STATE OF MAINE

1996 WATER QUALITY ASSESSMENT

A Report to Congress
Prepared Pursuant to Section 305(b) of the
Federal Water Pollution Control Act, as Amended

Prepared by the
Maine Department of Environmental Protection
Bureau of Land and Water Quality

Document Number: DEPLW96-15

ACKNOWLEDGEMENTS

For the 1996 Water Quality Assessment, the Department has thoroughly reviewed water quality information from as many reliable sources as possible. For the first time, we have used data from many volunteer groups who have demonstrated sound data acquisition principles. These include:

- **Affiliates of Clean Water/Partners In Monitoring**
  - **Camden PIM**
  - **Deer Isle/Stonington PIM**
  - **Eliot Volunteer Monitoring Program**
  - **Georges River Tidewater Watch**
  - **Medomak River Volunteer Monitoring Program**
- **Androscoggin River Watershed Pollution Prevention Project**
- **Maine Volunteer Lake Monitoring Program, Inc.**
- **Presumpscot Riverwatch**
- **Sheepscot Valley Conservation Association**

In recent years, the Department has cooperated in the training of volunteers to gather data. Our thanks go to the **University of Maine Cooperative Extension Service**, the **River Watch Network**, the **State Planning Office**, and the **USEPA Environmental Services Division** who have assisted in volunteer coordination and training.

Special acknowledgment goes to the **Penobscot Indian Nation** who conducted a comprehensive monitoring program for rivers, streams and lakes in the Penobscot River valley during 1994 and 1995, and who also assisted the Department with our monitoring work. This data has given us the most thorough assessment of water quality for any basin in the state.

Additional sources of data include:

- **Casco Bay Estuary Project**
- **Maine Department of Human Services**
- **Maine Department of Marine Resources**
- **USEPA - Environmental Services Division**
- **US Geological Survey, Maine District Office**

Information received from businesses through permit applications and compliance monitoring have also been incorporated in this water quality assessment.

Table of Contents

List of Tables

List of Tables (continued)

List of Tables (continued)

List of Figures

List of Figures (continued)

Dedication

"In dealing with the world and in making changes in it, we must recognize how closely we are bound up in our environment. For those of us who have enjoyed the benefits of living in Maine, there is a special heritage which we should understand and seek to protect."

Edmund S. Muskie
1914-1996

Edmund Sixtus Muskie was born in 1914 in Rumford Maine, where he became valedictorian of the Stephens High School class of 1932. Mr. Muskie attended Bates College in Lewiston, graduating cum laude in 1936 with a degree in history and government. Following his graduation from Cornell Law School, Mr. Muskie was admitted to the Maine bar and opened a law practice in Waterville. During World War II, Mr. Muskie served in the U.S. Naval Reserve on destroyer escorts in both the Atlantic and Pacific. He was discharged as a senior lieutenant in 1945, having earned three battle stars.

Mr. Muskie's political career was impressive. He was elected to three terms in the Maine House of Representatives beginning in 1946, and served as minority leader. In 1954, Representive Muskie became Maine's governor for two consecutive terms. Governor Muskie was subsequently elected to the U.S. Senate four times. He served as a U.S. Senator between 1958 and 1980, when he was appointed Secretary of State by President Jimmy Carter.

Edmund Muskie was recognized as a tireless advocate for environmental protection. Among his many accomplishments, he authored ground-breaking legislation including the Clean Air Act of 1970 and the Clean Water Act of 1972. Edmund Muskie's strength of conviction and far-sightedness contributed greatly to dramatic improvements in environmental quality over the past twenty five years, both in Maine and across the nation.

PART I

SUMMARY AND OVERVIEW

Introduction

The State of Maine is known for the beauty and abundance of its natural environment, especially its waters. The first inhabitants relied on Maine waters for food and transportation. Later, rivers were used to transport logs to lumber and paper mills, and to generate power. As cities and industries grew, the quality of Maine waters suffered. When the people of Maine recognized pollution as a threat to their future, they took actions to improve the environment. Beginning in the late 1960's, Maine was at the forefront of the national effort to protect the environment. The Federal Water Pollution Control Act of 1972 provided the framework for significant improvements in the quality of Maine waters that have been achieved in the past 20 years. Federal, State and local funds were spent to construct municipal wastewater treatment facilities. Many Maine industries also constructed facilities to treat their process wastewater. Maine people became more aware of issues affecting water quality and changed their actions appropriately.

The results are dramatic. Atlantic salmon and other fish now return to Maine rivers, and waters that were once open sewers are now clean enough to swim in. Unfortunately, Maine people are still not able to use all their waters. Toxic chemicals in fish limit the use of some Maine waters. Several wastewater treatment plants remain to be built, and many existing facilities need to be upgraded. Ground water, wetlands, rivers and streams, lakes and marine ecosytems continue to be threatened by toxics, bacteria, excess nutrients and poorly planned development

The Maine Department of Environmental Protection (DEP) recently completed a Strategic Plan which will be used to guide future environmental programs. The Strategic Plan is linked with the State of Maine's Performance Partnership Agreement with the U.S. Environmental Protection Agency. This Agreement provides an opportunity for greater dialogue and targeting on State priorities. The Strategic Plan contains the following goal with respect to water quality in Maine:

"To ensure that land and water resources are protected, restored and enhanced as ecological systems supporting both the natural world and human activities, and to ensure that all waters of the state meet or exceed their classification standards."

To measure progress toward this goal, a number of specific objectives were also developed:

Lakes and Ponds: By 2005, the overall trophic state of Maine lakes will be stable or improving. Continue and improve monitoring for toxics contamination in lakes so that measurable objectives may be set. (See Part III, Chapter 4: "Lakes Water Quality Assessment".)

Rivers and Streams: By 2005, reduce by 65 miles the portions of Maine rivers and streams that do not meet fishable/swimmable or other applicable water quality standards due to pollutants from combined sewer overflows (CSOs) and other sources, excluding dioxin. By 2002, have no Maine river under a fish consumption advisory due to dioxin. (See Part III, Chapter 3: "Rivers and Streams Water Quality Assessment".)

Estuarine and Marine Areas: By 2005, reduce by 10% the square miles of estuarine and marine habitat in nonattainment due to bacterial contamination. Reduce the square miles not supporting designated uses due to other causes and, by 2005, develop a scientific basis to define non-attainment, impaired and threatened coastal waters so that measureable objectives may be set in relation to these causes. By 1998, determine how to better protect, enhance and manage beach systems and associated coastal resources in Maine, and provide for a measurable objective. (See Part III, Chapter 5: "Estuary and Coastal Assessment".)

Wetlands: Ensure that wetlands of special significance are identified and protected, and that the loss of all wetlands due to regulated activity is minimized. Develop a data base and assessment methods so that a measurable objective may be set. (See Part III, Chapter 6: "Wetlands Assessment".)

Ground Water: By 2000, have a fundamental understanding and data necessary to set measurable objectives for the protection of ground water quality and evaluation of use, value and vulnerability. (See Part IV: "Ground Water Assessment".)

Watershed and Ecosystem Health: Continue to work to protect ecosystems and, by 2005, develop the information base needed to establish measurable objectives for the protection of ecosystem health. (See Part II, Chapter 2, Section A: "Watershed Approach".)

These objectives rely heavily on information from Maine's 305(b) Report for baseline and trend data, as described below.

The Quality of Maine Waters

Water quality can be described in terms of physical, chemical and biological characteristics, but public interest is centered on potential uses of water. The DEP receives many calls from citizens concerned with questions such as "Is this water safe for swimming?", and "Are fish safe to eat?". Maine waters are therefore managed under a use-based classification system. The designated uses under State law and Federal regulations are: fish consumption, aquatic life support, swimming, secondary contact, drinking water supply, and agriculture. Waters which attain Maine's lowest water quality classification standards (C for freshwater and SC for tidal waters) also meet the fishable-swimmable goals of the Clean Water Act. Maine law sets forth additional designated uses: industrial process and cooling water, hydroelectric power generation, and navigation.

- **Rivers and streams**. The total length of rivers, streams and brooks in the State of Maine is estimated as 31,672 miles. It is estimated that 476.4 miles (1.5%) do not fully support the fishable-swimmable goals of the Clean Water Act. For major rivers, approximately 78% of evaluated waters attain the fishable goal, while 91% are considered swimmable. A higher pecentage of minor rivers, streams and brooks meet the fishable (98.6%) and swimmable (99.4%) goals. Additionally, there are 98.3 miles (0.3%) of rivers and streams that do not meet higher classification standards assigned to those waters in Maine's water quality laws. The uses not fully supported are: Fish consumption - 268 miles (0.9%), Aquatic Life Support - 259 miles (0.8%), Swimming and Secondary Contact - 197.5 miles (0.6%).

- **Lakes and Ponds**: The total area of "significant" Maine Lakes and Ponds is estimated as 958,886 acres. Of this area, 70.0% of Maine lakes fully support designated uses other than fish consumption, 5.0% fully support those uses but are threatened, and 25.0% partially support the uses. GPA classification requirements established by State law other than for fish consumption, are met in 75.0% of the total acreage of Maine lakes. Uses not fully supported are: Aquatic Life Support - 19.1%, Swimming - 5.2%, and Trophic Stability - 2.5%. All Maine lakes are classified as not supporting fish consumption due to a fish consumption advisory issued in April 1994 that bans consumption for a subpopulation of the state.

- **Estuarine and Marine Waters**: Beginnning with this report, the Department of Marine Resources is using a new GIS system to audit classification of all flats and tidal waters and shellfishery closures. There are 230 closed shellfish areas reported, which is eight less than reported in the previous 305b report. More areas have been opened but there have also been additions to the closure list. The prohibited and conditionally closed areas encompass approximately 269,387 of 1,825,008 total acres (14.8%) of Maine tidal flats and waters. These area values cannot be compared with previous reports because of the change in audit methods.

- **Ground Water**: No estimate exists for the percentage of ground water not attaining its designated uses.

Causes and Sources Affecting Use Support

- In Maine, dioxin contamination in fish tissue is the single most significant cause of non-attainment of uses in major rivers.

- The most significant causes of non-attainment of uses in other riverine waters are dissolved oxygen deficit (organic enrichment), habitat alteration (particularly hydrological modifications from dams) and bacteria (pathogenic indicators).

- Significant sources of organic enrichment and bacteria in riverine waters include municipal point sources (mostly combined sewer overflows), nonpoint source pollution, and inadequate on-site wastewater treatment systems or untreated discharges.

- The most significant causes of non-attainment for lakes are mercury and organic enrichment from nonpoint sources such as atmospheric deposition, urban runoff, and agriculture.

- The most significant cause for non-attainment of uses for marine and estuarine waters is pathogenic indicators, mostly from municipal and small (overboard discharge) point sources.

- The most significant causes for non-attainment of ground water classification are: petroleum compounds from leaking underground and above ground storage tanks, other organic chemicals from leaking storage tanks or disposal practices, and bacteria from subsurface disposal systems or other sources.

Trends in Water Quality

- Fish consumption advisories have been issued for three Maine rivers and for lobsters, due to elevated levels of dioxin discovered in fish tissue and lobster tomalley. Maine has been working with the Kraft pulp and paper mills to reduce the levels of dioxin in their discharges. Recent data has shown a downward trend in contamination for some rivers. Current changes in bleaching technology being implemented by the mills are expected to reduce dioxin discharges. Maine has established a goal of eliminating dioxin advisories on its rivers by 2002.

- There has been a small overall increase in the number of river and stream miles in non-attainment. This is attributed to increased monitoring activity and the use of datasets not previously incorporated into the 305b process. This has led to the discovery of some waters that were not previously known to be in nonattainment and probably is not a signal of declining quality. Maine has made significant progress in some areas since the 1994 report. All but two river segments previously reported in nonattainment due to color, odor and foam impairing water contact recreation have been brought into compliance with Maine's 1998 color criteria, and are therefore removed from the listing of nonattainment waters. Bacteria problems have been corrected on several waterbodies, notably 15 miles of the Androscoggin River below the New Hampshire border due to the correction of problems at New Hampshire facilities. Several segments with toxicity problems have also been corrected and removed from the nonattainment list. Many new segments have been listed below hydroelectric facilities that impair aquatic life due to present flow management. Maine is presently negotiating new flow requirements for Water Quality Certification as part of the FERC relicensing process.

- Mercury contamination in Maine's waters is a growing concern. Maine did an extensive study of mercury contamination as part of the REMAP program and has since issued an advisory on fish consumption for all Maine lakes. The Surface Water Ambient Toxics Program currently underway has revealed that mercury contamination in river fish is similar to that found in lakes. It is expected that Maine may issue an advisory in the future for all freshwaters. The trend in mercury contamination is unknown at this time.

- The water quality of most Maine lakes has remained stable, thereby providing consistently clean water for all to appreciate. However, threats to lake water quality increase with development pressures, making lake protection the preferred management approach rather than restoration. Analyses of Maine lakes, however, demonstrate that the decline in quality of some lakes has been reduced and that preventative measures are working in other watersheds.

- Trends in lake water quality are difficult to assess due to the time lag between cause and observed effect. Data for 670 lakes (29.0% of "significant" Maine lakes) have been evaluated by the DEP. Of the 670 lakes, 381 (57%) had inadequate data to determine trends, 22 (3%) have a possible decline in water quality, 241 (36%) appear to have stable water quality, and 26 (4%) show a possible improvement in water quality.

- Marine and estuarine waters have not been comprehensively assessed (majority of monitoring is for bacteria only), therefore empirical evidence to conclude nonattainment or adverse impact is less available than for freshwaters. Biological standards must be developed to assess attainment and additional monitoring must be conducted to assess impact. Six "areas of concern" have been identified along the coast with respect to toxic contamination. Shellfish growing and harvesting areas have been the focus of pathogen indicator sampling. New audit methods for tracking closures are now in use by DMR and provide different numbers from previous reports. Comparison with previous reports is not recommended because differences are due to changes in the accounting system as well as changes in water quality.

- Regulations regarding underground storage tank installation have begun to show progress in ground water protection by decreasing the likelihood of new leaks. Closure of landfills and installation of covers over sand/salt piles will also protect the quality of ground water in the future. A recently initiated effort to prioritize ground water will provide a means to rank the relative vulnerability of ground water and thereby direct protection efforts. Coordinated groundwater database management is vital to the success of this effort.

Specifics

- The control of nonpoint source pollution is crucial to protecting Maine lakes, ground water, wetlands, coastal bays and restricted estuaries, smaller riverine waterbodies and selected larger rivers. Lake restoration efforts are addressing the results of nonpoint source pollution, while educational efforts are addressing the causes. Guidance has been published to help people implement Best Management Practices to control nonpoint source pollution throughout Maine.

- According to the US Fish & Wildlife Service, Maine is estimated to have lost about 20% of its wetlands since colonial times. New regulations have been adopted to better protect wetlands. A system to track wetlands losses has been developed and is in the beginning stages of implementation. A recent grant proposal, if funded, would allow the data to be incorporated into Maine's Geographic Information System.

- The greatest threat to Maine ground water is leaking underground storage tanks. Maine requires that all underground tanks be registered, and those tanks not sufficiently protective be removed. Under this program, 38,600 tanks have been registered, and 1,500 to 2,500 tanks have not yet been registered. About 23,000 tanks in Maine have been removed since 1986.

- All Maine people must take an active role in protecting their water resources. State, federal and regional agencies must continue to 1) do more to inform the public about environmental issues, 2) provide more and better technical assistance to municipalities, and 3) take an active role in introducing environmental issues to school curricula.

- The DEP needs to continue to link pollution prevention activities with the watershed approach to water quality management. The pilot program developed for the Androscoggin River basin has been very successful, involving local officials and citizen groups to establish programs to reduce pollution. DEP staff are working with the towns to establish local teams and to provide them with the knowledge and focus to identify problem areas and develop solutions.

PART II

BACKGROUND

Chapter 1 - Total Waters

Maine is the largest and least densely populated state in New England. Most of the population is concentrated in the southern and coastal portions of the State and in a broad band on either side of Interstate 95. Maine's 5,785 lakes and ponds cover an area somewhat larger than the State of Rhode Island. There are over 7,000 brooks, streams and rivers in Maine, ranging in length from less than two miles to nearly 200 miles with an estimated total length of 31,672 miles. The St. Croix, St. John, St. Francis and Southwest Branch of the St. John make up part of the U.S./Canada boundary while the Salmon Falls River lies on the Maine/New Hampshire boundary. Numerous lakes lie on the New Hampshire and Canadian boundaries. Inland and coastal wetlands and marshes in Maine are estimated to exceed 5,000,000 acres in area. At least 1,315 square miles are underlain by significant sand and gravel aquifers.

Over 400 river and stream systems, ranging in size from a few hundred acres to over 1,850 square miles, empty into Maine's estuarine and near shore waters. For most reporting purposes, Maine is divided by the U.S. Geological Survey into 6 major drainage basins. Two of these (the Western Coastal Basin and Eastern Coastal Basin) are, in fact, made up of dozens of smaller basins that empty into the Atlantic Ocean. Large portions of 4 river basins are located in New Hampshire, Quebec and New Brunswick. Table 2-1.1 presents this information in summary form.

The number of lakes, reservoirs and ponds, and the acres of lakes, reservoirs and ponds used in this report are taken from the Maine Department of Inland Fisheries and Wildlife (DIFW) Lake Index file rather than from USEPA RF3/DLG estimates. The Maine DEP believes that the DIFW Lake Index file (determined from 15' USGS topographic maps; 1:62,500 scale) provides a more accurate estimate of lake numbers and acres than the USEPA RF3/DLG estimates (based on maps having 1:100,000 scale).

In addition, all of our lake data is referenced by a lake identification number, as is the DIFW database containing lake acreage. It would be a monumental task to link the USEPA RF3/DLG acreage estimates to our database, and this could potentially introduce error due to map scale differences.

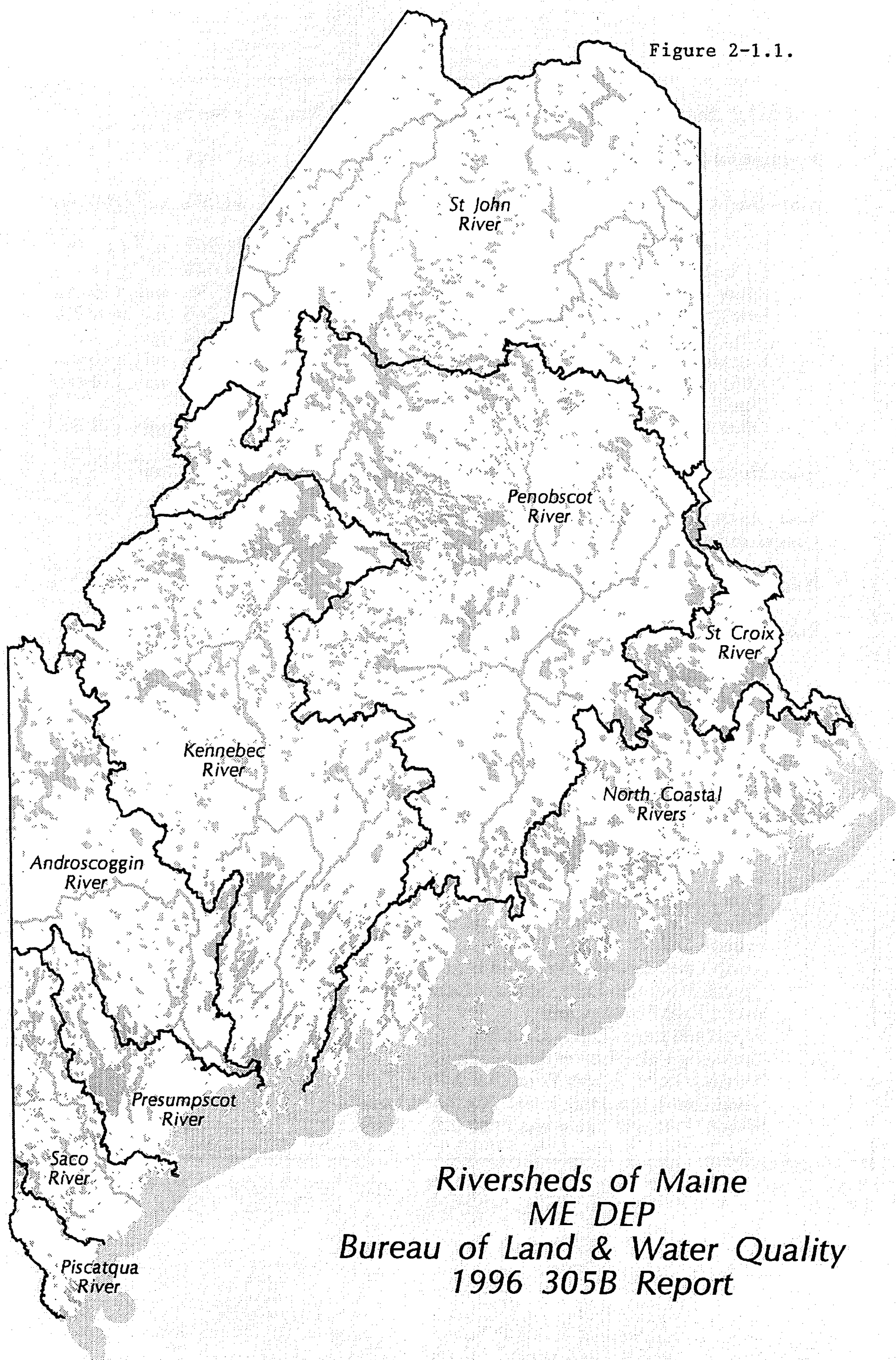
Under the auspices of the Casco Bay National Estuary Project, the entire coastline of the State of Maine has been digitized as a data layer on the State's Geographic Information System. The information was taken from USGS maps at a resolution of 1:24,000, which provides a much higher level of detail than the DLG estimates. With this higher level of detail and the inclusion of Maine island shoreline miles, this report now estimates that there are 5,249 coastal miles of shoreline.

Figures 2-1.1 through 2-1.4 depict the major river basins, biophysical regions, ecoregions and major surface waters, and climate regions for the State. Further information about these coverages may be obtained from the Maine Office of Geographic Information Systems, Augusta, Maine, (207) 287-3897.

Table 2-1.1 State of Maine: Population and Natural Resource Statistics.

Population (Mid-1990 estimate)	1,227,928		
State Surface Area	33,265	mi^2	(100.0%)
Forested Upland	21,262	mi^2	(63.9%)
Forested Wetland	4,688	mi^2	(14.1%)
Other Fresh Wetland	3,190	mi^2	(9.6%)
Brackish/Saline Wetland	246	mi^2	(0.7%)
Cropland	924	mi^2	(2.8%)
Pasture	216	mi^2	(0.6%)
All Lakes and Ponds (5,785/986,776 acres)	1,542	mi^2	(4.6%)
Significant Lakes and Ponds (2,314/958,886 acres)			
Other land	1197	mi^2	(3.6%)
Area Underlain by Significant Sand/Gravel Aquifers	1,315	mi^2	
Total Area of Estuarine/Marine Waters	2851	mi^2	
Linear miles of Ocean Coast	5,249	miles	
Number of Major Drainage Basins	6		
Total lengths of rivers, streams, etc.	31,672	miles	
Total length of rivers	3,704	miles	
Total length of streams	3,909	miles	
Total length of brooks	22,829	miles	
Total length of creeks, etc.	1,230	miles	
Names and mileages of inland border waters (total miles = 272)			
Monument Brook (U.S. - Canada)	11	miles	
Saint Croix R. (U.S. - Canada)	52	miles	
Saint Francis R. (U.S. - Canada)	27	miles	
Saint John R. (U.S. - Canada)	45	miles	
SW. Branch of the St. John R. (U.S. - Canada)	50	miles	
Salmon Falls R. (ME - NH)	30	miles	
North Lake, Grand Lake, Mud Lake, Spruce Mountain Lake, Spednik Lake, Grand Falls Flowage and Woodland Lake (U.S. - Canada)	42	miles	
Umbagog Lake, Lower Kimball Pond, Province Lake, Stump Pond, Balch Pond, Great East Lake, Horn Pond, Northeast Pond, Milton Pond and Spaulding Pond (ME - NH)	15	miles	

Figure 2-1.1.



Riversheds of Maine
ME DEP
Bureau of Land & Water Quality
1996 305B Report

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Figure 2-1.2.

