its composition varies, septage is characterized by large concentrations of grit, grease, solids, organics and pathogenic bacteria. Septage may settle and dewater poorly, making it difficult to treat. The characteristics of septage samples analyzed as part of the 208 study are summarized in the 208 Water Quality Plan for Rhode Island.

As of 1975, approximately 98,000 people in the Blackstone Region relied on septic tanks or cesspools for wastewater disposal and generated approximately 9 million gallons of septage. These numbers have since decreased, however, due to the extension of municipal sewers within the Blackstone Region. As can be seen in Table 711-05(20) the unsewered population and the volume of septage generated is projected to decrease significantly by the year 2,000.

Septage is collected by private firms contracted by individual homeowners. There are nearly 80 septage hauling firms licensed by the R.I. Department of Environmental Management. In many cases, communities which accept septage at their wastewater treatment facilities also require local licensing of the septic tank/cesspool cleaning companies.

There are two basic septage disposal methods: land disposal and disposal at publicly owned wastewater treatment facilities. Land disposal of septage is no longer utilized in Rhode Island due to the potential impacts on ground and/or surface water.

Septage disposal at wastewater treatment facilities does not impact ground or surface waters. However, it poses a major source of operating problems. These problems occur because treatment facilities can become overloaded by excessive amounts of septage and improper management of septage dumping. Due to overloading problems, some treatment plants that could accept septage refuse to do so. Factors that need to be controlled to reduce overloading problems include the following:

1. the source of septage;
2. variations in septage disposal fees;
3. the frequency of septage discharges.

For additional details regarding these three factors, refer to the 208 Water Quality Management Plan for Rhode Island.

One of the recommendations of the 208 Plan was for the Office of State Planning to develop a septage management plan for the communities in the Rhode Island 208 planning area. Of prime consideration in this management plan was the disposal of septage at wastewater treatment facilities, as well as those communities that can be served by the suggested septage disposal sites. To initiate this process, superintendents of wastewater treatment facilities were surveyed to determine the volume of septage treated, fees charged, and other factors. This information was used to draft and analyze five alternative management programs utilizing the techniques described in the 208 Plan. This analysis showed that allocation of septage for treatment can be made so that no treatment facility is overloaded. Other considerations included in this analysis were population of

Table 711-05(20)

ESTIMATED ANNUAL DOMESTIC SEPTAGE PRODUCTION
BLACKSTONE REGION

COMMUNITY	1975 POPULATION UNSEWERED	1975 SEPTAGE VOL.(gals.)	2000 POPULATION UNSEWERED	2000 SEPTAGE VOL.(gals.)
Burrillville	11,600	1,104,762	3,600	342,857
Central Falls	0	0	0	0
Cumberland	20,200	1,923,809	17,800	1,695,238
Glocester	6,400	609,524	3,400	323,810
Johnston	11,900	1,133,333	6,400	609,524
Lincoln	15,100	1,438,095	15,200	1,447,619
N. Providence	3,700	352,381	700	66,667
N. Smithfield	10,500	1,000,000	5,400	514,286
Pawtucket	1,000	95,238	0	0
Providence	0	0	0	0
Smithfield	14,500	1,380,952	1,900	180,952
Woonsocket	3,500	333,333	0	0
TOTAL	98,000	9,371,427	54,400	5,180,953

service areas, quantity of septage to be generated and processed, and social and geographic factors. One alternative was selected as best meeting needs through the year 2000. Figure 711-05(6) illustrates a districting scheme which was formulated for this alternative.

As can be seen in Figure 711-05(6) the Blackstone Region was divided into three septage management regions (1, 2, and 12). The City of Providence was not placed in a septage management region because the city is entirely served by municipal sewers. Due to current operating problems, the city's treatment plant is not a suitable septage disposal site for other cities or towns.

Table 711-05(21) lists the capacities of sewage treatment plants receiving septage and projections for septage generated in each city and town for the years 1980, 1985, 1990, 1995, and 2,000. Regions 1 and 2 are self-explanatory. Region 12 consists of Burrillville, Glocester, Smithfield, and North Providence. these four towns have the option of utilizing either the Burrillville or Smithfield sewage treatment plants. In addition, the towns of Foster, Scituate, and Johnston have been assigned to regions 10, 11, and 12 which means that septage from these three towns can be disposed of at facilities in any of the three regions. This was done because of the proximity of the northern portions of these towns to region 12, whereas the southern portions adjoin regions 10 and 11. Regions 10, 11, and 12 can accommodate at least 50 percent of the total septage load from each of the towns insuring that a given region will not be overloaded.

The Rhode Island Department of Environomental Management suggested that a management program for "routine" disposal of septage may not be necessary, but that some arrangement was needed to handle emergency situations. These situations might occur when established arrangements are interrupted by a breakdown or overload of a wastewater treatment facility, a decision by a plant operator or its governing body to reduce or eliminate acceptance of septage, or for other reasons.

Bill 81-H-6279 was introduced in the General Assembly to empower the Rhode Island Department of Environmental Management to promulgate orders for septage disposal during emergencies. The bill was amended through hearings held by the Joint Committee on Environment to place a time limit on such orders, provide for consultation with plant operators and local officials, and make other technical changes.

This bill was approved by the House, but was not acted upon by the Senate prior to adjournment. It will be carried over to the 1982 session.

Figure 711-05(6)

SEPTAGE MANAGEMENT REGIONS

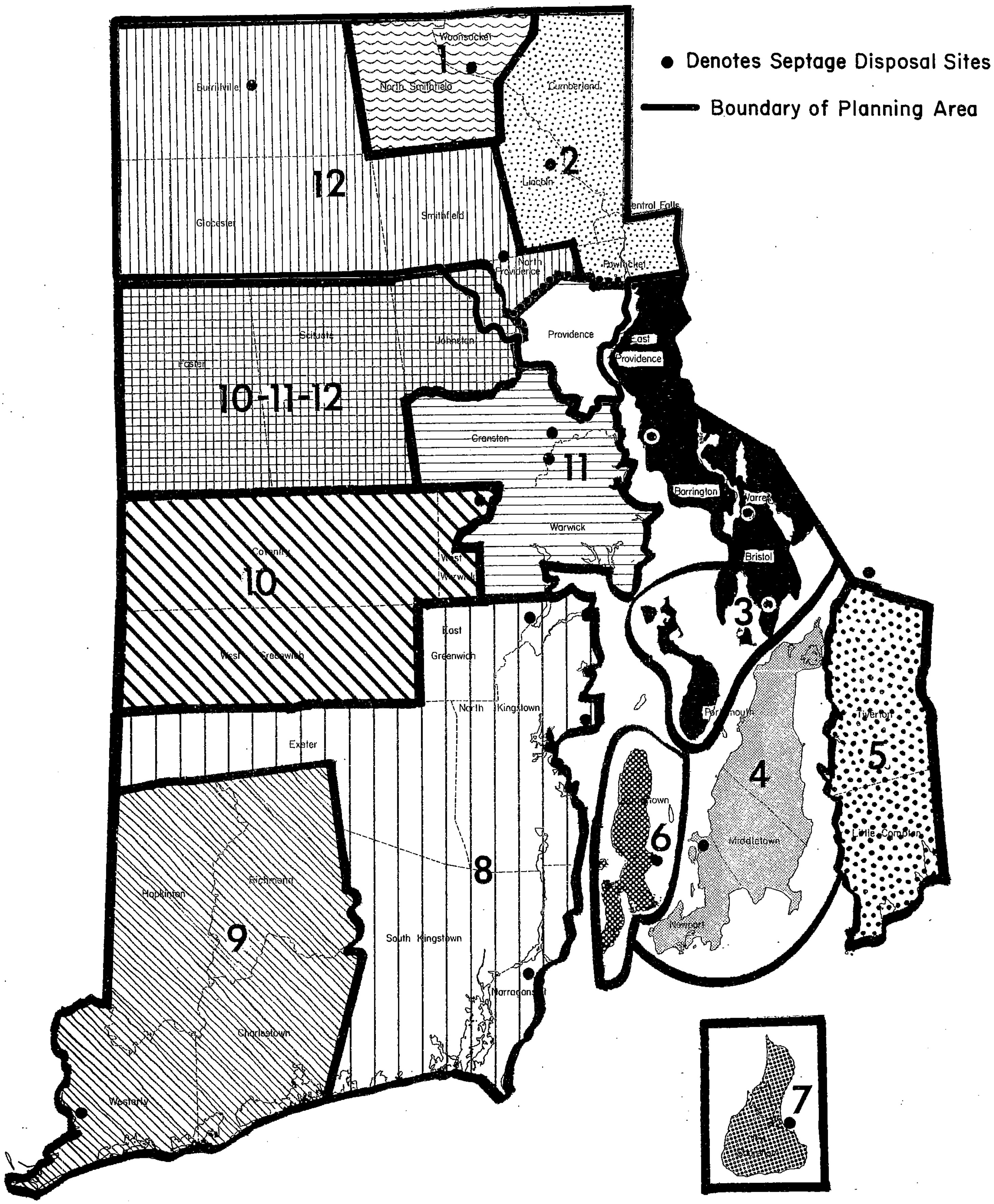


Table 711-05(21)

SEPTAGE ALLOCATIONS - BLACKSTONE REGION

Region			1980	1985	1990	1995	2000
			Treatment Plant Septage Capacity				
1	Woonsocket (STP)		11,497,500	12,391,750	13,541,500	14,435,750	15,330,000
			Septage Generated				
		N. Smithfield	857,143	761,905	666,667	590,476	514,286
		Woonsocket	266,667	200,000	142,857	76,190	0
		TSG	1,123,810	961,905	809,524	666,666	514,286
			Treatment Plant Septage Capacity				
2	B.V.D.C. (STP)		28,105,000	29,510,000	32,065,000	32,321,000	33,854,000
			Septage Generated				
		Central Falls	0	0	0	0	0
		Cumberland	1,857,143	1,809,524	1,780,952	1,733,333	1,695,238
		Lincoln	1,428,571	1,438,095	1,447,619	1,447,619	1,447,619
		Pawtucket	47,619	28,571	0	0	0
		TSG	3,333,333	3,276,190	3,228,571	3,180,952	3,142,857

				Treatment Plant Septage Capacity			
12	Burrillville		1,149,750	1,277,500	1,533,000	1,660,750	1,788,500
	Smithfield		2,299,500	2,555,000	2,938,250	3,193,750	3,449,250
	TSC		3,449,250	3,832,500	4,471,250	4,854,500	5,237,750
				Septage Generated			
		Burrillville	495,238	514,286	342,857	333,333	342,857
		Smithfield	152,381	161,905	161,905	171,429	180,952
		N. Providence	219,048	57,143	57,143	66,667	66,667
		Glocester	638,095	666,667	457,143	371,429	323,810
		Sub-total SG	1,504,762	1,400,001	1,019,048	942,858	914,286
		Foster (½)	166,667	176,191	180,953	190,476	200,000
		Scituate (½)	419,048	323,810	328,572	333,334	333,334
		Sub-total SG	2,090,477	1,900,002	1,528,573	1,466,668	1,447,620
		Johnston (½)	714,286	619,048	428,572	295,238	304,762
		TSG	2,804,763	2,519,050	1,957,145	1,761,906	1,752,382

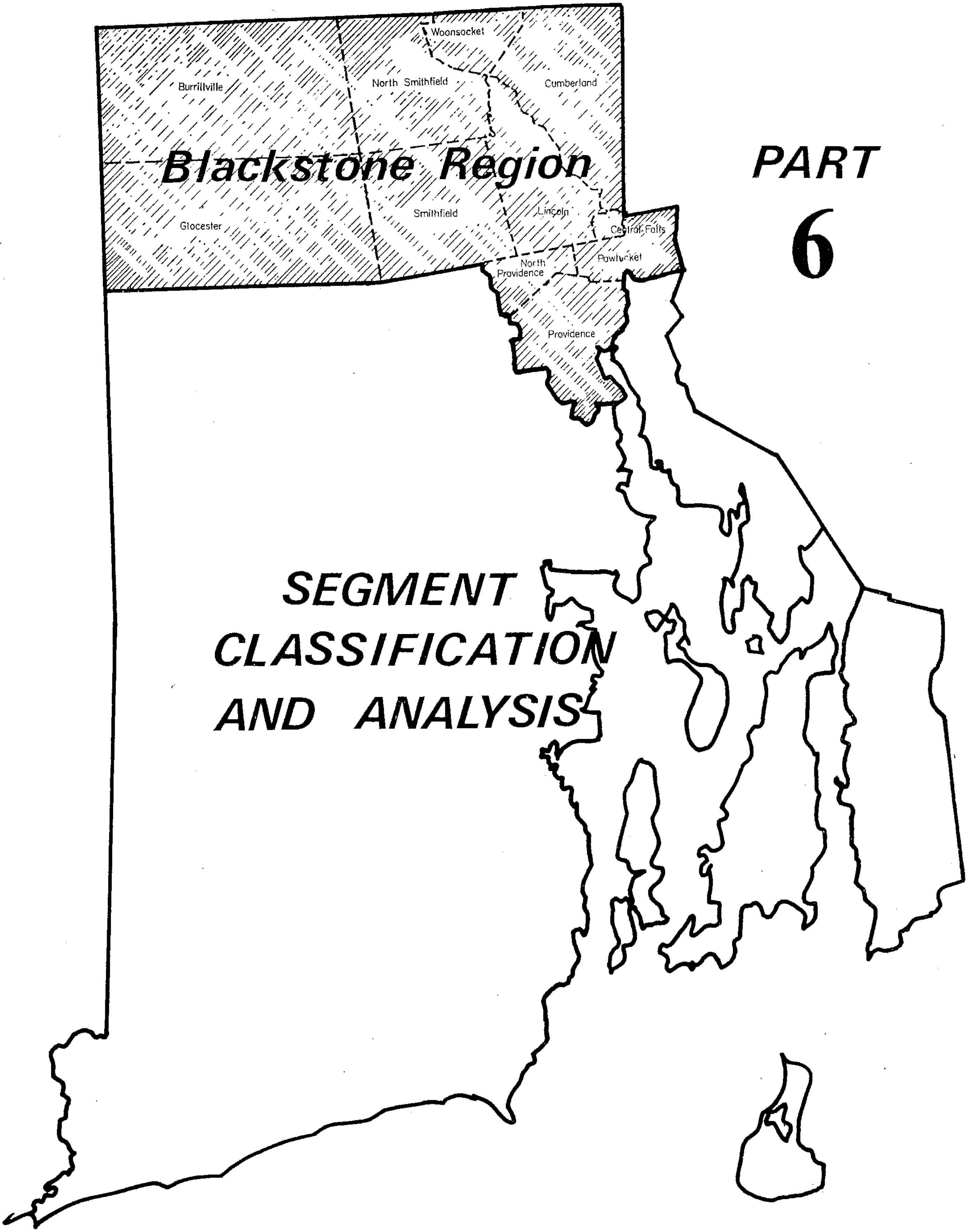
LEGEND: STP = Sewage Treatment Plant

TSG = Total Septage Generated

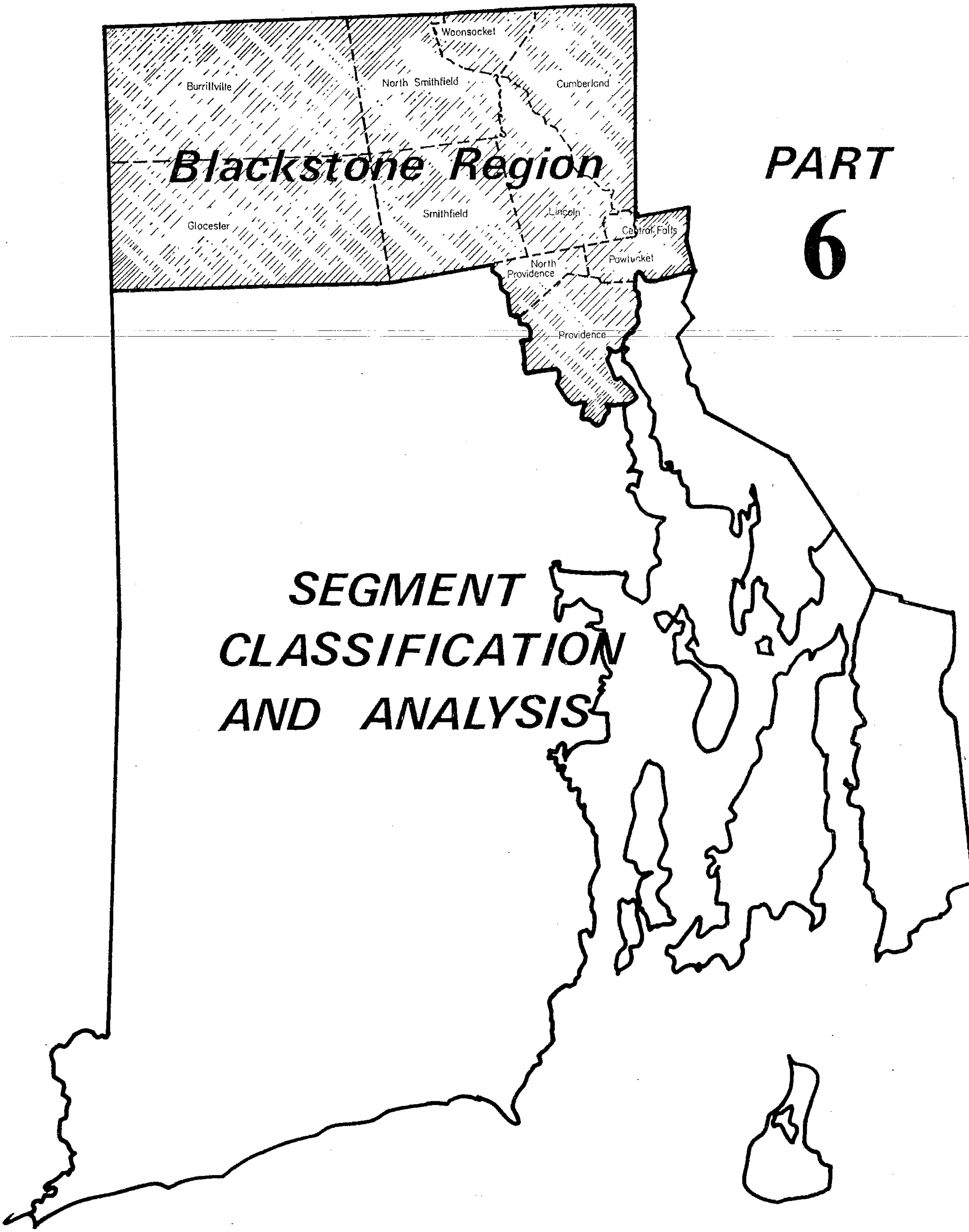
Septage expressed in gallons per year

PART 6

SEGMENT CLASSIFICATION AND ANALYSIS



PART 6



SEGMENT CLASSIFICATION AND ANALYSIS

711-06 SEGMENT CLASSIFICATION AND ANALYSIS

06-01 SEGMENT CLASSIFICATION

The Blackstone Region has been divided into nondegradation, effluent limited, and water quality segments, according to the following definitions:

> Nondegradation Class - The desired water quality standard can only be achieved by the prohibition of all new discharges except for certain non-contact cooling water discharges which meet the requirements of the Antidegradation Policy of the Department of Environmental Management.
>
> Effluent Limited Class - The water quality standard is now being met or there is certainty that water quality standards will be met by the application of effluent limitations required by Sections 301 (b)(1)(A) and 301(b)(1)(B) of the Clean Water Act of 1972, as amended.
>
> Water Quality Class - The desired water quality standard will not be achieved even after the application of effluent limitations required by Section 301(b)(1)(A) and 301(b)(1)(B) of the Clean Water Act of 1972, as amended.

The nondegradation, water quality, and effluent limited segment classifications were established by the Rhode Island Department of Environmental Management on the basis of whether or not the water quality classification could be met by secondary treatment for municipal treatment plants or best practical control technology for industry. All those segments which cannot meet their water quality standards with secondary treatment or best practical technology are classified water quality segments.

All Class A and B waters have been classified as nondegration segments because no new discharges are allowed in these segments. Due to the Antidegradation Policy, no degree of treatment to a pollution source, which is a new discharge to these segments, will be sufficient to meet this "no new discharge" criterion.

As illustrated on Figure 711-06(1) there are forty-one non-degradation segments in the Blackstone Region.

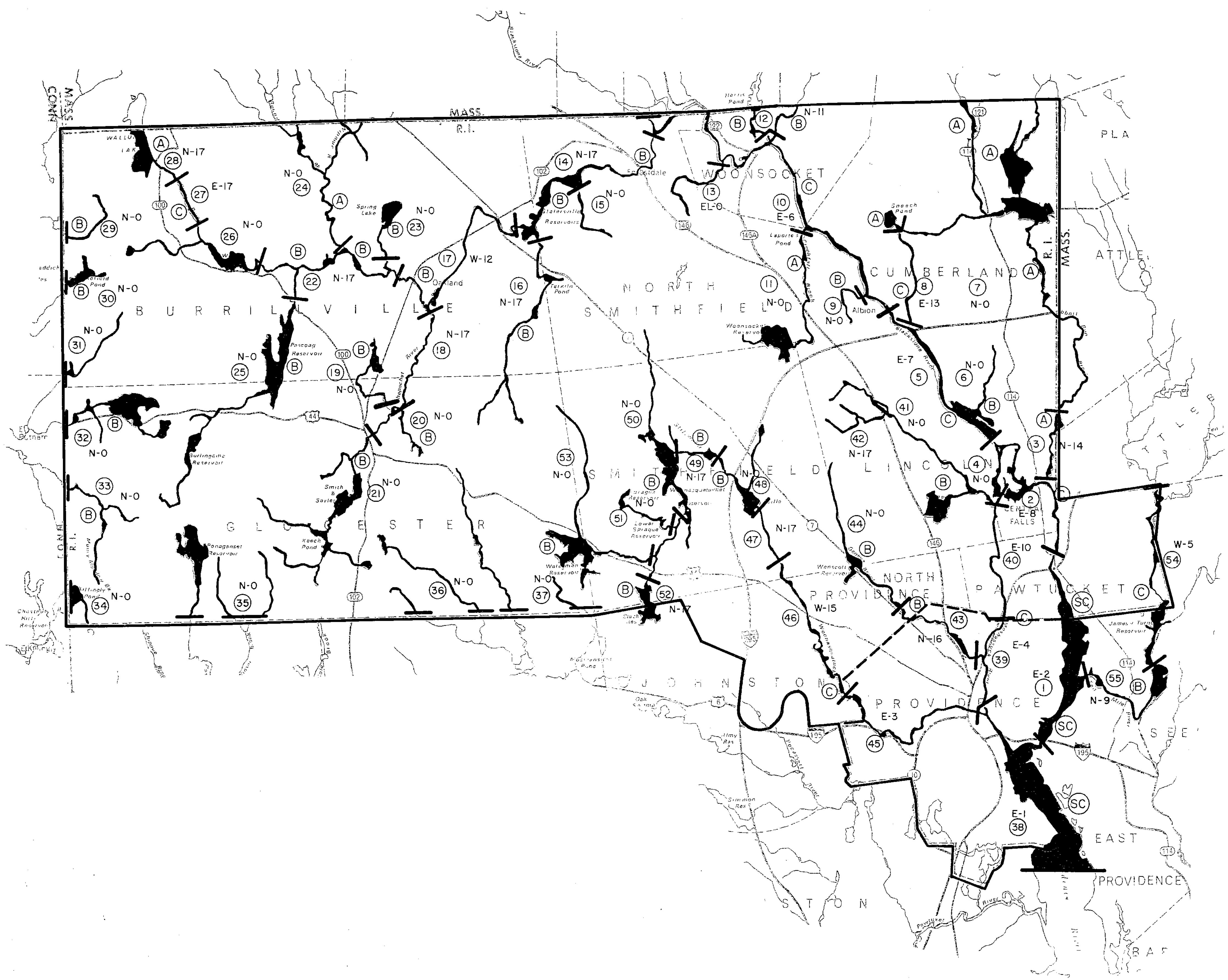
Segments 1, 2, 5, 8, 10, 13, 27, 38, 39, 40, and 45 have been classified as effluent-limited segments because water quality standards are being met or are expected to be met with the application of secondary treatment or best practical control technology to the discharges in these segments.