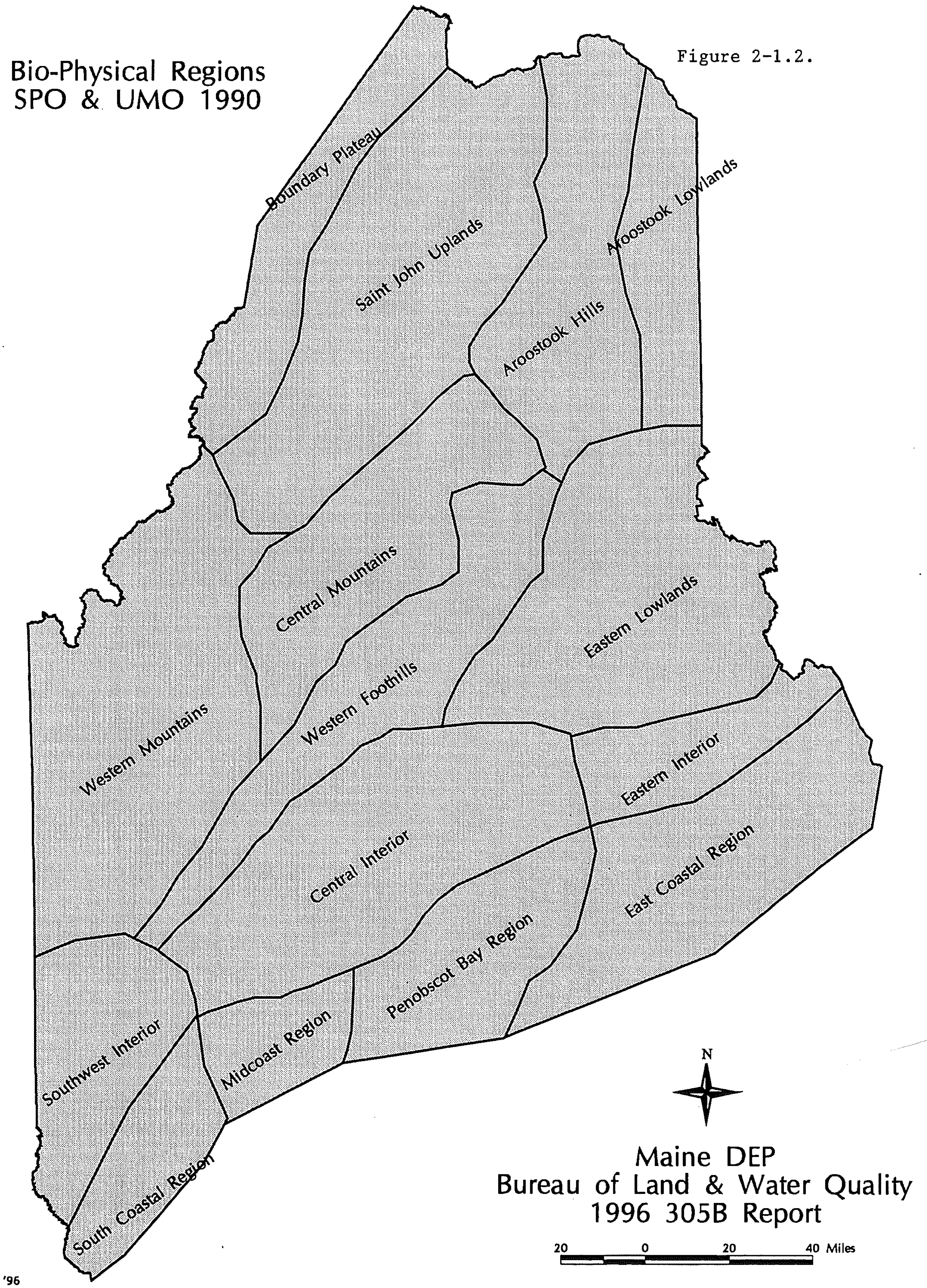
Bio-Physical Regions
SPO & UMO 1990
Boundary Plateau
Saint John Uplands
Aroostook Lowlands
Aroostook Hills
Central Mountains
Eastern Lowlands
Western Mountains
Western Foothills
Eastern Interior
Central Interior
East Coastal Region
Penobscot Bay Region
Southwest Interior
Midcoast Region
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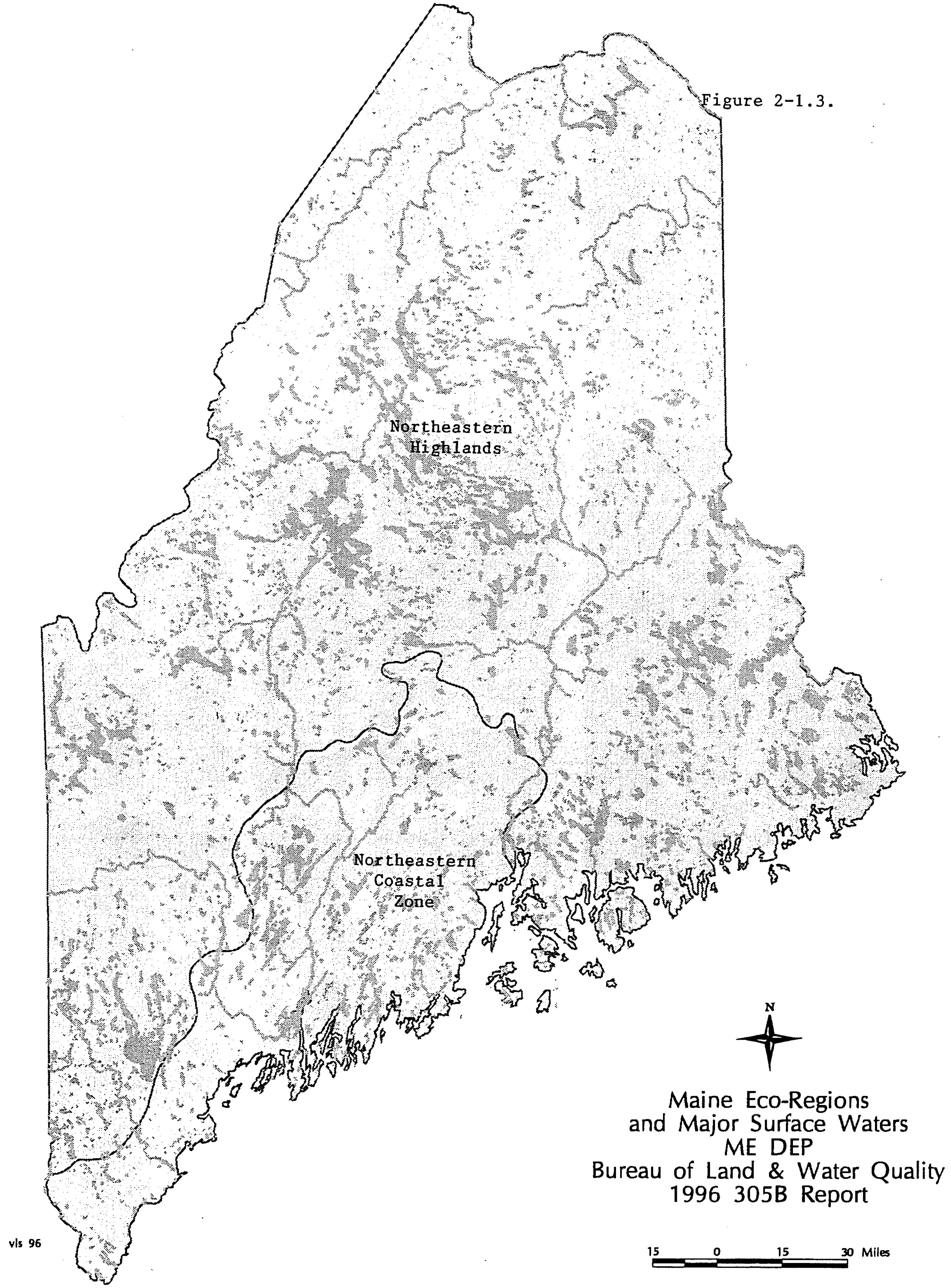
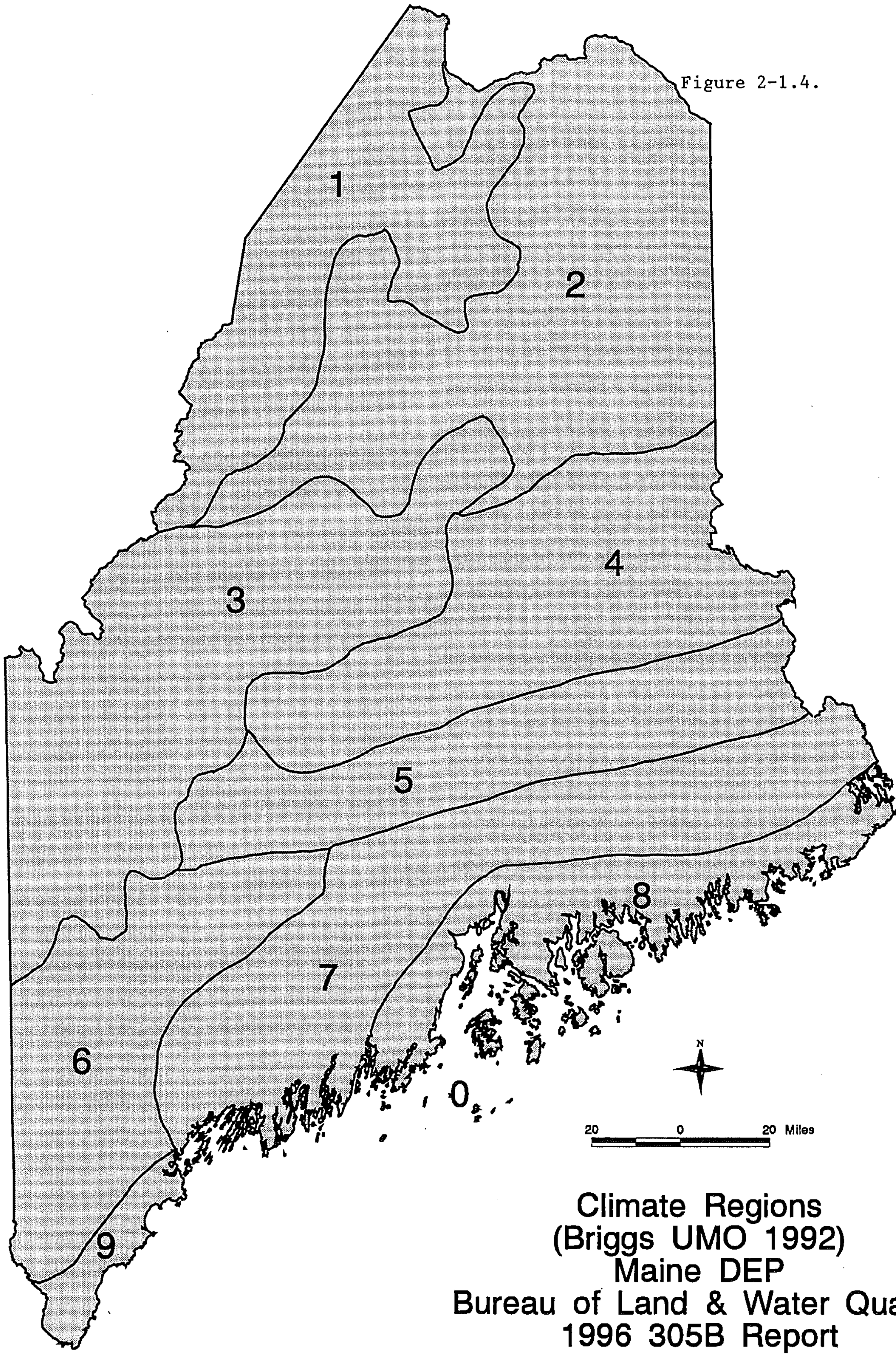
Figure 2-1.3.



Maine Eco-Regions
and Major Surface Waters
ME DEP
Bureau of Land & Water Quality
1996 305B Report

Figure 2-1.4.



Climate Regions
(Briggs UMO 1992)
Maine DEP
Bureau of Land & Water Quality
1996 305B Report

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Chapter 2: Water Pollution Control Program

A. Watershed Approach

Maine's water quality programs utilize watershed based strategies in many ways and at many levels. The following discusses the watershed based approaches of the Point Source Control Program, the Pollution Prevention Program and the Nonpoint Source Control Program.

1. Point Source Control

Contact: Dana Murch, DEP BLWQ, Division of Water Resource Regulation, (207) 287-7784.

EPA and DEP have undertaken a cooperative watershed-based approach to issuing National Pollutant Discharge Elimination (NPDES) permits. This initiative follows a five year cycle, with permits for each of five watersheds issued in the same year. Using this approach, EPA and DEP staff are better able to focus ambient water quality information collection and field work, and to manage the watershed as a whole. The process also allows other agencies to anticipate technical review requirements. The goal is to produce higher quality permits that improve protection for sensitive environmental areas. It is estimated that all major discharges will be reviewed within two five-year cycles. The schedule for the current cycle is:

1994: Androscoggin River
1995: St. John and Presumpscot Rivers
1996: Saco and Salmon Falls Rivers
1997: Penobscot River and Coast, Union River South and West
1998: Kennebec River and Coast to Presumpscot River

2. Androscoggin River Pollution Prevention Project

Contact: Katherine Metzger, DEP, (207) 287-8125.

Presently, sixteen communities in the Androscoggin watershed are involved at the municipal level with pollution prevention initiatives and have pollution prevention teams coordinated by the DEP. These initiatives have grown into what is called the Androscoggin Watershed Pollution Prevention Project. The focus began with water quality on the Androscoggin River, and has now expanded to include environmental quality projects that reach throughout the watershed. Examples of municipal projects are correcting malfunctioning septic systems, energy audits on wastewater treatment facilities, and the development of guidelines for automobile repair businesses to control, treat, and recycle wastes. A watershed-wide river water quality monitoring program has also been established. Other activities include river clean-ups, canoe trips, development of educational brochures and displays, and a household hazardous waste collection day.

With each of these projects, DEP provides technical assistance. In the past, technical assistance was generally targeted at facilities in non-compliance. Now, technical assistance is pro-active and focuses on preventing non-compliance and promoting ongoing improvement at the industrial, small business and municipal levels.

3. **Nonpoint Source Control**
   Contact: Jeff Dennis, DEP BLWQ, Division of Watershed Management, (207) 287-7847.

Assessment: More than 8,000 discreet watersheds have been delineated and digitized on GIS. These include all the lake watersheds as well as many small stream and estuarine watersheds. They provide the basis for several models used to evaluate to what degree watersheds are threatened by nonpoint sources. These include the Lake Vulnerability Index, the phosphorus allocation methodology for evaluating new development, and most recently the Watershed Pollution Potential Index.

The Lake Vulnerability Index has been used for nearly a decade as one means of identifying threatened lakes. This model is based on the assumption that new residential and commercial development will account for the majority of new phosphorus loading to Maine lakes. The model simply estimates the growth rate (based on new construction information in municipal property tax reports) for each lake watershed, assumes a given increase in phosphorus loading for each increment of growth and, using a simple phosphorus loading model sensitive to the hydrology of each lake, projects the annual increase in lake phosphorus concentration resulting from this growth. The higher the projected increase, the more vulnerable, or threatened, the lake. Since point discharges are not allowed to Maine lakes or their tributaries, the growth related phosphorus sources considered in this projection are all nonpoint.

In 1987 and 1988 the DEP developed a method for evaluating the potential impact of new development in lake watersheds based on an areal phosphorus allocation for each lake's watershed. The areal allocation is defined by the lakes current water quality status, its apparent susceptibility to internal recycling of phosphorus, its value as a water supply or coldwater fishery and an anticipated build out scenario for the lakes watershed. It is intended to evenly distribute the burden of lake protection over landowners in the watershed and over time. The allocation provides guidance to state and local regulators of new developments in sensitive lake watersheds.

The DEP has also developed a preliminary GIS based index to identify which of the 8,000+ delineated subwatersheds statewide have the greatest potential export of nonpoint pollutants to their receiving waters. The index, called the Watershed Pollution Potential Index (WPPI), is based on extraction of relevant land use, soils, slope, population and transportation information from various statewide GIS coverages for each subwatershed. The preliminary index, which focuses on nutrient export potential, has been developed for and applied to the Casco Bay watershed. It is currently being refined and will be applied to the western half of the state next, and eventually statewide when adequate land use coverage is developed for the entire state. Stream watersheds with high pollution potential indices are evaluated in the field for obvious impairment using a recently developed stream assessment methodology which relies heavily on an analysis of the macroinvertabrate community and is still being refined.

Volunteer watershed surveys are a key component of DEP's Nonpoint Source Control Program. Trained volunteers canvas the watershed identifying and describing/characterizing specific nonpoint pollutant sources. This information is screened and field evaluated by professionals (either DEP staff, SWCD staff or private consultants) to set priorities, identify solutions and define implementation strategies. All of the sixteen watershed surveys performed to date have been in lake watersheds and have been based on a lake watershed survey guidance manual developed in 1992. Surveys planned for the next few years include stream and coastal watershed surveys, and a guidance manual for Coastal Volunteer Watershed Surveys has recently been published. The results of watershed surveys often provide the core information for 319 NPS watershed implementation projects.

Prioritization: The DEP is in the process of developing and implementing an open ended nonpoint source prioritization system for water resources and their associated watersheds. The system is based on evaluations of impairment of/threat to the resource (as defined in part by the tools discussed above), relative value of the resource, technical feasibility of the solution and the level of public support. The system will identify priorities for resource assessment, watershed survey and planning, education and outreach, and BMP implementation. The system considers the resource in the context of its watershed at every level of evaluation.

Implementation: Many of the 319 NPS control implementation projects are "watershed" projects - projects which comprehensively address the nonpoint problems within an entire watershed. All the elements of these projects from education through planning and regulation to BMP implementation emphasize the entire watershed as the management unit for water resource protection. Even projects which are not comprehensive watershed projects are done with the aim of demonstrating or otherwise promoting BMP utilization throughout the watershed.

The State's Growth Management Program encourages municipalities to consider lake watersheds in their comprehensive planning process, and to tailor the regulation of development to the sensitivity of the watershed in which it occurs. DEP provides information and technical support to municipalities to accomplish this.

B. Water Quality Standards Program

Contact: David Courtemanch, DEP, BLWQ, Division of Environmental Assessment, (207) 287-3901.

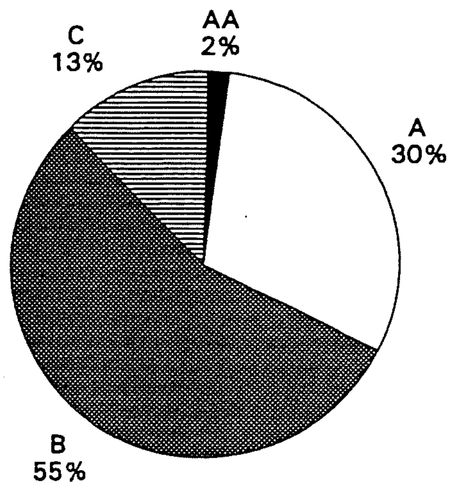
The water quality of Maine can be described in terms of physical, chemical and biological characteristics. Public interest in water quality is centered on the uses which can be made of water. Questions such as, "Is that water safe for swimming?", "Are fish caught there safe to eat?" and "Does the water in that lake turn green in the summer?" make up a large portion of the inquiries from the public received by the Department of Environmental Protection (DEP) Bureau of Land and Water Quality. To answer such questions, Maine waters are managed under a use-based classification system.

As established in Maine statute, a classification consists of designated uses (such as swimming or aquatic life habitat), criteria (such as bacteria, dissolved oxygen and aquatic life) which specify levels of water quality necessary to maintain the designated uses, and in some cases, specific limitations on certain activities such as types of discharges. Thus, to answer a question about swimming, one might reply, "Yes, that river is classified as suitable for water contact recreation and the data collected show that bacteria criteria are being met." If a water body is meeting all its classification standards, it can be described as "attaining its classification." If a water body is not attaining its classification, Maine statutes direct the DEP to take actions to improve water quality.

In addition to the Maine water quality classification system, the requirements of the Federal Clean Water Act (CWA) establish national interim goals (designated uses) "wherever attainable ... of ... the protection and propagation of fish, shellfish and wildlife ... [and] recreation in and on the water." Figure 2-2.1 shows the percentage of flowing water in Maine by classification. As presented in Table 2-2.1, Maine's water classification system contains no classifications with designated uses lower than the nation's interim goals. Classifications of waters are illustrated geographically in Figure 2-2.2.

Guidance from EPA on 305(b) reports requires that ambient water quality be described in two ways: 1) in terms of attaining the designated uses assigned under State law and, 2) in terms of attaining the interim goals of the CWA. **All waters which meet State standards also meet the interim goals of the Clean Water Act.**

Figure 2-2.1. Percentage of Flowing Water by Classification.



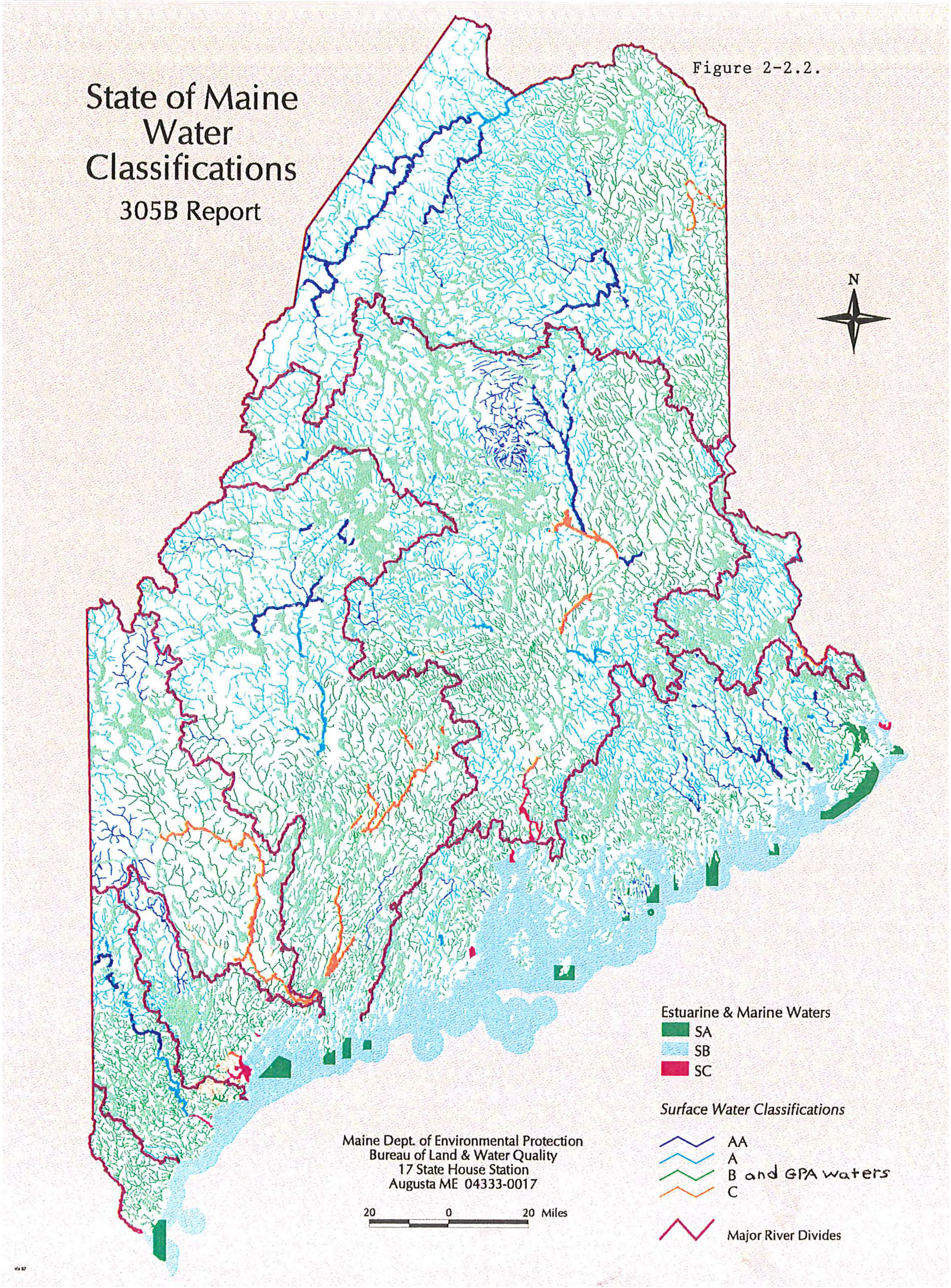
AA	84km	Highest Classification - Natural Waters - No Discharges Allowed
A	1272km	Natural Waters - Discharges only if no change to water quality
B	2326km	General Purpose Classification
C	526km	Commercial / Industrial Classification

Table 2-2.1. Summary of Surface Waters in Maine Classified for Designated Uses

Type of Water	Total Waters	Waters Fishable[1]	Classified Swimmable[2]	Waters Unclassified
Rivers (miles)	31,672	31,672	31,672	0
Lakes (acres)[3]	986,776	986,776	986,776	0
Estuary/coast[4] (square miles)	2,851	2,851	2,851	0

[1] The fishable CWA goal is defined as protection and propagation of fish, shellfish, and wildlife.
[2] The swimmable CWA goal is defined as providing for recreation in and on the water.
[3] Total lake acres is based on State of Maine Department of Inland Fisheries Lake Index file and determined from 15' USGS topographic maps (scale 1:62,500).
[4] Includes all marine waters within Maine's three mile territorial limit.

Figure 2-2.2.


State of Maine
Water
Classifications
305B Report
N
Estuarine & Marine Waters
SA
SB
SC
Surface Water Classifications
AA
A
B and GPA waters
C
Major River Divides
Maine Dept. of Environmental Protection
Bureau of Land & Water Quality
17 State House Station
Augusta ME 04333-0017
20
0
20 Miles

C. Point Source Control Program

Maine uses multiple approaches to ensure that point source discharges of wastes receive adequate treatment prior to their release to waters of the State. Maine law prohibits any discharge of wastes to waters of the State without a license, and to receive a license, an applicant has to demonstrate the ability to provide the appropriate level of treatment. All of the larger municipal and commercial sources of wastewater in the state are licensed and treated, or conveyed to licensed facilities for treatment. A few small towns or villages are only now installing treatment, mostly with Federal or State funding assistance. A number of financial assistance programs support new construction, as well as upgrades or additions to existing facilities.

Many communities in Maine are characterized by low population densities and depend on individual subsurface disposal systems to provide sewage treatment. For areas not served by community collection systems, the Maine Subsurface Wastewater Disposal Rules require that property owners provide adequate means of treating their own wastewater, in accordance with specifications established by the rules. The rules are enforced at the municipal level and administered at the State level by the Department of Human Services.

Most sources of wastewater of all types in Maine, including communities, industrial or commercial businesses, and residences, have either installed treatment facilities or discharge their wastes to facilities managed by other owners. The traditional approach with this group is: license compliance inspection coupled with technical assistance in operations and maintenance; enforcement where necessary; and periodic re-licensing. Recent new directions include expanded technical assistance in all aspects of treatment facility operations and maintenance, and pollution prevention.

1. Pollution Prevention

Contact: Don Albert, DEP BLWQ, Division of Engineering and Technical Assistance, (207) 287-7767.

Industrial Pollution Prevention: The water pollution prevention unit continued providing on-site technical assistance to eight large pulp and paper mills. Over the years the unit has helped mills reduce their biochemical oxygen demand (BOD) discharge by over 15,000 lbs/day. In addition, mills have reduced their use and of ammonia, phosphoric acid, and the emission of chloroform. The industry is saving more than $500,000 per year in reduced chemical and polymer use as a result of direct technical assistance. On September 29, 1995, the Department held a one-day conference on Pollution Prevention. The focus was on pollution prevention in paper mills throughout the state. Guest speakers included several industry representatives, Maine Governor King, DEP Commissioner Ned Sullivan, and Dr. Bruce Piasecki from Rensselaei Polytechnic Institute in New York.

Municipal Pollution Prevention: The MWPP program provided DEP and municipal officials information about effluent quality trends, facility design capabilities, chemical and energy use, and financial status. The objective is to assist in long-term planning and to reduce the potential for effluent violations. The MWPP program helped target technical assistance, establish benchmarks and measure municipal pollution prevention efforts.

Androscoggin River Basin Project: The Androscoggin River Basin Project has involved local officials and citizen groups to establish local teams that implemented many pollution prevention activities. A watershed-wide household hazardous waste collection was very successful. Nearly 300 students from eight schools within the watershed attended a Watershed Festival held at Bates College. Four canoe trips were held on the Androscoggin River. The purpose of the trips was to celebrate the successes that have been made and to get people out on the river to see what a beautiful river it is.

2. **Construction of Wastewater Treatment Facilities**
Contact: William Brown, DEP BLWQ, Division of Engineering and Technical Assistance, (207) 287-7804.

During the twenty-three years since the passage of the Clean Water Act (CWA), considerable amounts of grant and loan money have supported a very successful effort to clean up Maine's surface waters. Despite this success, there are still significant needs for continued clean-up efforts, directed less toward initial construction and more toward retrofits, upgrades, control of overflows and a larger number of smaller-scale problems. DEP administers multiple programs to address these remaining areas.

In some communities, existing treatment facilities are not adequately treating sewage, due to age of the facility, design deficiencies or operational problems. In other cases, the sewage collection system is in such poor condition that excessive water enters the system, either through underground infiltration or surface inflow, causing storm-related sewer overflows, ineffective treatment and/or excessive treatment and maintenance costs.

Although most of the larger communities in Maine are served by publicly-owned sewage treatment facilities, there are still some areas where domestic sewage is either inadequately treated or not treated at all. Such areas include entire towns or villages, as well as homes, businesses or seasonal dwellings, either singly or in small groups. Many of these communities include areas in which septic systems are malfunctioning and other areas where treatment systems simply do not exist (straight-pipe discharges).

Municipal Facilities Program: Federal and State cost-sharing funds for the construction of municipally-owned sewage treatment facilities, or planning, design and construction of facility upgrades are administered by DEP through its Municipal Wastewater Facilities Construction Program. In accordance with the requirements of the Federal Clean Water Act and State law (Title 38 MRSA, Sections 411 and 412), the State program is designed to distribute Federal and State loan and grant funds on a worst-first priority basis to communities with sewage treatment problems.

Although EPA Construction Grants funding ended in 1989, Maine still has six active projects being built with funds from this program. These projects range from construction of new facilities to upgrading equipment for improved process control. During State fiscal years 1994 and 1995, eleven new municipal wastewater treatment facilities, built with Construction Grant support, began operating in Maine. Even though Federal grants are no longer being made, Maine can provide grant support for wastewater treatment facility construction under several programs within and outside of DEP. The bond issues that provided the State match for Federal revolving fund capitalization included additional grant funds dedicated for various projects.

The State Revolving Fund (SRF) program began in 1989, also supported by EPA funds, but rather than outright grants to municipalities or quasi-municipal corporations, the State provides low-interest loans (2% below market rates). In some cases, state funds are used to provide grants where the cost of a given project would raise the user charge above 2% of the town's median household income. Since 1989, five bond issues have been passed by Maine voters, for a total of $16.7 million in state share matched by $79.5 million in Federal share to be spent on low-interest loans for wastewater treatment improvement projects. This program supports projects ranging from upgrades of primary facilities to secondary treatment and complete facility upgrades, to upgrades or additions of single treatment components such as pump stations, sludge handling systems or composting facilities, to combined sewer overflow abatement projects. Twenty-seven SRF projects have been completed and closed out, eight are underway and nine are proposed to start during 1996 or 1997.

The DEP Municipal Priority Point System is the mechanism used to rate individual projects. The system incorporates five priority categories listed in descending order of relative priority as follows: 1) water supply protection, 2) lakes protection, 3) shell-fishery protection, 4) water quality concerns, and 5) other facility needs. Within each of these priority categories, points are assigned depending on whether the severity of the problem is assessed as low, medium or high. The DEP Municipal Priority Point System is described in more detail in the "State of Maine Municipal Wastewater Construction Program," published annually by the Division of Engineering and Technical Assistance. In addition to describing the administrative aspects of the Municipal Wastewater Facilities Construction Program, the above-mentioned document includes the Multi-year SRF Project list and the Additional Needs project list. The Multi-year SRF Project list includes all projects likely to need upgrades, whether major or minor. The Additional Needs list is primarily for areas that presently do not have treatment facilities.

The progress of any municipal treatment or collection system project from planning stage to final construction is determined by a variety of factors including public opinion, availability of funds and changes in the priority rank of the project, relative to other projects.

Maine Combined Sewer Overflow Program
Contact: Steve McLaughlin, DEP BLWC, Division of Engineering and Technical Assistance, (207) 287-7768.

Thirty six Maine communities are served by combined sewer systems, which are partially or completely combined (ranging from 5% to 100%). During dry weather, all of the sewage in a combined system is conveyed to the treatment plant for adequate treatment. However, during rainstorms or snow-melt periods, stormwater mixes with the sanitary sewage, causing flows that exceed the capacity of the sewer system. This results in combined sewer overflows (CSOs), which vary extensively in pollutant types, concentrations and loads, as well as in volume of overflow and severity of impact to the receiving waterbodies. An additional seven towns with sanitary sewer overflows (SSOs) are being assisted by the CSO program because they experience storm-related overflows from their sanitary sewers which behave and exert effects similar to CSOs.

Maine has established an aggressive program, coordinated with EPA's CSO program, to assist communities in evaluating the design, condition, activity and effects of combined sewer systems and overflows. In 1989, the first CSO-related Maine bond issue was passed, establishing a fund of $ 2.4 million for four specific communities' projects. A second bond issue of $2.4 million was passed in 1990 to establish a fund to provide CSO planning grants at 25% of eligible costs. By the end of 1995, thirty three communities had been awarded CSO planning grants and fifteen communities had submitted CSO Master Plans.

Through these CSO Master Plans, communities conduct studies to determine: 1. the quantity and pollutant loads of CSOs; 2. the impact of CSOs on receiving waters; 3. sensitive areas, where uses are of higher priority and; 4. analysis and recommendation of technologies that will provide a high level of CSO control at a cost that communities can afford. However, it has become clear that the level of CSO control necessary for full attainment of current water quality standards will be very expensive and lengthy to complete. Indeed, several Maine communities have determined through studies of their sewer systems that complete CSO control would cause significant social and economic hardship. Also, most CSO control programs will require terms of up to 15-20 years to complete. Even if a community's recommended plan was to eventually eliminate all CSO problems, water quality standards and designated uses would continue to be violated until the program was complete. This would put the CSO communities in a dilemma. They would be doing all they were financially capable of doing, yet still be violating current water quality requirements. This would leave them open to potential lawsuits by people not in agreement with the recommended CSO Master Plans. Finally, communities need a clear sense of direction and assurance that the actions they take are appropriate and are in full compliance with the law.

EPA has recognized that most States with CSOs have water quality standards that do not adequately address wet weather impacts. EPA's CSO Control Policy of April 1994, recommends "review and revision, as appropriate, of water quality standards and their implementation procedures when developing CSO control plans to reflect the site-specific wet weather impacts of CSOs".

In response, the Maine DEP proposed changes to Maine's water quality standards and designated uses to allow Maine CSO communities to request from the Board of Environmental Protection temporary CSO subcategories. The new wet weather standards language was signed into law in June of 1995 and became effective in October of 1995. These site-specific CSO subcategories will remove designated uses for short periods of time after rain storms and snow melt in areas affected by existing CSOs. This will allow communities to continue to make progress in solving the CSO pollution problems without undue financial hardship, and meet state water quality standards. Regulations allowing the implementation of this new law are presently being drafted.

Maine Small Community Facilities Program
Contact: Richard Green, DEP BLWC, Division of Engineering and Technical Assistance, (207) 287-7765.

In 1981, the Maine Legislature enacted a law designed to allow the State to help finance small wastewater treatment projects. The law authorizes up to $1 million each year for the construction of waste treatment systems and authorizes the DEP to pay 25% to 100% of the costs of such systems. The maximum project cost funded by the program is $100,000 per year for each town. Projects are reviewed for priority points under a system very similar to the Municipal Priority List, and then selected from the resulting list in descending numerical order. Funds for this program are provided from bond issues approved by Maine voters. The Small Community Facilities Program was last funded for the 1996 construction season by a bond issue approved in November 1995.

This program fills a need which is largely unmet by the State Revolving Fund Program. It allows DEP to clean up scattered small-scale problems by funding installation of individual or cluster treatment systems in a very cost-effective manner. During the fourteen year period the Small Community Facilities Program has been in existence, 2881 small systems in 200 towns have been constructed through the expenditure of over $14 million in grant funds. As a result of these efforts, significant benefits have accrued, including the elimination of public health threats and reopening a number of shellfish growing areas to harvest.

3. Licensing of Wastewater Discharges
Contact: Dennis Merrill, DEP BLWQ, Division of Water Resource Regulation, 287-7788.

The Division of Water Resource Regulation, Bureau of Land & Water Quality, is responsible for the licensing and re-licensing of all surface wastewater discharges, whether industrial, commercial, municipal or residential. In Maine, the vast majority of wastewater discharge sources have previously been licensed. Therefore, the licensing program is focused largely upon renewal of existing licenses, rather than development of new licenses. As technology advances, and as our understanding of the effects of human activities upon the environment grows, the limits included in discharge licenses must be refocused. Currently, there are approximately 215 industrial licensees (includes cooling water and misc. sources), 135 municipal or quasi-municipal licensees, 58 schools with individual licenses, about 2100 small residential & commercial (res/com) licensees and 50 other licensees not in the above categories (mostly non-sanitary municipal sources or sanitary discharges from Federal or State facilities).

Wastewater discharge limits in the United States are based upon two criteria: 1) a standard of performance of technology or level of treatment provided for a specific wastewater or pollutant, or, 2) the level of treatment required to provide protection for the water quality standards of the receiving water. When developing license limits, the more stringent of these criteria is used in the license.

The Clean Water Act established national "standards of performance" for the control of pollutant discharges from all sources. Section 301 of the CWA required that, by 1977 all point source discharges of "conventional" pollutants be treated by the application of best practicable control technology. The Code of Federal Regulations, in Title 40, establishes these technology-based effluent limitations which severe as the minimum licensing standards for many point source discharges.

Municipal and industrial dischargers of wastewater containing toxic or hazardous pollutants are required to apply "best available control technology" in order to achieve effluent limitations established pursuant to Sections 301 and 307 of the CWA. The Administrator of the EPA publishes additional guidance in the form of effluent limitations and standards of treatment efficiency for control of specific pollutants from categories of discharge sources. As for discharges of conventional pollutants, effluent limitations for toxic and hazardous pollutants are included in the National Pollutant Discharge Elimination System (NPDES) permits and the Maine Waste Discharge Licenses for industrial or municipal dischargers. In early 1995, the Department began implementing the requirements of Maine's Surface Waters Toxics Control Program, which requires effluent testing for whole effluent toxicity (WET) and priority pollutants and many industrial and municipal treatment plants. The program is set forth in Chapter 530.5 of the Department rules.

Municipal Wastewater Treatment: The CWA requires that discharges from municipal treatment systems receive secondary treatment (providing 85% removal of conventional pollutants), except where water quality concerns require more stringent limits. The only exception to this requirement is a variance under Section 301(h) of the CWA, allowing primary treatment where the dilution ratio and depth of the water allows rapid mixing of the effluent into the receiving water. Maine has twelve municipal facilities discharging under primary variances; all discharge into the ocean or into waters with high-volume tidal flows.

Municipal licenses include requirements to disinfect at least seasonally due to the possibility of discharging pathogenic micro-organisms. Because most municipal dischargers use chlorine in some form to disinfect, limits for total residual chlorine are included in many municipal licenses. The deleterious environmental effects of reactive chlorine have led to the recent addition of de-chlorination requirements to many municipal licenses, especially for those that discharge into rivers with anadromous fish migrations. Municipal licenses also include requirements to monitor CSO activity and to develop plans for control of these overflows. Many municipalities accept wastewater from industrial or commercial facilities either with or without pre-treatment. Where an industrial source contributes 10% of the flow to a municipal facility and discharges a pollutant that has a categorical standard, a limit for that pollutant will be added to the municipal license.

Industrial Wastewater Treatment: A wide variety of industries in Maine use processes which result in the generation of contaminated wastewater. The chemical and biological constituents of wastewater from Maine's industrial point sources are as varied as the industries themselves and include everything from wood fiber to shrimp wastes to metallic compounds. Some industrial wastes lower the dissolved oxygen of the receiving waterbodies. Others may alter the pH or add pollutants with potential for toxic effects on aquatic life.

Starting in 1972, Maine and its industries made an intensive effort to provide best practicable treatment for all industrial discharges, many of which were untreated. By 1977, all major industries with individual discharges were providing secondary treatment or its equivalent. Since then, additional small industrial discharges have received treatment as municipal treatment facilities have been constructed, or individually, as additional untreated industrial discharges have been discovered.

Industrial dischargers in Maine are regulated in two ways: 1) the industry discharges to a municipal sewage collection system; or 2) the industry discharges directly to a receiving waterbody. Industries which discharge wastewater to publicly-owned sewage treatment facilities are required to pre-treat wastes which would otherwise interfere with the operation of those treatment facilities, or which would not be adequately treated by the municipal treatment process. The pretreatment program is presently administered as part of the NPDES program by the EPA, but the DEP conducts some of the pretreatment inspections and provides assistance to municipalities in understanding pretreatment issues and in developing local limits.

Industries that do not discharge to publicly-owned treatment facilities are issued NPDES permits by the EPA, as well as Waste Discharge Licenses from the Maine DEP. In all cases, the pollutant reduction required by the Maine license for a particular source of discharge is equal to or more stringent than the level of pollutant reduction required by the NPDES permit. The treatment efficiency required by those regulations is related to the type of wastewater produced by the industry, while the amount of the pollutant allowed to be discharged depends on the quantity of goods being manufactured daily.

Elimination of Licensed Overboard Discharges
Contact: Dave Achorn, DEP BLWC, Division of Engineering and Technical Assistance, (207) 287-7766.

From the inception of its waste discharge licensing program, Maine has issued licenses to individual homeowners or businesses, or to small clusters, where existing lots were unsuitable for subsurface disposal and no municipal system was available. This eventually led a large number of licensees (more than 2900 in 1987), which made it impossible for DEP to adequately monitor compliance or evaluate re-licensing applications. The large numbers of small overboard discharges (OBDs) led to closures of a significant number of shellfish growing areas.

Due to concern over the effects of the burgeoning number of licensed small point source discharges, the Maine Legislature passed an act (the "Overboard Discharge Law") in 1987 which prohibited new discharges of non-municipal sanitary wastewater. In 1989, substantial changes were made to the Overboard Discharge Law. These changes prohibited new discharges and expansions of existing, licensed discharges, required DEP to inspect all OBDs each year, established an inspection fee to fund the inspection effort, and established the OBD Removal Grant Program. For any licensed discharge to a shellfish growing area, plus great ponds and small rivers and streams with drainage areas of less than 10 square miles, which causes nuisance conditions, or for which subsurface disposal is a viable alternative, a conditional license is issued which expires 6 months after offer of grant assistance from the DEP. With the goal of reclaiming closed shellfish areas, this law has great significance for the future management of Maine coastal waters.

Since its start in 1989, the OBD Removal Program has been funded by successful bond issues in 1989, 1990, 1992 and 1993, for a total of $3.5 million. For any discharge targeted for removal, DEP grants will pay up to 90% of eligible costs for year-round residential replacements, 50% for commercial replacement systems and 25% for seasonal residential replacement systems. All of the funds for 1989 and 1990, 80% of the 1992 funds , and 60% of the 1993 funds have been encumbered. , Approximately 100 OBD systems have been eliminated, mostly from shellfish harvesting areas, and almost 200 additional systems are currently in the grant program.

4. Underground Injection Control Program
Contact: Pam Parker, DEP BLWQ, Division of Water Resource Regulation, 287-3901.

Underground injection wells are in reality a specialized form of subsurface wastewater disposal. They are being discussed separately, however, because they are the object of a specific regulatory program established by the Federal Safe Drinking Water Act. The Federal program groups underground injection wells into five classes as described below:

Class I: wells which discharge fluid waste, including hazardous and radioactive wastes, beneath an aquifer;

Class II: wells used to inject fluids associated with enhanced recovery from oil and gas wells;

Class III: wells used for solution mining of minerals;

Class IV: wells used to discharge hazardous or radioactive fluid wastes into or above an aquifer; and,

Class V: all other wastewater disposal wells.

Both the Safe Drinking Water Act and EPA regulations include provisions for delegation of primary enforcement authority (primacy) over the Underground Injection Control (UIC) program to states that demonstrate the necessary legal authority and technical and management capability. The DEP demonstrated the necessary authorities and capabilities and was awarded UIC Primacy for Class V wells effective September 26, 1983. The State UIC Program is established in rules of the Board of Environmental Protection, Chapter 543. The rules provide for review and, if appropriate, permitting of proposed Class I, II, and III wells using the procedures set forth in the Federal regulations cited previously. Class IV wells are prohibited based on statutory authority granted the Board by 38 MRSA Section 420, subsections (2) and (3). Class V wells will be handled in accordance with the Department's wastewater discharge licensing authorities as established by 38 MRSA, Sections 413 and 414.

Under Maine's UIC Program, several major categories of businesses (e.g. service stations, food processors, dry cleaners, photo processors, car and truck washes) were surveyed regarding their floor drains. For those with floor drains discharging only to surface water, the information was passed to the surface water point source control program. Many facilities with floor drains discharging into or onto the ground were sent notices of regulation (NOR), with explanation of the regulations and how to comply. Those failing to comply based on the NOR letter were sent Notices of Violation (NOVs). To date, only one UIC case has gone beyond the NOV stage: in that case, the violator entered into a Consent Agreement with the DEP for discharges, including hazardous wastes to the ground water and surface water. In addition to closing the floor drains and other remedial work, the violator paid a total monetary penalty of $70,000. In addition to this enforcement case, the UIC program has been successful in removing a large number of small, widespread threats to ground water. In some cases, small-scale sources of ongoing contamination of ground water were terminated, but no quantitative measures of these improvements exist.

5. Compliance Evaluation

Contact: David Dodge, DEP BLWQ, Division of Water Resource Regulation, 287-7659.

DEP uses a three-part program to evaluate compliance of wastewater treatment facilities. The compliance evaluation program involves on-site inspections of wastewater treatment facilities, sampling their effluent quality, and monthly evaluation of the licensees' self-monitoring reports. Discharge licenses also require immediate reporting of any major malfunctions, bypasses or exceedences of license limits to DEP inspectors.

The intent of the inspection program is to foster voluntary self compliance and to encourage licensees to be aggressive in attaining optimal operation and maintenance of their treatment facilities. During inspection, all areas of the treatment facility are inspected to ensure proper operation and maintenance, including treatment equipment, pumping systems, self-monitoring records, process control and laboratory testing procedures. Effluent samples are collected for analysis by DEP to ensure that self-monitoring by the licensees accurately represents the quality of the effluent.

An important part of the inspection & compliance program is monthly Non-Compliance Review (NCR) meetings held by the DWRR. At these meetings, representatives of all regional offices, the licensing section, the enforcement section and DETA discuss specific compliance problems at licensed treatment facilities and decide upon specific courses of action. Possible responses to compliance problems range from monitoring the situation to providing technical assistance, to formal enforcement action. The NCR process has improved consistency in addressing compliance problems, has helped foster voluntary compliance, and has facilitated the referral of appropriate violations to the enforcement section. In addition to monthly NCR meetings, Quarterly Noncompliance Review (QNCR) meetings are held with EPA to discuss and coordinate actions regarding waste water treatment problems.

DEP and EPA work together closely in the area of compliance evaluation, as both State and Federal permits are required in Maine. Inspections, enforcement actions and other compliance activities are shared, and DEP staff may serve as representatives for both agencies in most cases. DEP also assists with EPA's pretreatment program by conducting inspections or accompanying EPA staff, and by serving as a local contact for the public. DEP provides an inspector to serve as a Pretreatment Coordinator.

Technical assistance is also provided to the operators of wastewater treatment facilities. In addition to responding to requests for help with specific problems such as sludge bulking and odor control, programs are conducted which take a more systematic approach to improving wastewater treatment operations by examining all aspects of treatment plant design and operation.

Operations Management Evaluations (OMEs) are done to diagnose license compliance problems and to provide on-site operator training. OMEs are focused on operation and maintenance problems including process control, personnel and financial management. OMEs result in recommendations for procedural changes as well as follow-up operator training targeted towards improving wastewater treatment. DEP conducts twelve OMEs per year on a worst-first priority basis.

Maine requires that chief wastewater treatment plant operators be certified by the DEP through a certification process that consists of qualifying examinations for five levels of certification for biological facilities and three levels of certification for physical/chemical facilities. The smaller municipal facilities can have a Grade I operator in responsible charge, while the larger and/or more complex facilities must have a Grade V operator in responsible charge.

Investigation of Citizen Complaints: During the past two years, the DEP Bureau of Land and Water Quality has investigated over one thousand citizen complaints concerning discharges to the water. Many of these required field investigations and extensive follow-up work to achieve eventual compliance with discharge laws. A number of complaint investigations have led to lengthy enforcement actions. Overall, a significant portion of the bureau's staff time is devoted to responding to citizen concerns.

Due to program inefficiencies within individual bureaus, as well as to take advantage of the possibilities made available by the information age, the DEP is in the process of evaluating all of the complaint response programs within the agency. Over the next biennium, this effort should result in a more efficient, better coordinated and better managed complaint investigation and response system, both at the departmental level and within each bureau program.

6. **Enforcement of Water Quality Laws**
Contact: Dennis Merrill, DEP BLWQ, Division of Water Resource Regulation, 287-7788.

The general philosophy of the DEP, Bureau of Land and Water Quality is to gain compliance and resolve problems at the least formal level appropriate, and to maximize the spirit of cooperation between the DEP and the regulated community. By fostering voluntary compliance with Maine's water pollution control laws, the overall effectiveness of the enforcement program is maximized and unnecessary litigation is avoided.

Formal enforcement actions become necessary when violations of environmental laws are severe enough to warrant action regardless of the remediation effort; or when the violator is not responsive in preventing or remediating environmental damage or refuses to cooperate with DEP. Formal enforcement actions originate both from license or permit violations, and from detection of unlicensed activities through complaint investigation or other field work. DEP enforcement priorities have generally been based on the size of violations, potential for environmental harm, recurrence of violations and precedents involved.

The Division of Water Resource Regulation is responsible for all formal enforcement actions regarding wastewater discharges taken by the Bureau of Land and Water Quality. Enforcement of non-point source pollution problems is shared by the divisions of Water Resources Regulation and Land Resource Regulation in the Bureau of Land Quality. Other agencies such as the Land Use Regulation Commission in the Department of Conservation and local code enforcement offices also are able to address land use problems which lead to non-point source pollution. In addition to formal enforcement actions, the enforcement sections assist and confer with other units on violations that do not require formal action. Finally, considerable effort is put into assuring that compliance schedules and programs resulting from enforcement actions are properly implemented.

D. Nonpoint Source Control Program

Contact: Norm Marcotte, DEP BLWQ, Division of Watershed Management, (207) 287- 7727.

In 1991, the Maine legislature amended its water quality law to implement a Nonpoint Source Water Pollution Management Program to restore or protect water resources from pollution caused by nonpoint sources. The term "nonpoint source" (NPS) was created under the Federal Clean Water Act to distinguish "point source" discharges (i.e. sewage or industrial process wastewater discharges from pipes or ditches, etc.) for which permits are required, from other more diffuse sources that do not require permits. Atmospheric deposition is considered as a nonpoint source. Nonpoint sources of pollution are associated with all the various land uses in urban, suburban and rural areas, industry, agriculture, roadways, waste disposal, forestry activities, etc.

The Maine DEP administers Maine's NPS programs to promote a coordinated effort among responsible agencies to control or prevent nonpoint source pollution. The basic program objective is to prompt people to use State agency defined (38 M.R.S.A.410-H1) "best management practice guidelines" (BMPs) to prevent water pollution. Four state departments (Transportation, Agriculture, Conservation and Environmental Protection) are responsible for developing and implementing specific BMPs for the nine major categories of NPS pollution as outlined in the State's 1989 NPS Management Plan. These categories are Agriculture, Silviculture, Development, Resource Extraction, Transportation Facilities and Support, Chemical Use and Storage, Solid Waste Disposal, Marine Industries, and Hydrologic Modification.

For 1994-95, the Department continued to implement the NPS Management Plan to encourage actions by governments, organizations, industry, and individuals to prevent or minimize the discharge of NPS pollutants. Program resources were assigned to support efforts both statewide and in specific watersheds, to improve and protect waters that are threatened or impaired due to NPS pollution. The Department provided direct technical assistance and information about BMPs to agencies, municipalities, businesses, and individuals, and administered an NPS Pollution Prevention Grants program under section 319(h) of the Clean Water Act, to provide financial assistance to sponsors that encouraged or implemented BMPs through education efforts and field projects. The resulting diversity of resources, perspectives and expertise helped foster teamwork, better communications, technology transfer, and increased public involvement and awareness about NPS pollution.

NPS And Water Quality

Maine Waters Impaired or Threatened by NPS: The State of Maine uses a water classification system to assess and determine whether a water body has impaired or threatened water quality (38 MRSA § 464). This system sets water quality standards for different classes of waters. If a water body does not meet its assigned standards, it is considered "impaired". If a water body meets its criteria but soon may not due to existing or expected activities in its watershed, it is considered "threatened".

The State of Maine Water Quality Assessment uses available information to report the impairments and threats to water quality, including both point and nonpoint pollution sources. Part 3, Chapter 2 summarizes the sources and extent of waterbodies that fail to attain their classification standards.

Nonpoint source water pollution is the primary cause of the impairment or threatened status for lakes. The quality of the information upon which these data are based is highly variable. For lakes, there is a large set of data from the Lake Volunteer Monitoring Program and DEP monitoring efforts. Only a very few are receiving point source discharges.

The Assessment also identifies lakes which are considered threatened by nonpoint sources resulting from further development of their watersheds. This is based on the Lake Vulnerability Index which assesses the potential for lake eutrophication (i.e. overproduction of algae leading to a lack of oxygen). This potential is determined by measuring lake hydrology (i.e. flushing and turnover rates) and projecting population growth in the watershed.

Most of the water quality monitoring on rivers, streams and brooks has been performed to determine point source impacts. Thus, the small streams and brooks most susceptible to nonpoint source impacts are generally not evaluated unless they receive point source discharges. The Assessment therefore greatly underestimates the miles of stream impaired by NPS. Moreover, while the Assessment includes *impaired* rivers, streams and brooks, there has been no evaluation to identify *threatened* rivers, streams and brooks.

The situation is similar for marine waters. The Assessment identifies six marine and estuarine areas of concern for toxics contamination based on sediment and/or blue mussel tissue analysis. There are no standards for toxic contaminants in sediment or biological tissue, however, so it has not yet been determined whether the levels of contamination constitute an "impairment" or a "threat". This contamination is probably due to a combination of current and historical point and nonpoint pollution, but little work has been done to identify the sources.

NPS Assessment Initiatives: The lack of data on nonpoint source impacts to streams and coastal water bodies has significantly affected the focus of the nonpoint program. Since there has been reasonably good information available to identify impairments and threats to lakes, the majority of nonpoint source watershed projects and general technical assistance has been focused on lake watersheds. This is not because small streams and coastal water bodies are not affected by nonpoint sources, but rather because so few streams and estuaries have been evaluated for these impacts. Until recently, staff resources were not available to address these data deficiencies. But federal funding and a recent DEP reorganization have allowed some resources to address this need. So that the state's nonpoint source control effort can be focused more effectively, several new projects are underway to fill the information void.

The first of these projects is a method to identify watersheds most likely to have nonpoint source impacts, called the Watershed Pollution Potential Index (WPPI). The core of the index is a Geographic Information System (GIS) data layer containing the boundaries of 8,000 stream and lake watersheds statewide. The GIS extracts information within each watershed on population, housing density, road density by road class, land cover, slope and soils from several other data layers. It then combines the information to give a relative index of nonpoint pollution potential. The index is initially being developed for the Casco Bay drainage basin, but it will be applied statewide as soon as the land cover data layer is available.

Those watersheds for which the WPPI indicates a high nonpoint pollution potential will be prioritized for further assessment. In 1994, the Division of Watershed Management developed and tested a prototype rapid stream assessment procedure to identify obvious impacts on stream water quality, biota and habitats. The procedure requires only one visit to the stream in the late summer and, if proven successful, will be used to detect nonpoint source impacts in stream watersheds prioritized by the WPPI.