Segments 17, 46, and 54 have been classified water quality segments because water quality standards will not be met by the application of secondary treatment or best practical control technology to the discharges in these segments.

Characteristics for each segment in the Blackstone Region are given in Table 711-06(1). Tables 711-06(2) and 711-06(3) were utilized to calculate segment priority points.

(revised 6/30/82)

Figure 711-06(1)



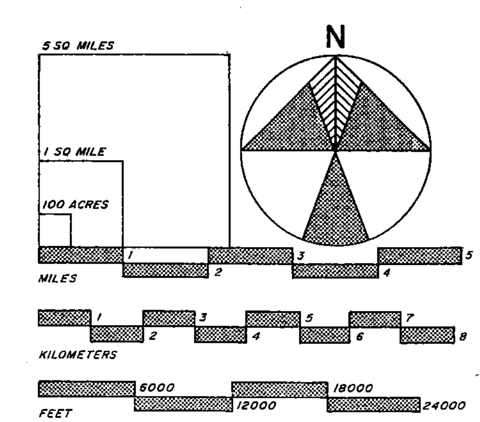
State of Rhode Island

Segment Classification Blackstone Region

Legend:

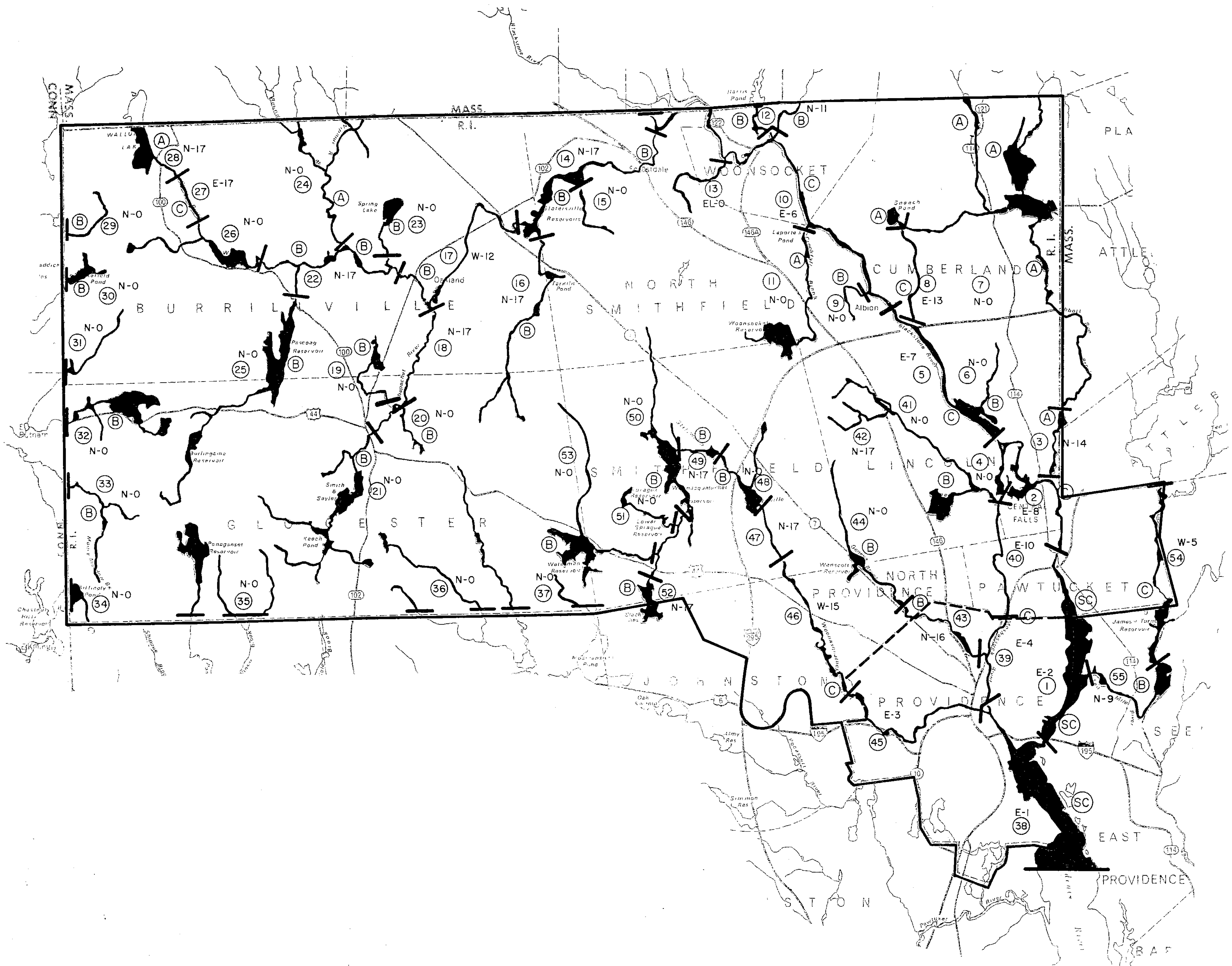
- Region Boundary
- Nondegradation Segment
- Effluent Limitation Segment
- Water Quality Segment
- (5) Segment Identification Number
- (A) Classification of Water Quality
- Segment Classification >N-O< Priority Ranking

Note: Providence is in both the Narragansett and Blackstone Regions



Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM assisted by federal grants through the Joint Funding Assistance Program

Figure 711-06(1)



State of Rhode Island

Segment Classification
Blackstone Region

Legend:

- Region Boundary
- Nondegradation Segment
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- Water Quality Segment
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- (A) Classification of Water Quality
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Note: Providence is in both the Narragansett and Blackstone Regions

5.50 MILES
1.50 MILE
100 ACRES
MILES 1 2 3 4 5
KILOMETERS 1 2 3 4 5 6 7 8
FEET 6000 12000 18000 24000

N

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Table 711-06(1)

SEGMENT CHARACTERISTICS - BLACKSTONE REGION

egment ent. umber	Segment Classifi- cation	Water Quality Classification (Usage)	Severity of Problem (Water Quality)	Points From TABLE 05-02(2)	Points From TABLE 05-02(3)	Segment Priority Totals TABLE (2) & TABLE (3)	Segment Priority Ranking
	EL	SC	Great	8(c)	3	11	2
	EL	C	Moderate	5(c)	3	8	8
	ND	A	Slight	2(a)	3	5	14
	ND	D	---	---	---		None
	EL	C	Moderate	5(c)	2	7	7
	ND	B	---	---	---	---	None
	ND	A	---	---	---	---	None
	EL	B	Moderate	5(b)	1	6	13
	ND	B	---	---	---	---	None
	EL	C	Moderate	5(c)	2	7	6
	ND	A	---	---	---	---	None
	ND	B	Moderate	5(b)	2	7	11
	EL	C	---	---	---	---	None
	ND	B	Slight	2(b)	1	3	17
	ND	B	---	---	---	---	None
	ND	B	Slight	2(b)	1	3	17
	WQ	C	Moderate	5(c)	1	6	12
	ND	B	Slight	2(b)	1	3	17
	ND	B	---	---	---	---	None
	ND	B	---	---	---	---	None
	ND	B	---	---	---	---	None
	ND	B	Slight	2(b)	1	3	17
	ND	B	---	---	---	---	None
	ND	A	---	---	---	---	None
	ND	B	---	---	---	---	None
	ND	B	---	---	---	---	None
	EL	C	Slight	2(c)	1	3	17
	ND	A	Slight	2(a)	1	3	17
	ND	B	---	---	---	---	None
	ND	B	---	---	---	---	None
	ND	B	---	---	---	---	None

Table 711-06(1) Continued

32	ND	B	---	---	---	---	None
33	ND	B	---	---	---	---	None
34	ND	B	---	---	---	---	None
35	ND	A	---	---	---	---	None
36	ND	A	---	---	---	---	None
37	ND	A	---	---	---	---	None
38	EL	SC	Great	8(c)	3	11	1
39	EL	C	Great	8(c)	3	11	4
40	EL	C	Moderate	5(c)	2	7	10
41	ND	B	---	---	---	---	None
42	ND	B	---	---	---	---	None
43	ND	B	Slight	2(b)	2	4	16
44	ND	B	---	---	---	---	None
45	EL	C	Great	8(c)	3	11	3
46	WQ	C	Slight	2(c)	2	4	15
47	ND	B	---	---	---	---	None
48	ND	B	---	---	---	---	None
49	ND	B	Slight	2(b)	1	3	17
50	ND	B	---	---	---	---	None
51	ND	B	---	---	---	---	None
52	ND	B	Slight	2(b)	1	3	17
53	ND	B	---	---	---	---	None
54	WQ	C	Great	8(c)	2	10	5
55	ND	B	Moderate	5(b)	2	7	9

Segment priority points are assigned by the Division of Water Resources in the Department of Environmental Management on the basis of the following major criteria:

(1) Severity of problem;

(2) Need for preservation of pure waters; and

(3) Population affected.

The priority points for the first two factors (severity of problem and preservation of pure waters) are obtained from Table 711-06(2).

Table 711-06(2)

Need for preservation of high quality water (usage)	Severity of pollution problems (water quality)			
	None	Slight	Moderate	Great
Shellfishing and drinking water supply	0	2	6	10
Bathing and Recreation	0	2	5	8
Propagation of fish and aquatic life	0	2	5	8
Industrial uses	0	1	2	3

The need for preservation of pure waters is based on the usage assigned to a water body through its water quality classification. The severity of pollution problems corresponds to existing water quality conditions. For any segment, a value indicating the effect of pollution on water usage can be obtained from Table 711-06(2) by reading across the line for a specific usage to the column which corresponds to the severity of pollution in the segment.

The third factor considered in assigning segment priority points is the population affected by the water quality of the segment. Since it is difficult to determine who is and who is not affected by the water quality in any given segment, the population affected is taken to be the population in the vicinity of the segment.

Priority points for the population affected are obtained from Table 711-06(3).

Table 711-06(3)

Population affected	Priority points
0-10,000	1
10,0001-50,000	2
50,000+	3

06-02 SEGMENT ANALYSIS

An analysis of each of the nondegradation, water quality, and effluent limited segments is given in the following pages. Table 711-06(4) provides a listing of the point source discharges to each segment, the type of discharge, and its severity of pollution ranking.

The severity of pollution ranking is a ranking among all point source discharges in the Blackstone Region according to the strength and/or toxicity of the wastewater discharge. The discharge with the greatest strength and/or toxicity has the highest ranking. It should be noted that all point source discharges after ranking number 30 were assessed to be minor and assigned the same rank.

Table 711-06(4)

EXISTING DISCHARGES LISTED BY SEGMENT
BLACKSTONE REGION

...ment ...nt. ...o.	Discharge No. (Type of Discharge[a])	Name of Discharger[b]	Severity of Pollution Ranking
1	N1(O)	Pawtucket Combined Sewer Overflows (C.S.O.) (5)	5
	N13(O)	Providence C.S.O. (7)	2
	N2(M)[c]	Blackstone Valley District Commission Wastewater Treatment Facility	3
	N3(O)[d]	Blackstone Valley District Commission C.S.O. (4)	6
	N4(I)[c]	Washburn Wire Co.	14
	N6(S)[c]	Okonite Co.	31
2	B22(S)	Valley Falls Individual Sewers	12
	B23(W)	Pawtucket Water Treatment Plant	27
	B24(I)	Corning Glass Works	15
	B25(O)	Central Falls C.S.O. (6)	7
	B26(O)	Pawtucket C.S.O. (13)	5
	B27(C)	American Clad Metals	31
	B28(C)	Carol Cable Co.	31
	B47(O)	Blackstone Valley District Commission C.S.O. (1)	6
5	B15(C)	H & H Screw Product Manufacturing	31
	B16(S)	Ashton Septic Tank Overflow	11
	B17(I)	Nife, Inc.	21
	B18(C)	Owens Corning Fiberglass Corp.	31
	B19(C)	Lonza Universal Chemical Corp.	31
	B20(W)	Cumberland Water Treatment Facility	30
	B21(C)	Okonite Co.	31
7	B14(C)	Mossberg Hubbard	31
8	B12(A)	Cumberland High School	17
0	B8(S)	Tupperware Co.	19
	B10(M)	Woonsocket Wastewater Treatment Facility	4
	B11	Woonsocket Water Treatment Facility	28

Table 711-06(4) Continued

11	B13(C)	A.T. Cross Co.	31
13	B9(C)	Birch Hill Poultry Farm	31
14	B5(C)	Service Color Corporation	31
	B7(S)	Tupperware Co. (Laboratory)	19
17	B3(S)	Glendale Individual Sewers	9
	B4(C)	Consolidated Thermoplastics (Turex, Inc.)	31
27	B1(A)	Zambarano Hospital	12
38	N13(O)	Providence C.S.O. (27)	2
	N14(C)	Narragansett Electric Co.	16
	N9(R)	Texaco, Inc.	24
	N15(C)	C.H. Sprague & Sons (Atlantic Terminal Corporation)	25
	N16(I)	Lehigh Portland Cemet Co.	23
	N17(R)	Sun Oil Co.	26
	N18(C)	Field's Point Mfg. Corp.	31
	N19(M)	Providence Wastewater Treatment Facility	1
	N20(R)[C]	Gulf Oil Co.	31
39	B33(O)	Providence C.S.O.(9)	2
	B34(C)	Quinn Packing Co.	31
	B35(C)	R.I. Tool Co.	31
40	B30(C)	Collyer Insultated Wire Co.	31
	B26(O)	Pawtucket C.S.O. (2)	5
	B25(O)	Central Falls C.S.O. (1)	7
	B47(O)	Blackstone Valley District Commission C.S.O. (2)	6
	B31(C)	Rubber Covered Products Co.	31
	B32(C)	Erco Buildings Corp.	31
42	B29(C)	Lincoln Dimensional Tube	20
43	B33(O)	Providence C.S.O. (3)	2
45	B33(O)	Providence C.S.O. (20)	2
	B43(C)	Cowan's Plastics Product Corporation	31
	B44(C)	Electronic Precision Circuitry	31
	B45(C)	Uncas Mfg. Co.	31
	B46(C)	Merchants Cold Storage	31

Table 711-06(4) Continued

6	B41(C)	Worcester Textile	31
	B42(C)	Brown and Sharpe Mfg.	31
7	B37(C)	Industrial Machine Corp.	31
	B38(C)	Narragansett Grey Iron Foundry, Inc.	31
	B39(C)	Mine Safety Appliances	31
	B40(M)	Smithfield Wastewater Treatment Facility	8

a. The letter within the parenthesis refers to the type of discharge. The discharge types have been classified into nine categories:

(A) Small and package wastewater treatment facilities
(C) Cooling water discharges
(I) Industrial discharges
(L) Laundry waste discharges
(M) Municipal wastewater discharges
(O) Bypass/Overflow discharges
(R) Surface water runoff from petroleum products storage areas
(S) Sanitary wastewater discharges
(W) Water treatment facilities

b. The location of the discharges is given on Figure 03-01(1)

c. Although these discharges are not located in the Blackstone Region, they are presented here because they discharge into segments that are discussed in this section of the report.

d. N3(O) has three discharges to this segment originating in the Narragansett Region and one discharge to this segment originating in the Blackstone Region.

06-02-01 Nondegradation Segments

Segment 3: The portion of Abbot Run Brook that includes Robin Hollow Pond and Happy Hollow Pond which are public water supply impoundments for the City of Pawtucket Water System. Potential nonpoint pollution from subsurface disposal systems in the Town of Cumberland is the reason for the priority point value of 5. Lateral sewers are currently under construction in this area and potential problems will be avoided when this construction is complete.

Segment 4: This segment is Scott Pond which does not have any problem priority points since there are no point or major nonpoint discharges to this segment.

Segment 6: This segment is Monastery Brook in Cumberland which flows into New Pond and the portion of New Pond north of the Providence-Worcester railroad tracks is also included. There are no point or nonpoint discharges to this segment.

Segment 7: This segment is comprised of Miscoe Lake from the Massachusetts - Rhode Island state line, an unnamed brook from Miscoe Lake to Catamint Brook, Catamint Brook, East Sneech Brook, Sneech Pond, Burnt Swamp Brook from the Rhode Island - Massachusetts state line to Diamond Hill Reservoir, and Abbott Run Brook from the Rhode Island - Massachusetts state line to Diamond Hill Reservoir. The only point discharges in this segment are from Mossberg Hubbard, a non-contact cooling water discharge which is not allowed a temperature increase over the ambient temperature of the stream according to its NPDES permit.

Segment 9: This segment is Mussey Brook and it does not have any priority points.

Segment 11: The Woonsocket Reservoir and Crookfall Brook comprise segment 11. Both are high quality waters with no point or nonpoint discharges.

Segment 12: The Mill River and the Peters River, from the Rhode Island - Massachusetts state line to the Blackstone River, have been assigned 7 priority points due to pollution caused by wastewater discharges in Massachusetts. The segment will not be in compliance with its water quality classification until the towns of Blackstone and Bellingham, Massachusetts are tied into the Woonsocket sewerage system and pollution further upstream is abated. This segment also suffers some unquantified urban runoff problems from the City of Woonsocket.

Segment 14: This segment is comprised of the Slatersville Reservoirs and the Branch River from the Slatersville Reservoirs to its confluence with the Blackstone River. Because of upstream discharges on segment 17, which affect segment 14, and the sewer point source discharges in the segment itself, this segment has been assigned 3 priority points. The lower portion of this segment (the Branch River from the Slatersville Reservoir to its confluence with the Blackstone River) is out of compliance with its classification due to sanitary and industrial discharges to this stretch of the River. There are 19 homes in Forestdale which currently discharge untreated sewage directly into the Branch River. The construction of municipal sewers in Burrillville will eliminate the discharges to Segment 17 and the construction of sewers in North Smithfield will eliminate the discharges to segment 14.

Segment 15: Segment 15 is Trout Brook, a class B water, which does not have any pollution problems.

Segment 16: This segment consists of Mowry Paine Brook and Tarkiln Pond. There are no point discharges to this segment.

Segment 18: This segment is the Chepachet River from the dam in Chepachet to the Branch River. Nonpoint discharges from individual disposal systems, in addition to direct discharges from individual homes, cause this segment to be out of compliance with its classification and have resulted in the assignment of 3 priority points to the segment. The proposed Burrillville sewerage system will not provide service to this area during the first phase of construction, so that a reduction in priority points is not expected in the near future.

Segment 19: There are no discharges to Sucker Pond or Sucker Brook, which are Class B waters.

Segment 20: Spring Grove Pond and an unnamed brook comprise this segment, to which there are no discharges.

Segment 21: This segment has no priority points and is comprised of Keech Pond, Smith and Sayles Reservoir, Shingle Mill Pond, and Stingo Brook.

Segment 22: This segment consists of the Clear River from the Wilson Reservoir Dam to one mile upstream from the confluence with the Chepachet River, and the Pascoag River from the Pascoag Reservoir to the confluence with the Clear River. The segment has 3 priority points and is out of compliance with its B classification due to pollution from individual sanitary waste discharges. This segment will be brought into compliance when this area ties into the Burrillville treatment plant.

Segment 23: There are no point or nonpoint source pollution problems on this segment, which is made up of Spring Lake and Herring Brook.

Segment 24: Round Top Brook, Chockalog River, and Nipmuc River comprise this segment, which has been assigned "no problem" priority points, since there are no discharges to this segment.

Segment 25: This segment is made up of the Burlingame Reservoir, Brandy Brook and the Pascoag Reservoir. The segment has no point or nonpoint source pollution problems.

Segment 26: This segment is comprised of Dry Arm Brook and the Clear River from one-half mile above Wilson Reservoir to the Wilson Reservoir Dam. Since there are no sources of pollution in this segment, it has not been assigned any priority points.

Segment 28: This segment consists of Wallum Lake and the Clear River to three-quarters of a mile below Wallum Lake. Wallum Lake is the water supply source for Zambarano Hospital, and is out of compliance with its classification because it is used for recreational purposes in Massachusetts. Since the Rhode Island Department of Health prohibits recreational use of water supply reservoirs, this segment will not be in compliance with its classification until current policies are changed in Rhode Island or recreational activities are discontinued in Massachusetts.

(revised 6/30/82)

Segment 29: Croff Farm Brook from its origin to the Rhode Island - Connecticut state line does not have pollution problems.

Segment 30: Blackmore Brook is a Class B stream and includes Wakefield Pond and Cedar Swamp Pond. The segment has "no problem" priority points.

Segment 31: This Class B segment consists of Keech Brook and Peck Pond, and is free from pollution sources.

Segment 32: Mary Brown Brook, Hawkins Pond, Clarkville Pond, Bowdish Reservoir, Wilbur Pond and Lake Washington constitute this Class B segment which does not have pollution problems.

Segment 33: This segment is comprised of all of Mowry Meadow Brook and Cady Brook to the Rhode Island - Connecticut state line. The segment has "no problem" priority points.

Segment 34: Whetstone Brook and Killingly Pond (most of which is in Connecticut) make up this segment which does not have any pollution problems.

Segment 35: This Class A segment is within the hydrologic boundary of the Pawtuxet River Basin. It includes all of Ponagansett Reservoir, Killy Brook and an unnamed brook, as well as the Ponagansett River and Winsor Brook to their confluence. There are no point or nonpoint discharges to this segment.

Segment 36: All of Mosquitohawk Brook, Huntinghouse Brook, and Peeptoad Brook to their confluence, make up this segment which does not have priority points.

Segment 37: This segment consists of an unnamed brook that flows into Moswaniscut Pond from the north. This class A segment does not have any point source discharges.

Segment 41: This segment consists of the Moshassuck River from its northwestern tributary to Saylesville.

Segment 42: The southwestern tributary of the Moshassuck River from its origin to its confluence with the main body of the Moshassuck River makes up this segment.

Segment 43: This segment from the West River (Geneva Brook) from where it crosses the Providence city line to its confluence with the Moshassuck River is out of compliance with its class B standard due to the discharge of a combined sewer overflow. Segment 43 has been assigned 4 priority points.

Segment 44: This segment is the West River (Geneva Brook) from its origin to the Providence city line.

Segment 47: The Woonasquatucket River from below the Georgiaville Dam to the Smithfield Wastewater Treatment Plant makes up this segment.

Segment 48: This segment is the Woonasquatucket River from Stillwater Reservoir to Georgiaville Pond dam. There are no pollution sources to this Class B segment which does not have any segment priority points.

Segment 49: This segment is the Woonasquatucket River from the Woonasquatucket Reservoir to the Stillwater Reservoir Dam. This segment is currently out of compliance due to the discharge from the Wionkheige Valley package treatment plant. This discharge should be eliminated in the near future by tying into the Smithfield sewerage system.

Segment 50: This Class B segment is the Woonasquatucket River from its origin at Primrose Pond up to and including the Woonasquatucket Reservoir. There are no pollution sources to this segment.

Segment 51: This segment consists of the Sprague and Lower Sprague Reservoirs. There are no pollution sources to this Class B segment.

Segment 52: The Slack Reservoir, which comprises this segment, is Class B and does not have any priority points.

Segment 53: This segment is comprised of an unnamed water course which runs from the Slack Reservoir to the Stillwater River, to the Woonasquatucket Reservoir, Nine Foot Brook, Waterman Reservoir, and the Stillwater River from Waterman Reservoir to 1.3 miles downstream from the reservoir. There are no pollution sources to this segment. However the potential impacts to the water quality of Ninefoot Brook from the Glocester Landfill should be assessed.

Segment 55: This segment is the James V. Turner Reservoir, the Ten Mile River from the Reservoir to Omega Pond and Omega Pond in East Providence. Although there are only two cooling water discharges to the segment, it has seven priority points because of inflow from Segment 54. Segment 54, a water quality segment, is degraded by sixty-two wastewater discharges into the Ten Mile River in Massachusetts, particularly the Attleboro and North Attleborough treatment plants. These discharges have caused this segment to be out of compliance with the Class B dissolved oxygen and coliform bacteria criteria, and have resulted in eutrophic and dissolved oxygen problems in Central Pond in segment 54.

The City of East Providence has designated the Turner Reservoir-Central Pond area for recreational use as a major city park. The city is prevented from utilizing Turner Reservoir as a natural swimming area because it does not currently meet Class B standards. The construction of advanced wastewater treatment facilities in Attleboro and North Attleborough with nutrient removal, as outlined in the Massachusetts Ten Mile River Basin Water Quality Management Plan, should result in the attainment of Class B standards in Turner Reservoir and the rest of this segment.

06-02-02 Effluent Limited Segments

Segment 1: This segment is the Seekonk River from its origin at the Main Street Dam in Pawtucket to the Providence River. In addition to urban runoff problems, the major discharges to this segment are the Providence, Blackstone Valley District Commission (BVDC)and, Pawtucket combined sewer overflows, and the Blackstone Valley wastewater treatment plant. Due to these discharges, this segment has been assigned 11 priority points and has the second highest priority ranking. Currently the BVDC wastewater treatment plant is being upgraded to secondary treatment. In addition, section 201 facilities plans have been prepared for the cities of Providence and Pawtucket to determine the most feasible alternative for treatment of combined sewer overflows.

Segment 2: This segment is the Blackstone River from the dam at New Pond, in Lonsdale, to the Main Street Dam in Pawtucket. The segment has been assigned 8 priority points, which is indicative of the Pawtucket, BVDC, and Central Falls combined sewer overflows. In addition to cooling water discharges, there is also an industrial discharge, Corning Glass Works, and nonpoint urban runoff problems.

Segment 5: The Blackstone River from below Albion Dam to the dam at New Pond, in Lonsdale makes up this segment. Segment 5 has been assigned 5 priority points due to 5 cooling water discharges and a discharge from Ashton individual sewers.

Segment 8: This segment is West Sneech Brook. The Cumberland High School secondary treatment plant discharges into this segment, which causes a moderate water quality problem and the segment to be assigned 6 priority points.

Segment 10: This segment is the Blackstone River from its initial crossing of the Massachusetts - Rhode Island state line to the Albion Dam. This segment has been assigned 7 priority points, which is indicative of moderate water pollution problems. Prior to January 1978, this segment had severe water pollution problems due to the discharge from the Woonsocket wastewater treatment facility. Since this facility was upgraded from primary to secondary treatment, however, the water quality in this segment has improved. Urban runoff from the City of Woonsocket is a source of pollution to this segment, although the effects have not been quantified.

The Blackstone River in Massachusetts has many segments out of compliance with their classification, due primarily to discharges from the Worcester wastewater treatment facility and combined sewer overflows. The effects of this pollution, with originates in Massachusetts, impacts the Blackstone River in Rhode Island. These effects could be mitigated with phosphorous removal by the Worcester treatment plant and the elimination of combined sewer overflows.

Segment 13: This segment is Cherry Brook and it does not have any pollution problems.

Segment 27: This segment is the Clear River from three-quarters of a mile below Wallum Lake to one-half mile above Wilson Reservoir. It has a Class C water quality classification and 3 priority points, due to the discharge from the Zambarano Hospital sewage treatment plant.

Segment 38: This segment is the Providence River from the confluence of the Woonasquatucket and Moshassuck Rivers to the Providence - Cranston city line.

This segment has been assigned eleven priority points and has the highest segment priority ranking because of the severe water quality problems which exist. The entire segment which is classified Class SC does not meet the water quality standards for this classification. The main cause of these substandard conditions is the City of Providence sewerage system, which has combined sewer overflows and a secondary treatment plant discharge at Field's Point. The discharges from the Providence combined sewers and from the Providence wastewater treatment plant have the highest severity of pollution rankings in the Blackstone Region. A 201 facilities plan was prepared for the City of Providence to assess the most feasible alternatives for the treatment of combined sewer overflows and to upgrade the wastewater treatment plant to comply with required effluent limitations for secondary treatment ((2)). Currently engineering studies are in progress to determine the most cost effective means of treatment for two major CSO discharges in the City of Providence. In addition to point source pollution, runoff is a major source of pollution to this segment, although urban runoff impacts have not yet been quantified.

Segment 39: This segment, which consists of the Moshassuck River from the Providence - Pawtucket city line to its confluence with the Woonasquatucket River, also has severe water quality problems. Because of the numerous combined sewer overflows from the Providence sewerage system and urban runoff problems to this segment, it has been assigned 11 priority points and a segment priority ranking of 4.

Segment 40: This segment of the Moshassuck River from Saylesville to the Pawtucket - Providence city line has a Class C water quality classification and 7 priority points. The major pollution source is from the CSOs in Central Falls in addition to urban runoff.

Segment 45: This Class C segment is the Woonasquatucket River from below Manton Dam to its confluence with the Moshassuck River. There are seven wastewater discharges to this segment, including 20 combined sewer overflows from the Providence sewerage system. Due to these discharges and urban runoff, this segment has been given 11 priority points and a segment priority ranking of 3. An engineering study is currently being conducted to abate combined sewer overflow impacts in this segment.

06-02-03 Water Quality Segments

Segment 17: This segment consists of the Clear River from one mile upstream of its confluence with the Chepachet River to the Branch River, and the Branch River to the Slatersville Reservoir. The segment has been assigned 6 priority points because of a raw sewage discharge from the Glendale individual sewers.

The Burrillville treatment plant provides phosphorus removal in order to prevent euthrophication of the phosphorus-limited Slatersville Reservoir. Because phosphorus removal is a form of advanced treatment, this segment has been classified as a "water quality" segment.

Segment 46: This Class C segment is the Woonasquatucket River from the Smithfield wastewater treatment plant to the Manton Dam. Although there are only three cooling water discharges to this segment, it has been assigned 4 priority points due to upstream discharges.

Because advanced treatment is required at the Smithfield wastewater treatment facility to maintain Class B standards, this segment has been classified as a "water quality" segment.

Segment 54: This Class C segment is the Ten Mile River from the Massachusetts - Rhode Island state line to the Central Pond Dam.

There are no point source discharges in this segment. However, discharges to the portion of this river in Massachusetts severely affect the water quality in

Rhode Island. A 1979 water quality survey by the R.I. Department of Environmental Management indicated that dissolved oxygen concentrations in this segment were below the minimum allowable for Class C waters (4.0 mg/l for sluggish eutrophic waters). These low dissolved oxygen concentrations are attributable to the discharges from the North Attleborough and Attleboro wastewater treatment plants and to the numerous jewelry and metal plating industrial discharges in the Massachusetts portion of this river. In addition to the dissolved oxygen problem, nutrients from the North Attleborough and Attleboro wastewater treatment facilities have caused algal blooms and eutrophication problems in Central Pond. This segment has been assigned 10 priority points.

In order for this segment to meet its Class C standards and for the Massachusetts portion of the Ten Mile River to meet its Class B and C standards, Attleboro and North Attleborough must both provide advanced treatment and nutrient removal at their wastewater treatment facilities. Because this segment will not meet its classification standards until advanced treatment is provided upstream, it is a water quality segment.

06-03 WASTE LOAD ALLOCATIONS FOR WATER QUALITY SEGMENTS

A waste load allocation for a segment is the assignment of target loads to point and, if appropriate, to non-point sources to achieve water quality standards in the most effective manner. It involves the selection of the best practicable water quality management alternative for the segment over a five year period with consideration of longer range needs ((39)).

Water quality is dependent on hydraulic conditions and complex biochemical reactions, which can be simulated with a mathematical model. Dissolved oxygen is the most important of the eight parameters defining the standards of water quality because of the oxygen demand exerted by organic wastes and warm water temperature.

Segment 46 in the Woonasquatucket River is a water quality segment since advanced treatment is required at the Smithfield wastewater treatment plant to maintain Class C standards in this segment. The discharge limitations for the Smithfield facility are 15 miligrams/liter for biochemical oxygen demand and total suspended solids on a daily average for the month. Discharge limitations for most other wastewater treatment plants in the Blackstone Region require secondary treatment or 30 miligrams/liter for biological oxygen demand and total suspended solids.

Segment 17 in the Clear and Branch Rivers is a water quality segment since advanced treatment (phosphorous removal) is required at the Burrillville wastewater treatment plant to prevent eutrophication of the Slatersville Reservoirs. The discharge limitations for the Burrillville treatment plant require 1.0 miligrams/liter of phosphorous per day on a monthly average.

There are no point source discharges in the water quality segment (segment 54) on the Ten Mile River in Rhode Island. At the present time, water quality in the Ten Mile River is controlled primarily by the discharges of the Attleboro and North Attleborough wastewater treatment facilities. During drought conditions, it is estimated that over 80 percent of the flow in the river comes from these discharges. As a result, advanced treatment including the seasonal removal of phosphorous is required at both municipal plants ((37)).

Since there is no data to quantify the impacts of urban runoff at this time, it is not possible to assign target loads to this non-point source of pollution. Table 711-06(5) lists those segments within the region that are, however, believed to have urban runoff impacts.

Table 711-06(5)

RIVER SEGMENTS IMPACTED BY URBAN RUNOFF

River Segment Number	River
1	Seekonk
2	Blackstone
5	Blackstone
10	Blackstone
12	Mill and Peters
38	Providence River
39	Moshassuck River
40	Moshassuck River
43	West River
44	West River
45	Woonasquatucket
46	Woonasquatucket
55	Ten Mile River

Refer to Figure 711-06(1) to determine the location of each segment number.

06-04 TARGET ABATEMENT DATES

The compliance or target abatement dates for point source discharges, except cooling water discharges, are presented in Table 711-06(6). These dates were obtained from the NPDES permits or are based on projected completion dates of municipal sewerage systems scheduled for construction. The present treatment for these discharges and the treatment proposed for meeting permit requirements are also given in this table.

Industries tying into municipal sewage treatment systems may be required to pretreat wastes prior to discharge.

(revised 6/30/82)

Table 711-06(6)

TREATMENT AND TARGET ABATEMENT DATES FOR POINT SOURCE DISCHARGES[a]
BLACKSTONE REGION

Point Source Map Refer. No.	Discharger	Present Treatment	Proposed Treatment	Compliance or Target Abatement Date
B1(a)	Zambarano Hospital	Extended Aeration, Sand Filters and Chlorination	No Change	—
B2(M)	Burrillville Sewage Treatment Plant	Secondary Activated Sludge	No Change	—
B3(S)	Glendale Individual Sewers	Some homes have no treatment, others have septic tanks	Community Septic Tank	unavailable
B7(S)	Tupperware Co. (Laboratory)	Secondary	Tie into Woonsocket sewerage system	1982
B8(S)	Tupperware Co.	Secondary	Tie into Woonsocket sewerage system	1982
B10(M)	Woonsocket Wastewater Treatment Facility	Secondary Activated Sludge	No Change	—
B11(W)	Woonsocket Water Treatment Facility	None	No Change	—
B12(A)	Cumberland High School	Extended aeration and chlorination	Tie into BVDC sewerage system	1982
B16(S)	Ashton Septic Tank Overflow	Septic Tank	Submit Facilities Plan (S.201) detailing action to be taken	1982

(Revised 6/30/82

Table 711-06(6) Continued

B17(I)	Nife, Inc.	Neutralization, ion-exchange	No Change	—
B20(W)	Cumberland Water Treatment Plant	None	No Change	—
B22(S)	Valley Falls Individual Sewers	None	Submit Facilities Plan (S.201) detailing action to be taken	—
B23(W)	Pawtucket Water Treatment Plant	None	No Change	—
B24(I)	Corning Glass Works	Neutralization	No Change	—
B25(O)	Central Falls C.S.O.	None	Primary Treatment and Disinfection	1983
B26(O) & N1(O)	Providence C.S.O.	None	Primary Treatment and Disinfection	1983
B32(O) & N13(O)	Providence C.S.O.	None	Primary Treatment and Disinfection	Not Available
B39(M)	Smithfield Wastewater Treatment Facility	Secondary Activated Sludge	None	—
N1(O)	See B26(0)	—	—	—
N2(M)[b]	Blackstone Valley District Commission Wastewater Treatment Facility	Secondary Activated Sludge	Modifications to existing system to meet effluent standards and operate at design capacity	1982

(Revised 6/30/82)

Table 711-06(6) Continued

N3(O)[c]	BVDC Overflows	None	—	—
N4(I)[c]	Washburn Wire	Oil Separation	Modifications to comply with best professional judgement	1983
N9(R)	Texaco, Inc.	Oil Separation	No Change	—
N13(O)	See B32(O)	—	—	—
N16(I)	Lehigh Portland Cement Co.	Settling Tank	No Change	—
N17(R)	Sun Oil Co.	Oil Separation	No Change	—
N19(M)	Providence Wastewater Treatment Facility	Secondary Activated Sludge	Renovations to meet effluent standards and operate at design capacity	Not Available
N20(R)[c]	Gulf Oil Co.	Oil separation	No Change	—

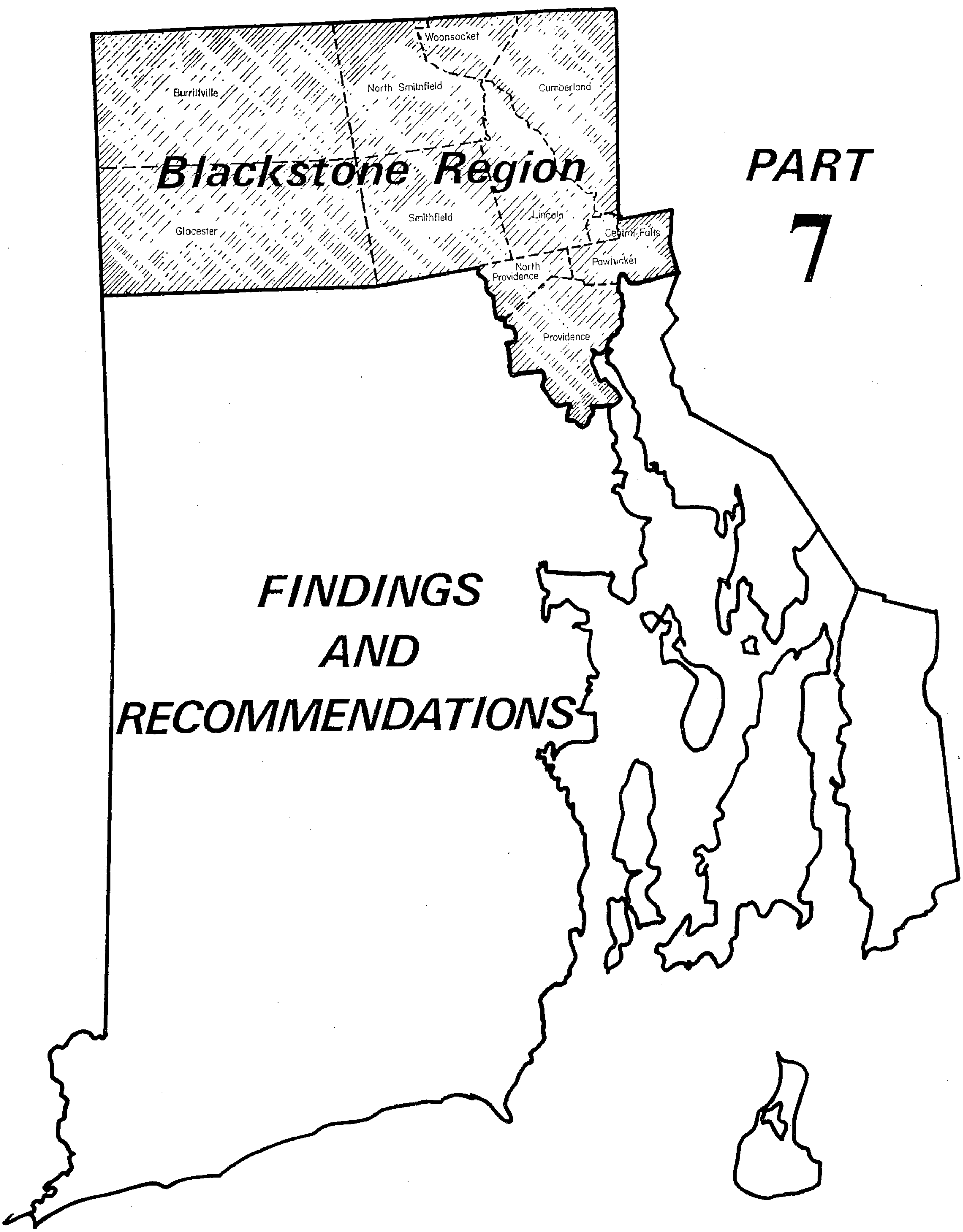
a. Does not include cooling water discharges.

b. N2(M) is located in the Narragansett Region but is included here because most of its service area is in the Blackstone Region

c. Discharges in both the Narragansett and Blackstone Regions.

(Revised 6/30/82)

PART 7

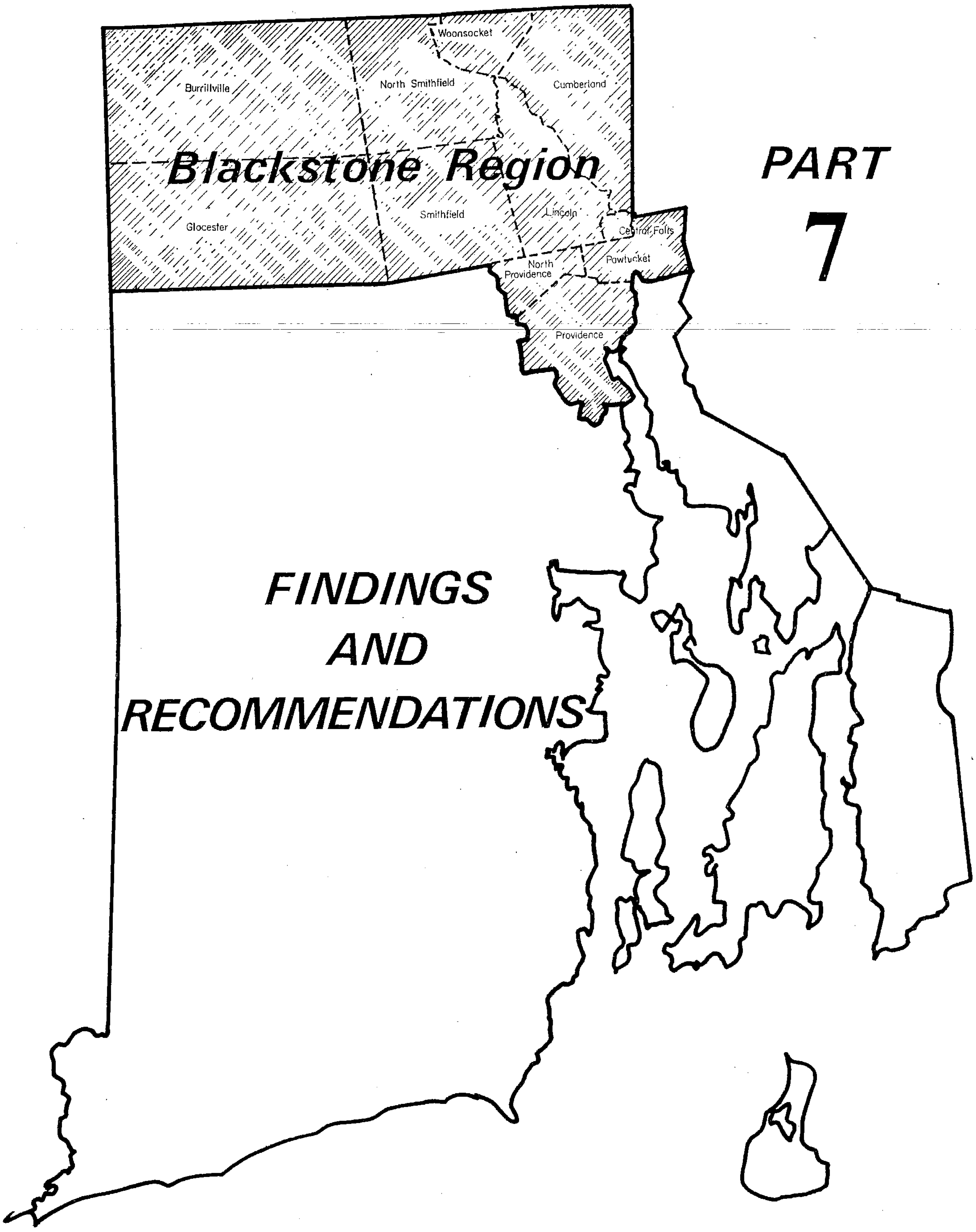


FINDINGS AND RECOMMENDATIONS

PART 7

Blackstone Region

FINDINGS AND RECOMMENDATIONS



711-07 FINDINGS AND RECOMMENDATIONS

07-01 GENERAL FINDINGS

In assessing the need for municipal sewerage and water supply facilities, several factors affecting the growth potential of the region must first be considered. Factors such as population changes, economic growth, and patterns of land development provide basics for the recommendations which are discussed in Chapter 07-03.

07-01-01 Population

The population of the Blackstone Region according to 1980 Bureau of the Census figures is 441,602. Table 711-07(1) depicts the population for each town in the region for 1970, 1980, and 2000. By the year 2000, the population of the Blackstone Region is projected to be 429,288, which is a 3 percent decrease from the 1980 population ((35)). The population for the state in the year 2,000 is projected to be 1,005,600 which is a 6 percent increase from the 1980 population of 947,154.

The population decrease within the Blackstone Region is caused primarily by the loss of population in the cities of Central Falls, Providence, and Pawtucket with 35, 16, and 15 percent losses respectively. The following towns will be experiencing significant population increases between 1980 and 2000: Glocester (36%), Lincoln (20%), Smithfield (19%), North Smithfield (14%), and Johnston (12%).

07-01-02 The Economy

Most communities try to attract some industrial development as a means of balancing the tax burden and providing local employment. In their attempts to lure such industries, however, communities must consider the needs, and effects of such development. Many industries discharge large volumes of wastewater, and thus they require a treatment facility. The Rhode Island water quality criteria adopted by DEM contain an anti-degradation policy which prohibits new discharges of wastewater (except cooling water) into Class A, SA, B, or SB waters. This policy means that water-using industries cannot locate on sites where discharge to Class C waters or a public sewer is not feasible. Communities in the Blackstone Region must concentrate their efforts on attracting industries which do not use large quantities of water. Table 711-07(2) shows the industrially zoned areas in the Blackstone Region and the availability of sewers and water at those sites. A map showing industrially zoned land and sewered lands in non-urban areas is included in the 208 Water Quality Plan for Rhode Island.