Other Initiatives:

- The DEP provided funding and/or technical assistance for seven watershed surveys during 1994-95, including Roxbury Pond, Thompson Lake, No Name Pond, Crystal Pond, Kezar lake, Duckpuddle Pond, and Sabattus Pond. Watershed surveys are field surveys conducted by volunteers to determine the extent of pollution in a watershed. The goal of a watershed survey is to identify as many nonpoint sources of pollution in the watershed as possible, with particular emphasis on using BMPs and sources of technical assistance for watershed owners. These surveys help determine the extent of pollution in the watersheds and help residents become more aware of pollution sources, which prompts some landowners to use BMPs.

- Efforts are underway to refine the Lake Vulnerability Index so it will reflect not only growth potential in a watershed but also some other natural risk factors such as the presence of marine clay.

- A work plan is being developed to identify which coastal waterbodies are most sensitive to nutrient enrichment. However, funding to perform this work is still not clear.

- Work to determine whether the data on toxic contamination in marine sediments and biological tissue should be considered as part of the assessment for impairment or threat to water quality, is continuing. Work plans will be prepared to investigate the extent and cause of the contamination in those areas that are considered to be threatened or impaired.

The above information will be incorporated, along with historical data, into a prioritization system to target the state's nonpoint source control and watershed management efforts toward areas of greatest need or risk.

The Importance of BMPs for NPS Control: Best Management Practices (BMPs) are the primary tools for preventing or abating water pollution caused by nonpoint sources. Utilizing BMPs as the cornerstone of its efforts, the NPS Program has experienced varying degrees of success with raising public awareness and acceptance of nonpoint source pollution, what it is, what it does, and how it can be controlled. Success in convincing people to use BMPs has varied with the level of educational effort directed at explaining the problem, and the level of resources available to mplement the "fixes" (i.e., the BMPs themselves). The extent to which a significant environmental risk can be demonstrated to the public often determines the degree to which preventive or corrective action is supported. In Maine, lakes are the resources at greatest risk from nonpoint pollution sources. Towns that have sensitive lakes, and particularly those whose residents live on and regularly use those lakes, usually are aware of NPS issues and potential solutions because the greatest educational effort has focused on lake-related NPS issues.

Normal seasonal and annual variation in runoff causes naturally wide ranges in water and habitat conditions. Identifying the magnitude of water quality and habitat benefits resulting from the installation of BMPs usually requires expensive long term monitoring. There are few direct measures of water quality improvement due to BMP implementation. The many BMPs that have been implemented independent of watershed projects, either voluntarily or as a result of regulation, have resulted in reduced loading of pollutants to receiving waters and elimination of many chronic problems (for instance, recurring sedimentation below an eroding ditch washout). Clearly, there are strong indications that a sustained effort applied over many years in a specific watershed to gain adoption of all types of BMPs can significantly reduce pollutant loading and help improve water quality. Widespread improvements in watershed stewardship and use of BMPs over years can yield important improvements in water quality. This has been demonstrated in several Section 314 lake restoration projects, and in the Section 319(b) Unity Pond watershed project (Table 3-4.7).

Guidance manuals developed for implementing nonpont source BMP practices include:

"Maine Erosion & Sediment Control Handbook for Construction: Best Management Practices", Cumberland County Soil and Water Conservation District and DEP, March, 1991.

"Strategy for Managing Nonpoint Source Pollution from Agricultural Sources and Best Management System Guidelines," Developed by: NPS Agricultural Task Force, October, 1991.

"Best Management Practices for Erosion and Sediment Control", Maine Department of Transportation (MDOT), May, 1992.

"Erosion and Sediment Control Handbook for Timber Harvesting Operations - Best Management Practices," Maine Forest Service, June, 1991.

"Phosphorus Control in Lake Watersheds: A Technical Guide to Evaluating New Development", DEP, issued 1989, revised 1992.

"Maine Best Management Practices for Stormwater Quality and Quantity Control", DEP, November, 1995.

"BMPs for Marinas and Boatyards: Controlling Nonpoint Pollution in Maine, an Environmental Guide for Marinas & Boatyards", DEP/ SPO, December, 1995.

"Best Management Practices for Maine Agricultural Producers. Protecting Groundwater from Nutrients and Pesticides", University of Maine Cooperative Extension, May, 1989.

Program Planning, Coordination and Management

The State's 1989 NPS Management Plan directs NPS efforts on a statewide basis and on specific waterbodies listed as "priority waters" (Table 2-2.2). Priority waters are selected based on NPS impairment or threat status, value of the waters, and feasibility for success of restoration or protection efforts. The NPS Management Plan and the list of priority waters provide a basis for structuring 319 implementation projects and other NPS projects that help turn BMP planning and development ideas into effective on-the-ground pollution controls.

Coastal Nonpoint Source Program

Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 requires the State to amend its Nonpoint Source Management Plan to comply with federal guidelines focused on nonpoint sources that impact coastal waters. The State submitted an amended plan in July, 1995. The main thrust of these proposed amendments is that the State must have enforceable mechanisms to implement management practices for agriculture; forestry; urban development; transportation; hydromodification; and marine industries. The State may continue to rely primarily on non-regulatory tools to implement best management practices, but must have backup authority to enforce these practices when the voluntary methods do not work. Coastal Zone Management communities are shown in Figure 2-2.3.

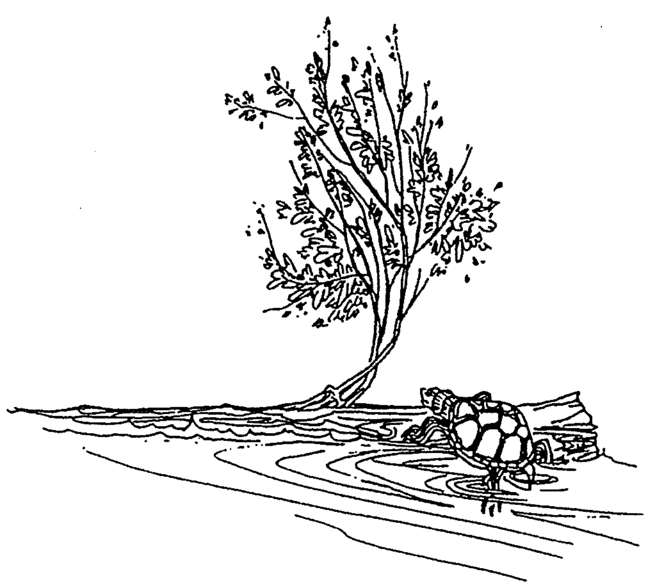


Table 2-2.2 Maine NPS Priority Waters List

Source: Maine Nonpoint Source Management Plan

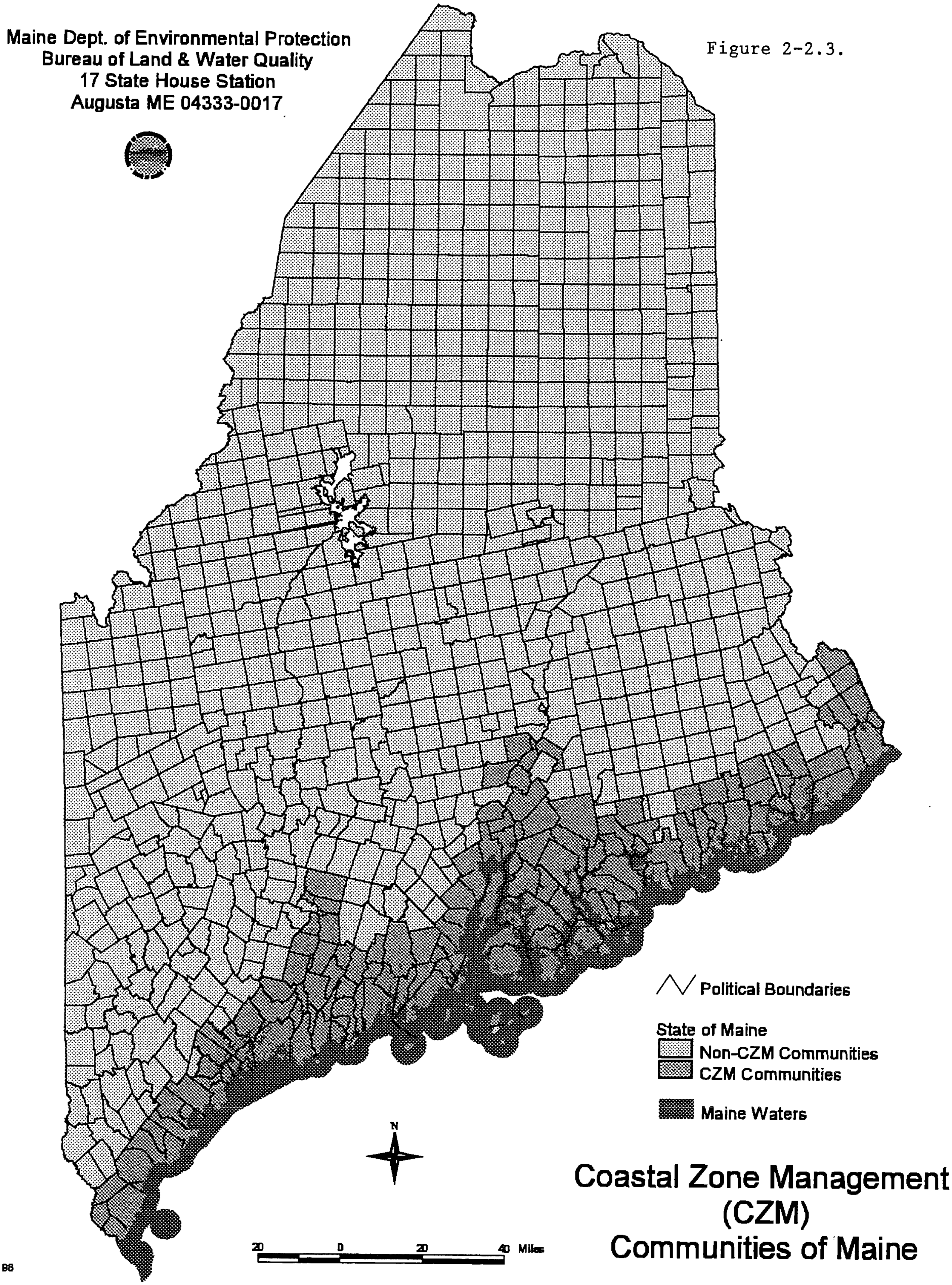
The following is the list of priority waterbodies, as ammended in 1992, for lakes, rivers and marine waterbodies for which the Department will focus the Nonpoint Source Program. The list is intended to be flexible as the rankings of individual waterbodies are expected to change with changes in environmental, demographic, and political situations. It is expected that the list will be reviewed every two years as the water quality assessment report is completed.

WATERBODY #	NAME	COUNTY
STREAMS		
128	Perley Brook	Aroostook
135-144	Aroostook River	Aroostook
140	Presque Isle Stream	Aroostook
149, 150	Upper & Lower Prestile Stream	Aroostook
152	Meduxnekeag River	Aroostook
224	Kenduskeag Stream	Penobscot
225	Souadabscook Stream	Penobscot
317	Varnum Stream	Franklin
318	Wilson Stream	Franklin
320	Carrabbassett Stream	Franklin
	Mill Stream	Somerset
322	Messalonskee Star	Kennebec
325	Sebasticook River	Kennebec
326	Twentyfive-mile Stream	Kennebec
333	Bond Brook	Kennebec
334	Cobbosseecontee Stream	Kennebec
411	Dead River	Kennebec
414	Little Androscoggin R.	Oxford
418	Sabattus River	Androscoggin
523	St. George River	Knox
526	Damariscotta River	Lincoln
603	Royal River	Cumberland
607	Pleasant River	Cumberland
614	Ossipee River	York
615	Little Ossipee River	York
618, 619	Saco River	York, Cumberland
623	Mousam River	York

Table 2-2.2 (continued). Maine NPS Priority Waters List

WATERBODY #	NAME	COUNTY
LAKES		
123	Long Lake	Aroostook
124	Cross Lake	Aroostook
125	Square Lake	Aroostook
145	Madawaska Lake	Aroostook
223	Pushaw Lake	Penobscot
321	Belgrade Lakes	Kennebec
325	Sebasticook Lake	Penobscot
326	Unity Pond	Waldo
328	China Lake	Kennebec
333	3-mile Pond	Kennebec
333	Webber Pond	Kennebec
334	Cobbosseecontee	Kennebec
335	Togus Pond	Kennebec
410	Canton Lake	Oxford
413	Lake Auburn	Androscoggin
414	Thompson Lake	Oxford
414	Pennesewassee Lake	Oxford
517	Branch Lake	Hancock
517	Floods Pond	Hancock
518	Graham Lake	Hancock
520	Philips Lake	Hancock
522	Lake Megunticook	Knox
523	St. George River	Knox
524	Chickawaukie	Knox
527	Damariscotta Lake	Lincoln
530	Nequassett Lake	Sagadahoc
605, 606	Sebago Lake	Cumberland
623	Mousam Lake	York
603	Sabathday Lake	Cumberland
605	Highland Lake (Bridgton)	Cumberland
605	Keoka Lake	Oxford
407	Roxbury Pond	Oxford
MARINE		
	Casco Bay	Cumberland
	Boothbay Harbor	Lincoln
	Cobscook Bay	Washington
	Piscataqua River Estuary	York, Oxford
	Scarborough River Estuary	Cumberland

Figure 2-2.3.


Maine Dept. of Environmental Protection
Bureau of Land & Water Quality
17 State House Station
Augusta ME 04333-0017
Political Boundaries
State of Maine
Non-CZM Communities
CZM Communities
Maine Waters
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Coastal Zone Management
(CZM)
Communities of Maine
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Chapter 3 - Cost/Benefit Analysis

The assessment of costs and benefits of water quality protection is an extremely difficult exercise. Determination of direct economic costs of environmental regulation is complex, but with some effort, financial outlays can be determined. Indirect economic costs of water quality protection, such as jobs lost or gained, effects on competitiveness, productivity, worker satisfaction, etc., are often based on assumptions or subjective evaluations and are difficult to distinguish unequivocally from other economic costs.

Comparison of the benefits of water quality protection to economic costs is difficult at best, and often impossible. Because dollar values cannot be assigned to many of the benefits, the environment would nearly always suffer by restricting the comparison to economic aspects. In fact, such a superficial analysis of water quality protection efforts would undoubtedly have deterred the progress Maine has made over the last three decades. Tourism is an important component of Maine's economy; water quality undeniably is one component of Maine's attraction to tourists, but what is the increment resulting from our efforts to protect and improve our waters?

The direct benefits of the construction of numerous wastewater treatment plants for industrial and municipal facilities have been dramatic. Waterbodies that were once polluted are now supporting their designated uses of swimming, fishing, wildlife habitat, and recreation. Some Maine towns currently charge premium taxes for riverfront properties that, only 20 years ago, no one wanted. After cleaning up the severe pollution our focus has now shifted to sources and contaminants that were previously masked by the large-scale problems.

Water Quality and Property Values

Contact: Roy Bouchard, DEP BLWQ, Division of Environmental Assessment, (207) 287-7798.

The University of Maine recently published a report which analyzes the linkage between lake clarity and property values ("Water Quality Affects Property Prices: A Case Study of Selected Maine Lakes", Maine Agricultural and Forest Experiment Station, Misc. Report 398, February, 1996). This hedonic valuation study is the first of its kind on lakes, and will form the basis for a companion study using contingent valuation methods in 1996-97. The purpose of these projects is to quantify the economic costs of degraded lake water quality. The current work shows that, although varying somewhat by market area, a one meter reduction of summertime minimum clarity (secchi transparency) results in 3-15+% reductions in expected market price of shorefront property. Additional analysis by DEP suggests that as much as 3-5 % of the tax burden could be shifted from shorefront owners to others in the watershed depending on the town involved. Preliminary estimates of aggregate property value loss on the 164 monitored low-color lakes which have minimum clarity below 3 meters is between 200 and 400 million dollars.

In addition to the above studies, the University of Maine and DEP are currently completing a pilot study to develop a simple method of estimating the partial value of lakes in the local economy. The study focuses on transient lake users, visitors (e.g. renters) and summer/year round residents using tailored interview survey tools. This technique may be used to evaluate the direct economic activity generated by a lake in a regional or town-wide context. Through these and future studies, Maine will be able to demonstrate direct benefits of good lake water quality, including previously unquantified values of lakes to those who do not fish them or live on them. Such information is one tool for promoting sound watershed management and participation by towns and their citizens.

Case Study: Eastern Maine Initiative to Reopen Shellfish Harvesting Areas

Contacts:
Jeff Emery, DEP, Eastern Maine Regional Office, (207) 941-4570
David Achorn, DEP, Overboard Discharge Grants, (207) 287-7766
Richard Green, DEP, Small Community Grants, (207) 287-7765
Paul Anderson, DMR, Shellfish Sanitation, (207) 633-9500

Background: The Maine Departments of Environmental Protection (DEP) and Marine Resources (DMR) launched a major initiative in 1995 to target polluted shellfish harvesting areas in Eastern Maine for cleanup. Many of these areas have been off-limits due to contamination from failing or inadequate wastewater treatment systems.

Strategy: The project is a cooperative effort involving homeowners and municipal officials as well as two State agencies. Staff from the Lamoine office of the DMR collected water quality data and conducted shoreline surveys to determine where the greatest benefit could be gained by reopening closed areas. With this information, staff from the Eastern Maine Regional office of DEP tapped two programs, the Overboard Discharge Grant Program and the Small Community Grant Program, to achieve the desired results. These programs help fund replacements for septic systems and straight pipes along the coast.

Results: By the end of 1995, 1800 acres had already been reopened for shellfish harvesting and aquaculture. DEP and DMR plan to continue targeting coastal communities in order to open more shellfish areas in Eastern Maine. As a result of this initiative, Maine people will profit both economically and environmentally.

Shellfish Harvesting
Contact: Casco Bay Estuary Project, (207) 828-1043.

Another example of direct economic benefits of water quality protection is the elimination of pollution sources from shellfishing areas. In 1993, the Casco Bay Estuary Project proposed a study of the soft-shell clam industry to determine the size and values of the clam resource in

Casco Bay, and to estimate the costs and benefits associated with pollution source control or removal. Cost/benefit analyses for pollution control measures were conducted for two sites, Buttermilk Cove in Brunswick and Town Landing Cove in Cumberland. For Buttermilk Cove, the costs and benefits were readily defineable. Using present values, the study estimated that income earned by clam diggers would be fourteen times the cost of remediation. The costs include construction and maintenance of a waste water disposal system with an assumed life span of 20 years. The net present value of the remediated resource for Buttermilk Cove was estimated at $929,901.

The existing harvestable soft-shell clam resource in Town Landing Cove was calculated as $39,600, however pollution sources could not be identified. Remediation costs were therefore impossible to estimate. The final project report is entitled "Economic Analysis of the Soft-shell Clam, Mya arenaria, Industry in Casco Bay", by Christopher S. Heinig, Peter J. Moore, Donald W. Newberg and Louisa R. Moore, February 1995 (revised September 1995).

Costs of the State Water Quality Program
Contact: Paul Dutram, DEP BLWQ, (207) 287-7696.

Despite serious understaffing due to Maine's budget problems, 85 staff within the Bureau of Land and Water Quality work directly in the evaluation, protection or regulation of water resources. These staff include administrators, environmental specialists, biologists, geologists and engineers. In 1995, the cost to administer water-related programs was approximately $4.2 million. An additional $2.1 million supported 27 positions focused primarily on land use regulation, however these staff are frequently involved with related water quality issues. Programs in the Bureau of Land and Water Quality include licensing, compliance, enforcement, technical assistance, pollution prevention, wastewater engineering, environmental assessment, lake restoration, nonpoint source control and groundwater protection. There are numerous other programs within and outside of the DEP that control impacts to water quality (i.e. the Subsurface Waste Disposal Rules, Agriculture's Pesticide Control Board and Manure Handling Compliance Program, Marine Resources shellfish program, Soil Conservation Service farming assistance). There is no comprehensive effort to catalog all water quality-related State administrative costs.

New Facility Construction
Contact: William Brown, DEP BLWQ, Division of Engineering and Technical Assistance, (207) 287-7804.

In 1994 and 1995, 27 projects were completed with assistance from the Maine Construction Grants Program (11), the State Revolving Fund(16) or a combination of Farmers Home Administration grant/loan and State grant money. These projects included new facilities, upgrades, additions, modifications and abatement of combined sewer overflows for a total cost of approximately $110,000,000 to complete. In addition to this list of complete projects, 17 projects are in progress, with an estimated total worth of $63,787,000.

Combined Sewer Overflows
Steve McLaughlin, DEP BLWQ, Division of Engineering and Technical Assistance, (207) 287-7768.)

As of January 1996, the Combined Sewer Overflow (CSO) Program has provided 25% grants totalling nurary 1$1,786,965.79 to support development of thirty three CSO Master Plans or sewer system studies. This represents a total CSO planning effort to date of approximately $7,150,000. Table 2-3.1 contains information obtained from eight Master Plans. Together, these eight master plans propose a total of approximately $160 million in projects to abate or control CSOs. It is estimated that $250-350 million will be needed over the next fifteen years to abate CSOs statewide. Contact:

Small Community Grants
Contact: Richard Green, DEP BLWC, Division of Engineering and Technical Assistance, (207) 287-7765.

The Small Community Program, since 1982, has disbursed $14,000,000 in grant funds to assist municipalities in construction of individual or cluster systems to eliminate discharges to surface waters from malfunctioning systems or straight pipes. This amount of funding has resulted in construction of new treatment facilities worth approximately $16,000,000. Since the 1994 305(b) report, $4,000,000 has been disbursed to fund approximately $4,500,000 in new small facility construction.

Table 2-3.1. CSO Volumes And Costs For Eight Communities

Community	Average Annual Overflow (gallons)	Average Days/year of overflows	Cost of Recommended Plan
Auburn	100,000,000	64	$13,000,000 to 22,000,000 depending on final recommendation
Augusta	58,000,000	40-60	$29,000,000
Bangor	635,000,000	62	$28,000,000
Bath	5,600,000	21	$3,800,000
Brewer	725,000,000	29	$7,300,000 for first phase only
Lewiston-Auburn Water Pollution Control Authority (LAWPCA)	232,000,000	77	$14,000,000 - 30,000,000 depending on final recommendation
Lewiston	208,000,000	71	$20,000,000 ?
Portland	720,000,000	44	$52,000,000
South Portland	196,000,000 gallons/year	25-37	$11,500,000
TOTAL	2,879,000,000 gallons/year		$160,000,000 +

Overboard Discharge Grants
Contact: Dave Achorn, DEP BLWC, Division of Engineering and Technical Assistance, (207) 287-7766.

The Overboard Discharge Grant Program commenced in 1990 and to date has been funded with $3.5 million in bond issue funds. Eighty-two grants totaling $2.9 million have been made to towns and individuals. The program has spent $1,040,000 while, removing 106 systems worth approximately $2,000,000. These systems are often constructed on very limited sites, which results in higher than normal costs to achieve the benefit of eliminating the wastewater discharges from commercially valuable shellfishing areas.

At present, no comprehensive data exist on the total wastewater treatment infrastructure installed by businesses and industries, or on the annual increment.

Nonpoint Source Management
Contact: Norm Marcotte, NPS Coordinator, DEP BLWQ, Division of Watershed Management, (207) 287-7727.

Table 2-3.2 summarizes costs for nonpoint source pollution management involving federal grants under Section 319 of the Clean Water Act and non-federal matching funds.

Table 2-3.2 . Summary of Section 319 Grant Totals by Grant Year.
(Source: Maine DEP grant records, January 1996)

GRANT YEAR	FEDERAL COST	NON-FEDERAL MATCH	TOTAL
1994	$732,200	$488,302	$1,220,502
1995	$1,121,000	$747,200	$1,868,200
1996 (targeted)	($1,089,200)	($726,133)	($1,815,333)

Pollution Prevention
Contact: Don Albert, DEP BLWQ, Division of Engineering and Technical Assistance, (207) 287-7767.

Any costs to implement pollution prevention programs are generally counterbalanced many times over by economic benefits alone, and produce significant environmental benefits as well. By reducing or eliminating the use of toxic chemicals, the environment suffers less contamination, human health is affected less by environmental contamination, businesses reduce their regulatory costs, treatment costs often decline and many industries have actually reduced their production costs as a result of re-evaluating their processes during pollution prevention programs.

Chapter 4: Special State Concerns And Recommendations

Priorities for Environmental Protection

The Maine Environmental Priorities Project (MEPP) was initiated in 1993. It represents a collaborative effort among State government officials, environmental organizations, businesses, academic institutions, and the general public to set priorities for environmental protection. The MEPP process is designed to identify, compare and rank environmental problems. As a result of this process, a number of issues were identified as "high risk" with respect to ecological, public health and/or quality of life concerns. The high risk issues related to water quality are summarized below. Source: "Maine Environmental Priorities Project, Report from the Steering Committee, Consensus Ranking of Environmental Risks Facing Maine", January, 1996.

1. Drinking Water and Domestic Use Water

Private Water Supplies: Approximately 78% of people in Maine obtain their drinking water from private supplies, most of which are individual ground water wells. Nitrates and nitrites from septic systems and agricultural activities are common sources of groundwater contamination in Maine. Other significant causes of contamination include oil and gasoline spills, leaking petroleum storage tanks, arsenic, agricultural pesticides, and improper handling, storage or disposal of industrial chemicals.

Public Water Supplies: Of the Maine residents served by public water supplies, approximately 20-25% receive water from ground water sources, and are therefore exposed to the risks associated with private supplies. Most public supplies come from surface waters, however. These sources have a higher incidence of contamination by bacteria and parasites such as giardia and cryptosporidium. Although all public drinking water is chlorinated and most is filtered, the Maine Department of Human Services noted an increase in microbial contamination between 1994 and 1995. Other health concerns include trihalomethanes, which are chemical by-products of the chlorination process, and the presence of lead from plumbing fixtures or lead soldered pipe.

2. Freshwater and Marine Ecosystems

Land Use: Increased residential development pressure has become a major threat to Maine waters, especially in southern, central and coastal areas. While agriculture and forestry techniques have improved with the use of Best Management Practices, these activities also continue to impact water quality. A direct effect of poor land use practices is the loss of wetlands which provide critical wildlife habitat, flood protection, ground water recharge and shoreline erosion control. Wetlands also trap sediment, nutrients and contaminants which can damage aquatic ecosystems. Increased nutrient and sediment loading to lakes, rivers and coastal waters accelerates eutrophication and destroys aquatic habitat.

Non-Native Species: Accidental or illegal introductions of non-native species pose a risk to existing aquatic communities. Fisheries in some Maine lakes have been altered by species including northern pike, muskelunge, black crappie and several minnows. Exotic plants such as Eurasian milfoil often spread rapidly once introduced.