There also can be problems with industries which are not large water users. Those industries which do not tie into a waste treatment facility will have to use other means of waste disposal, such as sub-surface disposal. Many industrially zoned sites in the region which are not served by sewers have soils which will present limitations for subsurface system installation.

One effect of industrial development which often has not received much attention is the pollutant potential of stormwater runoff from the large impervious

Table 711-07(1)

POPULATION TRENDS AND PROJECTIONS
BLACKSTONE REGION

Community	1970[1]	1980	2000[1]
Burrillville	10,087	13,164	14,800
Central Falls	18,716	16,995	13,352
Cumberland	26,605	27,069	29,979
Glocester	5,160	7,550	10,180
Johnston[2]	22,037	29,907	33,495
Lincoln	16,182	16,949	19,440
North Providence	24,337	29,188	33,014
North Smithfield	9,349	9,972	11,122
Pawtucket	76,984	71,204	63,219
Providence	179,116	156,804	134,522
Smithfield	13,468	16,886	20,748
Woonsocket	46,820	45,914	45,417
Totals	448,861	441,602	429,288

1. 1970 and 1980 figures are from the Bureau of the Census, while figures for the year 2000 were projected from the 1980 census incorporating the same assumptions utilized to project the change in population from 1980 to 2000 in Technical Paper Number 83 Rhode Island Population Projections, April 1979.

2. Includes the total population of Johnston instead of just that portion within the Blackstone Region.

Table 711-07(2)

SUMMARY OF INDUSTRIAL SITE FACILITIES AND UTILITIES BY CITY AND TOWN, 1977

City or Town	Total Acres	Total Sites	Without Water Acres	Without Water Sites	Without Sewer Acres	Without Sewer Sites
Burrillville	476	13	313	7	467	13
Central Falls	230	6	--	--	--	--
Cumberland	1,052	8	2	1	337	4
Glocester	215	2	215	2	215	2
Johnston	483	11	18	1	343	6
Lincoln	1,246	8	--	--	46	2
No. Providence	99	9	--	--	--	--
No. Smithfield	681	4	--	--	681	4
Pawtucket	959	14	--	--	6	2
Smithfield	1,941	14	348	7	371	7
Woonsocket	832	13	--	--	--	--
REGION TOTAL	8,205	102	896	18	2,446	40

Source: 208 Water Quality Plan for Rhode Island surfaces which usually accompany such uses. Toxic substances spilled in parking areas, seepage from stored materials, and leachate from dumping sites all have potential to contaminate water bodies.

It is estimated that in 1980 the total employment figure for the Blackstone Region will be approximately 265,100, and by the year 2000 this figure will be approximately 305,500 ((36)). Table 711-07(3) depicts total employment for each community in the Blackstone Region for 1980 and the year 2000. The industries within this region that are projected to have the greatest absolute employment increases are manufacturing, service industries, and wholesale and retail trade. The communities within the region that are projected to have the greatest absolute increases are Providence, Pawtucket, and Woonsocket. The developing communities in the Blackstone Region should evaluate land to be zoned and used for industry in view of soil types, slopes, groundwater aquifers and recharge areas, and availability of public utilities to protect surface and groundwater.

07-01-03 Patterns of Land Development

Water quality is strongly correlated with patterns of land development. Urban water bodies are usually altered by the discharge of pollutants, while water bodies located in rural areas tend to have higher water quality. Once development patterns, that are conducive to the generation of both point and nonpoint pollution, are established, it is extremely difficult and costly to effectively abate that pollution. However, with proper land use planning and design, new developments may avoid the runoff pollution problems associated with older urban areas. Land use recommendations cited in this plan are primarily directed to communities in developing and rural areas, so that future growth can be accommodated without causing water quality deterioration or expensive municipal wastewater treatment facilities.

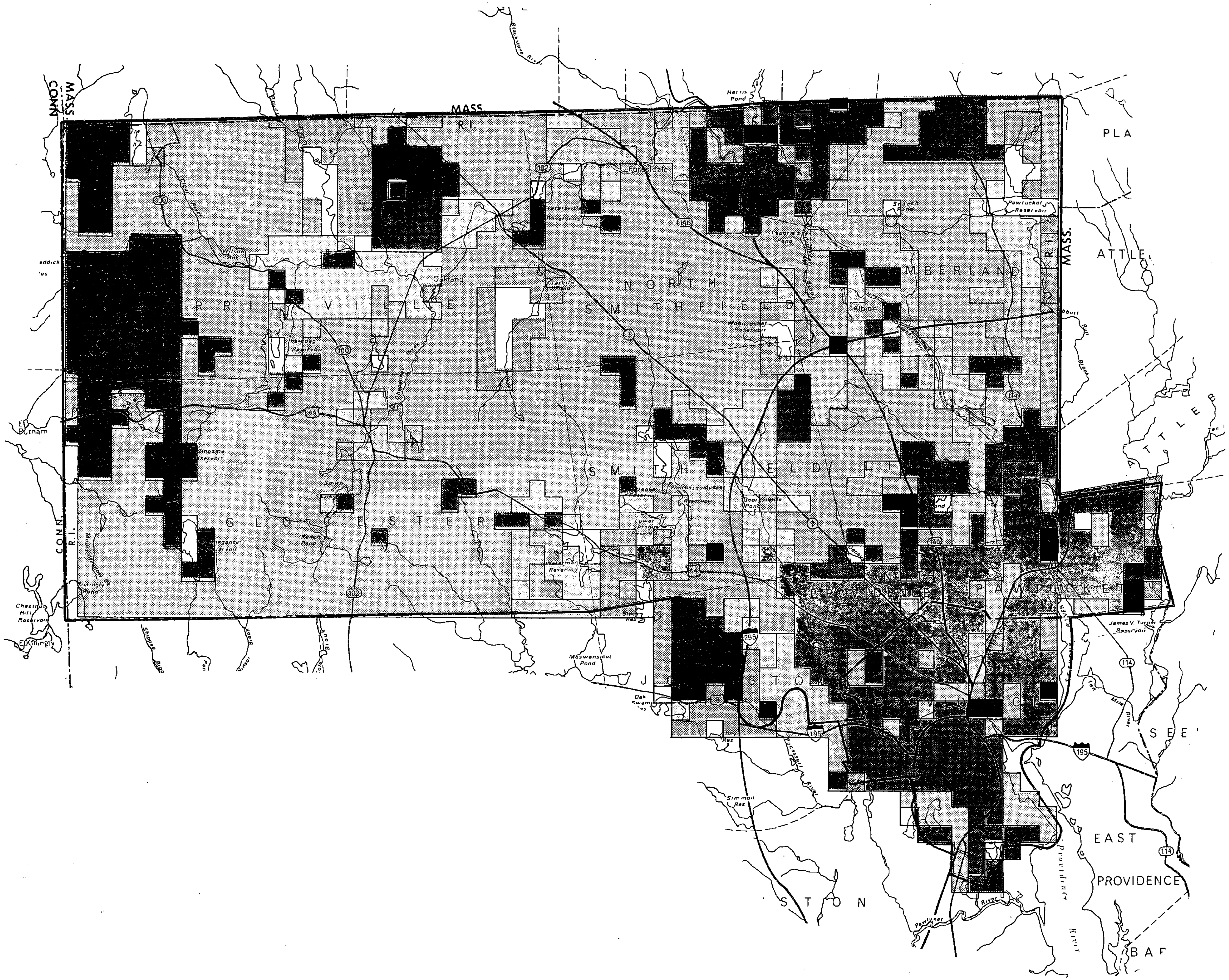
A future land use plan for the State of Rhode Island entitled State Land Use Policies and Plan, (Land Use Plan) has been adopted as an element of the State Guide Plan, by the State Planning Council ((31)). Six broad land use categories are included in the state plan: residential, commercial, industrial, governmental and institutional, airports, and open space. For a more detailed explanation of each land use category refer to he Land Use Plan.

Figure 711-07(1) illustrates the proposed development (1990) of the Blackstone Region according to the State's land use plan. The plan was developed on the basis of a 92 acre grid system in order to determine the distribution of the various land use categories. Table 711-07(4) depicts the distribution in acres by community within the basin.

The total population of the Blackstone Region for the year 2000 has been projected to decrease by approximately 3 percent. However, the decrease is attributed to declining populations in the cities of Central Falls, Pawtucket, Providence, and Woonsocket. The remaining cities and towns in the Blackstone Region will experience moderate growth over the next 20 years. It is paramount that this growth be controlled in order to accomodate development in an orderly fashion.

The degree to which land use should be controlled and pollution abatement measures applied should be related to the ecological significance of the lands and waters involved. There are several types of areas which are particularly sensitive and should be protected from pollution. These types are described below:

Figure 711-07(1)



State of Rhode Island

Land Use Plan 1990
Blackstone Region

Legend:

- Residential : High Density
- Residential : Medium Density
- Residential : Low Density
- Commercial
- Industrial
- Airports
- Governmental, Institutional
- Open Space : Recreation
- Open Space : Conservation
- Open Space : Woodland, Open Land
- Region Boundary

Note: Providence is in both the Narragansett and Blackstone Regions

N

5 SQ MILES
1 SQ MILE
100 ACRES

MILES 1 2 3 4 5

KILOMETERS 1 2 3 4 5 6 7 8

FEET 6000 12000 18000 24000

Prepared by the RHODE ISLAND STATEWIDE PLANNING PROGRAM assisted by federal grants through the Joint Funding Assistance Program

Table 711-07(4)

FUTURE LAND USE 1990 BY COMMUNITY FOR THE BLACKSTONE REGION (IN ACRES)

Community	Residential Densities: Low	Medium	High	Commercial	Industrial	Airports	Govt. Inst.	Recreation	Conservation	Forest Open
Burrillville	3,358	1,150	368	---	276	---	92	4,784	3,680	14,812
Central Falls	---	---	230	---	184	---	---	---	---	---
Cumberland	644	3,680	1,012	---	828	---	---	2,300	828	7,400
Glocester	690	522	---	---	---	---	---	368	276	8,096
Johnston	736	3,036	1,104	100	300	---	---	1,900	200	7,000
Lincoln	368	1,058	552	---	276	---	92	552	92	1,196
North Providence	---	---	2,852	---	100	---	100	500	---	---
North Smithfield	552	1,656	368	---	92	---	---	368	460	11,300
Pawtucket	---	---	4,048	300	600	---	100	300	400	---
Providence	---	---	8,464	300	1,000	---	700	600	---	---
Smithfield	736	1,656	460	100	1,400	600	500	1,200	400	8,900
Woonsocket	---	---	3,400	300	700	---	---	500	---	100

Source: R.I. Statewide Planning Program, State Land Use Policies and Plan Providence, Rhode Island: 1975

Areas suitable for groundwater development - Much of Rhode Island depends upon high-quality groundwater supplies as sources of potable water. Those aquifers which are of current or potential importance as drinking water supplies should be protected from contamination. In order to protect the aquifers, controls also must be placed on activities which occur in the recharge areas for these groundwater supplies. Groundwater aquifers which are of importance as current and future sources of potable water in the Blackstone Region are shown on Figure 711-03(2).

Surface water reservoirs - Many Rhode Island communities rely upon surface water reservoirs, such as the Scituate, for public water supply. As is the case with groundwater aquifers, these must be protected from contamination which would endanger the suitability of the water for drinking. Reservoirs which are of current or potential value as sources of potable water have been identified and are shown on Figure 711-03(1).

Coastal ponds - Coastal ponds and wetlands are recognized under the Federal Coastal Zone Management Act and the state's coastal resources management program to be critical natural areas which must be protected. They are primary habitats of many forms of aquatic fish and plant life, and they have fragile ecosystems which can be adversely affected by many activities of man. However, there are no coastal ponds within the Blackstone Region.

Freshwater wetlands - Freshwater wetlands have been recognized as important natural resources. They have been identified by the R.I. Department of Environmental Management, and they are shown on maps on file at DEM. An accurate identification, however, requires on-site inspection.

Class A and Class B waters - Those waters which already are of fishable-swimmable water quality should be protected from degradation. Residential, commercial, industrial, and recreational uses all have potential to cause water pollution if they are not properly located and designed. Class A and Class B waters have been identified by DEM and are shown on Figure 711-03(1).

Floodplains - Floodplains serve as water storage areas, and development reduces the water-holding capacity of these lands. Reduction in water-holding capacity in turn increases the rate of flow into the receiving waters during periods of heavy precipitation, causing downstream flooding and erosion. Floodplains in Rhode Island have been defined and identified by the Federal Flood Insurance Administration, and a set of these maps is on file at the Rhode Island Statewide Planning Program office.

A. Existing Land Use Control Programs

There are several federal, state and local programs which affect the use of land in Rhode Island. Some of these are directed specifically to protection of certain of the environmentally sensitive water-related areas described above. These programs are discussed briefly below.

Federal Programs

The relationship between land use and water quality is specifically recognized in Section 208 of the Federal Clean Water Act, which requires that the 208 plan establish a program to "regulate the location, modification and construction of any facilities . . . which may result in any discharge." This section also focuses on the institution of land use controls to minimize pollution from nonpoint sources, such as agriculture and construction.

The Safe Drinking Water Act of 1974 provides that federal funds be omitted in areas where aquifers are in danger of contamination. The 208 land use recommendations are a means of helping to ensure that such contamination does not occur.

The Coastal Zone Management Act of 1972 provides for the development of management plans to protect the nation's coastal waters, shorelands, and inland waters which have a direct and significant impact on coastal waters. There are several relationships between coastal zone management planning and water quality planning, undertaken through Section 208 of the act. Section 307 of the Coastal Zone Management Act specifically provides that programs developed pursuant to the Clean Water Act will be incorporated as the water quality component of coastal zone management programs. This provision attempts to achieve compatible planning between the two programs, and a memorandum of understanding has been entered into between Rhode Island's 208 planning program and the state's coastal resources management agency. All proposals for activity in the coastal zone are evaluated in terms of their impact on water quality, among other factors. However, the Coastal Zone Management Act has limited application to this region.

Two other federal acts which affect land use are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. These provide flood insurance to owners of properties subject to flooding, provided communities implement structural controls based upon minimum standards set by the Federal Emergency Management Agency. Regulations promulgated under this act require such things as that the lowest floor of residential structures be elevated at least to the 100-year flood level. This program has been criticized heavily on the grounds that it encourages development in flood-prone areas by subsidizing insurance which might not otherwise be available, except at extremely high cost.

State Programs

There are several state laws aimed at protecting wetlands and shoreline areas. These include controls over intertidal salt marshes, coastal wetlands, and freshwater wetlands.

Freshwater wetlands, including marshes, swamps, bogs, and other types of wetland areas, are protected under the Fresh Water Wetlands Act of 1971, and the amendments to this act of 1974. The act prohibits the alteration of freshwater wetlands by excavation, drainage, fill and other activities without first obtaining a permit from the Department of Environmental Management and the approval of the local city or town council. A violator under this act may be required to restore the wetland to its previous condition, and he also is liable for a fine of up to $1000 for each violation.

The Fresh Water Wetlands Act, Sections 2-1-19 through 2-1-25, also defines floodplains as areas adjacent to a river or stream which are likely to be covered with floodwaters resulting from a 100-year frequency storm. These floodplains are considered wetlands under the act, along with any land within 50 feet of the edge of a bog, marsh, swamp or pond.

Chap. 46-23 of the General Laws established the Coastal Resources Management Council (CRMC) to plan and coordinate activities in the coastal areas. Several specific types of activities over which the CRMC has jurisdiction are set out in the act:

- power generating and desalination plants;
- chemical or petroleum processing, transfer, or storage;
- minerals extraction;
- shoreline protection facilities and physiographical features;
- intertidal salt marshes; and
- sewage treatment and disposal, and solid waste disposal facilities.

The CRMC has adopted a coastal management plan in accordance with the national legislation. The 208 plan is the water quality element of this coastal plan. A memorandum of understanding has been entered into by the 208 project and the CRMC to ensure coordination of the two planning processes. The R.I. Coastal Resources Management Council has authority to regulate potentially polluting activities within coastal wetlands and contiguous land areas within 200 feet of these wetlands. The CRMC plan recognizes that sewage disposal and stormwater runoff occurring outside that 200-foot area can affect the quality of coastal waters, but coastal permits are required only for "major" activities which occur beyond the 200-foot boundary.

Local Programs

Local governments traditionally have had the primary authority for regulating land use. This authority is granted to the cities and towns by the state zoning and subdivision enabling acts, which were adopted during the early 1920's. The acts set forth specific purposes for land use controls and describe the kinds of actions which can be taken.

Zoning - Zoning ordinances divide the land in a community into districts and specify the uses which are permitted in each. Every community in Rhode Island has adopted zoning ordinances. In the Blackstone Region most communities adopted their ordinances under the provisions of the general state zoning enabling act.

The zoning powers, as stated in the general enabling act, are as follows:

> . . .to regulate and restrict the height, number of stories and size of buildings and other structures, the percentage of lot that may be occupied, the size of yards, courts and other open spaces, the density of population, the location and use of buildings, structures and land for trade, industry, residence or other purposes, and to prohibit or limit uses of land in areas deemed to be subject to seasonal or periodic flooding.
>
> For any and all of said purposes said city or town council may divide the municipality into districts of such number, shape, and area as it may deem best suited to carry out the purposes of this chapter; and within such districts it may regulate and restrict the erection, construction, reconstruction, alteration, repair or use of building, structures or land. All such regulations shall be uniform for each class or kind of buildings throughout each

district but the regulations in one district may differ from those in other districts.

The most persistent controversy with regard to zoning is the so called "taking issue". The Fifth Amendment to the U.S. Constitution provides protection for property owners: ". . .nor shall private property be taken for public use, without just compensation." Courts have held that a municipality cannot zone property in such a way that the owner is "denied all economic use" of the land. It is often difficult to determine at what point zoning restrictions constitute such an unlawful taking.

The interpretation of the takings clause is a crucial matter for the future of environmental regulatory programs. Restrictions designed to protect environmentally sensitive areas will limit the use of private land, and the regulations will be nothing more than delaying tactics unless the courts uphold them. Land use regulations are more likely to be upheld if they are closely tied to sound factual evidence. There has been a growing recognition of the need to ensure that urban development occurs in a nondestructive fashion and that natural resources are conserved.

<u>Subdivision Regulation</u> - Subdivision regulation is a second major land use tool available to local communities in the Blackstone Region. The subdivision enabling act gives local planning boards or commissions the power to adopt rules and regulations governing the platting of land and to review proposed plats for compliance with the regulations. Developers may appeal rulings of the planning board to the zoning board of review. The enabling act sets forth the purposes of subdivision regulation as follows:

> . . .to make adequate provisions for traffic; to lessen traffic accidents; to promote safety from fire and other dangers; to provide adequate light and air; to prevent overcrowding of land; to prevent the development of unsanitary areas for housing purposes; to secure a well-articulated street and highway system; to promote a coordinated development of unbuilt areas; to secure an appropriate allotment of land area in new developments for all the requirements of community life; to conserve natural beauty and other natural resources; to conform to any master plan which may have been adopted; to furnish guidance for the wise and efficient expenditure of funds for public works; and to facilitate the adequate, efficient and economic provision of transportation, water supply, sewerage, recreation and other public utilities and requisites.

B. Land Use Controls And Water Quality

The major pollution sources which can be partially alleviated by proper land use planning are leachate from landfills and individual subsurface disposal systems, and stormwater runoff. Landfills are discussed in detail in Section 711-05-01 of this report.

Leachate Pollution

Approximately 30 percent of the Blackstone Region depends upon individual subsurface systems for disposal of household wastes. The ability of the land to support development utilizing these systems is related to the size of the lot, and to site characteristics, such as soil type, the height of the water table, and the depth to bedrock. Because installation of public sewerage facilities is expensive and encourages growth, many communities would prefer to continue the use of septic systems. In order to help ensure that these systems function properly, communities should regulate the sizes of lots where such systems are used, in a manner which will achieve their water quality objectives, as well as other development goals. Calculations made for the 208 Plan indicate the following minimum lot sizes for the residential development using subsurface systems:

> The minimum lot size in areas to be served by individual subsurface disposal systems and public water should be at least 15,000 square feet; the minimum in areas to be served by subsurface disposal and private wells should be at least 1½ acres, or approximately 60,000 square feet.

Because of the close relationship between the characteristics of the soil and the proper functioning of septic systems, it is desirable for communities to utilize the soil surveys prepared by the U.S. Soil Conservation Service in the development of the zoning map. Specific requirements can be placed in the zoning ordinance for consideration of the suitability of soil for a proposed type of development. A specific soil consideration requirement should be incorporated into zoning ordinance provisions.

For development adjacent to streams and ponds, additional land use regulations may be desirable. The current regulations of the Department of Environmental Management for siting of subsurface disposal systems require that the leaching field be at least 50 feet from any water body. Although this distance may be adequate for the attenuation of pollutants that can be removed by the soil, a greater setback for all on-site construction activities would be desirable, where possible, to preserve the natural vegetative conditions along the pond or stream bank, and to mitigate surface water runoff and erosion problems.

In watersheds of public water supply reservoirs and recharge areas for important aquifers, a maximum density of one dwelling unit for every two acres is desirable. These low densities will help ensure that leachate does not harm important water supplies and fragile ecosystems. In addition, they will help ensure that the land will be capable of absorbing stormwater runoff.

Leachate from improperly constructed storage tanks for gasoline and other chemicals is another source of groundwater pollution. If storage tanks and pipelines are located where the soil is exceptionally permeable or where the soil is exceptionally permeable or where the water table is close to the surface, pollution dangers are increased.

Urban Runoff

There are numerous effects on the hydrologic system when land is converted from natural conditions to urban uses. These changes may include the following:

- a decrease in soil porosity through compaction
- the elimination of surface areas which retain precipitation
- an increase in impermeable surfaces
- a decrease in vegetation which decreases transpiration and interception of water

- an increase in the smoothness of surfaces
- an increase in surface water runoff.

In the Blackstone Region's urban areas, land use regulation will not have a significant effect on urban runoff or the pollution it causes since development has already occurred. In developing and rural areas, however, it may be possible to avoid future problems of the types which now exist in the heavily built-up northeastern quarter of the state.

In medium-low to low-density areas (1½ or more acres per dwelling unit), the land should be capable of absorbing most stormwater. In areas where the soils are impermeable, however, or the development occurs very close to a water body, there may be water quality impacts from urban runoff. Tools which communities might use to reduce or eliminate runoff are described below.

Buffer Strips - The degree to which streams and ponds become polluted is related to the distance of the development from the water body. One way to reduce or eliminate pollutants from both leachate and runoff is to establish and maintain a vegetated buffer strip extending from the banks or high-water mark of the stream or pond to some point landward. This strip protects adjacent developments from the water, and it protects the water from adjacent developments. Such strips are useful for runoff control only where there is no storm drainage system constructed, because storm sewers will usually pass through the buffer strip to discharge the pollutional load to the receiving water. Even where there are storm drains, however, buffer strips offer aesthetic and recreational possibilities.

Developing communities should establish a setback requirement of 100 feet from the rainy-season flow line of a stream or 100 feet from the high-water mark of any lake or pond, wherever possible. A 300-foot setback is recommended from public water supply reservoirs, and a 400-foot setback is recommended from any groundwater aquifer pumping center. Land disturbance during construction should be minimized, and the natural vegetation should be left intact, as much as possible. If natural vegetation is removed, the area should be revegetated as soon as possible to reduce impacts from erosion and sedimentation.