Dams and Hydrologic Manipulation: Dam construction and flow alteration may adversely affect aquatic systems in a number of ways. Potential impacts include loss of wetlands and aquatic/riparian habitat, fluctuating water levels and reduced fish passage. In Maine, such changes have reduced or eliminated some historic anadromous fish runs, including those of Atlantic salmon, sturgeon, alewives and smelt.

Harvesting in Estuaries and Marine Waters: Recent dramatic declines in commercial fisheries in the Gulf of Maine have lead to concern about harvesting practices and over-fishing. The potential impact of coastal pollution is largely unknown. Since the early 1980's, groundfish landings have declined by approximately 40%, and clam stocks by roughly 67%. There is also concern over current harvesting rates for lobsters and sea urchins. Outbreaks of "red tide" caused by a tiny marine dinoflagellate are common in the Gulf of Maine. These organisms accumulate in shellfish, and produce a toxin which may cause paralytic shellfish poisoning in humans. The Department of Marine Resources conducts regular monitoring, and closes affected areas to harvesting.

3. Surface Water and Sediments

Lakes: Non-point source pollution is the primary threat to Maine lakes. Sources include commercial and residential development, agriculture, and atmospheric deposition. Runoff rich in nutrients may result in algal blooms, dissolved oxygen depletion, fish kills and other changes in aquatic communities. Since May 1994, a consumption advisory has been in place for all Maine lakes due to high levels of mercury detected in fish. Elevated levels of mercury and associated reproductive and health problems have also been detected in loons and eagles which consume fish from Maine lakes.

Rivers and Streams: In addition to non-point sources of pollution, many rivers in Maine are adversely impacted by industrial point sources, domestic wastewater treatment plants and combined sewer overflows which contribute nutrients, heavy metals, and organic compounds. Fish consumption advisories have been issued for 236 river miles due to dioxin contamination.

Estuarine and Marine Waters: Maine coastal waters are also vulnerable to nutrient enrichment and eutrophication. The presence of metals and other toxic compounds in marine organisms and sediments is a concern. Significant sources of marine pollution include municipal discharges, combined sewer overflows and overboard discharges. The Department of Human Services has issued a consumption advisory for lobster tomalley because of high dioxin levels. Many shellfish harvesting areas in Maine are closed either seasonally or year round due to bacterial contamination. In the fall of 1996, a major oil spill in Portland Harbor resulted in additional widespread closures of shellfish harvesting areas along the southern Maine coast.

Strategies and Recommendations

Although we have achieved much success in reducing water quality impairment from large single sources, the types of problems facing our water resources today demand new and innovative approaches. As this report illuminates, the most prevalent unaddressed threats to our surface waters are from the cumulative impacts of smaller more diffuse sources. The Department is pursuing a number of strategies to improve our ability to address these problems.

Pollution Prevention

Contact: Ronald Dyer, Office of Innovation and Assistance, DEP Office of the Commissioner, (207) 287-2812.

The DEP has made a substantial commitment to pollution prevention (P2), which is critical for the future of environmental protection. Regulation based upon waste treatment and end-of-pipe controls has allowed tremendous strides in environmental improvement, and regulatory efforts must not be abandoned. To achieve the next level of environmental improvement, however, we must now invest in preventive measures and implement processes that generate less pollution. P2 offers a non-regulatory approach to environmental protection by focusing on removal of pollution and elimination of toxics from processes. Pollution prevention provides businesses the opportunity to reduce operating costs, reduce future environmental liability and create green marketing strategies. P2 is a cost-effective approach that produces tremendous environmental benefit. Pollution prevention makes good business and environmental sense for Maine.

In its 1994 Agenda For Action, the Department includes pollution prevention as one of five priorities. That documents calls for a pollution prevention program that: encourages the use of nonpolluting technologies and waste minimization; promotes the sustainable use of natural resources and protection of the environment through conservation, recycling and material reuse; and includes environmental considerations when evaluating products and processes.

Toward that end, DEP conducts training workshops for industry, and serves as a statewide clearinghouse for pollution prevention technology and idea transfer. DEP also administers the Small Business Technical Assistance and Maine Environmental Partnership Programs, and publishes a quarterly newsletter and other materials. Pollution Prevention teams consisting of staff from DEP and industrial facilities work together intensively to evaluate and improve all areas of the operation from production through waste treatment.

Toxics Monitoring of Surface Waters

Contact: Barry Mower, DEP BLWQ, Division of Environmental Assessment, (207) 287-7777.

Good data is essential for detecting water quality problems, describing the status and trends of our waters, effectively designing programs to protect water quality, and measuring environmental results. In 1993, EPA funded a study of fish tissue contamination in Maine lakes. Through the Regional Environmental Monitoring and Assessment Program (REMAP), DEP obtained fish tissue, water quality and sediment baseline data for 125 lakes statewide.

The Surface Water Ambient Toxics Monitoring Program (SWAT) was established in 1994 to provide comprehensive long-term monitoring of toxic pollutants in rivers and coastal waters. If fully funded by the Maine Legislature in 1996, the SWAT program will include an additional lakes component. Together with other toxic monitoring initiatives such as the Dioxin Monitoring Program, which focuses on contamination below major known sources, the SWAT program will, over time, present a clearer appraisal of the nature, extent and fate of toxins in Maine's surface waters. It will also provide a basis to evaluate the risks that toxic substances present to humans and the environment.

Whole Effluent Toxicity Testing
Contact: Dennis Merrill, DEP BLWQ, Division of Water Resource Regulation, (207) 287-7788.

Maine's program to evaluate the discharge of toxic pollutants, Chapter 530.5 of DEP rules, has been in place for nearly a year. Many wastewater treatment facilities have begun testing their effluent as required by the rule, and those results are being submitted to DEP. In addition, considerable effluent toxicity data collected to meet EPA permit requirements or for other reasons are also kept on file.

Whole Effluent Toxicity testing has identified a significant number of municipal treatment facilities which have demonstrated either reasonable potential for effluent toxicity or actual water quality exceedences. Of the 67 facilities which have done "No Observable Effect Level" (NOEL) testing, 33 (49%) were found to have reasonable potential for water quality impacts using EPA's method to calculate reasonable potential. Eighteen facilities (27%) demonstrated effluent toxicity sufficient to exceed water quality criteria at low flow conditions.

As initially constructed, the toxics rule places its primary emphasis on the toxic characteristics of individual discharges, and individual toxicity problems must be identified and addressed on a facility-by-facility basis. It is equally important, however, that test results be reviewed on a more global basis to see if trends or common problems can be identified. Toward this end, the data management systems used to store and evaluate toxicity test results need to be refined to make them as useful and responsive as possible.

While not specifically addressed in the toxics rule, some attention should be given to the "absolute" toxicity of effluents. Absolute toxicity could be thought of as "pounds" toxicity and includes consideration of both test values and discharge quantities. As written, the rule relies largely on dilution factors and fails to address the actual amount or degree of effluent toxicity in any other sense. By looking at absolute toxicity coupled with knowledge of demographic and physical attributes of each treatment system, it may be possible to compare facilities on a uniform basis to determine the most significant loading or relatively more toxic characteristics. This sort of information and perspective would help to support pollution prevention efforts.

Watershed Management
Contact: Don Witherill, DEP BLWQ, Division of Watershed Management, (207) 287-7725.

The Department supports the watershed approach as a means to comprehensively assess resources, identify threats, and produce solutions that are tailored to the problems. Setting priorities based on impacts to the resource can help target available funds where they are most needed. A common feature of a watershed approach is regulatory flexibility; regulatory controls are combined with other approaches to produce the best environmental results at the lowest cost. Further, watershed management typically involves all levels of government as well as the private sector.

Land Use and Growth Management
Contact: Jeff Madore, DEP BLWQ, Division of Land Resource Regulation, (207) 287-7848.

It has long been recognized that land use practices have direct impacts on water quality. The State of Maine has several programs in place to regulate land use activities with potential adverse environmental effects. The Site Location of Development Law (Site Law) requires developers of large projects to obtain permits from the Department before beginning construction. Under the Natural Resources Protection Act (NRPA), a permit from the Department is required for any activity in, on or adjacent to a protected natural resource, including rivers, streams, brooks, great ponds, coastal wetlands, freshwater wetlands, sand dunes and fragile mountain areas. The Mandatory Shoreland Zoning Act requires towns to control building sites, land uses, and placement of structures within the shoreland area in order to protect water quality, habitat and fishing industries, and to conserve shore cover, public access, natural beauty and open space. Also important to environmental protection is the Growth Management Act, enacted in 1988. This program is based on comprehensive planning and stronger state and local cooperation.

Changes to the NRPA in 1995 made it more consistent with the Federal wetlands regulatory program, and allowed State review of projects in smaller wetlands. Significant revisions to the Site Law, including new stormwater management and erosion control laws, were also passed in 1996. These changes will become effective on July 1, 1997.

Education and Outreach
Contact: Barbara Welch, DEP BLWC, (207) 287-7682.

Since many of the impacts to the environment come from individual actions, public education is vital. The Department has a responsibility to help each citizen to better understand the environment; the consequences of his or her actions upon it and what can be done to avoid them, and the requirements of environmental laws. Voluntary compliance is the primary means of environmental protection.

Each year the DEP performs many outreach tasks with the intention of informing, educating, and involving Maine citizens interested in water quality-related issues. Five central issues for managing Maine water resources have persisted from previous years. The central issues include 1) improving the coordination and cooperation of federal, state, regional and local governments,

2) educating and involving the people of Maine in the process of managing their environmental resources, 3) increasing the enforcement of environmental laws, 4) providing technical assistance to municipalities, 5) increasing the monitoring of water quality, and 6) promoting the incorporation of environmental education into the curiculum of Maine schools in order to educate tomorrow's decision-makers.

Volunteer Monitoring

Contacts: Web Pearsall, DEP BLWC, (207) 287-7649, Scott Williams, Maine Volunteer Lakes Monitoring Program, (207) 225-2070, and Kathleen Leyden (coastal monitoring), State Planning Office, (207) 287-3261.

A corollary of the education/outreach program is the support of volunteer monitoring. Maine citizens in many areas of the State, including lake watersheds, rivers and coastal areas are increasingly interested and concerned about the quality of their waters. Many of these people are willing to devote time and effort to monitor the quality of their waters in order to help protect and improve those waters. The Department has helped organize and present the annual Water Quality Monitoring Fair, which provides workshops and seminars on many facets of establishing and running volunteer monitoring programs. Additionally, this fair is an event at which volunteers can share their experiences with other volunteers and establish better lines of communication with the staff of DEP and other state agencies with expertise or responsibilties in the habitats of interest to the volunteers. The State will be well-served to continue support of this program and expand its assistance to volunteer monitors in other ways, such as establishing a statewide database management system for coastal volunteer monitoring data.

Geographic Information System (GIS)

Contact: Maine Office of Geographic Informations Systems, (207) 287-3897.

The Maine Geographic Information System will serve as the foundation for a system of well-coordinated and accurate natural resource management information. The spatial format of GIS greatly enhances the analysis of technical information, leading to better informed planning and regulatory decisions, which also provides greater predictability for the regulated community. The Department has recently established a study group to evaluate how the DEP can make the best and most effective use of GIS in its programs. In addition, the Division of Environmental Assessment contains a newly created Environmental Indicators Unit, which will be able to provide services and support to enhance our ability to use all of our water quality and water impact databases, as well as GIS.

Environmental Indicators

Contact: Leon Tsomides, DEP BLWQ, Division of Environmental Assessment, (207) 287-7844.

The State of Maine, as well as the rest of the nation, have used a performance-based regulatory approach since the passage of the Clean Water Act. This approach was appropriate and achieved tremendous strides toward reducing discharges of pollutants to the environment, with corresponding dramatic improvement in the quality of our waters. This approach should be maintained in place, but now needs to be augmented by other approaches. One of these is the use of impact standards that measure actual biological response. Maine's environmental law incorporates biological community integrity standards, and rules establishing the numerical criteria to determine whether those standards are met have been developed for rivers and streams. The State needs to continue its progress in this area and expand the use of biological community integrity measures to all types of State waters.

PART III

SURFACE WATER ASSESSMENT

Chapter 1 - Surface Water Monitoring Program

Background

The water sampling programs of the DEP Bureau of Land and Water Quality are conducted to administer two portions of environmental law: the Water Classification Program (38 MRSA, Article 4-A); and Protection and Improvement of Waters (38 MRSA, Chapter 3). Although the Bureau of Land and Water Quality works under the authority of numerous other statutes and regulations, for the water resources and water quality programs, they can be considered as secondary and supportive of the Water Classification Program and Protection and Improvement of Waters statutes.

The following is a description of the water sampling program of the Bureau of Land and Water Quality:

I. **Ambient Water Quality Monitoring**

A. **Attainment of Classification**. Assess attainment of present and proposed standards for the classification of surface waters.

1. Bacteria
2. Dissolved oxygen
3. Aquatic/marine life (ambient biomonitoring)
4. Trophic state (for lakes)
5. Other parameters (e.g. priority pollutants at selected sites)

B. **Assimilative Capacity and Wasteload Allocation Studies**. Assess whether present and proposed discharges and/or impoundments would violate the classification standards for dissolved oxygen, temperature, toxics, etc. during 7Q10 (the minimum seven day low flow which occurs once in ten years) or other critical flow conditions.

1. Ambient monitoring
    a. Flow gauging
    b. Time-of-travel studies
    c. Intensive sampling of discharges and ambient waters for preselected conditions.
2. Modeling to predict assimilative capacity of waterbodies at critical flows.

C. **Combined Sewer Overflow Master Plans.**

1. Ambient monitoring
    a. water quantity/event frequency
    b. water quality
2. Sewage system modeling

D. **Hydropower Licensing/Relicensing.** Ambient monitoring is required as a condition of licensing. Habitat assessment required to determine allowable drawdown and downstream flow alteration.

E. **Lake Diagnostic Studies**. Assess lake problems through analysis of in-lake and lake watershed parameters.

F. **Tissue Monitoring**. Assessment of contamination levels of metals and organics in fish and shellfish tissues through Maine's Surface Waters Ambient Toxics (SWAT) Monitoring Program and Dioxin Monitoring Program and the Regional Environmental Monitoring and Assessment Program (REMAP).

G. **Sediment Monitoring**. Assessment of contamination levels in sediments for metals and organics (SWAT, REMAP and Casco Bay Estuary Project).

H. **Special Studies**. Sampling programs supportive of scientific research necessary for the resolution of difficult, hypothetical and/or unusual water quality problems.

II. **Treatment Plant Compliance Monitoring**

A. **Compliance Sampling**. Assess compliance with wastewater discharge licenses by sampling effluents.

B. **Bioassay Monitoring.** Assess toxic effects of whole or mixed effluents using standardized laboratory bioassays.

C. **Diagnostic Evaluations**. Aid municipal treatment plant compliance through intensive diagnostic evaluations.

III. **Investigations**

A. **Complaint Investigations**. Respond to allegations of unlicensed discharges by sampling suspected discharges and ambient water quality above and below suspected discharges.

B. **Sanitary Surveys**.

The ambient water quality monitoring program results in the following products:

1. A biennial report to Congress (Section 305b) and the Maine Legislature which describes the attainment status of all State waters;

2. Recommendations on license conditions for wastewater discharges;

3. Reports evaluating the attainment impacts that would result from proposed changes in classification standards and/or assignments of classification;

4. Reports addressing specific environmental problems (e.g. establishing or rescinding advisories); and,

5. Reports, articles and news releases for local officials and the general public describing the suitability of various State waters for swimming and fishing.

Table 3-1.1. Priorities for Water Quality Sampling.

HIGH PRIORITY

Fresh	Marine
1. Lakes with extremely vulnerable or highly vulnerable characteristics.	1. Commercially harvested shellfish areas.
2. River mainstems which receive multiple major discharges.	2. Swimming areas.
3. Streams and brooks which drain populated or agricultural areas.	3. Harbors and other confined waters adjacent to population centers.
4. Select pristine waters representativeof similarly situated waters.	4. Select pristine waters which are considered to be representative of similarly situated waters.

MEDIUM PRIORITY

Fresh	Marine
1. Waters (other than lakes) impacted by nonpoint source pollution.	1. Shellfish areas which are occasionally harvested.
2. Waters with threatened quality due to proposed discharges and/or activities.	2. Waters with threatened quality due to proposed discharges and/or activities
3. Lakes with moderately vulnerable characteristics.	

LOW PRIORITY

Fresh	Marine
1. Most pristine/unthreatened waters.	1. Most pristine/unthreatened waters.

DEP FIVE YEAR MONITORING ROTATION

St. John, Presumpscot watersheds	1994
Saco, Southern coastal watersheds	1995
Penobscot, downeast watersheds	1996
Kennebec, mid coast watersheds	1997
Androscoggin watershed	1998

Selection of Waterbodies To Be Sampled

The steps necessary for generation of the products described above include: selection of waterbodies to be sampled, selection of appropriate sampling locations on those water bodies, establishing sampling stations, scheduling of sampling at these stations, sampling by qualified personnel, data entry, processing and analysis.

Water quality is the cumulative result of multiple factors. The Maine ambient water quality monitoring program is biased toward waters in the more populated areas of the State and specifically toward those waters impacted by people. Table 3-1.1 serves as a general guide for selection of waters to be sampled (high priority). This guide is not restrictive. The state is currently monitoring on a five year rotation of watersheds one year in advance of licensing activities for each watershed. In addition to those waters selected by the Maine DEP for monitoring, additional waters are monitored by groups such as the US Geological Survey, Penobscot Indian Nation and a number of volunteer monitoring groups, each of which have their own purposes forselecting a water and the parameters to be monitored. As practical, the Maine DEP coordinates monitoring with these groups.

I. **River and stream assessment of attainment.**

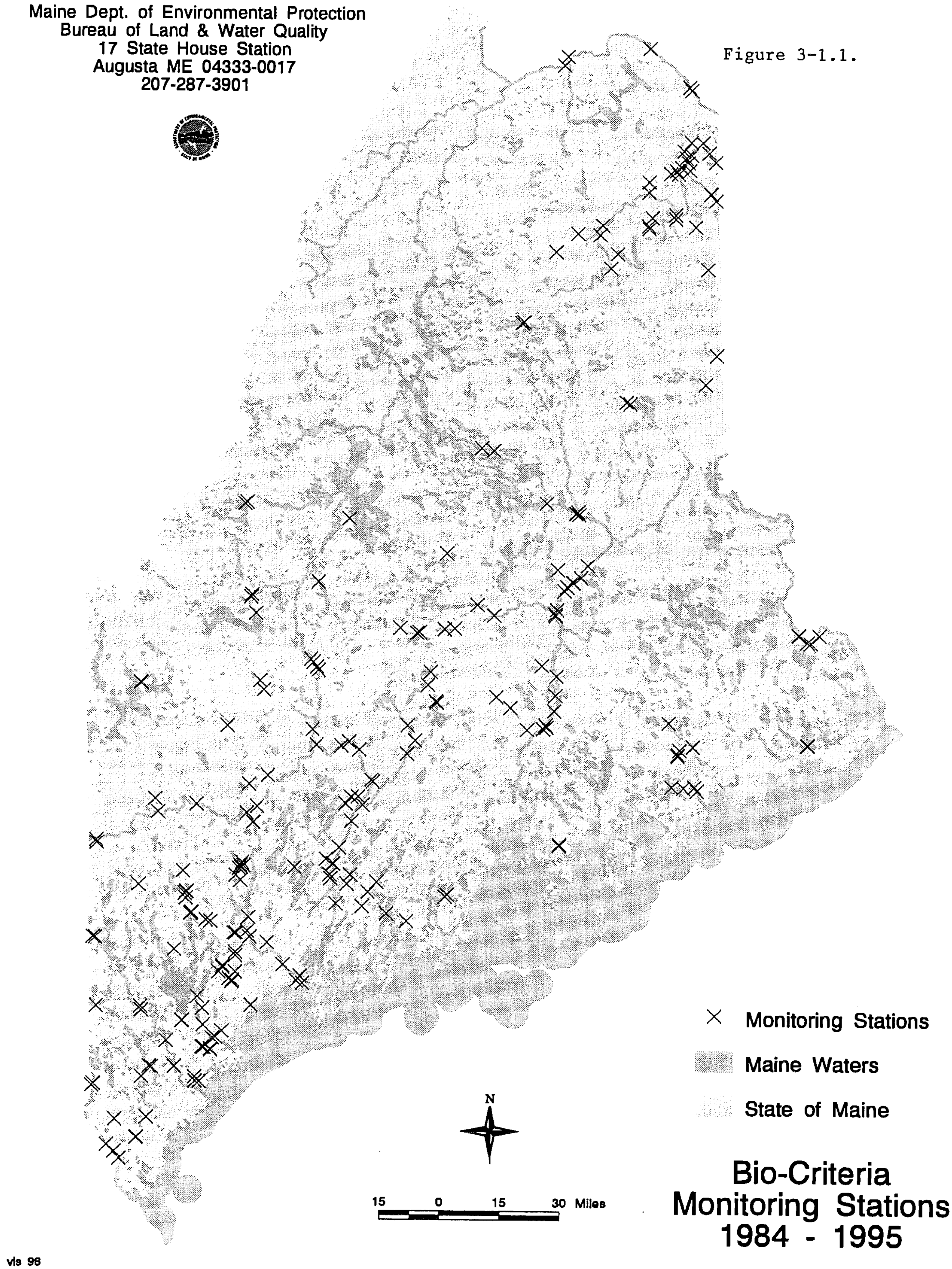
A. **Assessment of Bacteria Standards.** To produce an assessment of attainment for human contact water quality criteria, a minimum of 12 samples should be collected between May 15 and September 30 at regular intervals (usually weekly). The samples are then analyzed for the most probable number of *Escherichia coli* bacteria.

B. **Assessment of Dissolved Oxygen Standards.** Dissolved oxygen sampling is scheduled for "worst case" conditions of low flow and high temperature. Sampling is focused on flows which approximate 7Q10 when available. Additionally, the DEP and USGS cooperatively maintain a number of full time monitors on the major rivers below important dischargers.

C. **Biological Monitoring of Rivers, Streams and Brooks.** Contact: Susan Davies, DEP BLWQ, Division of Environmental Assessment, (207) 287-7778.

The State of Maine water quality classification law includes explicit language pertaining to the condition of aquatic life. These aquatic life standards establish, in narrative form, the characteristics of the aquatic community that are required to exist in order for a waterbody to attain a given classification, and these characteristics are specific and different for each water quality classification. The standards are further refined, in the statute by defining many technical and specific use terms, allowing a clear conceptualization of the general differences in aquatic life between classes. The narrative standards allow the State to discriminate between three water quality classes, in terms of the aquatic biota they are capable of supporting. The specific language in the standards is drafted in such a way as

Figure 3-1.1.



Maine Dept. of Environmental Protection
Bureau of Land & Water Quality
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Augusta ME 04333-0017
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Monitoring Stations
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to provide for the use of available benthic macroinvertebrate community assessment approaches, to determine attainment of classification.

Approximately 260 stations on 84 different rivers and streams have been monitored to assess the condition of the benthic macroinvertebrate community since the program was started in 1983 (Figure 3-1.1). Sample collection and analytical methods are described in Chapter 2 of this section. The program currently is able to sample about 35 sites per year. The electronic database contains raw data and computed analyses for 430 sampling events.

The State of Maine uses the results generated through this protocol in water quality management, reporting, planning, permitting, and enforcement and has found it to yield valuable information not provided by the traditional tests of water quality such as chemistry, dissolved oxygen and effluent toxicity testing.

D. **Assimilative Capacity Studies.** The DEP conducts assimilative capacity studies for toxic compounds and for oxygen-demanding substances. The results of these studies are used to establish license conditions for point source dischargers to these waters.

1. **Assimilative Capacity for Toxics**. Maine has adopted EPA's Ambient Water Quality Criteria (AWQC) to prevent "toxic pollutants in toxic amounts" in State waters. Maine's Toxic Pollution Control Program, Chapter 530.5, describes integration of the AWQC with licensing procedures. Initially, the AWQC are used to calculate effluent limitations. These are compared to Best Practical Technology (BPT) based effluent limits and the more stringent of the two limits is proposed in the draft wastewater discharge license. There is also a provision for site-specific criteria in the rule.

Site-specific methods generally follow EPA's Water Effects Ratio guidance with additional requirements specific to Maine. The major deviation from EPA testing protocol is the DEP requirement that a salmonid be used for testing toxicity to fish. This is required because Maine's Water Quality Standards require that all fresh surface waters be suitable to support all species of fish indigenous to the receiving waters. Salmonids are indigenous to almost all Maine waters. Other differences include a greater number of tests than is required by EPA.

2. **Assimilative capacity for oxygen-demanding substances**. The following situations precipitate studies of assimilative capacity:

a. For rivers where D.O. has been found to be lower than the requirements of classification, a study is conducted to determine how much reduction in pollutant loading is required to attain classification standards for D.O.

b. For rivers where a new BOD discharge is proposed, the river is modeled to ensure that the new discharge will not violate the D.O. requirements of classification.

c. For rivers where construction of a new dam is proposed, Section 401 of the Clean Water Act prohibits federal licensing of any dam which would violate the standards of State water quality classification. Assimilative capacity analysis ensures that the decreased aeration and increased time-of-travel caused by the dam will not violate the D.O. requirements of classification.

An assimilative capacity study for D.O. begins with field surveys designed for the calibration and verification of a water quality model. At least two data sets are collected during river conditions of low flow and high temperature. These conditions, because of the low D.O. levels which occur then, are considered to be the most critical for river habitats. The field surveys include hydraulic, physical and chemical analysis of the river including time-of-travel as determined by dye injection, measurement of cross sectional area, dissolved oxygen, temperature, salinity, sediment oxygen demand, chlorophyll a, nitrogen series, phosphorus series, BOD_5 and ultimate BOD. Extensive analysis of effluents entering the river is also done during field surveys. Nonpoint sources of water pollution are also estimated if they are thought to be significantly affecting the river's water quality.

The next step involves utilizing the data sets to calibrate and verify a computerized water quality model. Model calibration is accomplished by varying parameter factors until the model output matches the field survey results for BOD, temperature, D.O. and other parameters. The computerized river model is considered verified when the model which was calibrated by use of the first data set is run under the flow and temperature conditions of the second data set and the model output matches the BOD and D.O. data collected during the second field survey. The models most often used are QUAL-2E and WASP4. The modeling sometimes shows a need for additional data. This results in a third and, occasionally, a fourth field survey to collect the necessary data.

II. **Lake Monitoring.** The Water Resource Survey Section of the DEP Division of Environmental Assessment coordinates the lake monitoring program. Data is stored in Foxpro databases and is available to staff on the departmental computer network in read-only format.

The Maine lake monitoring program includes the following components:

A. Volunteer Monitoring Program (VMP)

Contacts: Web Pearsall, DEP BLWQ, Division of Environmental Assessment, (207) 287-7649 and Scott Williams, VMP, (207) 225-2070.

The purpose of the Voluntary Monitoring Program is two-fold. It provides transparency data on a large number of lakes (Figure 3-1.2), which are used to identify water quality trends. At least 40 additional lakes are currently being sampled for dissolved oxygen and other parameters. The VMP provides the largest core of data for lake assessment. Lake ecology and watershed education is the second goal of the program.

The VMP has been incorporated as a private organization. The DEP maintains control of data management and provide technical assistance to the program. The VMP provides data on water clarity (Secchi disk) measured at least twice per month for 5 months of the year. Additionally, dissolved oxygen profiles (1 meter) are measured on some lakes. The DEP has published a manual entitled "Standard Field Methods for Lake Water Quality Monitoring" to assist groups wanting to perform additional testing.

B. Diagnostic Study Lakes

Contact: Roy Bouchard, DEP BLWQ, Division of Environmental Assessment, (207) 287-7798.

The vulnerability index, in combination with the volunteer monitoring program, has identified lakes with potential need of diagnostic analysis. The State has not undertaken any new diagnostic studies. Some limited, privately-funded diagnoses have been performed on such lakes as Pattee and East Ponds. Trends of declining water quality have been evident on several lakes in Maine, such as Mousam Lake. Diagnostic studies would allow determination of the nature of problems, external sources of phosphorus loading, the extent of internal loading and the feasibility of potential solutions.

C. Special Study Lakes

Contacts: Roy Bouchard, Division of Environmental Assessment, (207) 287-7798, and Barry Mower (Lake George Study), DEP BLWQ, Division of Environmental Assessment, (207) 287-7777,

The DEP monitors a number of lakes to provide answers to specific questions. For example, the Division of Environmental Assessment has monitored zooplankton and phytoplankton populations at Lake George in Canaan since 1987. The Department of Marine Resources has a program to re-establish sea-run alewives, and plans to stock alewives in several productive lakes in Central Maine. The Lake George study was undertaken to determine if stocking of this efficient planktivore will encourage undesireable blue-green algal blooms by depleting the zooplankton community. A reduction in the number of Cladocera was noted after alewives were stocked, however there were no apparent changes in algae as measured by Secchi disk transparency, total phosphorus and chlorophyll a. Sampling was completed in 1995.

A study on the efficiency of wetland-wet pond systems in the removal of phosphorus from agricultural runoff has been completed in Aroostook County. Long and Cross Lakes have historically received large amounts of high phosphorus runoff from agricultural lands. The study entailed monitoring runoff entering and exiting the wet ponds and determining efficiencies of phosphorus, organic matter, and suspended solids removal. The wet ponds proved to be both highly effective in solids and phosphorus removal, and cost effective when combined with agricultural BMPs for water quality protection.

D. Environmental Monitoring and Assessment Program (EMAP) and Regional Monitoring and Assessment Program (REMAP)
Contact: Barry Mower, DEP BLWQ, Division of Environmental Assessment, (207) 287-7777.

Maine is part of EPA's EMAP, with 64 lakes included in the sampling effort. The samples have been analyzed, but the interpretation of the data is not included in this assessment. Maine also received a special grant (REMAP) to study toxic contamination in 125 randomly selected lakes (Figure 3-1.3). High levels of mercury were found in fish collected from the majority of lakes sampled. As a result of the REMAP study, a fish consumption advisory was issued jointly by DEP and the Maine Department of Human Services in May 1994. In September, 1995, DEP published the results of the study in a data report entitled "Fish Tissue Contamination in Maine Lakes". The data report is available on diskette from the Division of Environmental Assessment.

E. Lakes Bioassessment
Contact: Linda Bacon, DEP BLWQ, Division of Environmental Assessment, (207) 287-7749.

In 1995, Maine cooperated in a 104(b)(3) sponsored trial of the draft Lake Biocriteria-Bioassessment Protocol. The resultant analysis, along with those performed by Vermont and Wisconsin, should allow EPA to refine the suggested metrics in light of their trial use on currently available data sets with all their shortcomings. It also allows some estimation of the density of data necesssary to use these metrics. Our analysis indicates that basic lake categories can be established on a bio-regional level on the basis of morphometry and related chemical characteristics. We have also demonstrated that these lake categories are distinctly different with respect to basic trophic metrics. This suggests that there are potentially several basic lake types in Maine with different expectations for trophic status based on regional and physical diferences. This in turn will allow us to better evaluate our expectations for lakes and their reponses to watershed differences.

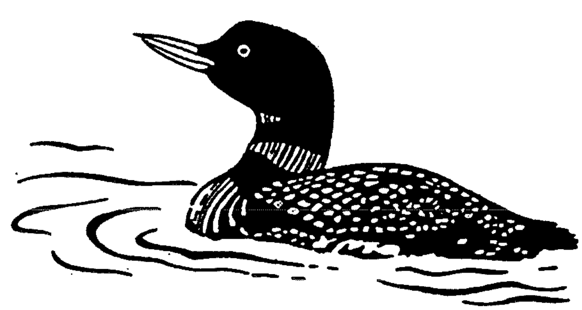
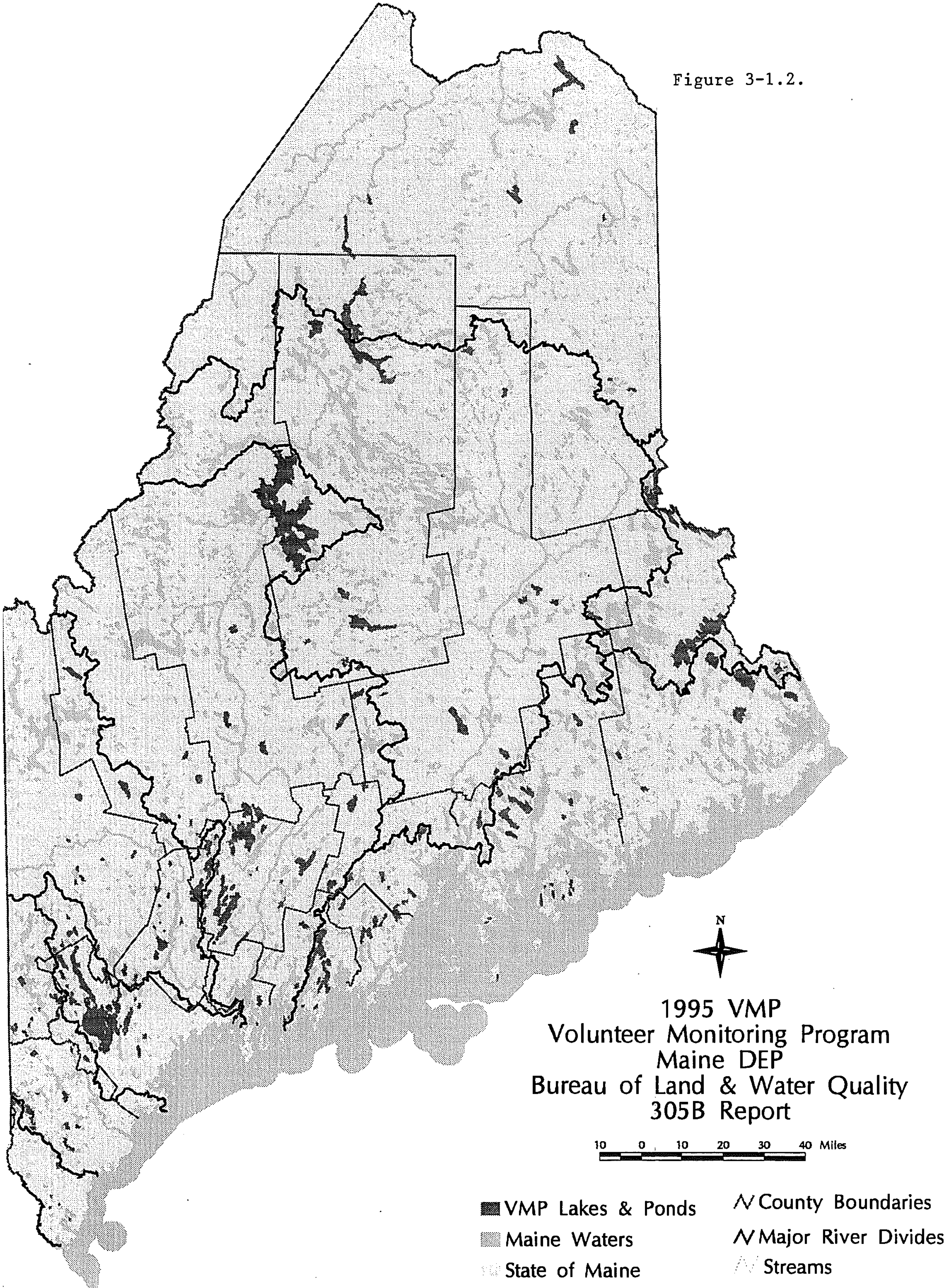


Figure 3-1.2.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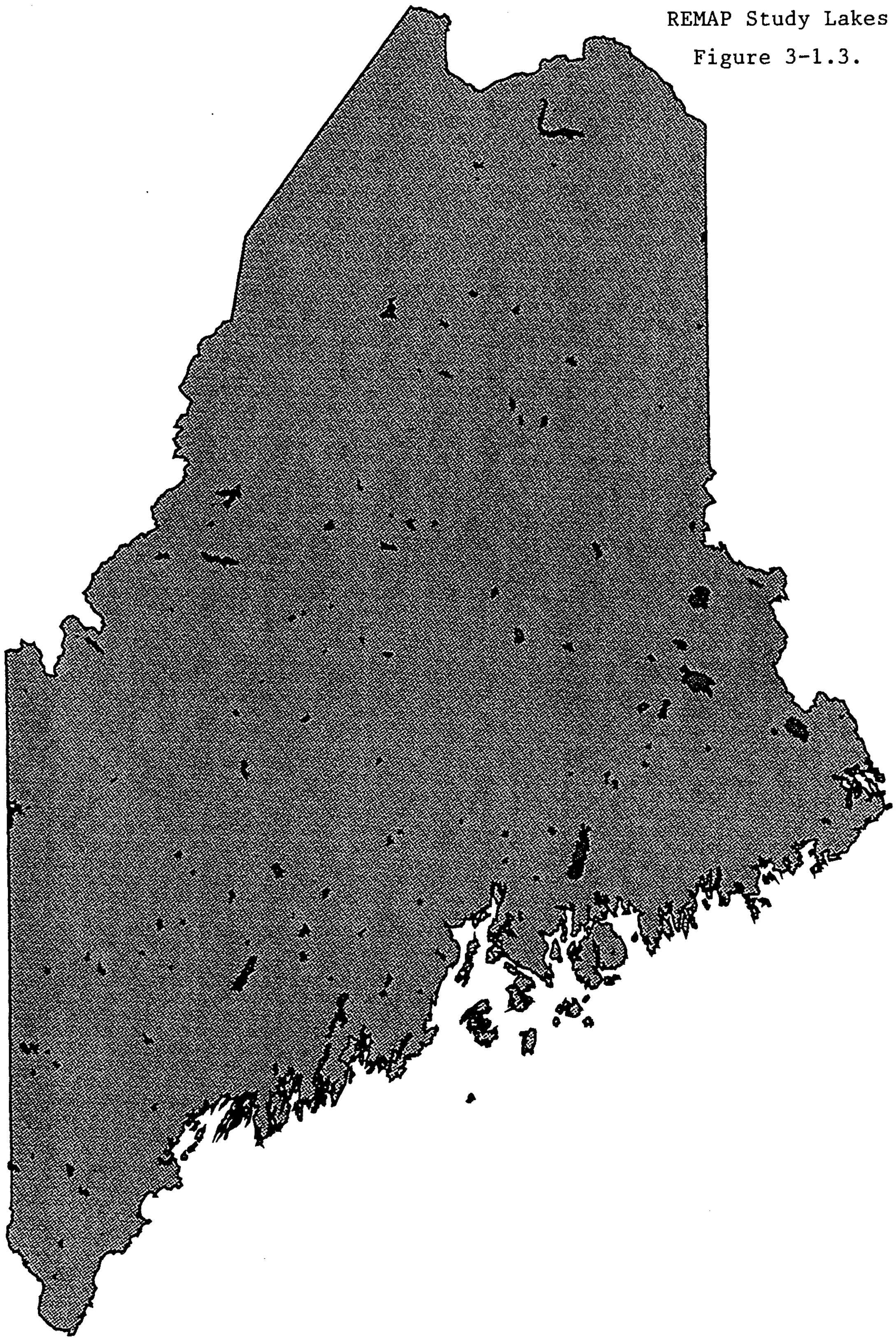
Maine Waters
State of Maine
County Boundaries
Major River Divides
Streams

REMAP Study Lakes

Figure 3-1.3.



REMAP 1994
State of Maine

Maine Department of
Environmental Protection
Land & Water Bureau
vls '94

III. Estuarine/Marine Monitoring

Contact: John Sowles, DEP BLWQ, Division of Environmental Assessment, (207) 287-6110.

The largest monitoring program on the Maine coast is that conducted by the Department of Marine Resources, which is concerned with bacteria levels in shellfish propagation areas and with marine biotoxins. Marine bacteriology is conducted in accordance with the protocols of the National Shellfish Sanitation Program to protect public health. Although most of the bacteria monitoring is to verify acceptable conditions within shellfish areas, some monitoring is in conjuction with pollution abatement projects.

Monitoring of dissolved oxygen, temperature, salinity and nutrients is being conducted in Maine's coastal waters to further describe the oxygen content of those waters and the effects of discharges and eutrophication. D.O. depressions have been documented in harbors with restricted water circulation. The DEP continues monitoring toxic contamination along Maine's coast, focusing on tissue contamination in blue mussels and lobsters, and contaminant accumulation in sediments. Much of this work presently focuses on establishing background levels of contaminants. This work is done through the Surface Water Ambient Toxics Program and Gulfwatch Project.

Coastal Volunteer Monitoring

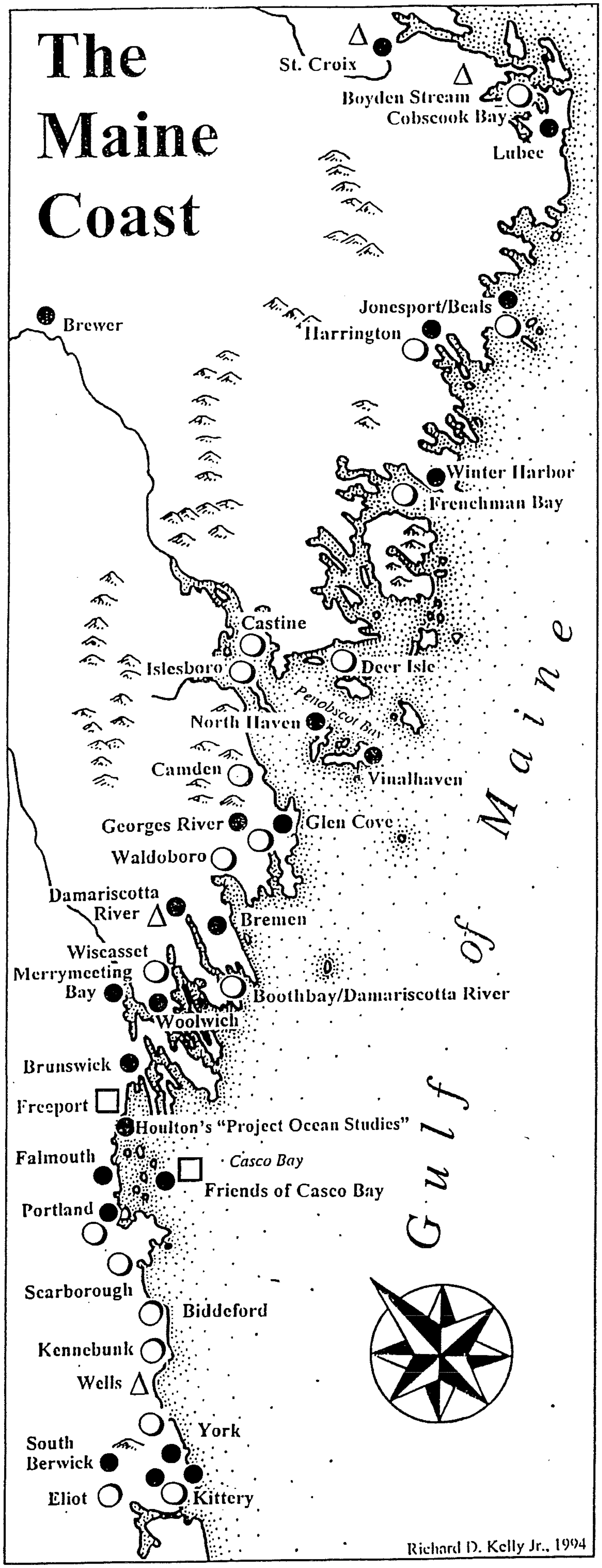
Contacts: Kathleen Leyden, Maine State Planning Office, (207) 287-3144, or Esperanza Stancioff, University of Maine Cooperative Extension at (207) 594-2104.

About 1,000 volunteers in 25 groups are monitoring marine and estuarine waters and freshwater feeder streams in Maine (Figure 3-1.4). Most of these groups receive financial support, training and ongoing technical assistance from the Maine State Planning Office/Maine Coastal Program and the University of Maine Cooperative Extension. While the primary objective for most of these groups is to restore closed shellfish growing areas, others are collecting baseline data, monitoring swimming beaches and helping local officials to identify pollution sources. Volunteers also perform watershed pollution source surveys. The majority of the groups have active student participation in their monitoring program. Nineteen Clean Water/Partners in Monitoring groups have established labs at high schools and share sampling and laboratory tasks between students and adult volunteers.

The standard sampling regime for most of these groups includes temperature, salinity, dissolved oxygen, fecal coliform, and in some areas, turbidity and pH. DO profiles and storm event monitoring have also been undertaken by volunteers in some areas. The sampling season is random with respect to tidal stage and meteorological condition and conducted bi-weekly from April through October/November (weather permitting.) Standard methods are used by all groups and field and lab procedures are documented in "Clean Water: A Guide to Water Quality Monitoring". Groups write individual quality assurance/quality control plans and qa/qc checks are conducted throughout the monitoring season. Approximately 300 estuarine/marine stations and 200 river/stream stations are being sampled through this effort. Coastal monitoring groups store their data on MURPHY, the citizen monitoring database developed by the Friends of Casco Bay. Efforts are currently underway by the state of Maine to store and analyze this data and to report on coastal trends.

Figure 3-1.4.

Coastal Water Quality Monitoring and Citizen Education Groups



- ○ Shore Stewards, Partners in Monitoring Groups
- △ Other Coastal Monitoring groups assisted by the University of Maine Cooperative Extension
- ● Shore Stewards mini-grant program sites
- □ Other independent coastal monitoring groups

Tools Needed to Improve Assessment Abilities

1. Support for lake assessment from both Federal and State sources would be of great benefit to Maine's lake program. Reinstatement of the Lakes Assessment portion of the 314 program would be an efficient and cost effective use of public funds. In 1995, Maine used 604(b) funds (and currently proposes to use 319 funds) for partial support of the lakes Volunteer Monitoring Program. The VMP-derived data has been used for most aspects of lake water quality management in Maine, from NPS awareness education efforts to support for growth management initiatives at the local level.

In 1995, the VMP data provided the basis for the 104(b)(3) Bioassessment-Biocriteria Protocol trial and an economics study relating property values to lake water quality that has gained national attention. Long-term trend detection methods are currently being evaluated using our historic data set. This program must have secure funding to meet our future needs. For example, we need to expand our efforts to support evaluation of low dissolved oxygen conditions in our lakes (and subsequent use-attainment reporting for the 305(b) report). We also should use citizen volunteers to gather data for support of lake assessment needs such as user preference surveys, shoreline condition/habitat surveys, and special projects.

2. The linkage between watershed scale information, regional geographic and demographic data, and lake modeling must be strengthened. In particular, drainage line and polygon coding via GIS is needed to update routing models (such as our Vulnerability Index) that predict lake trophic reponse. Specifically, sub-drainage divides must be coded with lake identifiers to allow the extraction of direct and indirect watershed information. This information would allow much improved estimation of the sensitivity of individual lakes and lake systems to watershed disturbance thus allowing better definition of high priorirty watersheds for NPS and watershed management.

3. Continued refinement of the Watershed Pollution Potential Index is needed, especially in the area of land use evaluation, including satellite image interpretation backed up by ground verification for use classification. Current work has shown some potential, but statewide application of such a screening tool requires extensive work. Assessment abilities should also extend to more traditional watershed evaluations. EPA should restructure program criteria for CWA Sections 319 and 314 (at a minimum) to allow watershed surveys, thus ensuring that 319 and TMDL projects are adequately designed, major watershed problems are targeted and statewide prioritization of projects is facilitated. In particular, allowing increased use of 319 funding for watershed and NPS surveys, growth and development analyses and targeted water quality evaluations (to estimate the sensitivity of waterbodies to NPS changes) would enhance our related programs.

4. The DEP has a major need for an improved data management system. This system is needed for both ambient water quality data and permit compliance data. It must be user friendly, automatically calculate and display summary data, have useful report retrievals and statistical analysis capabilities, have built in logic to determine attainment status at both the Federal and

State levels, and be linked to the state Geographic Information System. It would be even more useful to have such a system available to all agencies in the state to facilitate data sharing. The former would require staff devoted not only to design and implement the system but to get all historic data entered and maintain the system in the future. Some of the historic data is already in databases or spreadsheets and could be reformatted and transferred electronically to a new system, however, the bulk of data collected on rivers and streams resides only on paper.

5. Maine needs to develop its use of EPA's WaterBody System to facilitate production of the 305(b) report.

6. Maine needs to develop a capability to coordinate water quality assessment activities and data acquisition with other state agencies and citizen monitoirng groups, thus eliminating duplication of efforts, maximizing assessment effort and facilitating data sharing . At this point, there may be as many as 30 entities in the state doing this type of work, some of which submit copies of the data to us and some of which we probably don't even know about. Increased inter-agency coordination and efficient data management will allow us to better assess the status of our waters.

7. Support for implementation and trial of regional lake bioassessment methods and development of estuarine/coastal bioassessment methods will be necessary if states are to fulfill EPA's expectations for bio-criteria use. This will require a number of multi-year projects supported at the State and Regional level to field test reliable metrics and biological indicators.

Chapter 2 - Assessment Methodology and Summary Data

Methodology

This section of the report describes the methodology used to analyze the data for attainment status.

I. **Rivers, Streams and Marine Waters.** To assess what portion of Maine's rivers, streams and brooks meet the goals of the Clean Water Act (CWA), this report uses bacteriological, dissolved oxygen, fish/shellfish consumption, and aquatic life criteria contained in the Maine water quality standards.

A. **Bacteria**. The criteria used to determine the suitability for recreation in and on the water are based on bacteriological data. The interpretation of bacteriological data has required the establishment of several protocols.

1. The standards for determining attainment of the CWA goals are geometric means of 142 *Escherichia coli*/100 milliliters (mL) and 14 enterococci/100 mL of human origin for freshwater and marine estuarine waters respectively. The geometric mean standards for *E. coli* and enterococci are based on a 90% confidence limit (log standard deviation = 0.5) with a sample size of n=12. If necessary, different sample sizes may be interpreted using the appropriate value for a 90% confidence limit. Since Maine has higher classifications with more stringent requirements than the interim goals of the CWA, waters can sometimes not attain their Maine classification standard but still attain the interim goals of the CWA.

2. Maine has adopted instantaneous bacteria standards (949 *E. coli*/100 mL for Class C rivers and streams and 94 enterococci/100 mL for Class SC) which correspond to the 90% confidence limit for n=1.

3. All indicator bacteria are assumed to be of human origin unless there are no known sources of human waste affecting bacteria levels. This protocol has led to some livestock-impacted waters being assessed as attaining bacteria standards despite high bacteria levels.

B. **Dissolved Oxygen**. To assess what Maine rivers, streams and brooks provide for the protection and propagation of fish and wildlife, the DEP uses an adaptation of the dissolved oxygen (D.O.) criteria proposed by EPA (Federal Register, Vol. 50, No. 76, p. 15634, 4/19/85), as well as the dissolved oxygen standards specified in the Maine classification system. For waters receiving point source discharges, use of computer modeling is the preferred method for assessing D.O. attainment. For example, Class C riverine waterbodies are considered to be providing for the interim CWA goals of protection and propagation of fish and wildlife if they are predicted to have a seven-day minimum D.O. greater than 5.0 mg/L at flows equal to or greater than 7Q10 (the lowest seven-day flow occurring once in ten years), and 6.5 mg/L at 30Q10 . A dissolved oxygen criterion of 70% of saturation is used to assess whether D.O. in Maine estuarine and marine Class SC waters are meeting the interim goals of the CWA.

C. **Aquatic Community Assessment** Maine relies upon ambient biomonitoring of benthic macroinvertebrates to assess aquatic community-level impacts of toxics and other nonconventional pollutants. Samples of the benthic macroinvertebrate community are collected by the placement of three wire baskets filled with bank-run gravel (1.5 cm-5.0 cm diameter), in each sampled location for one month. Preferred sampler placement is free-flowing first to seventh order rivers and streams, having at least some velocity and a scoured substrate. Sampling season coincides with the period of highest temperature and lowest flow (mid-July to mid-September), and samplers are left in place for 28 +/- 4 days, within that time period. Samples are processed in the field through an ASTM standard No. 30 sieve (600 micron aperture) and all organisms are removed in the laboratory and identified to the lowest practicable level.

Determination of the presence and extent of impact involves quantitative analysis of the organism names and counts. Thirty indices and measures of benthic macroinvertebrate community structure and function are computed within the electronic database managment system. The resulting information is then analyzed using a multivariate statistical model developed by the State which assesses the communities in comparison to statistically derived reference conditions for Maine waters. A probability of the likelihood of membership within one of four groups is computed. These groups correspond to the three water quality classes, and a fourth "class" representing non-attainment of minimum standards. A sampled site is found to be in non-attainment of its assigned class if it is placed in any lower classification (with at least 60% probability) by the model, after passing professional technical review of the results by program biologists.

D. **Fish/shellfish Consumption**. Fish and shellfish must also be suitable for human consumption as determined by the State Toxicologist of the Maine Department of Human Services and according to the National Shellfish Sanitation Program. Waters with published advisories are determined to be nonsupporting or partial supporting depending on the wording of the advisory. Partial support is used when some limited number or amount of fish/shellfish may be consumed or where a shellfishery is open for depuration harvesting.

E. **Assessment of Attainment for Rivers, Streams and Marine Waters:**

1. **Fish Consumption**

<u>Supporting</u>: No fish/shellfish consumption advisories in effect.

<u>Partially Supporting</u>: "Restricted Consumption" fish/shellfish advisory or ban in effect during the reporting period for the general population or a subpopulation that

could be at potentially greater risk (e.g., pregnant or nursing women, children). Restricted consumption is defined as limits on the number of fish of one or more species consumed per unit time. The limit on number consumed often varies with fish size. Shellfish areas open to depuration harvesting only.

Not supporting: Advisory or shellfish closure recommending no consumption.

2. **Aquatic Life Support**

Supporting: Rivers, streams or brooks that meet Maine's Class C standards for oxygen content and toxicity, and exhibit no other impairments that would reduce the viability of an indigenous fishery or other aquatic life, as defined in Maine's draft biocriteria.