In many cases, the land ownership patterns may preclude setbacks of this size. By requiring a large minimum lot size in waterfront and sensitive areas, however, the community can increase the probability that a landowner will have sufficient space on his or her lot to allow for the setback as well as a dwelling with a subsurface disposal system and a well.

Cluster and Planned Unit Development - Any measures which reduce the percentage of a development which is in impervious surfaces also reduces the amount of runoff. For this reason, cluster developments and planned unit developments offer water quality advantages. In cluster developments, lot sizes are reduced and houses are placed closer together than in a conventional subdivision. In exchange, added open space is gained. Allowing this type of residential pattern in the local zoning ordinances facilitates protection of sensitive lands by reducing the pressures on land owners and developers to use as much of their land as possible to maximize economic gain. They also reduce the amount of land needed for streets and walkways, thus reducing the amount of run-off.

Planned unit developments are similar to clusters, but they allow for uses other than residential. they offer the same advantages as cluster developments, with particular benefits in reduced stormwater runoff. The mixing of residential, commercial and industrial development in an efficient, well-planned unit greatly reduces the need for paved roads and provides considerable natural open space.

Subdivision Regulations - Communities also can use their subdivision regulations to reduce runoff from new developments. In most communities in Rhode Island, the regulations include provisions for drainage improvements, but these often are inadequate. In view of the potential for pollution from stormwater runoff, it is desirable for communities to take whatever steps are available to them to reduce runoff. A sample regulation designed for this purpose is included in the 208 Water Quality Plan for Rhode Island.

Water Quality Issues Special to Rural Areas

While all the recommended actions are equally applicable to developing and rural areas, there are some issues which relate specifically to rural communities. Agricultural operations create special pollutional potential, and the land use goals of rural communities may be different from those of developing communities.

In general, water quality in the rural areas of the state is extremely good; there are only a few cases where small concentrations of development have caused a deterioration to Class C water. In these areas, there is an excellent opportunity to use wise land management to ensure that this water quality remains high. Preservation of the rural character of these communities is an effective means of ensuring that environmental pollution does not reduce the scenic quality or the quality of life.

One of the issues considered is the effect of application of fertilizers on groundwater. In rural areas of the region, heavy application of nitrogen fertilizers has potential to contaminate aquifers and private wells, and it can contribute to the eutrophication of fresh and salt water. This danger is also present where homeowners make frequent application of garden or lawn fertilizers. Maintaining natural vegetated buffers is one way to reduce the danger related to this problem. Another is to educate homeowners in waterfront areas as to the possible impacts of fertilizers on water quality.

The State Land Use Policies and Plan recommends an average density of one dwelling unit for each five acres in rural areas, to emphasize the bucolic nature of these areas, rather than their residential potential. Low-density development can also achieve other objectives such as the preservation of wildlife habitats, reduction of air pollution and absorption of flood waters. This recommendation is not inconsistent with this plan, although smaller lots probably are sufficient to meet water quality goals. Communities wishing to combine water quality protection with other land use objectives, such as preservation of the rural character, may want to utilize even larger lot sizes. One effective technique would be to establish exclusive agricultural zones in farming sections. Such zoning may be possible under the current zoning enabling act. Under this scheme, areas with particular potential as farmland could be zoned as exclusively agricultural, with very large minimum lot sizes, such as ten acres or more.

Before instituting exclusive agricultural zones, the community would have to prepare a plan which discusses the role of agriculture in the community, locates important agricultural lands, and explains how zoning will be used to preserve agricultural land. If these zones are to be created, they should be specifically to preserve agriculture, and not be provided for large-lot residential zoning. The primary use should be agriculture, just as industry is the primary use in an industrial zone. Residences which are accessory to the agricultural use should be permitted, but only to provide shelter for those engaged in agricultural production.

Other Land Use Tools

Land acquisition and tax incentives are tools communities can use to help implement community development objectives. Outright acquisition of sensitive lands is an excellent means of protecting them from development. Although there is some expense involved in such a program, in the long run it may prove cost-effective in protecting valuable resources and preventing problems which could be costly to correct. For example, all the land within a 400-foot radius of any proposed pumping center could be acquired to prevent pollution of the groundwater.

Several studies have found that it can be less expensive for a community to purchase land outright than to allow it to be developed and to pay for the services which would be required by the development. Land trusts and land banking schemes are among those measures which can be used to keep open space out of the development market. Each community should adopt an open space plan which considers the full range of acquisition mechanisms. Many Rhode Island cities and towns did such studies as part of their recently completed conservation, open space and recreation plans.

Probably the most common type of open space tax reduction is for agricultural land. Many states concerned about the conversion of prime agricultural land to more intensive uses have instituted programs intended to preserve farmland. In Rhode Island, the Farmland Preservation Act of 1981 and the Farm Forest and Open Space Act could be utilized to preserve valuable land from development.

The Farmland Preservation Act established an agricultural land preservation commission to conduct the inventory and acquisition of development rights to farmlands in the State of Rhode Island. This program, if funded, would be expensive since the aquisition of development rights usually represents two-thirds or more of the fair market value of farmland. The purchase of development rights is considered by many to be the only effective means to preserve farmland on the urban fringe where development pressures are most intense and the differences between land values for farming and for development are most divergent.

The state Farm, Forest, and Open Space Act could be utilized to give tax breaks to landowners possessing qualifying agricultural, forested, or open space property. The goal of this program is to give tax incentives to landowners to keep property from being developed.

Some environmentally sensitive areas should be protected on a state level in addition to the local level. Several states have adopted critical areas legislation to guarantee the proper management of environmentally sensitive areas. The State-Local Land Management Bill introduced in the state legislature in 1978 proposed to satisfy this need. Excerpts from this bill (chapter 3) which define critical water resource protection areas are as follows:

CHAPTER 3

Areas of Critical Concern

28.1-3-1. DEFINITION OF AREAS OF CRITICAL CONCERN,-(a)

(1) (iii) public water supply sources, including surface waters and ground waters used by the public for drinking or other domestic uses, dumping centers, groundwater reservoirs, and land located in natural watersheds; and

(3) an area containing or having a significant impact upon a natural resource, including:

(i) unusually fragile lands, where uncontrolled or incompatible development could result in irreversible damage to important natural systems, including shorelines of lakes, ponds, and streams; wildlife habitats, including habitats of rare or endangered species; rare or valuable ecosystems, biologic features, and geologic formations; and other unique and significant areas;

(ii) natural hazard lands, where uncontrolled or incompatible development could endanger life and property, including flood plains, steep slopes subject to slides or erosion, areas subject to weather disasters, and areas of unstable geologic formations; and

(iii) renewable resource lands, where uncontrolled or incompatible development could result in loss or reduction of continued long-range productivity that would endanger water, food, fiber, or forest resources, including watersheds, aquifer recharge areas as defined by the water resources board; prime and unique agricultural land as defined for Rhode Island by the soil conservation service of the department of agriculture; and land in woodland suitability classes 1, 2 and 3 as defined for Rhode Island by the soil conservation services of the U.S. Department of Agriculture.

The state legislature should enact, as soon as possible, critical areas legislation which will protect environmentally sensitive water related areas in Rhode Island.

07-02 WASTEWATER TREATMENT FACILITIES

In order to improve the treatment of, or eliminate wastewater discharges in the Blackstone Region and to provide sewerage systems for areas in need of this utility, some municipal wastewater treatment facilities construction is required in the Region. Existing sewer service area, programmed sewer service areas and, areas recommended for service are illustrated in the 208 Plan. A detailed description of existing, proposed, or recommended sewerage facilities for each community is presented below.

07-02-01 Town of Burrillville

A facilities plan (Section 201) for the Town of Burrillville was prepared by the engineering firm of Metcalf and Eddy, Inc. in 1975. The report proposed three sewer service areas for the town, consisting of the following: the Pascoag/Harrisville service area, which comprises the villages of Pascoag, Bridgeton, Harrisville, Oakland and Mapleville and consists of about 6,600 acres; the Spring Lake service area which consists of about 200 acres and includes the residential development around Spring Lake; and the Glendale/Nasonville service area which consists of about 3,600 acres and includes the villages of Mohegan, Nasonville, Glendale, Oak Valley and Tarkiln.

A secondary wastewater treatment plant was recently completed near Harrisville to treat the wastes of the Pascoag/Harrisville service area and Spring Lake service area. Treatment at this facility consists of secondary activated sludge with phosphorous removal. Phosphorous removal is required pursuant to the Rhode Island Department of Environmental Management Standards of Quality for Classification of Waters of the State, which state "new discharges of wastes containing phosphates will not be permitted into or immediately upstream of lakes or ponds."

Since there is a surface water impoundment located below the treatment plant discharge, advanced treatment in the form of phosphorous removal is mandated.

An additional facilities plan will be prepared to assess the most feasible alternative for treating the wastes of the Glendale/Nasonville area. The most likely alternatives would be the construction of a community septic tank or the construction of an interceptor that will tie this area into the Burrillville sewage system. The current plan for providing sewer service for the Town of Burrillville appears to be adequate. Low density zoning in the areas of town not proposed to be serviced should preclude the need for sewers.

07-02-02 City of Central Falls

The entire City of Central Falls is served by municipal sewers which tie into the Blackstone Valley District Commission treatment plant in East Providence. The City of Central Falls, like the cities of Pawtucket and Providence, combine their sanitary sewage with stormwater runoff during periods of heavy rainfall. It has been determined that there are approximately 125 storm events per year that cause the discharge of untreated sanitary sewage and stormwater runoff directly into the Blackstone, Moshassuck, and Seekonk Rivers, in addition to the extreme upper end of Narragansett Bay ((5)). There are 30 combined sewer overflows (CSOs) in the cities of Pawtucket and Central Falls, which have adjoining sewerage systems. There are 8 CSOs in Central Falls. A facilities plan, prepared for the

City of Central Falls recommended that the 8 CSOs be treated at two separate satellite treatment facilities ((5)). Treatment at each facility will consist of primary treatment and disinfection prior to discharge. Similar recommendations have been made for the cities of Pawtucket and Providence. The implementation of satellite treatment facilities in the City of Central Falls is being postponed until studies in Providence are completed to save on engineering and design costs for combined sewer overflows. The treatment of CSOs should be postponed until better information becomes available to insure their most cost effective abatement.

07-02-03 Town of Cumberland

The only areas of Cumberland with sewer systems are Ashton, Valley Falls, Lonsdale, and Cumberland Hill. The Ashton system presently discharges partially treated sewage into the Blackstone River. This discharge should be eliminated by tying into the BVDC systems. Some houses and business establishments in the Lonsdale area discharge wastewater into the Blackstone River through storm drains and sanitary sewers, and sanitary discharges in the Valley Falls area threaten the quality of the Abbot Run Brook. The Town of Cumberland has extended sewer service east of High Street in Valley Falls. However, this project will not eliminate all the discharges in Valley Falls and Lonsdale. The Abbott Valley Run Interceptor, which collects wastes from an industrial park in the vicinity of I-295, will collect the sewage from the service areas in Valley Falls.

A facilities plan is currently being prepared for the Town of Cumberland that will assess the Town's sewerage needs. Poor soil conditions in most of Cumberland and an expected population increase will require additional sewer service in developing areas. According to the 208 Areawide Water Quality Management Plan - Inventory of Subsurface Disposal Systems, potential on-site waste disposal problem areas in Cumberland include: Arnold Mills, Diamond Hill Road, the Manville-Cumberland Hill area, and Mendon Road. A facilities plan is being prepared to determine the sewerage needs and priorities of the entire community. At a minimum, this study should include the following:

a) Delineate areas of the Town of Cumberland with existing problems that may now require sewer service and develop a priority ranking. Indicate areas in the Town that may require sewer service in the future due to anticipated development.

b) Project population served and flows tributary to the BVDC system over the next 20 years from Lincoln and Cumberland. An engineering report prepared for the Town of Lincoln in 1970 could serve as a basis for determining projected flows from that Town.

c) Determine the adequacy of the existing BVDC interceptors to carry the anticipated flows from proposed service areas in Cumberland and from interceptors in Lincoln and Smithfield. The financial responsibility of the Town and the BVDC should be identified for each structural item proposed.

Sewage collected in the Town of Cumberland and treated at BVDC's plant produced an average daily flow of 0.9 mgd and served a population of approximately 7,700 in 1975.

07-02-04 Town of Glocester

The state land use plan proposes four small areas of medium density residential development in Glocester: one immediately south of the Pascoag Reservoir in the north central part of town, one adequate to Smith and Sayles Reservoir near Keech Pond, one in the Chepachet area, and one in the southeastern portion of Glocester.

At present time, Glocester relies entirely upon individual septic tanks and cesspools for the disposal and treatment of wastewater. Two built-up areas in the Town, Harmony and Chepachet, have had high repair and alteration rates for ISDS systems. These two places may require municipal sewerage in the future to alleviate these problems. Other areas of the Town are not expected to require sewers because of their low density.

The Town should prepare a comprehensive sewer plan by applying for a 201 facilities planning grant to determine the need for sewers in the Chepachet and Harmony sections. Alternatives that should be considered for the Chepachet section are: (1) rehabilitation of on-site systems; (2) collection and treatment with land disposal; (3) collection and treatment in Burrillville with discharge to the Clear River.

For the Harmony section, three alternatives should be considered: (1) rehabilitation of on-site systems; (2) collection and treatment with land disposal; (3) collection with treatment provided at the Smithfield wastewater treatment facility.

07-02-05 Town of Johnston

In 1977, approximately 15,300 of the town's 25,200 residents were served by sewers. The average daily flow of the system in 1977 was 2.03 mgd. The sewer system is located in that area of the Town east of I-295. Wastewater from the Johnston sewerage system is treated at the Providence municipal wastewater treatment facility.

At times, the flow in parts of the sewerage system is at or near capacity, causing surcharging and sewage overflows. The Plainfield Street Interceptor and the Atwood Avenue Interceptor have severe surcharging problems. Because of this, the Rhode Island Department of Environmental Management has issued an order to the Town prohibiting new connections of commercial or industrial establishments to the sewerage system. One of the contributing factors to this surcharging problem has been found to be excessive infiltration and inflow. Under a 1974 plan of study for sewerage improvements in the Providence sewerage system, (which serves Johnston, North Providence and parts of Cranston) a sewer system evaluation of infiltration and inflow was recommended for the cities of Providence, North Providence and Johnston. This recommended study was conducted in 1975 and found that Providence and Johnston have a possible dry weather infiltration and inflow of 25.2 mgd and 1.80 mgd, respectively ((1)). The conclusion of this study was that through rehabilitation of the Providence-Johnston sewerage systems, 14.66 mgd of the infiltration/inflow could be eliminated. This figure was later modified to 13 mgd ((4)). If this 13 mgd figure is applied proportionately to the above estimates of possible infiltration and inflow in the Providence and Johnston sewerage systems, it can be concluded that 0.9 mgd of the possible 1.8 infiltration and inflow in Johnston could be cost effectively eliminated. Because of the surcharging and infiltration inflow problems, a facilities plan (Section 201) is currently being conducted for the Town of Johnston which will detail improvements to be made to the sewerage system. This study should also indicate areas of the Town which will require sewer service and a program for providing it.

The present zoning west of I-295 requires only 10,000 square foot lots for residential development. If this area were developed extensively with those lot sizes, there is a high probability that sewers would be required in the future because of poor soil conditions. Areas with high and moderate probability of need for sewers because of present densities of development and soil conditions are: Susan Circle, Cherry Hill Road, Buratti Plat, Calcagni Terrace, Morgan Avenue, Memorial Plat, Farm Street, Cavalcade Boulevard, Green Meadows Plat, Elm Street, Pine Hill Avenue, Thornton Area, and King Street. Western Johnston should be rezoned from its present 10,000 square foot residential zoning to 1½ acre residential zoning to preclude the need for sewers and public water.

07-02-06 Town of Lincoln

Less than 20 percent of Lincoln's population is served by public sewers. There are two sewer systems in the Town: one is tributary to the North Providence system and the other to the BVDC system. Almost all of the Town's collected sewage goes into the BVDC system.

The average daily flow generated by the Town in 1977 was 2.23 mgd. The remainder of the population is served by individual subsurface disposal systems. However, according to a report prepared for the Town of Lincoln, the subsoil in many areas is not conducive to individual disposal systems ((45)). For this reason, the report recommended that eventually the entire community be served by sewers. Only those areas with the greatest need for municipal sewers (referred to as Phase I sewers in the engineering report) are recommended to be served in the near future. Phase I sewers are proposed to extend the service areas in Manville, Albion, Saylesville and Lonsdale, and to separate combined sewers in Manville.

The sewer extensions in Albion have been completed and the extension of sewers and separation of combined sewers in Manville has begun. It is not known when work will begin on the extension of sewers in Saylesville and Lonsdale.

07-02-07 Town of North Providence

As of 1977, approximately 90 percent of North Providence's population of 27,600 was served by sewers which are tributary to the Providence system and the average daily flow in 1977 was 9.39 mgd.

Although recent improvements to the system have reduced excessive infiltration and inflow, in 1975 half of the 9.4 mgd flow from North Providence to the treatment plant was estimated to be infiltration and inflow ((1)). Because of this excessive infiltration and inflow in the sewerage system, a facilities Section 201) plan, which will detail improvements to be made, is currently being conducted.

Future land use patterns suggested by the State Land Use Plan, will result in high density residential development throughout most of the Town. Sewer service will be available to almost all of the projected population for the year 2,000.

07-02-08 Town of North Smithfield

Some municipal sewers have been constructed in North Smithfield. Currently Union Village, Park Square and a small portion of Slatersville have been completed. The remainder of Slatersville and Forestdale will be sewered subject to the availability of funding. However, this project is not currently on the State Construction Grants Priority List. The area to be sewered in North Smithfield is delineated as a programmed service area (34). Collected sewage will be conveyed via the Cherry Brook Interceptor to the Woonsocket wastewater treatment plant.

07-02-09 City of Pawtucket

Almost all non-residential land uses and more than 95 percent of the dwelling units in Pawtucket are served by municipal sewers. In most sections of the city the sewers are combined with stormwater runoff, and during periods of heavy rainfall, stormwater and untreated sewage are discharged directly into the Blackstone, Moshassuck, and Seekonk Rivers in addition to the extreme upper end of Narragansett Bay.

There are 22 combined sewer overflows (CSOs) in Pawtucket that are activated by approximately 125 storm events per year ((3)). A facilities plan, prepared for the City of Pawtucket recommended that the 22 CSOs be treated at four separate satellite treatment facilities ((3)). Treatment at each facility will consist of primary treatment and disinfection prior to discharge. Similar recommendations have been made for the cities of Central Falls and Providence for the treatment of their CSOs. The implementation of satellite treatment facilities in the City of Pawtucket is being postponed until studies in Providence are completed which may save on engineering and design costs in Pawtucket. The treatment of CSOs in Pawtucket and in Central Falls should be postponed until better information becomes available to insure their most cost effective abatement.

07-02-10 City of Providence

The entire City of Providence is served by a municipal sewer system. The Providence wastewater treatment facility, located at Field's Point, serves, in addition to Providence, Johnston, North Providence, parts of Lincoln, and the Narragansett Brewery in Cranston. The design capacity for this treatment facility is 60 million gallons per day but because stormwater runoff is combined with sanitary sewage, this capacity can be greatly exceeded. There are CSOs at 65 locations within Providence. These CSOs discharge directly into the Woonasquatucket, West, Seekonk, Moshassuck, and Providence Rivers. Due to the discharge of improperly treated sewage from the plant after heavy rainfall, the Rhode Island Department of Health closes the upper Narraganset Bay to shellfishing. During 1977, 1978, 1979, and 1980 the upper bay was closed to shellfishing 71, 74, 100, and 61 percent of the year respectively.

In addition to exceeding its design flow capacity from CSOs, the Providence treatment facility has not been consistently achieving secondary treatment as required by the EPA. This is primarily due to the age of the facility which was built in 1900. The resulting degradation of water quality from the Providence plant caused the EPA to take enforcement action against the City. As a result, a consent decree between the EPA and the City, issued by the U.S. District Court, required the City to take necessary action to finance the repair and restoration of the City's treatment facilities. This work was finished in May, 1980.

On August 7, 1979, Governor J. Joseph Garrahy issued a policy statement regarding the Providence sewage treatment facility and the water quality of Narragansett Bay. This policy statement was based on a recommendation of the 208 Water Quality Management Plan for Rhode Island. The Governor outlined two major goals in his policy statement:

1) The need to accelerate construction of improvements to the Providence treatment facility, and;

2) The need to ensure efficient management and operation of all sewage treatment facilities in the State.

To attain these objectives, the Governor appointed a Sewage Facilities Task Force. In February 1980 this task force issued its final report. Their report recommended the following:

1) A state/regional sewer authority be created to serve the City of Providence and the Towns of Johnston and North Providence. This authority should be modeled after the Blackstone Valley District Commission; however, its governing board should include state members appointed by the Governor with the advice and consent of the Senate, and local members appointed by the chief elected officials of the communities served;

2) The State of Rhode Island should issue general obligation bonds to finance the State and local share of construction costs for capital projects of this new authority. These bonds should be amortized as follows:

   90% from State revenues and Federal aid;
   10% from assessments by the authority.;

3) A bond issue of an estimated $87.7 million should be requested to accelerate the construction of combined sewer overflow treatment facilities numbers 2 and 9 and the upgrading of the Providence Wastewater Treatment Plant;

4) A strategy should be developed and implemented to obtain a pre-financing agreement from the federal government and to recommend statutory changes to the Clean Water Act in order to enable Rhode Island to receive its "fair share" of federal water pollution control construction grants.

On March 16, 1980 Senate Bill 2877 was passed creating the Narragansett Bay Sewer District Commission and authorizing the state to issue General Obligation Bonds and Notes in an amount not to exceed 87 million dollars for the purpose of improving the Providence sewage treatment facility. At a general election November 4, 1980, the people of Rhode Island approved the 87 million dollar bond issue to finance improvements to the Providence plant.

A facilities plan prepared for the City of Providence in 1979, recommended the following:

approximately 14.4 mgd of extraneous dry weather flow could be eliminated from the Providence and Johnston sewer system by rehabilitating the sewers

separation of the combined sewer overflow system was not recommended because the costs and non-quantifiable repercussions of an extensive separation program would be enormous. It is more desirable to retain the existing combined system and to treat the urban runoff as part of the combined sewage

existing 65 CSOs should be consolidated into 9 CSO treatment facilities. These facilities should be designed to provide preliminary and primary treatment and disinfection for the established design flows. The facilities will be designed to function as possible future storage facilities which can be interfaced with dry weather facilities, in view of the possible need to achieve a higher degree of treatment in the future ((4)).

Currently two of the nine proposed CSO treatment facilities are being studied, CSO 2 which discharges into the Woonasquatucket River, and CSO 9 which discharges into the Providence River, to determine the most feasible treatment. These studies should continue to determine the most efficient and cost effective means of treatment. In addition, the following is recommended:

The highest priority should be given to upgrading the treatment facility to comply with secondary treatment.

Water quality sampling should be conducted by DEM in those rivers receiving CSO discharges to assess water quality impacts and to aid in the establishment of priorities for the treatment of additional CSOs.

sewer use charges should be revised to generate enough revenue to support the cost of operating and maintaining the sewage collection and treatment system.