Not Supporting: Rivers, streams or brooks that exhibit dissolved oxygen depression, turbidity, extreme water level fluctuations, toxic contamination, thermal modifications, or other impacts that would reduce the viability of an indigenous fishery or other aquatic life.

3. **Recreation In and On the Water**

Supporting: Rivers streams and brooks that meet or exceed Maine's Class C standards for bacteria of human origin (see I.A., above).

Not Supporting: Rivers, streams or brooks that fail to meet either the instantaneous or geometric mean standards for Class C waters. If sampling indicates the instantaneous bacteria standard has been exceeded due to combined sewer overflows (CSOs), the affected waters are considered to be in non-attainment for the entire year.

II. Lakes. Attainment of Clean Water Act goals and designated use support in lakes has been assessed using chemical data and other indicators. Detailed descriptions of use assessment can be found in Part III, Chapter 4: Water Quality Assessment of Lakes. A summary of the tools used to assess designated uses follows:

Fish consumption during the reporting period is assessed using fish advisories. Shellfishing and agriculture are not designated uses for Maine lakes and therefore, are not assessed. Attainment of aquatic life support is primarily based on dissolved oxygen levels in the bottom waters of a lake, but may also be based on turbidity, or extreme water level fluctuations. The designated use of swimming is primarily assessed using trophic information (presence or absence of algal blooms). Secondary contact is assumed to be fully supported in all Maine lakes, therefore no specific assessment criterion has been developed. The designated use of drinking water is fully supported as there have been no water supply closures or advisories during the reporting period.

The State designated use 'trophic stability' (condition) is assessed by examination of the dataset for trends. The state designated uses of lake water for industrial process and cooling water, hydroelectric power generation, and navigation are all assumed to be fully supported in Maine, thus no specific assessment criteria have been developed.

III. "Evaluated" and "Monitored" status

Table 3.2.1 presents the overall use support for surface waters based on evaluated or monitored information. Maine reports on the use support for 100% of its waters based on either "evaluated" or "monitored" information. "Monitored" waters include those segments where data has been collected for one or more water quality standards described in the Methodology section above, within the past 5 years. Segments may be variable in size and are determined by hydrologic/geographic considerations (e.g. river reach), area of influence from discharge(s) or other defining features that would indicate the extent to which data is expected to be representative. Monitored segments may also include waters for which there is a current, verified water quality model available. "Evaluated" waters include those segments for which there is only qualitative information, or where data is greater than 5 years old and there is no known change in the status of discharges or land use that would indicate a change in quality

Water Quality Summary

About 1.5% of Maine riverine waters are not fully supporting their designated uses. The length of rivers, streams and brooks not attaining full use is 476.4 miles, which is a slight increase over the 1994 assessment report. This probably reflects greater monitoring activity that occurred in this reporting period and the discovery of previously unknown nonattainment segments rather than an overall decline in water quality. River miles with fish consumption advisories have remained the same... The number of pollution-related fish kills in this reporting cycle has increased unfortunately, however the magnitude of these kills has been small. Significant improvements have been made on a number of river segments. In addition to the 476.4 miles of rivers and streams that do not meet minimum Clean Water Act standards, an additional 98.3 miles do not meet Maine's water standards for higher classification assignments.

Currently, a statewide fish consumption advisory is in effect for all Maine lakes due to mercury contamination. Analysis of other lake water quality factors shows the following. Based on area, 70.0% (1994-70.3%) of Maine lakes fully support designated uses, 25.0% (1994-24.4%) partially support the uses, and 5.0% are fully supporting, but threatened. Of significant Maine lake area, 75.0% (1994-75.6%) meets the GPA classification requirements established by State law; 25.0% (1994-24.4%) does not. The Lake Water Quality Assessment chapter (Part III, Chapter 4) details GPA classification requirements and use support status with respect to "Significant" lakes. The Waterbody System (WBS) is not used to track attainment status for lakes at this time due to the difficulty of extracting information from our master databases and raw data files and then entering it into the WBS. We currently use a number of Foxpro databases and extraction programs to store data and obtain the necessary attainment statistics to compile this report. Figures 3-2.1 and 3-2.2 depict locations of significant lakes having impaired and threatened water quality.

Currently, no marine or estuarine waters fully support their designated uses due to a statewide advisory on the consumption of lobster tomalley (hepatopancreas) because of dioxin contamination. Approximately 420.9 square miles of estuarine and marine waters are not fully supporting their designated uses for reasons other than the lobster tomalley advisory. This is primarily due to bacteria discharges that prevent harvesting or allow only for depuration harvesting.

A summary of the extent to which designated uses of Maine water quality classifications are not being supported is presented in Table 3-2.1. Table 3-2.2 summarizes attainment of the designated uses of State Law and the Clean Water Act. Because some Maine classifications are more stringent than those of the CWA, the sizes of water bodies indicated as attaining classifications in Table 3-2.2 may be larger than those indicated in Table 3-2.1.

Causes and Sources of Non-Attainment of Designated Uses

The causes and sources of non-attainment of water quality standards vary significantly depending on the type of water resource considered. The total sizes of waters not fully supporting uses is broken down by cause categories (Table 3-2.3) and source categories (Table 3-2.4). Figures 3-2.3 and 3-2.4 show the distribution of overboard discharges and combined sewer overflows.

The most significant cause of non-attainment in larger Maine rivers and coastal waters is the presence of priority pollutants, specifically dioxin. Atmospheric depostion of mercury is the most significant problem affecting lakes. Mercury may be equally significant in Maine's rivers however data is insufficient at this time to make that judgement. Non-attainment in smaller rivers, streams and brooks is most often caused by high levels of nutrients (organic enrichment) which results in the depletion of dissolved oxygen. A number of segments behind and below hydroelectric dams have been identified in non-attainment of support of aquatic life. Organic enrichment is also the most significant cause of non-attainment of Maine lakes (other than mercury). Estuaries and marine waters are also heavily affected by indicators of pathogen contamination, but the presence of small overboard discharges is the primary reason for many closures regardless of water quality. Several areas are currently closed due to the lack of sufficient water quality information.

The assignment of source magnitudes is relative and based on the number of sources present in a particular lake watershed. A source magnitude of "Major" is assigned when there is only one known source category in a watershed. Source magnitudes of "Moderate/Minor" are assigned when multiple source categories exist in a watershed. Occasionally, if multiple source categories exist and a predominant source category exists, then the predominant category would be assigned a "Major" magnitude and subsequent source categories would be assigned "Moderate/Minor" magnitudes.

Table 3-2.1 Overall Use Support in Assessed Surface Waters in Maine.

Type of Waterbody: Rivers, Streams, and Brooks (linear miles)

Use Support	Evaluated	Monitored	Total
Fully supporting	20,591.1	10,604.5[1]	31,195.6
Fully supporting, but threatened	not determined		0
Partially supporting	0	148.6	148.6
Not supporting	58.5	269.3	327.8
TOTAL	20,649.6	11,022.4	31,672

Type of Waterbody: Significant Lakes and Ponds (acres)

Use Support	Evaluated	Monitored	Total
Fully supporting	140,767	530,523	671,290
Fully supporting, but threatened	9,566	38,010	47,576
Partially supporting[2]	26,862	213,048	239,910
(Partially supporting, mercury advisory)	(850,353)	(108,423)	(958,776)
Not supporting	0	0	0
TOTAL	177,195	781,581	958,776

Type of Waterbody: Estuarine and Marine Waters (square miles)

Use Support	Evaluated	Monitored	Total
Fully supporting	2,130.730	300.0[1]	2,430.7
Fully supporting, but threatened	0.0	0.0	0.0
Partially supporting[2]	0.0	38.4	38.4
(Partially supporting, dioxin advisory)	(2801.6)	(50.0[1])	(2851.6)
Not supporting	0.0	382.5	382.5
TOTAL	2,130.7	720.9	2851.6

[1] Estimated miles/area of monitored river/stream and estuarine/marine waters.
[2]. Partial support does not include statewide advisories for mercury in lake fish or dioxin in lobster tomalley.

Table 3-2.2 Individual Use Support Summary for Surface Waters in Maine

Type of Waterbody: Rivers, Streams and Brooks (linear miles)

Use	Supporting	Supporting, but Threatened[1]	Partially Supporting	Not Supporting	Not Attainable	Unassessed[2]
Fish Consumption	31,425.6	0	268	0	0	0
Aquatic Life Support	31,412.8	0	0	259.2	0	0
Swimming	31,474.5	0	0	197.5	0	0
Secondary Contact	31,474.5	0	0	197.5	0	0
Drinking Water Supply	0	0	0	2.5	0	31,669.5
Agriculture	31,672	0	0	0	0	0

Type of Waterbody: Significant Lakes and Ponds (acres)

Use	Supporting	Supporting, but Threatened[1]	Partially Supporting	Not Supporting	Not Attainable	Unassessed[2]
Fish Consumption[7]	0	0	958,886	0	0	0
Aquatic Life Support	724,736	50,984	183,056	0	0	110
Swimming	805,208	103,607	49,961	0	0	110
Secondary Contact	958,776	0	0	0	0	110
Drinking Water Supply[3]	958,776	0	0	0	0	110
ADDITIONAL STATE USES:						
Trophic Stability	840,070	94,974	23,732	0	0	110
Industrial Process & Cooling Water, Hydropower, & Navigation	958,776	0	0	0	0	110

Type of Waterbody: Estuarine and Marine Waters (estimated square miles)

Use	Supporting	Supporting, but Threatened[1]	Partially Supporting	Not Supporting	Not Attainable	Unassessed
Shellfish (Square miles)[4]	2430.1	0	38.4	382.5		
Shellfish (lobster tomalley only)[7]	0	0	2851	0	0	
Aquatic Life Support (Square Miles)[5]	2841.5	0	0	9.5	0	
Swimming (Square Miles)[6]	2,846.1	0	0	4.9	0	

1 Size Threatened is not a sub-category of size fully supporting.
2 Unassessed areas are assumed to fully support the designated use.
3 Waterbody can be used as drinking water source with reasonable treatment ranging from chlorination to filtration and chlorination.
4 Acreage estimated by the Maine Department of Marine Resources.
5 Use category includes propagation of fish, shellfish and wildlife.
6 Use category includes recreation in and on the water.
7 Based on statewide fish/shellfish consumption advisory.

Table 3-2.3 Causes of Surface Water Non-attainment in Maine.

Rivers, Streams and Brooks (linear miles)

Cause Categories	Major Impact	Moderate/Minor Impact
Priority Organics	270.5	
Metals	7.4	2.0
Total toxics	6.6	4.0
Organic Enrichment	193.0	10.0
Hydrologic modification	27.2	14.0
Pathogen Indicators	197.5	
Thermal modification		5.0
Taste and Odor	79.0	
Habitat Alteration	0.2	3.5
pH	1.0	

Significant Lakes and Ponds (acres)

Cause Categories	Major Impact	Moderate/Minor Impact
Nutrients	2,851	72,291
Siltation	0	40,118
Organic Enrichment	141,246	56,541
Flow Alteration	0	30
Other Habitat Alterations	26,748	7,865
Taste and Odor	0	3,845
Metals - Fish Tissue	958,886	0

Estuarine and Marine Waters (square miles)

Cause Categories	Major Impact	Moderate/Minor Impact
Priority Pollutants	2,851	
Total toxics	3	
Organic Enrichment	10.4	
Pathogen Indicators	382.5	38.4

Table 3-2.4 Sources of Surface Water Non-attainment in Maine.

Type of Water Body: Rivers, Streams and Brooks (linear miles)

Source Categories	Major Impact	Moderate/Minor Impact
Unknown	5.0	
Industrial Point Sources	247.0	
Municipal Point Sources	21.0	
Combined Sewer Overflows	130.2	
Agriculture	68.5	9.0
Urban Runoff/Storm Sewers	40.9	
Resource extraction	1.4	
Habitat Modification	0.7	3.5
Onsite Waste Treatment (domestic)	45.3	1.5
Flow Regulation	27.2	14.0
In-place Contamination	39.5	3.5

Type of Water Body: Significant Lakes and Ponds (acres)

Source Categories	Major Impact	Moderate/Minor Impact
Industrial Point Sources	0	4,288
Municipal Point Sources	76	4,458
Agriculture[1]	1,466	71,508
Aquaculture	30	0
Silviculture	5,730	49,655
Construction	32	1,344
Urban Runoff/Storm Sewers [1]	36,687	111,500
Shoreline Development	35,105	86,445
Residential Development	1,582	13,706
General Development	0	7,879
Urban Runoff	0	3,470
Land Disposal [1]	0	1,999
Hazardous Waste	0	1,420
Hydro-modification	26,748	7,865
Other [1]	23	33,202
In-Place Contaminants	0	18,080
Internal P Recycling	0	18,080
Source Unknown	69,998	827
Atmospheric Deposition	958,886	0

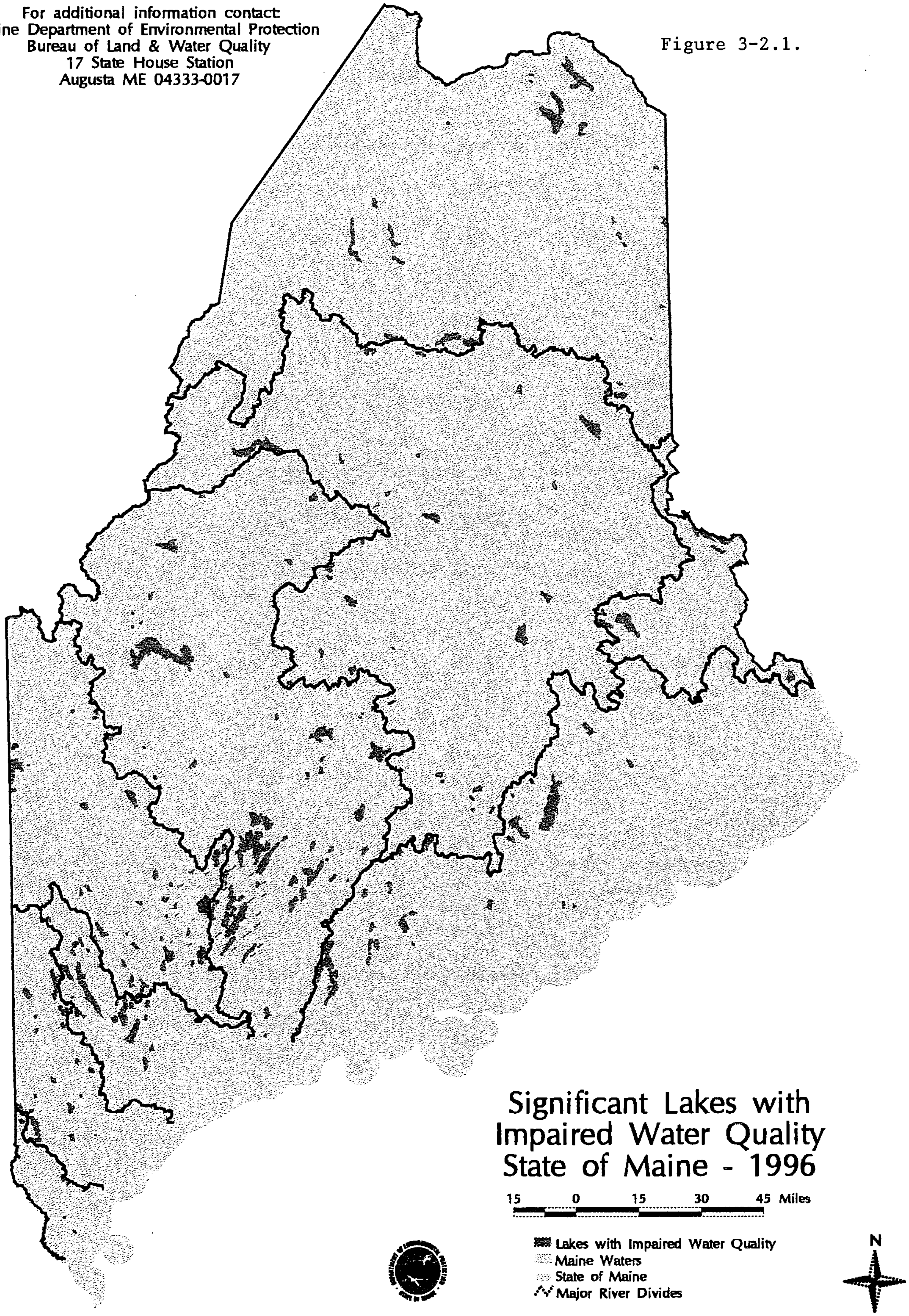
Type of Water Body: Marine and Estuarine Waters (square miles)

Source Categories	Major Impact	Moderate/Minor Impact
Industrial Point Source	2851	
Municipal Point/Overboard Discharge	382.5	38.4
Combined Sewer Overflows	14	

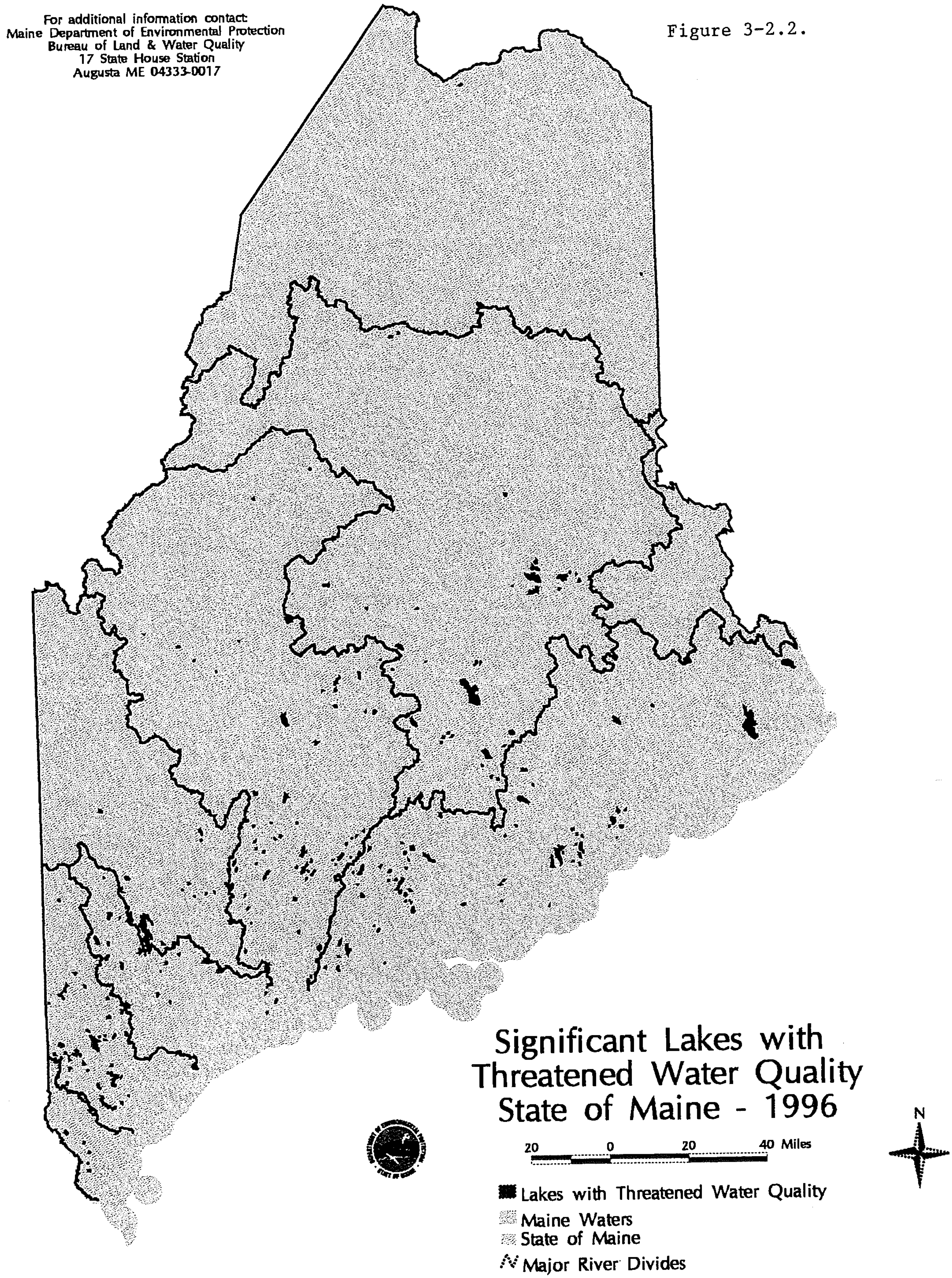
[1]General category acreage is inclusive of subcategory acreages.

For additional information contact:
Maine Department of Environmental Protection
Bureau of Land & Water Quality
17 State House Station
Augusta ME 04333-0017

Figure 3-2.1.



Significant Lakes with Impaired Water Quality State of Maine - 1996


For additional information contact:
Maine Department of Environmental Protection
Bureau of Land & Water Quality
17 State House Station
Augusta ME 04333-0017
Significant Lakes with Threatened Water Quality State of Maine - 1996
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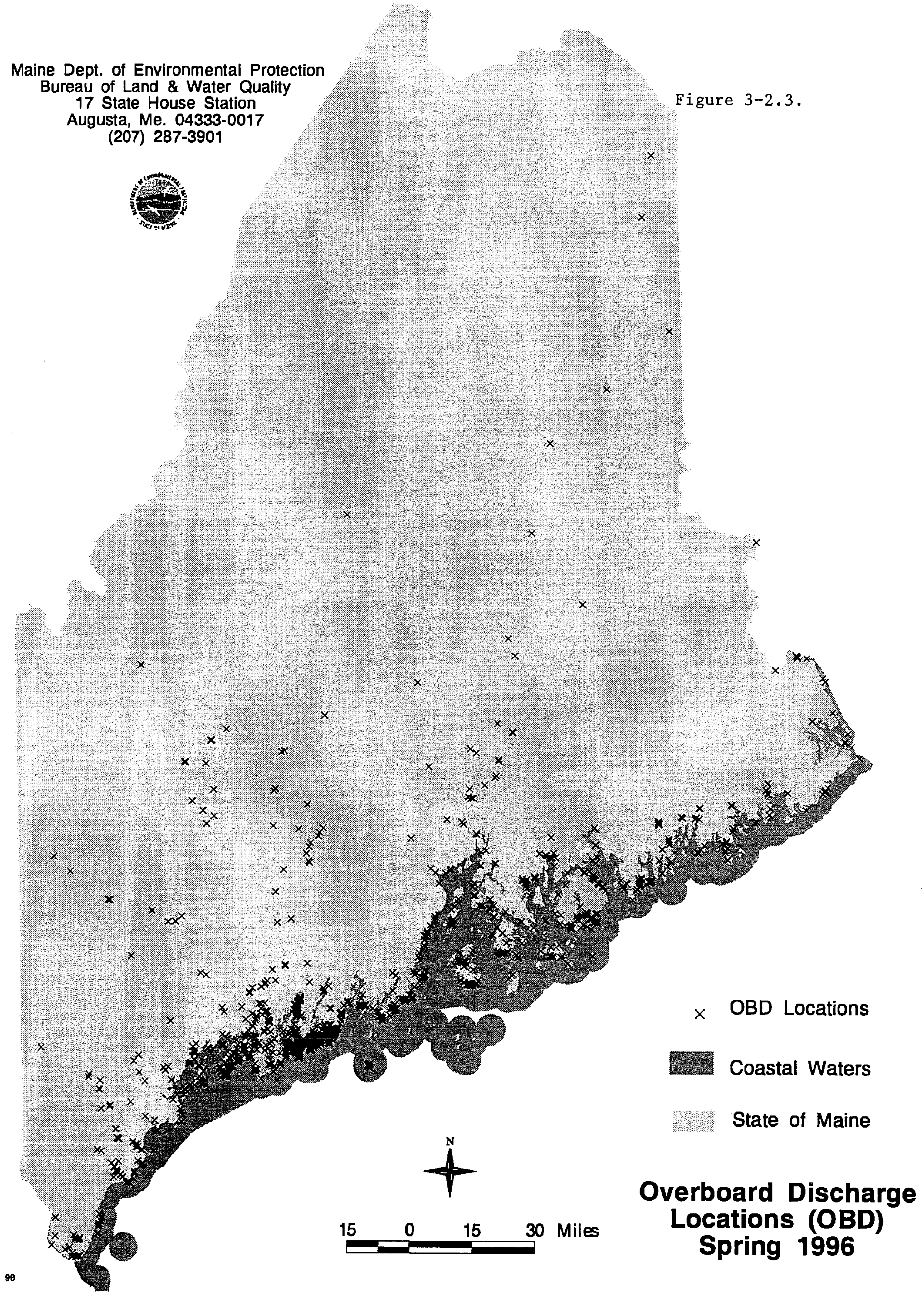
Lakes with Threatened Water Quality
Maine Waters
State of Maine
Major River Divides

Figure 3-2.2.

Figure 3-2.3.


Maine Dept. of Environmental Protection
Bureau of Land & Water Quality
17 State House Station
Augusta, Me. 04333-0017
(207) 287-3901
OBD Locations
Coastal Waters
State of Maine
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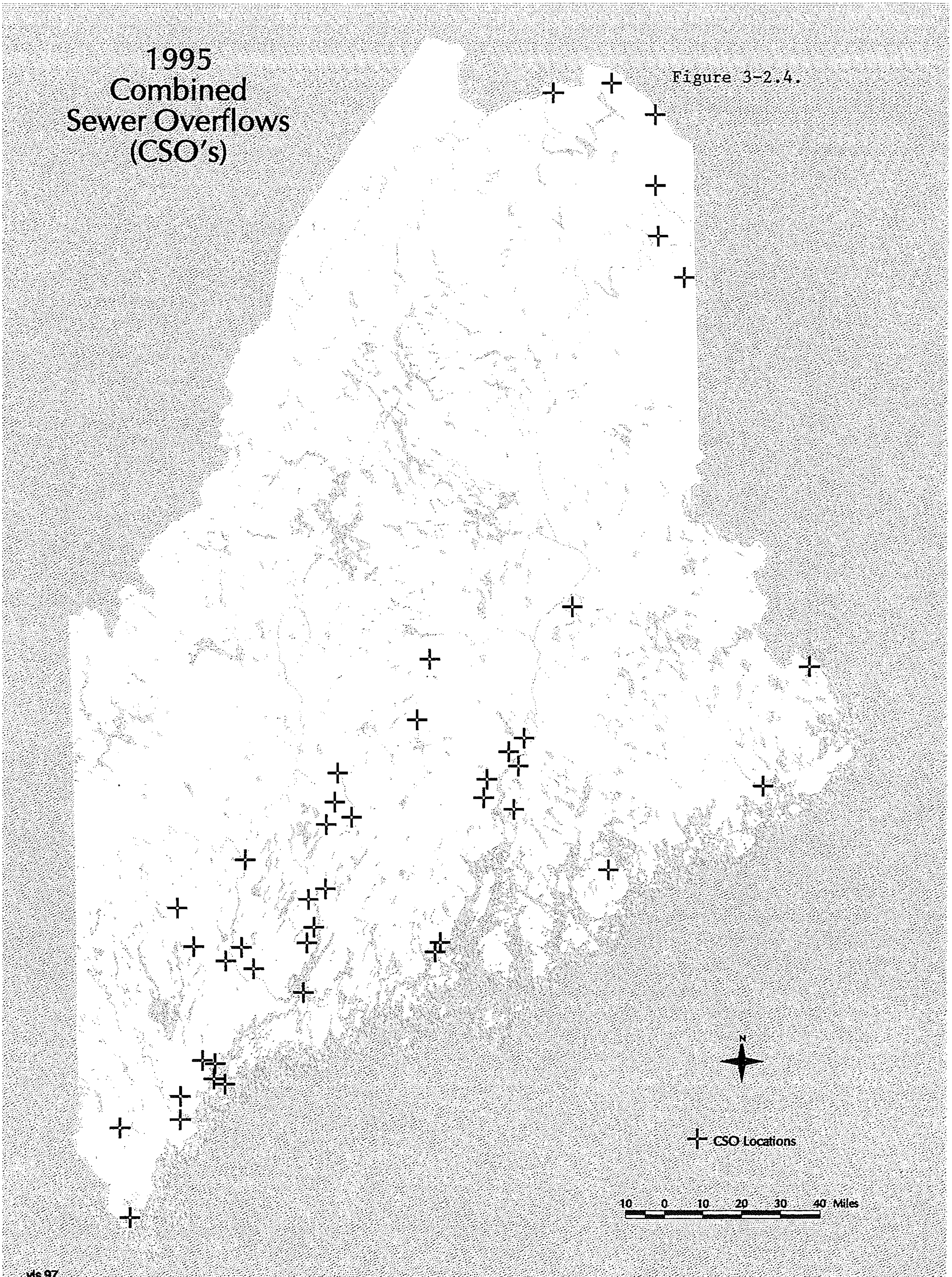
15 0 15 30 Miles
Overboard Discharge Locations (OBD) Spring 1996
JPL 98

Figure 3-2.4.