07-02-11 Town of Smithfield

Sewage disposal in the Town at present is primarily by means of subsurface disposal systems. An engineering report prepared by the Town in 1968 recommended a two-stage sewer construction program. Stage I construction was to serve the Esmond, Georgiaville and Greenville sections of the Town and was to include construction of a wastewater treatment facility at Esmond. The second stage of construction was to extend the service area to the Spragueville section of the Town and in Greenville.

Since the updating of the 1968 report with a facilities plan, the Town has decided to construct the originally proposed two-stage project simultaneously. The project was completed in 1978. Sewage collected by this system is conveyed to a wastewater treatment facility in the Esmond section of the Town.

The design average flow for the plant is 3.5 mgd. It is expected that the design flow will be reached by the year 2000. Included in this flow are 0.5 mgd of industrial wastewater and about 0.2 mgd of sewage flow from the Harmony section of Glocester. Approximately 85 percent of the town's population should be connected to the system in the near future.

The Smithfield treatment plant discharges into a water quality segment in the Woonasquatucket River. To maintain Class C standards in this segment, advanced treatment of 15 milligrams/liter for biological oxygen demand and total suspended solids on a daily average for the month is required. Most wastewater treatment plants in the Blackstone Region require secondary treatment or 30 miligrams/liter for biological oxygen demand and total suspended solids.

The areas of the Town which would require sewer service based on the land use patterns recommended in the State Land Use Plan approximate those areas where sewers are presently being constructed. The northeastern corner of the Town requiring service according to the State Land Use Plan is the Smithfield Industrial Park. Wastewater from the Smithfield Industrial Park will be conveyed to the Blackstone Valley District Commission (BVDC) wastewater treatment facility via the Washington Highway and BVDC interceptors.

07-02-12 City of Woonsocket

The City of Woonsocket has an existing sewerage system which serves nearly all of its population, and in 1977 had an average daily flow of 6.67 mgd. The two main interceptors for the Woonsocket system were currently renovated. Because the low level interceptor had insufficient capacity to carry the year 2020 peak flow, relief was needed to adequately transport future flows from neighboring communities in Massachusetts. Also the Cherry Brook Interceptor was replaced by a larger interceptor so that it will be capable of handling sewage flows from North Smithfield.

The upgrading of the wastewater treatment plant from primary to secondary treatment was completed in January, 1978. In addition to the upgrading of the treatment plant, its capacity was also increased to 16 mgd average daily flow and 32 mgd peak flow. It is anticipated that the improvements to the plant will decrease the BOD loading from about 10,000 lbs. a day to 2,200 lbs/day at a flow of 10 mgd.

07-03 RECOMMENDATIONS

Generally, the water quality in the Blackstone Region is very good. The most notable exception is the head of upper Narragansett Bay, where the most intensive development in the state has occurred. The implementation of the following recommendations will aid to improve those waters that are currently out of compliance with state water quality standards and maintain the quality of those waters that are in compliance with state water quality standards. These recommendations have been adopted from the 208 Water Quality Plan for Rhode Island.

07-03-01 Growth and Land Use

Water quality is strongly correlated with land use. Urban waterways usually are polluted, whereas high quality waters generally are located in rural areas. Both point and nonpoint sources of pollution contribute to the poor water quality in urban areas.

As indicated in the urban runoff section, once development patterns conducive to direct runoff of pollutants have been established, there is little that can be done (at reasonable cost) to effectively abate that pollution. However, with proper planning and design, new developments may avoid the runoff pollution problems associated with older urban areas. Accordingly, land use recommendations are primarily directed to communities in developing and rural areas of Rhode Island, so that future growth may be accommodated without causing water quality deterioration or the need for expensive municipal sewerage systems. Special protective measures are recommended for areas considered to be environmentally sensitive, water-related lands, particularly areas suitable for groundwater development, surface water supply watershed, wetlands, floodplains, and lands adjacent to coastal ponds and Class A and B waters.

The land use recommendations are as follows:

- Communities should evaluate land to be zoned for industrial use in view of groundwater reservoirs, soil types, slopes, and availability of public utilities, as well as access to transportation facilities and adjacent land use.

*** - Local governments should use their zoning, subdivision and other available controls to minimize the likelihood of water pollution from urban runoff generated at commercial and industrial sites.

- The minimum lot size in areas to be served by individual subsurface disposal systems and public water should be at least 15,000 square feet; the minimum in areas to be served by subsurface disposal and private wells should be at least 1½ acres, or approximately 60,000 square feet.

***Denotes those 208 recommendations that have been conditionally certified by the EPA. Refer to Certification of Plan Elements by the Governor and Approval by the U.S. Environmental Protection Agency. May 1980 for the specific conditions.

(revised 6/30/82)

*** - In waterfront areas and adjacent to wetlands, development using individual subsurface disposal systems and private wells should be at a maximum density of one dwelling unit per acre. In areas adjacent to public water supply reservoirs, the maximum density should be no more than one dwelling unit for every two acres.

- In rural communities which wish to preserve their rural character and/or accomplish other objectives of low-intensity use while protecting high-quality waters, large lot (five acres per dwelling unit) and/or exclusive agricultural zones should be considered.

- Each community should review its zoning ordinance in relation to the soil survey information, if these data were not used in developing the current zoning regulations and map. This action will help ensure that the soils are suited to the types and intensities of development permitted under the ordinance provisions. A specific soil consideration requirement is strongly urged.

- There should be no building allowed which will require filling of wetlands unless a permit is obtained from DEM. In floodplains, there should be no building other than structures accessory to conservation and open space uses or facilities which frequently must be located in flood hazard areas in order to perform their intended functions. (For example, a port facility usually must be located in a flood hazard area). The maximum density of residential development in public water supply and coastal pond watersheds and in important aquifer recharge areas should be one dwelling unit for every two acres of land.

- The Statewide Planning Program should review the State Building Code with reference to regulations affecting the design and construction of underground storage tanks for gasoline and other chemicals. Recommendations for changes in the code to ensure groundwater protection should be made to the State Building Code Commission.

*** - Developing communities should establish a setback requirement of 150 feet from the rainy-season flow line of a stream or 50 feet from the high-water mark of any lake or pond, wherever possible. A 300 foot setback is recommended from public water supply reservoirs, and a 400 foot setback is recommended from any groundwater aquifer pumping center. Land disturbance during construction should be minimized, and the natural vegetation should be left intact, as much as possible. If natural vegetation is removed, the area should be revegetated as soon as possible.

- State zoning enabling legislation should be changed to allow specifically cluster and planned unit developments. The proposed State-Local Land Management Bill would fulfill this purpose.

***Denotes those 208 recommendations that have been conditionally certified by the EPA. Refer to Certification of Plan Elements by the Governor and Approval by the U.S. Environmental Protection Agency. May 1980 for the specific conditions.

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- Local communities should zone waterfront areas for large-lot or cluster-type developments, in order to reduce runoff. If special enabling legislation is required, the communities should petition the state legislature for the appropriate provisions. Again, the State-Local Land Management Bill would provide the necessary authorization.

- Developing and rural communities should use their subdivision regulations to promulgate design standards to mitigate water pollution from stormwater runoff.

- Natural buffer strips of 300 feet from the rainy-season flowline of a stream or the high-water mark of a natural body of standing water should be provided in rural areas, wherever possible.

- The state and communities should study the costs and benefits of land acquisition and tax incentives as means of protecting environmentally sensitive, water-related areas from pollution.

- The state legislature should enact critical areas legislation which will protect environmentally sensitive, water-related areas in Rhode Island.

07-03-02 Sewage Disposal

A. Municipal Sewerage Systems

Municipal sewerage needs fall into two general categories:

(1) existing sewerage systems, including treatment facilities, that need repair or improvement; and

(2) areas that may need to provide sewer service because of problems with individual sewage disposal systems.

The sewerage needs of many of the older cities in the Region fall into the first category. The combined sewer systems in Providence, Pawtucket and Central Falls and the inefficient Providence wastewater treatment facility have created major water quality problems in the Providence River and Upper Narragansett Bay. Facilities plans for these cities have estimated that treatment of discharges from the nearly 100 combined sewer overflows may cost approximately 200 million dollars. In addition, the cost of upgrading the Providence wastewater treatment facility could be as much as 95 million dollars.

Although plans for municipal facilities to alleviate serious water pollution in the Providence River have been developed, the costs of the recommended facilities present a problem. At present, EPA construction grant funding available to Rhode Island is approximately 26 million dollars per year through fiscal year 1982. The uncertain future of additional funding from EPA may delay construction of many of the needed facilities.

- The U.S. Congress and EPA should revise the present construction grant allocation formula so that Rhode Island receives a greater allocation. Under the present formula, Maine receives $10 million more than Rhode

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Island even though its population is nearly the same as Rhode Island's; New Hampshire receives $16 million more than Rhode Island even though it has less population than Rhode Island.

- EPA should clarify its policies with regard to the funding of advanced treatment facilities and combined sewer overflow improvements. If additional funding for the timely completion of these projects is not possible under the Clean Water Act, then it should be amended to allow separate additional funding for these projects.

- The U.S. Congress and EPA should make a commitment to fund the construction grants program beyond FY 1982.

In recent years, there has been growing concern regarding the impacts of present wastewater chlorination practices. This concern has focused on the direct toxicity of chlorine to aquatic organisms and the formation of cancer-causing substances from the reaction of chlorine with organics in wastewater. Since state policy does not allow wastewater discharges tributary to water supply sources, the toxicity of chlorine and its reaction products on aquatic life is an issue of greatest wastewater effluents can be reduced. However, because public health standards mandate wastewater disinfection in waters tributary to shellfish beds, the use of chlorine at most facilities could not be eliminated without very large expenditures of public funds on alternative disinfection systems.

- If a municipal wastewater treatment facility is consistently meeting state coliform standards, the superintendent should request permission from DEM to reduce the chlorine residual to the minimum required to obtain the coliform requirement deemed appropriate.

- Existing municipal wastewater treatment plants discharging to fresh waters should install dechlorination facilities and dechlorinate their discharges at least during summer months (May 1 to October 1). Alternatives to chlorine disinfection should be considered in planning new or expanded treatment facilities. The Burrillville wastewater facility is the only plant in the Blackstone Region that dechlorinates their discharges during the summer months (May 1 to October 1).

B. Individual Subsurface Disposal Systems

Much of the population in the developing communities in the Blackstone Region depend upon septic tanks or cesspools to dispose of household wastes. Properly operating subsurface disposal systems efficiently remove most pollutants (except for nitrates) from sewage and are more cost effective to install than municipal sewer systems.

The major problem with subsurface systems is that they can fail,creating a health hazard or nuisance conditions. There are a number of reasons why systems fail, some of which are not well understood. However, failed systems can be rehabilitated and subsurface systems can be designed and maintained to reduce the chance of failures. In addition, the initiation of an ISDS management program discussed in Chapter 05-05-03 should reduce the chance of ISDS failures in the future.

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- Because subsurface disposal systems are less expensive than municipal 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.

*** - Groundwater sampling has indicated some problems with nitrates from subsurface disposal systems, lot sizes of two acres in existing and potential municipal water supply watersheds and groundwater reservoirs are recommended to ensure that nitrate concentrations in drinking water will be below the established standard of 10 ppm.

- All new ISDS systems should be set back at least 150 feet from any water body to prevent nutrient enrichment from ISDS leachate.

- Local communities should review approved ISDS permits upon their receipt from DEM to ensure that they are in accordance with local building 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 or not 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

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Statewide Planning Program computer so that areas with high failure rates could be readily identified and corrective action taken.

- 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.

- Water conservation devices should be utilized in the home to help maintain septic systems.

07-03-03 Urban Runoff

Rain that falls on impervious surfaces in an urban area cannot penetrate the soil and must be conveyed to nearby water courses to minimize the impacts from flooding. Pollutants that have accumulated on impervious surfaces are either dissolved or physically transmitted with the flowing stormwater into adjacent water bodies.

There is no easy means of abating urban runoff pollution. However, the 208 recommendations call for a management program integrating treatment of receiving waters, source controls and land use controls to reduce urban runoff impacts. Additional stormwater sampling and analysis also are recommended to refine the understanding of Rhode Island's urban runoff problems and to permit selection and justification of further control measures.

The primary recommendations for short-term implementation pertain to problem identification. This effort should include the following:

- Continue studies to identify the scope of the problem;
- Monitor stormwater to refine the identification of the problem.

Recommendations in these two areas are presented below, followed by recommendations pertaining to control measures. These recommendations are from the Final Urban Stormwater Evaluation Report ((38)).

A. Problem Identification

- The problem identification effort begun in the initial 208 study should be completed. In the area of public health impacts, this effort should include the evaluation of all water supply reservoirs under existing and future (e.g. year 2000) land use conditions using screening methodologies presented in the Final Urban Stormwater Evaluation Report ((38)). This work will identify those parameters and locations of public health concern with respect to stormwater runoff impacts on drinking water supplies.

- Additional studies should be conducted regarding the impacts of urban stormwater runoff on water quality and shellfishing in Narragansett Bay. Control of these impacts is dependent upon the feasibility of funding combined sewer overflow abatement projects in the cities of Central Falls, Pawtucket, and Providence, however.

- The impacts to aquatic life should be assessed utilizing the techniques described in the Final Urban Stormwater Evaluation Report for both existing and future land use. This will enable the identification of all parameters and locations of concern with respect to stormwater runoff impacts on aquatic life.

- Prior to initiating the study described above, improved data should be obtained, particularly for residential land use categories.

B. Stormwater Sampling Program and Refined Analysis

- After completion of the previously described analyses, a stormwater sampling program should be designed and carried out. The sampling program should serve two technical purposes: revise the assumed average concentrations of urban runoff pollutants by land use, and obtain data pertaining to critical problem areas identified in the initial problem identification effort. To serve the first purpose, sampling stations should be located at the outlet of subbasins with 1-5 square miles of drainage area that are dominated by one type of land use. The second purpose would be served by including such sampling stations in areas draining to initially identified problem locations (particularly drinking water supplies). Several other factors, such as accessibility and proximity to rainfall gauges, bear on the selection of sampling locations.

  With the data obtained as recommended above, the techniques utilized in the initial problem identification effort can be calibrated and applied in a more refined manner. Then certain special-purpose studies could be undertaken, to more definitively establish present or future problems. These special-purpose studies (some of which could be initiated earlier) could include any or all of the following:

  - More frequent analyses (e.g., monthly) of surface water supply sources for lead, mercury, indicator bacteria, and other potential problem substances, to complement the short-term problem-identification effort recommended above (with which it should be coordinated), by establishing a long-term data base

  - Bioassay tests, microbiological sampling, and biomonitoring studies to aid in the accurate identification of water quality and aquatic life impacts of stormwater runoff

  - Estimation of impacts of suspended solids and nutrients on water uses to aid in the establishment of a sound point source nutrient control program, among other purposes

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- A generalized hydrologic analysis of pertinent streamflow and rainfall characteristics.

The purpose of the sampling program and affiliated computational analyses is to refine the understanding of urban runoff problems to permit selection and justification of control measures. Without knowing the full scope of problems that will be initially identified, it is impossible at this time to estimate the full costs involved. However, based on experience with other 208 studies, $300,000 would be a reasonable order-of-magnitude estimate for the complete sampling program. Such an effort should be spread out over a 3 to 5-year period, to allow adequate interaction between sampling and computational efforts.

C. Control Measures

Additional problem identification work will be required before definitive recommendations for substantial control measures can be made, but the following alternatives appear to offer the greatest potential for mitigating the impacts of urban stormwater runoff.

- Provide adequate treatment of water withdrawn for public water supply to remove metals, toxics, and taste and odors. The Department of Health should continue to monitor for these pollutants and if present removals are not adequate, pilot studies should be conducted to determine process changes, such as treatment by granular activated carbon, that may be required to achieve drinking water standards. If standards cannot be met with process changes, then new sources of supply should be utilized.

- Implement best management practices during construction of buildings and highways to control erosion. A uniform erosion and sediment control statute should be adopted by the state.

- Aeration of lakes and rivers should be considered as a possible means of reducing storm runoff-induced dissolved oxygen problems.

- Chemicals, such as fertilizers, pesticides and road salts should be carefully and sparingly applied.

*** - The federal government should undertake an effort to have lead compounds removed from gasoline and to control other motor vehicle toxicants.

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- Illegal discharges and wastewater overflows to sewers should be eliminated. A public education program should be carried out to reduce the disposal of leaves, garden clippings, used automobile crankcase oil, and the like, in stormwater inlets.

- To encourage and provide for proper disposal of waste oil, the state should adopt a used oil recycling act. DEM currently has initiated a waste oil recycling program.

*** - Measures should be adopted which restrict land uses in sensitive areas. These "non-structural" controls would include land use planning (including open space and conservation planning) and restrictive zoning. Considering available technology for abating stormwater pollution, such measures may represent the only means of preventing water quality degradation in some areas. Most of the present urban region in the state lies at the downstream ends of rivers and near coastal waters, where some dilution of urban runoff can be provided. As a general policy, future land use planning in Rhode Island should direct growth to existing urban and coastal areas and away from upstream undeveloped areas.

07-03-04 Landfills

Of the 22 landfills in the Blackstone Region, 5 are still active. Leachate generated at both active and inactive landfills may result in the contamination of ground and surface water. From a management standpoint, landfill-generated pollution is most serious where it is affecting or potentially could affect groundwater aquifers, surface water supply reservoirs, and/or pristine water bodies.

The following recommendations are aimed at minimizing the need for future landfills, ensuring proper operation of existing landfills, and providing for groundwater protection in the siting of hazardous waste disposal facilities and new landfills.

A. Reduction of Solid Waste

- Because landfills all generate leachate and are possible sources of pollution, it is recommended that recycling be practiced as much as possible, in order to reduce the quantity of wastes and the need for new landfills. The following measures would serve to maximize attainment of this objective:

  - passing mandatory deposit legislation ("bottle bill") in Rhode Island
  - recycling oil, flat papers, bottles, and cans by source separation
  - burning as fuel those materials that cannot be recycled and that are combustible. The Solid Waste Management Corpor-

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ation resource recovery facility proposes to recover this energy potential of solid waste.

B. Monitoring Program

- DEM should undertake a monitoring program at four or five landfill sites representative of different hydrogeologic conditions in the state. This sampling program should consist of the installation of monitoring wells at varying distances from the landfills to measure the attenuation of leachate. Based on costs for well installation, sampling, and analyses carried out for the 208 program, the estimated cost of this sampling program would be $30,000 - 45,000 per year.

C. Changes to Existing Regulations

- DEM should continue to administer the program for licensing landfill operators. Existing regulations should be strengthened as follows:

  - A 200-foot buffer between landfills and surface water may not be sufficient to preclude leachate contamination, as attenuation capacity varies from site to site. DEM should be given discretion to require a greater setback from surface water bodies on a site-specific basis. This is especially important for protection of existing high quality (Class A and B) waters. Similarly, DEM should have discretionary authority to require a buffer greater than 200 feet between a landfill and any water supply wells. The direction of groundwater flow from the landfill is an essential consideration in determining a safe distance for location of wells.

  - Given the porous nature of Rhode Island soils, the required 4-foot depth to water table may not be adequate to protect groundwater from serious leachate pollution. The U.S. Environmental Protection Agency recommends five-foot depth to water table (Residual Waste Best Management Practices) and greater depth should be required by DEM on a site-specific basis.

  - In addition to the groundwater standard, there should be a required minimum depth to bedrock. Such a standard is needed because the leachate will tend to spread over a larger area in shallow soils than in deep soils, causing an increased risk of pollution of nearby surface waters. A 6-foot minimum depth to bedrock is recommended, with DEM given discretion to require greater distances on a site-specific basis.

  - Impervious final cover, preferably clay or silt, should be required in order to minimize infiltration into the landfill. Application of two feet of top soil over the impervious material should be required as a base for vegetating the

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site. The use of impervious cover necessitates proper venting of the methane produced by decomposition of the landfill waste. Methane extraction from closed landfills should be investigated as a potential energy source.

- The establishment of vegetation is important for controlling erosion, increasing evapotranspiration, and aesthetics. Vegetation has been found lacking, however, at almost every Rhode Island landfill site evaluated. The landfill operation regulations should require vegetation of all completed and intermediate slopes and surfaces.

- Temporary sediment control measures are needed to mitigate impacts of erosion from active areas of landfills where establishment of vegetation is not practicable. State regulations should require landfill operations (both private and municipal) to meet the same erosion and sediment control standards as other earth-moving activities. Measures for controlling erosion and sedimentation from construction sites are summarized in Chapter 05-03.

- The landfill operation regulations should specify required grades to reduce infiltration while not encouraging erosion. Slopes of not less than 2 percent and not more than 15 percent are recommended.

- The landfill licensing regulations should prohibit the siting of any new landfill in water-related environmentally sensitive areas, particularly recharge areas for groundwater reservoirs with water supply potential, surface water supply watersheds, and near coastal ponds.

D. Groundwater Legislation

*** - Groundwater protection legislation should be enacted that will prohibit the siting of landfills, hazardous waste disposal facilities, and other specified uses (e.g. road salt storage) in groundwater reservoir aquifers and recharge areas.

E. Groundwater Protection

*** - The Statewide Planning Program should delineate groundwater reservoir and associated recharge areas which constitute existing or potential public water supply sources.

*** - DEM should adopt regulations which prohibit new sanitary landfills in the groundwater reservoir and recharge areas designated by the Program.

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*** – Existing landfills located in these groundwater reservoir and recharge areas should be closely monitored by DEM to determine if the landfills are polluting the reservoirs. If there is evidence of leachate contamination, then the offending landfill should be closed in such a manner that infiltration will be minimized.

The landfills listed below are located in groundwater reservoir recharge areas. Those indicated with an asterisk (*) are located in recharge areas for groundwater reservoirs recommended by the 208 study for delineation as existing or potential public water supply sources.

208 Inventory Map No.	OPEN LANDFILLS
Number 5	*Burrillville
Number 16	*Glocester
Number 23	*North Smithfield, Landfill & Resource, Inc.
Number 24	Pawtucket Incinerator
	CLOSED LANDFILLS
Number 4	*Burrillville
Number 8	*Cumberland, Albion Rd.
Number 9	*Cumberland, J.M. Mills
Number 37	Central Falls, Arrow Street
Number 38	Central Falls, Lincoln Almond Field
Number 39	Central Falls, Brook St.
Number 41	*Cumberland, Curran Rd.
Number 45	Lincoln, Dupraw
Number 46	Lincoln, Elm Tree
Number 53	Pawtucket, Grotto Ave.
Number 54	Pawtucket, Canal St.
Number 58	Providence Dump
Number 59	Providence Dump
———	*Western Sand and Gravel

– DEM should adopt regulations which prohibit both new and existing hazardous waste disposal facilities in groundwater reservoir and recharge areas delineated by the Statewide Planning Program. The sites listed below have been used for disposal of hazardous wastes. Those indicated with an asterisk (*) are located in recharge areas for groundwater reservoirs recommended by the 208 study for delineation as existing or potential public water supply sources.

MAJOR SITES

*Cumberland, J.M Mills
*North Smithfield, Landfill & Resource Recovery, Inc.
*North Smithfield, Western Sand and Gravel
Smithfield, Davis Liquid Waste Site

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F. Hazardous Wastes

- Currently there are no sites in Rhode Island which are permitted to receive hazardous wastes. Disposal, storage and/or treatment of hazardous wastes should be allowed only at a completely secure site, with a dual impermeable liner and leachate collection and treatment system, or with other appropriate safeguards. Such a facility should be strictly prohibited from being sited in water-related, environmentally sensitive areas. Stringent siting, design and operating requirements have been incorporated into the state's hazardous waste regulations.

07-03-05 Road Salt

The environmental impacts associated with storage and use of this salt include: decline of roadside vegetation; loss of permeability in roadside soil; automobile corrosion; damage to highways, highway structures and underground utilities; and contamination of groundwater and (to a lesser degree) surface water.

Contamination of groundwater used, or with potential for use, as potable water supplies is considered the most critical long-term effect of current road salting practices. Fortunately, sodium and chloride concentrations in public water supplies in Rhode Island generally have not risen to the extent that they have in Massachusetts and Connecticut. However, in the interest of avoiding future problems, it is important to restrict Rhode Island's road salt use.

The following actions are recommended to reduce the impact of road salt on water quality.

A. Road Salt Storage

- With the exception of salt piles located adjacent to salt water bodies in areas served by public water, all salt piles and sand/salt mixtures should be enclosed by one of the first two (or comparable) methods listed in Section 05-04. Highest priority should be given to enclosing stockpiles located within water supply watersheds, or within recharge areas of groundwater aquifers currently used for public water supply or with potential for public water supply development.

B. Road Salt Use

- All town highway departments should act to minimize their use of road salts in winter road maintenance. For general use, the proportion of salt in the sand/salt mix should be no more than one part salt to six parts of sand (6:1 sand to salt mixture). The Town of North Smithfield already uses an even smaller proportion of salt (9:1 or 10:1 sand to salt ratio), except for heavier applications in the case of particularly icy areas or severe storm conditions. Similarly, other municipalities should attempt to further reduce the proportion of salt in the sand/salt mixture applied to town roads, whenever and wherever feasible.

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- Environmentally sensitive areas associated with present or potential ground or surface water supplies should be considered water resource protection areas, and special restrictions should be applied to the use of road salts in such areas. Sand should be used as much as possible. If salt must be used, a 10:1 sand to salt ratio with a salt mixture of 3 parts sodium chloride to one part calcium chloride is recommended. Such a road salt "premix" has been used for several years in critical water supply areas in Connecticut to stem the rise in sodium concentrations in public water supply reservoirs.

- The Rhode Island Department of Transportation (DOT) should gradually reduce the proportion of salt in the sand/salt mixture applied to state-maintained roads, aiming for a 6:1 sand/salt mixture for general use. Efforts undertaken thus far to reduce road salt use by the Department are commendable, but further reduction is still desirable from an environmental standpoint. DOT could increase the sand/salt mixture to 6:1 for one section of road on a trial basis, to determine the effectiveness of this application rate. Within water resource protection areas, the amount of sodium chloride applied to state roads should be reduced as recommended for town roads, unless the highways have drainage systems designed to divert road salt runoff from these sensitive areas.

C. Sodium Concentration Guideline

- Consideration should be given by the Department of Health to establishing a public health guideline for sodium in drinking water in Rhode Island. The adoption of a sodium guideline would not mean that a water supply that exceeds that level would have to be shut down, but rather that sodium concentrations in the supply should be closely monitored, and the source of contamination should be investigated and abated, if possible. Concentrations in excess of the recommended limit could be publicly announced to alert those on sodium-restricted diets. The need for such a guideline results from the continued introduction of sodium chloride into the environment and the continued potential for sodium leaching into water supplies.

07-03-06 Erosion and Sedimentation

Soil loss from construction sites in Rhode Island has been estimated at 35.7 tons per acre per year. The estimated soil loss from untreated cropland is 11.2 tons per acre per year. A certain amount of erosion is natural, accounting for the three tons per acre per year tolerable limit guideline used by the Soil Conservation Service. Soil loss beyond that limit constitutes a source of excess sedimentation in waterways, and also robs the land of productive top soil. Sediments can carry other pollutants as well, such as nutrients, pesticides, and bacterial contaminants from animal wastes.

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Erosion and sedimentation both from construction sites and from cultivated land are readily controllable through application of best management practices. The primary problems in ensuring that best management practices are applied, are lack of legislation for controlling construction and lack of funds for agricultural measures. Accordingly, recommendations are aimed at establishing an institutional framework for erosion and sediment control and obtaining funding through the Rural Clean Water Program for agricultural runoff control in Rhode Island.

A. Construction-Related

*** - State legislation should be adopted to establish minimum standards for controlling erosion and sedimentation. Local cities or towns would be responsible for ensuring compliance with these standards. The legislation should also establish specific erosion and sedimentation controls for certain critical areas which the state would be able to enforce directly.

- Best management practices to control erosion and sedimentation should be used by all state agencies engaged in construction activities.

B. Agriculture-Related

- The Soil Conservation Districts should be designated advisory agencies for agricultural runoff control in the Northern, Southern, and Eastern Conservation Districts.

- Funding should be sought under the Rural Clean Water Program for implementing erosion control techniques. The State Rural Clean Water Coordinating Committee has had two previous applications for funding under this program rejected. Their efforts to solicit funds should be continued.

- The Soil Conservation Service and the Agricultural Stabilization and Conservation Service should jointly administer the Rural Clean Water Program, when funding becomes available.

- The tax-exempt provisions of Chapter 44-3(22) should be amended to apply to the installation of best management practices. Any real or personal property acquired or altered to control pollution from agricultural land uses should also be given the same tax-exempt status as property acquired to control industrial pollution.

- Compliance with the best management practices recommended by the 208 Plan should be voluntary to the maximum extent possible.

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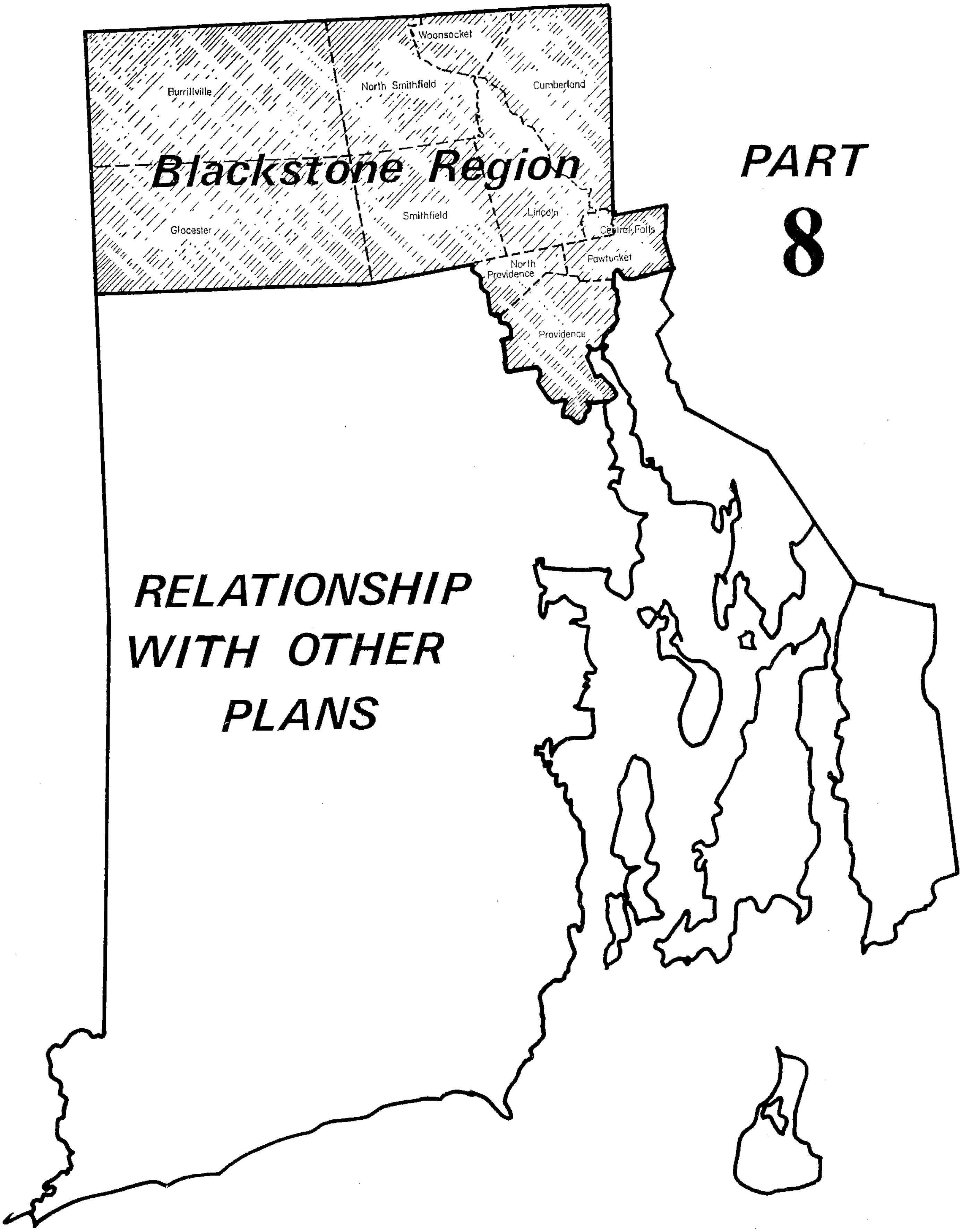
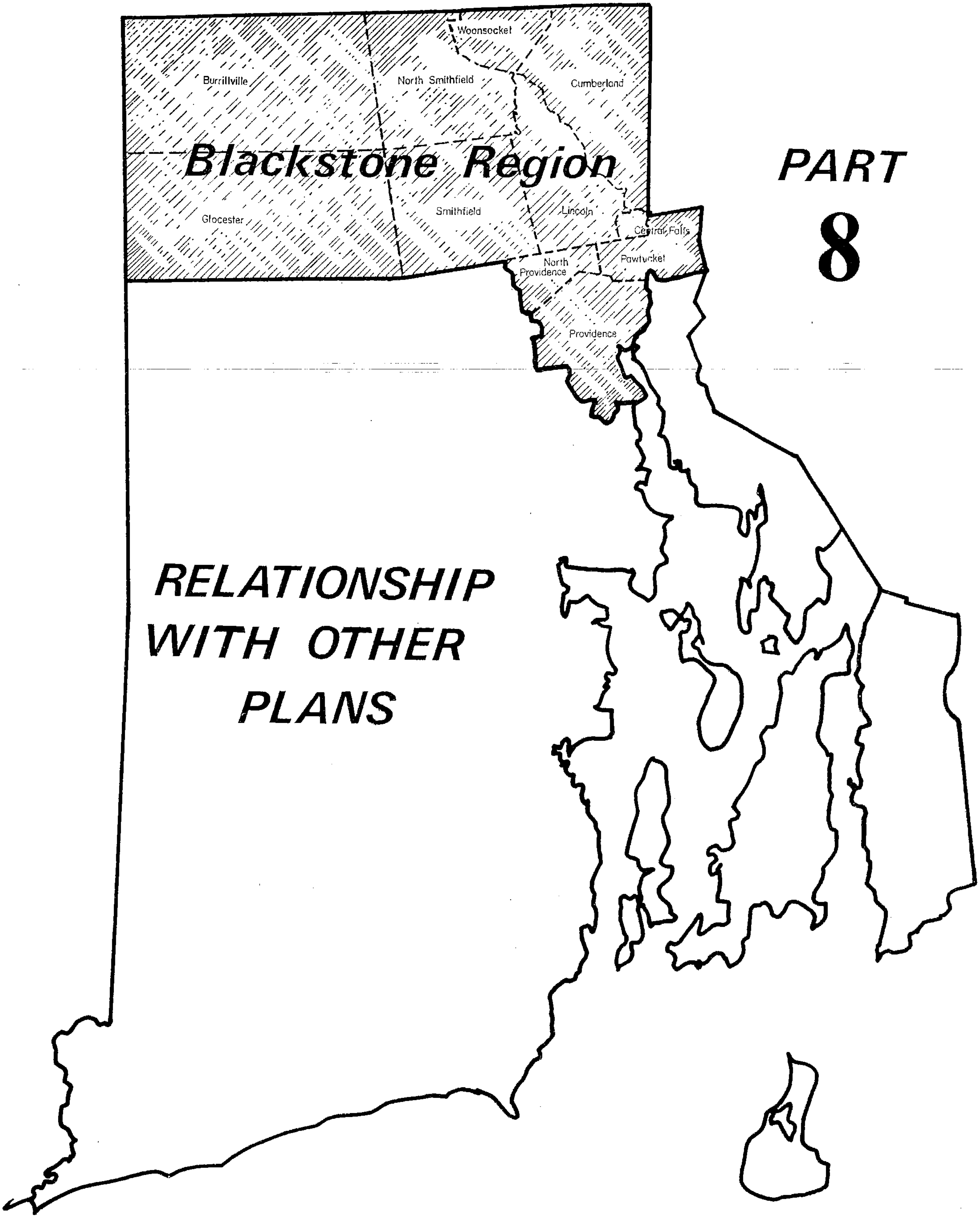
PART 8



RELATIONSHIP WITH OTHER PLANS

PART 8

RELATIONSHIP WITH OTHER PLANS



711-08 RELATIONSHIP WITH OTHER PLANS

08-01 FEDERAL, STATE, AND LOCAL PLANNING COORDINATION

The Statewide Planning Program and the Department of Environmental Management utilize a number of mechanisms, described below, to insure that the state's water quality management plans are coordinated with other federal, state, and local plans and programs.

08-01-01 U.S. Environmental Protection Agency

The water quality management process begins with agreements reached between the U.S. Environmental Protection Agency and the approved State continuing planning process agencies designated for water quality management planning, R.I. Statewide Planning and R.I. Department of Environmental Management. The agreements are called:

1) The State/EPA agreement, which designates the priorities that specific water pollution problems receive.
2) The approved work plan, which describes water quality tasks to be completed within designated time frames.
3) The grant agreement, regarding water quality.

A Water Quality Management Plan must be certified by the Governor to show he has adopted plan elements contained in the State Water Quality Management Plan.

Prior to the Governor's review of a plan, the EPA conducts a review to insure compliance with federal EPA goals and objectives.

After a plan is certified by the Governor, the EPA Regional Water Division Director conducts an additional review of this plan. The Director may involve specialists and staff from other EPA divisions in the review. EPA National Headquarters also assists the Regional Director in the review by providing technical guidance. The Regional Director has the option to approve the plan, conditionally approve it (pending revisions), or reject the plan entirely.

08-01-02 Level B Study - Southeastern New England Water and Related Land Resources (SENE) Study

The SENE Study is a comprehensive federal-state plan coordinated by the New England River Basins Commission.

The purpose of the SENE Study was to identify and recommend actions to be taken by all levels of government and private interests to secure for the people of the region the full range of uses and benefits which may be provided by balanced conservation and development of water and related land resources. The objective of the study was to determine ways through which water and related land management could help meet two of the compelling needs of the region:

1) Sound and solid economic opportunity; and

2) A living environment of clean water, open space and beauty that enriches human dignity and enjoyment.

The SENE Study was consulted and data incorporated into this water quality management plan where appropriate. Most of the recommendations of this plan are consistent with those of the SENE Study.

The SENE Study was adopted as an element of the Comprehensive, Coordinated, Joint Plan for water and related land resources of New England, by the New England River Basins Commission, under provisions of the Water Resources Planning Act (42 U.S.C. 1962-b-3). This plan, and the statute on which it is based, remain in full force and effect. However, the New England River Basins Commission was terminated on September 30, 1981, by Executive Order No. 12319 (September 9, 1981). Therefore there is no way to amend or update this plan.

08-01-03 State Plans and Programs

A. Governor's Office

In 1972, a Policy and Program Review staff was created to more closely integrate the policy direction of the Chief Executive with the development activities of the operating agencies of state government. There are several agencies that make or implement policies by their respective mandates and actions. The Governor, as charged by the Constitution, is required to make short-range decisions that very often have long-range implications. The Policy and Program Review staff works with the State Planning Council; the Office of State Planning; the Budget Office; the Rhode Island Port Authority and Economic Development Corporation; the Department of Economic Development; the Department of Environmental Management; the Department of Community Affairs (particularly the Division of Planning and Development); the Department of Transportation; the Housing and Mortgage Finance Corporation; the State Energy Office; the Public Utilities Commission; and other state agencies that impact development policy in conducting this process.

B. State Planning Council

The State Planning Council assists the Office of State Planning in coordinating the planning and development activities of state departments and agencies, local governments and private individuals. The State Planning Council and the Office of State Planning are also charged with the responsibility of developing and adopting a long-range guide plan for the state. All statements of goals and policies and all elements of the State Guide Plan must be approved by the Council, following public hearings.

C. Technical Committee

Technical guidance for the Program is provided by the Technical Committee, appointed by the State Planning Council. This Committee is also comprised of state, local, private, and federal representatives. The Committee gives technical direction to the staff, reviews all work while in progress and upon completion, reviews all major reports and plans and recommends action thereon to the State Planning Council, and advises the Council on the performance of all of its functions.

D. A-95 Review Process

In Rhode Island, the Statewide Planning Program is designated as the state clearinghouse for federal and federally-assisted projects under Office of Management and Budget Circular A-95. Under this regulation, proposed federal grants and loans under designated programs, direct federal development actions, and state plans are subject to review under provisions of 1) Section 204 of the Demonstration Cities and Metropolitan Development Act of 1966, 2) Title IV of the Intergovernmental Cooperation Act of 1968, and 3) Section 102 (2-c) of the National Environmental Policy Act of 1969.

The A-95 review process in Rhode Island is further strengthened by close coordination with capital improvement programming, which is designed to integrate capital acquisitions with a broad scale long-term supporting fiscal program. As part of the capital development program, the Budget Division estimates the cost of total long-term needs by categories corresponding to the state's program structure. Capital needs are then reviewed relevent to the needs and priorities of the entire state. The sources of proposals for the capital development program include agency requests for capital investments, functional elements of the State Guide Plan, and recommendations of the Budget Division.

E. State Guide Plan

The State Guide Plan serves as a guide for the physical, social, and economic development of the State and provides for its long range development. All planning studies are coordinated with this long range guide plan and because the completed elements of the State Guide Plan are being placed on a continuous maintenance basis, the plan will provide an essential framework that will be responsive in evaluating relevent capital improvement proposals, as well as short-term proposals that have long-range implications.

The Phase II water quality management plans, when completed, will constitute the water quality element of the State Guide Plan. The Phase II plans are an update and revision of the Phase I water quality management plans which currently constitute the water quality element of the State Guide Plan. The planning areas for the Phase II plans have been restructured into four regions (Blackstone, Narragansett, Pawcatuck, and Pawtuxet) from the seven river basins (Blackstone, Moosup, Moshassuck, Narragansett, Pawcatuck, Pawtuxet and Woonasquatucket) for which plans were prepared in the Phase I basin planning effort. These plans will update and incorporate changes in the region since completion of Phase I plans and will include input from the 208 Plan on non-point pollution source assessments. They will also address future water supply demands, alternatives for meeting these demands, and effect of these alternatives on water quality.

Because the availability of municipal sewerage and water supply facilities can be strongly development-inducing, Part 711-07 of this plan was closely coordinated with the land use element of the State Guide Plan.

F. Areawide Waste Treatment Management Plan

On April 23, 1975 the Governor designated the entire State of Rhode Island as a single areawide waste treatment management planning area.

The specific objectives of the Rhode Island 208 plan include:

1) the establishment of problem type, severity, and area of influence;

2) the development or update of all needed facilities plans describing several alternative solutions;

3) the development of sludge management plans including the handling of septic tank sludge;

4) an inventory and assessment of the effects of combined sewers on water quality including the development of several alternative solutions;

5) the evaluation of water quality classifications and revision where necessary, to reflect feasible uses of the water courses;

6) an evaluation and development of alternative treatment systems for industry;

7) the identification of <u>major</u> non-point sources of pollution, their effect on surface water quality, priorities and alternatives for their consequent abatement;

8) the determination and evaluation of groundwater pollution problems from non-point sources and the development of the necessary constraints to protect groundwater resources;

9) the development of detailed soil surveys and mapping to identify areas amenable to individual sub-surface disposal and development;

10) the review of individual community land use plans and the development of the necessary controls and constraints to regulate location and/or generation of potential non-point and point pollution sources;

11) the review of existing studies and authorities (e.g. Blackstone Valley District Commission) for the management of wastewater. Recommend the expansion and creation of the necessary arrangement to develop the necessary agency to manage or control wastewater generations;

12) a public participation program that will generate useable and significant input through the interaction of citizens and the 208 planning staff and public officials by the development of working committees and public meetings; and

13) an implementation program to carry out the recommended alternatives and the associated arrangements in (11) above including a self-sustaining financial program and a continuing planning process to annually update the approved final plan.

The completed 208 plan has become a part of the Continuing Planning Process and its recommendations are implemented by management agencies that are designated in the plan.

G. Department of Health Records and Plans

This plan was prepared in conjunction with the Division of Water Supply of the Rhode Island Department of Health. The Divisions files provided extensive quantitative information.

H. Department of Environmental Management Plans

This plan was also prepared in conjunction with the Division of Water Resrouces of the Rhode Island Department of Environmental Management. The Division's files and its water pollution control plans for fiscal year 1975, 1976, 1978 and 1979 provided extensive quantitative and background information.

I. Other State Plans

The technical and planning efforts of the Rhode Island Water Resources Board with regard to water supply resources have major significance in the Blackstone Region. The inter-relationships and the problem associated with water supply development and water quality are considered throughout this plan.

All permit applications for physical development in the coastal zone are reviewed by the Statewide Planning Program for consistency with the State Guide Plan, of which the Water Quality Management Plan is a part. These permit applications are required under the Rhode Island Coastal Resources Management Act, which is administered by the Coastal Resources Management Council and the Division of Coastal Resources of the Department of Environmental Management. The Council is also responsible for the preparation and implementation of a Coastal Resources Management Plan, which, by law must be consistent with the State Guide Plan. Planning coordination and staff assistance are provided to the Council by the Statewide Planning Program, the Department of Environmental Management, and the U.S. EPA through memoranda of understanding. All development applications subject to the OMB Circular A-95 review process are referred by the Statewide Planning Program to the Coastal Resources Management Council for review and comment.

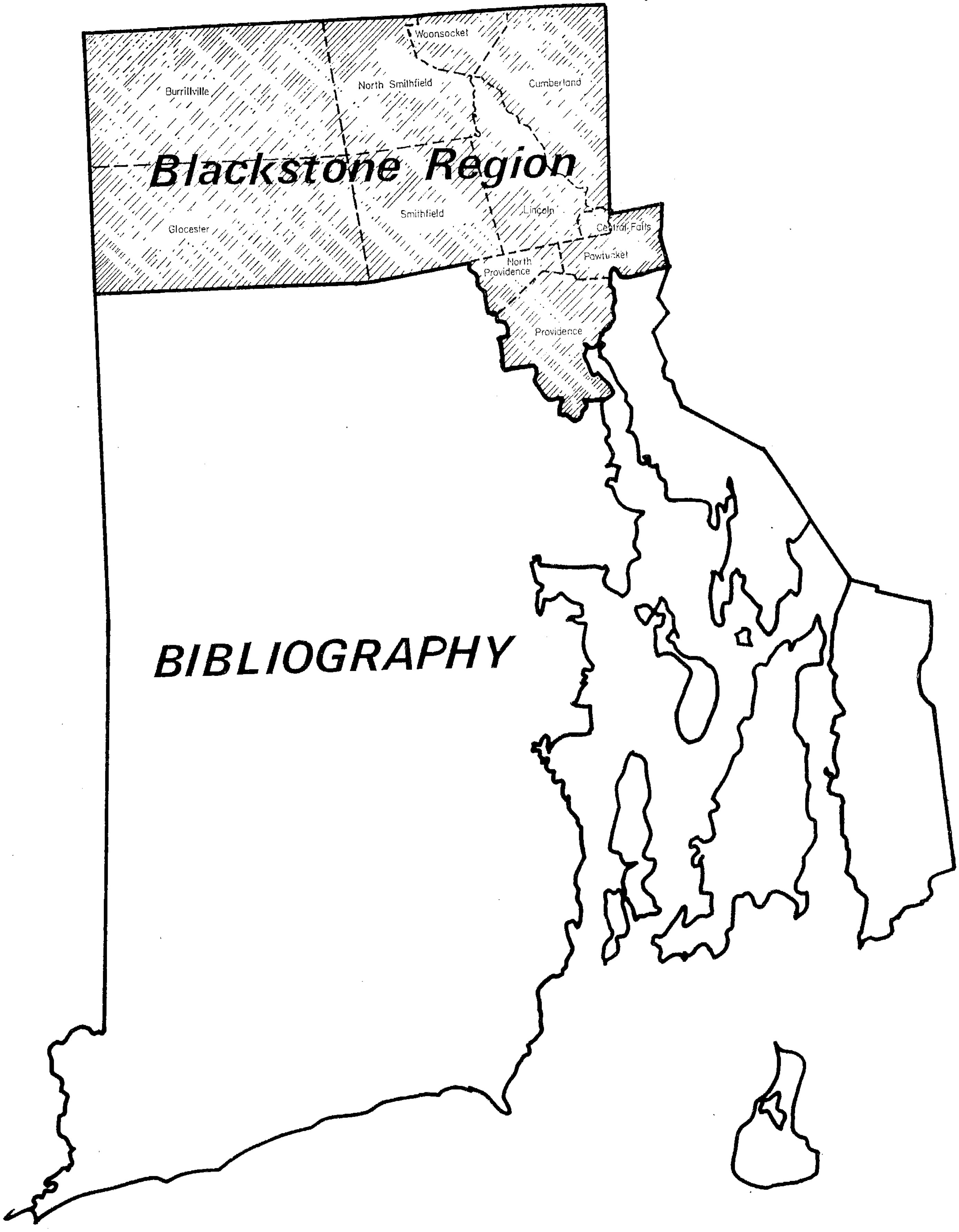
08-01-04 Local Plans

Technical data and information was obtained from facilities planning and engineering reports prepared for the towns of Burrillville, North Smithfield, North Providence, and Smithfield; and the cities of Providence, Pawtucket, Central Falls, and Woonsocket. Many of the recommendations cited in this plan were based upon the results of studies prepared for municipal governments.

08-02 USES OF THE PLAN

This plan, which serves to coordinate water quality management planning on a region wide scale, also provide guidance for the planning of related public facilities in the basin. Recommendations made in future revisions of other elements of the State Guide Plan and other state level plans should be considered in the light of those made herein. This coordination is particularly important for other development-inducing public services, particularly transportation, and public water systems.

Planning at the municipal level may make use of this plan and other elements of the State Guide Plan by encouraging desirable growth patterns within and among the communities, as well as in assuring the highest quality environment and public facilities possible. This plan sets forth recommendations which have significant implications for municipal economies, growth patterns, infrastructure, and fiscal programs. In doing so, this plan serves to keep local interests abreast of planning at the state level -- planning which can affect the future of municipalities for many years to come.



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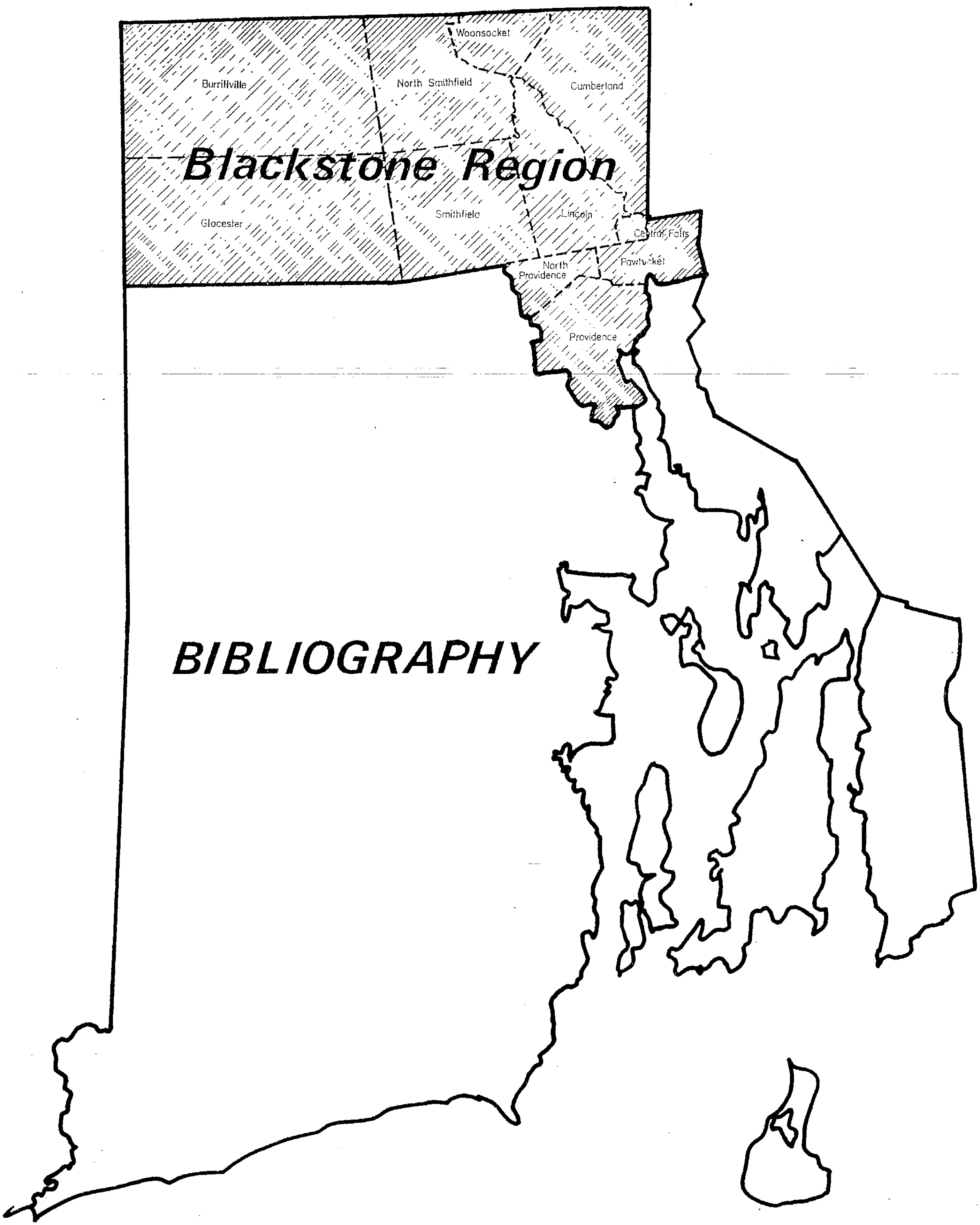

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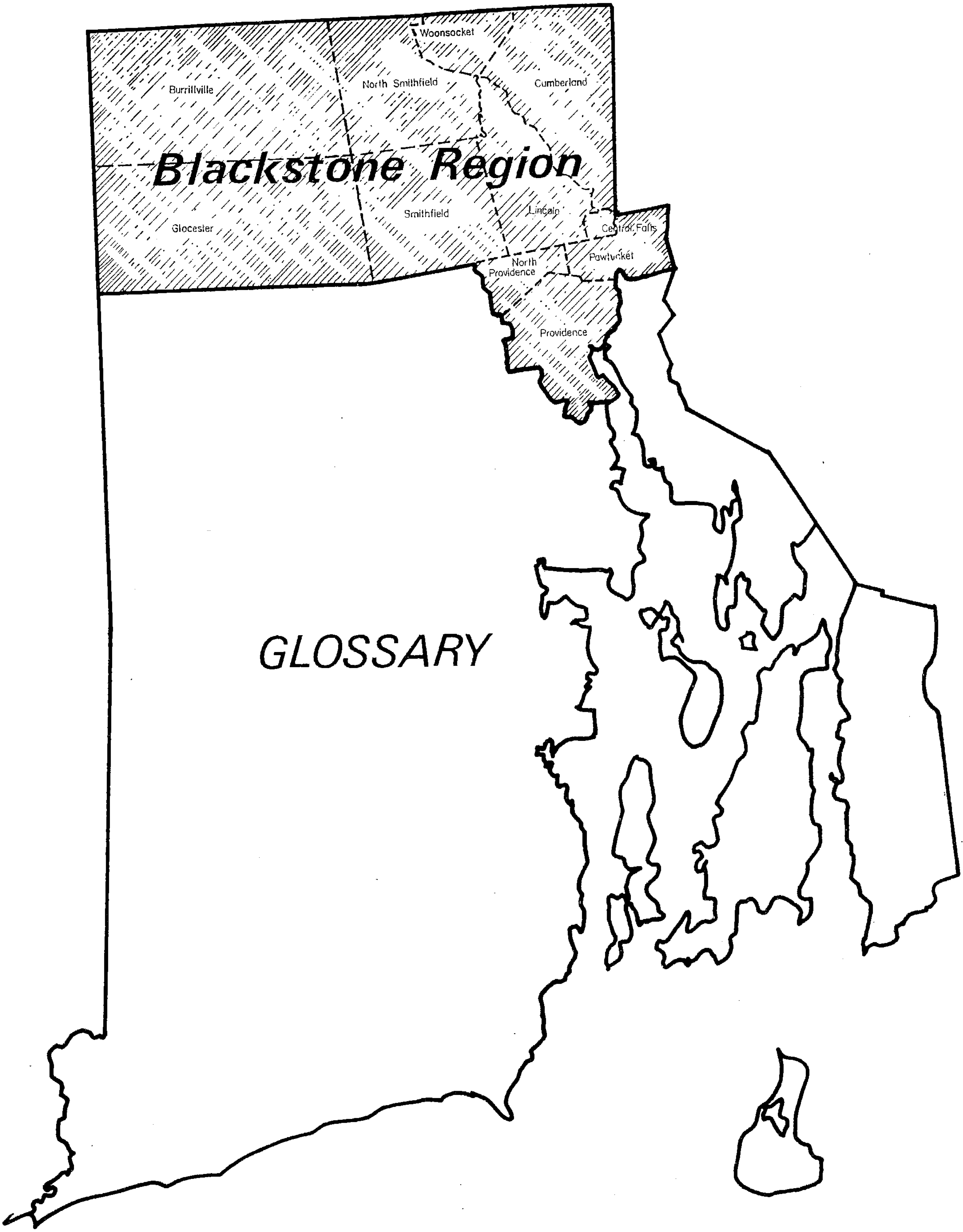
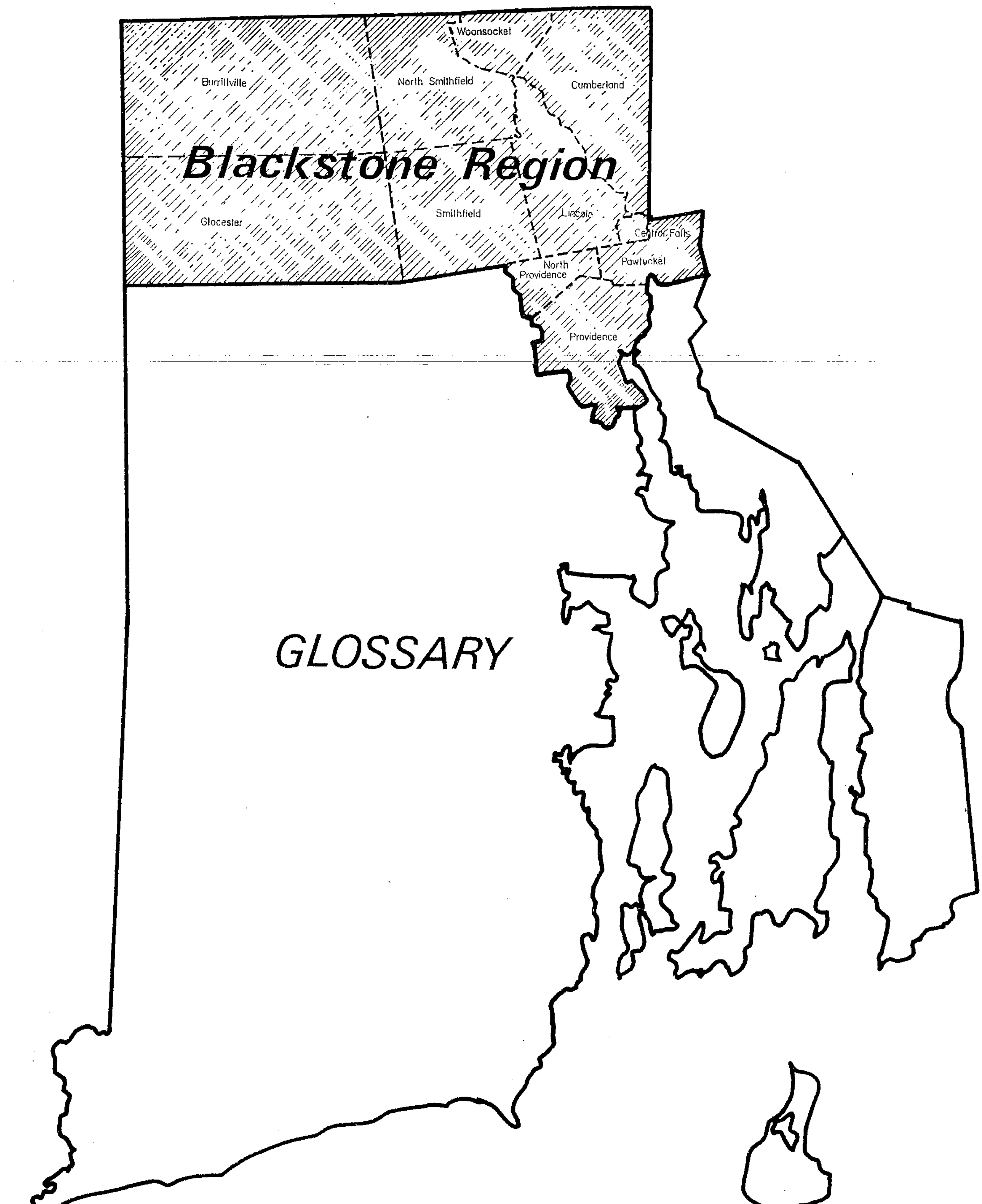


Blackstone Region
Woonsocket
Burrillville
North Smithfield
Cumberland
Smithfield
Lincoln
Glocester
Central Falls
North Providence
Pawtucket
Providence

GLOSSARY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GLOSSARY

GLOSSARY

abatement-reduction of the degree or intensity of pollution.

activated sludge process-a secondary waste treatment process using biologically active sewage sludge to hasten breakdown of organic matter in raw sewage.

advanced sewage treatment-waste water treatment beyond the secondary or biological stage that includes removal of nutrients such as phosphorous and nitrogen and/or high percentage of BOD and TSS. Advanced waste treatment, known as tertiary treatment, is the "polishing stage" of waste water treatment and produces a high quality effluent.

algal bloom-a proliferation of living algae on the surface of lakes, streams, or ponds.

ambient monitoring-monitoring of instream water quality. Ambient monitoring consists of trend and intensive monitoring.

aquifer-an underground bed or stratum of earth, gravel or porous stone that contains water.

assimilative capacity-the capacity of a water body to receive waste-water discharges without violation of water quality standards.

basin abatement priority ranking-the priority ranking assigned to municipal sewerage construction projects in a river basin.

biochemical oxygen demand (BOD)-a measure of the amount of oxygen consumed in the biological processes during the breakdown of organic matter in water. Large amounts of organic waste use up large amounts of dissolved oxygen, thus the greater the degree of pollution, the greater the BOD.

best practicable treatment (BPT)-the minimum degree of treatment as prescribed by EPA. For municipal discharges, this is secondary treatment. For industrial discharges, guidelines are established by EPA for each type of industry.

BOD_5-the amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter. This value is usually obtained from a standard laboratory test.

coliform bacteria-any of a number of organisms common to the intestinal tract of man and animals whose presence in waste water is an indicator of pollution and of potentially dangerous bacterial contamination.

combined sewer-a sewer that carries both sanitary sewage and storm water.

combined sewer overflow-discharges from a combined sewer. This usually occurs during wet weather when the flow in the sewer is beyond its capacity, but can also occur during dry weather if the sewer is not properly mantained.

construction grant priority-the priority assigned to municipal sewerage construction projects on a statewide basis.

cooling water-water which has been used for cooling. Its only contaminant is heat.

dissolved oxygen (DO)-the oxygen dissolved in water. Adequate DO is necessary for the life of fish and other aquatic organisms and for the prevention of offensive odors. Low DO concentrations generally are due to discharge of excessive organic solids having high BOD.

effluent-the waste water discharged into a receiving water. The waste water may be partially or completely treated or in its natural state.

effluent limitation-any restriction established for discharge into a water body.

effluent limitation segment-a segment where application of the best practicable treatment to each discharge will result in the attainment of water quality goals.

effluent monitoring-monitoring of waste water discharges.

estuary-an area where fresh water meets salt water; for example bays, mouths of rivers, salt marshes and lagoons.

eutrophication-the aging process by which a lake evolves into a bog or marsh and ultimately disappears. During eutrophication the lake becomes rich in nutritive compounds which spur algal growth and other microscopic plant life which fill in the lake over the years.

facilities plan (201 plan)-a plan prepared by a municipality describing sewerage facilities needs and alternatives, and including an environmental assessment of the project. This plan must be prepared for the community to be eligible for a federal construction grant.

force main-(F.M.)-a sewer in which sewage is pumped under pressure rather than flowing by gravity.

hydrologic boundary-the boundary of a river basin as defined by its drainage area.

individual sewage disposal system-a sewage disposal system for a single dwelling unit or business establishment; usually a septic tank and leaching field or a cesspool.

infiltration/inflow-total quantity of water, other than sewage, entering a sewer system. Infiltration is water entering a sewer system and service connections from the ground through such sources as defective pipes, pipe joints, or manhole walls. Inflow is water discharged into a sewer system from such sources as roof leaders, drains, catch basins, manhole covers, street wash waters, etc.

intensive monitoring-ambient monitoring which is done over a twenty-four hour period at a number of locations in sequence down the river.

interceptor sewer-a sewer which collects the flows from main and trunk sewers and carries it to a central point for treatment or discharge.

lateral sewer-sewers that collect sewage from homes or businesses and which discharge into a branch or other common sewer.

most probable number (MPN)-a statistically derived estimate of the number of bacteria in a 100 ml sample of water.

non-point source discharges-a source of pollution which is not discharged through a pipe or conduit; such as stormwater runoff and leachate.

NPDES permit-a permit issued by EPA regulating the concentration of pollutants in a wastewater discharge.

nutrients-elements or compounds essential as raw materials for organism growth and development, such as nitrogen and phosphorous.

outfall-the mouth of a sewer, drain or conduit where effluent is discharged into the receiving waters.

parameter-a physical property whose value describes the condition of a water body.

pH-a measure of the hydrogen-ion activity in a liquid. pH is represented on a scale of 0 to 14 with 7 representing a neutral state, 0 representing the most "acid" state and 14 the least "acid" state.

point source discharge-a discharge of pollutants through a pipe or similar conduit.

pollution-the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.

pollution load-the amount of pollutants which are discharged to a receiving water.

pre-treatment-in waste water treatment, any process used to reduce pollution load before the waste water is introduced into a main sewer system or delivered to a treatment plant for substantial reduction of the pollution load.

primary sewage treatment-the first stage in waste water treatment in which substantially all floating or settleable solids are mechanically removed by screening and sedimentation.

receiving water-a water which receives either a point or non-point discharge.

runoff-the portion of rainfall, melted snow or irrigation water that flows across ground surfaces and eventually is returned to streams.

sanitary sewage-sewage discharging from the sanitary conveniences of dwellings, office buildings, factories or institutions.

sanitary sewers-sewers that carry domestic, commercial or industrial waste waters. Storm water is excluded from sanitary sewers.

secondary treatment-waste water treatment beyond primary treatment and providing at least 85 percent removals of BOD_5 and TSS. The most common method of secondary treatment is the activated sludge process.

segment-a section of a waterbody with common water quality characteristics and use classification. Waterbodies are divided into segments in order to facilitate the analysis and description of the impact of waste water discharges.

segment class-the classification of a segment as either an "effluent limitation" or "water quality" segment.

segment priority points-the points assigned to a segment based on the severity of pollution in the segment, the water usage assigned to the segment and the population affected by the pollution.

segment priority ranking-a ranking among the segments of a basin based upon the segment's priority points. The purpose of the ranking is to indicate the priority for pollution abatement measures within that segment.

septage-the solids and liquid which are pumped out of septic tanks.

septic tank-an underground tank used for disposal of domestic sewage. Heavy solids settle to the bottom and liquid flows into drains and then into the ground. Sludge is pumped out at regular intervals.

severity of pollution ranking-the ranking assigned to pollution sources based on the effect of the discharge on the receiving water.

sewage-the liquid wastes from residences and commercial and industrial establishments. When carried in sewers, it would also include such ground water, surface water and storm water as may be present.

sewer-any pipe of conduit used to collect and carry away sewage or storm water runoff from the generating source to treatment plants or receiving plants or receiving streams.

sewerage-the entire system of sewage collection, treatment, and disposal.

sludge-the solids removed from sewage during waste water treatment.

storm sewer-a pipe or conduit that collects and transports rain and snow runoff to a receiving water.

total oxygen demand (TOD)-the theoretical oxygen demand that would be exerted by the breakdown of organic matter in sewage and the conversion of ammonia to nitrate. TOD can be calculated by using the following formula:

$$TOD\ (\#/day) = 1.47\ (BOD_5) + 4.57\ (NH_3\text{-}N)$$

where BOD_5 = five day BOD (#/day)
and $(NH_3\text{-}N)$ = ammonia nitrogen in #/day.

trend monitoring-monitoring at regular intervals throughout the year at the same site.

trickling filter-a secondary treatment system consisting of a bed of rocks or stones that support bacterial growth. Sewage is trickled over the bed enabling the bacteria to breakdown organic wastes.

waste water-water which has been used for a particular purpose and must be disposed of.

water quality segment-a segment in which water quality standards will not be met even with the application of best practiable treatment.

ABBREVIATIONS

BOD-biochemical oxygen demand

BOD_5-5 day biochemical oxygen demand

BPT-best practicable treatment

BVDC-Blackstone Valley District Commission

CBD- Central Business District

cfs-cubic feet per second

DO-dissolved oxygen

EPA-U. S. Environmental Protection Agency

F.M.-force main

gpcd-gallons per capita daily

gpd-gallons per day

JTU-Jackson Turbidity Units

kg-kilograms

mg-million gallons

mgd-million gallons daily

mg/l-milligrams per liter

NPDES-National Pollutant Discharge Elimination System

ppd-pounds per day

P.S.-pump station

RIDOH-Rhode Island Department of Health

RISPP-Rhode Island Statewide Planning Program

TOD-Total oxygen demand

TSS-Total Suspended Solids

USGS-U. S. Geological Survey