1995
Combined
Sewer Overflows
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CSO Locations
10 0 10 20 30 40 Miles
vls 97

Chapter 3 - Water Quality Assessment of Rivers, Streams and Brooks

Contact: David Courtemanch, Division of Environmental Assessment, Bureau of Land and Water Quality,.(207) 287-7789.

The percentage of watercourse miles suitable for fishing and swimming in Maine is highest for small watercourses and lowest for major rivers (Table 3-3.1). This is due to patterns of settlement and industrialization in Maine. Because of the greater potential for development of major Maine rivers, water pollution problems are most severe there. There has been an overall increase in swimmable miles and a slight overall decrease of fishable miles since the 1994 assessment.

Table 3-3.1. Rivers, Streams and Brooks Evaluated for the Interim Goals of the Clean Water Act.

Waterbody Type	Miles in Maine	Miles "Fishable"	Miles "Swimmable"
Major Rivers[1]	1141	887.5 (78%)	1037.5 (91%)
Minor Rivers, Streams, and Brooks	30,531	30,342.4 (99.0%)	30,433 (99.7%)
TOTAL	31,672	31,229.9 (98.6%)	31,470.5 (99.4%)

[1] Major: Those with a drainage area greater than 500 square miles.

Main Stems of Major Rivers

Maine rivers with a drainage area greater than 500 square miles deserve special consideration in assessing ambient water quality. This is due to settlement patterns as well as the potentially greater opportunities for recreation and habitat on these 19 major rivers. Eleven of these 19 rivers are tributaries of still larger rivers. Five of the 19 rivers (the Allagash, Dead, Fish, East Branch and West Branch of the Penobscot) lie in remote areas and can be characterized as pristine (with the exception of the West Branch, these rivers are classified AA or A). Six of these 19 rivers (the Mattawamkeag, Moose, Piscataquis, Saco, Sandy, and Union) are less densely settled and industrialized than the following group but historically had segments with pollution problems.

Table 3-3.2. Maine Attainment Status: Major Rivers.

River Name	Maine Length (miles)	Fishable[1] miles	Swimmable[2] miles	Fishable/ Swimmable miles	
Androscoggin[3]	124	0	100	0	(0%)
Kennebec[3]	145	89	89	89	(61%)
Dead	22	22	22	22	(100%)
Moose	13	13	13	13	(100%)
Sandy	86	86	86	86	(100%)
Sebasticook	50	48	48	48	(96%)
Penobscot[3]	80	24	71	24	(29%)
East Branch	46	46	46	46	(100%)
Mattawamkeag	48	48	48	48	(100%)
Piscataquis	47	47	47	47	(100%)
West Branch	36	31	33	28	(78%)
Presumpscot	23	16	16	16	(70%)
Saco	81	80.5	80.5	80.5	(99%)
Saint Croix	30	27	30	27	(90%)
Saint John[4]	161	161	159	159	(99%)
Allagash	64	64	64	64	(100%)
Aroostook	69	69	69	69	(100%)
Fish	13	13	13	13	(100%)
Union	3	3	3	3	(100%)
TOTAL MILES	1141	887.5	1037.5	884	
PERCENT OF TOTAL		(78%)	(91%)	(77%)	

[1] Those which attain the criteria for protection and propagation of fish and wildlife.
[2] Those which attain the criteria for recreation in and on the water.
[3] Segments of the Androscoggin (124 miles), Kennebec (56 miles) and Penobscot (56.5 miles) Rivers do not fully attain the interim goal of fishable due to the presence of dioxin in fish tissues. The State Toxicologist has issued an advisory to limit consumption of fish from these rivers.
[4] That portion of the basin upstream of the Hamlin, Maine - Grand Falls, New Brunswick boundary.

The remaining eight of the 19 rivers (the Androscoggin, Aroostook, Kennebec, Penobscot, Presumpscot, Saint Croix, Sebasticook and Saint John) are pristine in their upper watersheds but pass through urban, industrial and agricultural areas in their lower reaches. Prior to the treatment of industrial and municipal wastewater, these eight rivers had serious pollution problems in their lower reaches. The Androscoggin River was once characterized as one of the ten most polluted rivers in the nation.

Significant progress has been made since the 1994 assessment. Most notable is a gain of 115 miles attaining swimmable standards. This is due to several large segments of the Androscoggin and Penobscot Rivers improving their water color quality and the removal of a significant bacteria source originating in New Hampshire that affected a segment of the Androscoggin in Maine.

As shown in Table 3-3.2, 887.5 of 1,141 miles of major river main stems in Maine attain the interim goals of the Clean Water Act. The most significant cause for not fully supporting the uses of the main stem rivers is the presence of dioxin from industrial point sources. Additional problems are caused by discharges of untreated municipal wastewater (CSOs), inadequate sewers or treatment facilities. Each stream segment in Maine which does not attain classification standards is identified in Chapter 4 of Appendix I along with a description of the cause(s) of non-attainment.

Building wastewater treatment facilities has not solve certain water quality problems on Maine's major rivers. Maine cities and larger towns also have problems with their wastewater collection systems. A serious problem is combined sewer overflows (CSOs). The relative importance of nonpoint source pollution is increasing as point source problems are eliminated A detailed discussion of point and nonpoint control programs may be found in Part V, Chapters 1 and 2, of this report.

Small Streams

Small stream segments totalling 218.6 miles are found to be in nonattainment from all causes. This is a slight increase over the 1994 assessment but reflects the inclusion of new waters discovered using new data sources. Despite the increase of nonattainment miles, a number of waters have been improved and removed from the list of nonattainment waters (found in Chapter IV of Appendix I). These include several segments that previously had toxic problems or discharges of untreated or poorly treated sewage. As in previous years, most documented progress has been made where treatment could be applied to point sources. Treatment of nonpoint source problems with followup assessment is needed to document effectiveness of nonpoint source abatement programs.

Case Study: Bond Brook Project

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Background: Bond Brook, a tributary to the Kennebec River in Augusta, was historically a popular site for trout and salmon fishing. As development in the Augusta region increased, the brook and its fishery suffered major imacts from uncontrolled building, road construction, poorly maintained banks and ditches, agriculture and mining activities. By the late 1980s, local citizens began to consider Bond Brook a "lost" resource.

Approach: In 1992, the Kennebec County Soil and Water Conservation District (KCSWCD) received a $49,250 grant from the Maine Department of Environmental Protection (DEP) to restore portions of the brook's shoreline, and to reduce recurrent discharges. The project was undertaken in cooperation with the DEP, the Environmental Protection Agency (EPA), the Maine Departments of Inland Fisheries and Wildlife (DIFW) and Consevation (DOC), the Natural Resources Conservation Service (NRCS), the City of Augusta, Trout Unlimited, and local citizens. The overall objectives of the project were to repair significant erosion sites adjacent to the brook, to educate the public about non-point source pollution and Best Management Practices (BMPs), and to generate support for pollution prevention.

Accomplishments: Significant accomplishments include construction and demonstraton of an innovative livestock exclusion and watering site, training residents in the use of forestry BMPs, and production of a videotape featuring the restoration and protection of Bond Brook. Erosion control BMP demonstration projects (riprap, vegetative planting and mulching, slope preparation and stabilization) were installed at seven sites in the watershed. Satellite projects were also developed where technical assistance was provided, but no project funds were spent. These include instruction in fill placement and soil stabilization techniques, stormwater runoff control, revegetation plan reviews, ditch constuction and maintenance, and assistance in fish ladder permitting and constuction at the Governor Hill State Fish Hatchery.

Results: Preliminary results suggest that water quality is improving. Recent sampling by the Maine Department of Inland Fisheries and Wildlife and the U.S. Fish and Wildlife Service has shown that salmonids (brown trout) are inhabiting some Bond Brook tributaries. Repaired erosion sites are contributing significantly less sediment to the brook. While it is difficult to quantify the effects of the project without long-term monitoring, the ultimate measure of success will be the continued implementation of BMPs by local landowners, and the degree to which residents of the watershed support future pollution prevention efforts.

Water Quality Trends

Trends between the 1996 report and previous 305b reports is difficult. This year, many new data sources were employed causing a number of waterbodies to be listed as nonattainment. Also, the state is improving its NPS assessment capability Many of these waters, particularly the small streams where there is less monitoring conducted, may have had water quality problems for many years but were not monitored and not reported. Therefore it is hard to conclude what trend exists.

The best information is for large rivers where monitoring is more continuous and comprehensive. These waters show a continued trend toward improvement. The Maine DEP has established a goal to remove dioxin advisories by the year 2002. Paper mills have pledged to adopt technology to reduce dioxin. This will also yield benefits of reducing color discharges. All communities with CSOs are also engaged in assessment, rehabilitation and treatment to remove or reduce these sources.

A number of new segments associated with hydropower facilities have been listed as nonattainment based on information received during the relicensing process of these facilities. Many of these segments are small but the effect of certain facilities on the downstream biota can be profound. The Maine DEP has taken an active role in the relicensing of hydroelectric facilities in the state. New certifications have required re-adjusting flows, usually increasing minimum flows to benefit aquatic life in and below many impoundments. Maine has many more hydroelectric facilities scheduled for relicensing in the next few years and will pursue similar agreements with the operators.

Toxic contamination appears to be a significant concern for the state in coming years. With the repopulation of fisheries on many rivers following waste removal in the 1970's, we are finding that some populations carry significant contaminant burdens. Recent sampling for dioxin has shown some decline of this contaminant in fish tissues, however advisories are still continuing for this contaminant. Additional monitoring planned for the next few years through the Surface Water Ambient Toxics program may reveal other contamination problems. Mercury contamination is of primary concern due to its widespread presence documented in our lakes. PCB contamination is another area of concern, however, data is incomplete to determine if a health or ecological threat exists at this time.

Chapter 4 - Water Quality Assessment of Lakes

Summary statistics for use support and causes or sources of impairment in Maine lakes can be found in Tables 3-2.1 through 3-2.4 in Part III, Chapter Two: Assessment Methodology and Summary Data. Of the 243 lakes (239,910 acres) not fully supporting uses, 1 lake (76 acres) has its major contribution from a point source and 242 lakes (239,834 acres) have major contributions from nonpoint source pollution.

Background

To improve consistency in 305(b) reports nationally, EPA restricted "significant" lakes to publicly-owned lakes with public access in 1992. In the State of Maine, all Great Ponds are defined by Statute to be publicly-owned (Title 17 M.R.S.A., Section 3860). The Great Ponds definition includes inland bodies of water in excess of 10 acres or, if artificially impounded, in excess of 30 acres (Title 38 M.R.S.A., Section 480-B). For the purposes of this assessment, "significant" lakes are publicly-owned lakes for which bathymetric/morphometric surveys exist, vulnerability modeling has been performed, or for which some trophic data has been gathered. This is a functional definition only and not intended to define relative value or need for protection. The water quality statistics presented in this chapter, except those under the topic "Acid Effects on Lakes", are based on the acreage of "significant" lakes rather than the acreage of all lakes. Table 3-4.1 illustrates how the "significant" lake population considered in this report compares to the total lake population.

Table 3-4.1. Maine Lake Population Statistics.

	Number(%)	Acreage(%)
Total Lakes	5,785 (100%)	986,776 (100%)
1996 Significant Lakes	2,314 (40%)	958,886 (97.2%)

Maine employs several tools to assess lake water quality and potential for change. Some of these, such as the Vulnerability Index (VI), focus on planning for the inevitable fact that Maine watersheds are going to change over the next several decades. Others, such as Trophic State Index, are primarily used for generic classification of productivity and trend detection. Maine also uses basic trophic state indicators (transparency and dissolved oxygen depletion) to assess the degree of impairment in human use potential and habitat degradation as well as trend detection.

The Maine statutory goals for the management of lakes and ponds (Class GPA) include: stable or decreasing trophic state, freedom from culturally-induced algal blooms which impair their use and enjoyment, and no impairment of aquatic habitat. While Maine statute defines this condition as acceptable water quality, it does not mandate natural or pristine conditions where lake watersheds already had extensive agricultural or residential development. The Maine management goal for lakes recognizes the existing diversity of trophic state.

Trophic Status
Contact: Linda Bacon, DEP BLWQ, Division of Environmental Assessment, (207) 287-7749.

The trophic state of a Maine lake is determined using measurements of transparency, chlorophyll and phosphorus concentrations. It may also be assigned subjectively to lakes that are not monitored. Since 1979, Maine has calculated a Trophic State Index (TSI) for monitored lakes having sufficient data. This numerical index is valuable in that it integrates a substantial amount of data to yield a relatively unbiased evaluation of overall water quality. This metric also allows an objective method of ranking lakes and detecting trends which may be masked by reliance on transparency readings alone. TSI statistics are calculated for lakes on which trophic data exists for only one parameter (usually transparency) but the most reliable TSI indicator of overall conditions is based on all three parameters.

Assignment of trophic status based on subjective evaluation or on limited data such as minimum Secchi disk transparency (SDT) readings does not directly equate to the numerical TSI. It does, however, allow some assessment of trophic status on the largest possible number of Maine lakes and is particularly useful for planning purposes. Many lakes have been assigned one of the three trophic ratings based on the professional judgment of DEP staff or Maine Department of Inland Fisheries and Wildlife (DIFW) staff. Trophic status ratings were made by the DIFW on almost all of the significant lakes included in the Maine Lakes Survey (approximately 1900). These determinations were based primarily on the subjective assessment of a staff biologist as to the potential fisheries productivity and morphometry of a lake. DEP staff have assigned trophic status to some lakes not evaluated by the DIFW when specific knowledge, including public reports of repeated blooms or related nuisance conditions, provided a basis for evaluation.

For the purposes of this report, trophic status has been assigned to lakes under criteria which reflect both professional judgment and numerical data. Table 3-4.2 illustrates how numerical criteria relate to trophic status. Oligotrophic lakes are characterized by low productivity and

Table 3-4.2. Numerical Criteria for Evaluation of Trophic Status in Maine.

Parameter	Oligotrophic	Mesotrophic[1]	Eutrophic
TSI[2]	0-25	25-60	>60 &/or repeated algal blooms
SDT[2]	> 8 M.	4-8 M	< 4 M.
CHL a	< 1.5 ppb	1.5 - 7 ppb	> 7 ppb
Total Phosphorus[2]	< 4.5 ppb	4.5 - 20 ppb	>20 ppb

[1] No repeated algal blooms (SDT minimum < 2.0 M.)
[2] If color is > 25 Standard Platinum Units (SPU) or not known, chlorophyll a concentration (CHL a) and professional judgment must be used to assign trophic category.

Table 3-4.3. Trophic Status of Significant Publicly-Owned Maine Lakes.

Status	Number of Lakes	Acreage of Lakes
Total	2,314	958,886
Assessed	1,733	926,878
Oligotrophic	142	121,801
Mesotrophic	989	625,616
Eutrophic	602	179,461
Hypereutrophic	0	0
Dystrophic	N/A	N/A
Unknown	581	32,008

above average transparency, mesotrophic lakes have moderate productivity and average transparency, and eutrophic lakes are highly productive, have below average transparency, and may support nuisance algal blooms.

Table 3-4.3 summarizes trophic status of significant Maine lakes regardless of trophic assignment source (DEP or DIFW). Of significant lake acres, 79.1% have been assigned trophic status by DEP, 17.6 % have been assigned trophic status by DIFW and 3.3% remain unassigned. Table 3-4.4 displays the DEP-assigned trophic rating for 700 monitored lakes broken down by major drainage basin. The remaining 1033 significant lakes, as evaluated by DIFW, are described in Table 3-4.5.

As noted earlier, DEP and DIFW trophic assignments are not equivalent. For example, it is likely that a large number of the 518 lakes rated "eutrophic" by DIFW would be assigned a mesotrophic status by DEP if sufficient monitoring data were available. This is primarily because DIFW considers the productivity, not only of the water, but of the entire ecosystem; thus lakes with extensive natural macrophyte beds but with clear water were often evaluated by DIFW biologists as eutrophic.

By definition, dystrophic implies that a lake has high color [>45 Standard Platinum Units (SPU)] due to humic acids accompanied by depressed dissolved oxygen concentrations. Lakes in this category can be shallow or deep but often have a substantial adjacent wetland area as the source of humic enrichment. No lakes have been assigned to the "dystrophic" category. There are a number of reasons for this. First, there are many lakes for which we have no color data and no simple way to characterize adjacent wetland areas in the watersheds of all significant lakes. Second, dystrophy is not truly exclusive of the other three classifications. For example, it is valid to call Threecornered Pond eutrophic as well as dystrophic, however it is described as eutrophic in this report.

Table 3-4.4.Trophic Status of 700 Significant Maine Lakes by River Basin (DEP-Monitored lakes).

Basin	Oligotrophic acres	Mesotrophic acres	Eutrophic acres
Saint John	2,840	57,888	14,361
Penobscot	23,192	144,413	3,626
Kennebec	7,439	153,791	24,866
Androscoggin	4,680	71,824	2,711
Eastern Coastal	32,004	120,963	26,481
Western Coastal	32,170	33,858	1,451
All Basins	102,325	582,737	73,496
Number of Lakes	**66**	**550**	**84**
% of Significant Lake Area (958,886 acres)	**10.7%**	**60.8%**	**7.7%**
% of Total Lake Area (986,776 acres)	**10.4%**	**59.0%**	**7.4%**

Table 3-4.5. Trophic Status of 1,033 Significant Maine Lakes (DIFW Evaluation).

Class	Number of Lakes	Acres
Oligotrophic	77	20,635
Mesotrophic	438	41,692
Eutrophic	518	105,993
Total	1,033	168,320

Of the significant lakes, 3.3% of the surface area remains unclassified for trophic status because data or evaluations do not exist, despite having vulnerability modeling or morphometric surveys done. Trophic status is not included for 2.8% of the total lake acreage because these lakes did not meet the "significant" criteria.

Control Methods
Contact: Roy Bouchard, DEP BLWQ, (207) 287-3901.

Existing State programs for controlling pollution of lakes generally fall into three categories: Regulation, Planning, and Technical Assistance and Guidelines. The DEP has abated many of the major sources of pollution to numerous Maine lakes through statutes, regulations, permit review, and lake restoration projects. The major threat to maintaining the present lake water quality is changing land use. The greatest change has been the transition from predominantly forested land to numerous small residential developments, with significant cumulative impacts on water quality. A heightened public awareness of the vulnerability of lake water quality has resulted in recognition of nonpoint sources (NPS) of pollution, primarily nutrients and sediments, as a priority for action.

Control methods include installation and maintenance of agricultural conservation practices, erosion control on private and commercial properties, and reduction of shoreland zone groundwater pollution. Awareness of the need for effective silvicultural management is also increasing in Maine, not only as it affects water quality of Maine lakes and streams, but also for habitat diversity and maintenance of long-term productivity. State agencies have begun to place more emphasis on training and education. Agriculture continues to be a major source of enrichment to lakes. Despite a general decline in the agricultural sector of the Maine economy, it can still be the catalyst for new lake water quality problems.

The EPA Clean Lakes Program was significant in furthering the Maine goal of eliminating culturally-induced algal blooms from Maine lakes. The Federal CWA, Section 319 Nonpoint Source Control Program enhanced the effectiveness of the Section 314 Clean Lakes Program and other lake protection activities. Emphasis on water quality protection, including the implementation of Best Management Practices (BMPs) to reduce nutrient loading, complements the Maine Phosphorus Control Program. Section 319 watershed projects have been completed on Sebago Lake, Unity Pond (Twenty-five Mile Stream), Taylor Pond and Boyden Lake. Watershed projects are currently underway on Damariscotta Lake, China Lake, Range Pond, Thompson Lake, Cobbossee Lake, Webber Pond and Threemile Pond. The following lakes have 319 funded demonstration projects: Ellis (Roxbury) Pond, Wilson Pond (Wilton), Pleasant Lake (Island Falls), Mattawamkeag Lake, China Lake, Crystal Pond (Turner), Daigle Pond and Worthly Pond (Peru).

I. **Regulation**

A. **Water Classification**
Contact: Dave Courtemanch, DEP BLWQ, Division of Environmental Assessment, (207) 287-3901.

The Maine statutory classification of lakes and ponds, Class GPA, includes a stable or decreasing trophic state, freedom from culturally induced algal blooms which impair use and enjoyment, and no impairment of aquatic habitat (38 M.R.S.A., Article 4-A). The statute also prohibits new point source discharges of pollutants to lakes or tributaries of lakes. Existing licensed sources are allowed to remain only as long as no practical alternative exists. At this time there are four municipal discharges to lakes. Two of these municipal discharges (Rangeley and Sanford) receive tertiary treatment for phosphorus removal. The Town of Rangely has developed engineering proposals for removal of its discharge to Haley Pond by early 1997. The St. Agatha discharge to Long Lake was removed in 1994.

B. **Subsurface Wastewater Disposal**

Contact: Department of Human Services, Division of Health Engineering, (207) 287-5338.

During the last twenty years, substantial numbers of domestic wastewater discharges to lakes have been removed through application of the Maine Subsurface Wastewater Disposal Rules and the statutory prohibition against discharges.

C. **Natural Resources Protection Act**

Contact: DEP BLWQ, Division of Land Resources Regulation, (207) 287-3901.

In 1988, the Maine Legislature consolidated a number of resource protection statutes and regulations under the Natural Resources Protection Act (NRPA). The act requires that alterations to shorelines of lakes, streams and wetlands must not have adverse impacts on water quality or aquatic habitat. Wetlands which are hydraulically connected to lakes are considered by DEP to be part of the lakes themselves in terms of protection of habitat and water quality. Development of residential and commercial projects, and other activities above certain thresholds, are regulated not only by local governments, but also by the DEP. One of the objectives of review is to require stormwater management and erosion control so as to minimize new sources of sediment and phosphorus to lakes, especially to impaired lakes. Consideration is also given to the potential cumulative impact of proposed developments in the watershed.

D. **Shoreland Zoning**

Contact: Municipal Codes Enforcement Officer, or DEP BLWQ, Division of Watershed Management, (207) 287-3901.

Maine requires local adoption and enforcement of shoreland zoning. In a defined area around lakes and major rivers, municipalities must impose at least minimum standards for setbacks, lot clearing, and permitted types of land use. While of substantial benefit to lake water quality protection, these ordinances usually do not affect the entire watershed and usually reflect only minimum protection standards for lakes. The 1991 mandatory inclusion of zoning on freshwater wetlands and all second order or larger streams will help considerably in focusing attention on other areas of sensitive lake watersheds.

E. **Municipal Land Use Ordinances**
Contact: Municipal Codes Enforcement Officer or local Planning Board.

Municipal land use ordinances vary widely across the State in terms of their detail and application concerning lake protection. Adoption of comprehensive plans under the Maine Growth Management Act allows municipalities to set water quality protection goals which form the basis for adoption of specific local programs and regulations. The most common features of these ordinances revolve around local planning board review of subdivisions and standards for road construction. A number of municipalities have also adopted general land use ordinances, which control (or at least set guidelines for) such activities as timber harvesting and general erosion control. An increasing number of ordinances incorporate references to specific lake watersheds with special standards for water quality protection. Municipalities are being encouraged to adopt aerial phosphorus allocations for their lake watersheds according to Phosphorus Control in Lake Watersheds: A Technical Guide to Evaluating New Development, Revised September 1992.

F. **Regulation in Unorganized Areas**
Contact: Land Use Regulation Commission, (207) 435-6437 (Ashland region), (207) 695-2466 (Greenville region), (207) 827-6191 (Old Town region), (207) 764-2053 (Presque Isle region), or (207) 864-5064 (Rangley region).

In approximately 52% of Maine's land area (and thus for fully half its lakes) the Land Use Regulation Commission (LURC) is the planning and zoning agency regulating development. Permit application reviews specifically consider water quality impacts and are often done on a cooperative basis with DEP, particularly in lake watersheds.

G. **Forestry Practices**
Contact: Department of Conservation, Maine Forest Service, (207) 287-2791.

The Forestry Practices Act of 1989 and corresponding rules regulate the size of clear-cuts and regeneration standards for these cuts. Most timber is grown and harvested in unincorporated townships of the state under the jurisdiction of LURC. Standards for stream crossings, road and ditch construction and general erosion control are enforced by LURC and are vital to reducing nutrient and sediment impacts on lakes and streams in the northern part of the state. In June 1991, the Maine Forest Service, at the request and with the support of the Department of Environmental Protection, published BMPs for erosion and sediment control in logging operations as part of the State's Section 319 program. These guidelines are adapted from LURC standards and the DEP encourages their use throughout the state in workshops, demonstrations and training sessions. Maine does not require training of timber harvesters in resource protection, but the BMPs are being incorporated into a new certified loggers program sponsored by the timber harvesting industry.

II. Planning

The management of Maine lakes revolves around maintenance and improvement of water quality. The section on Control Methods details many of the tools used to achieve these twin goals, but DEP is currently emphasizing several aspects which hold the most promise for long-term benefits.

A. Great Pond Task Force

Contact: Roy Bouchard, DEP BLWQ, Division of Environmental Assessment. (207) 287-7798.

The Commission on Maine Lakes was directed by the Maine Legislature to assess the threats to lake water quality and make recommendations to combat these. As a result of the Commission's report, legislation created a Great Pond Task Force. This task force will develop a new management strategy and guidelines governing surface uses of lakes, and will improve public education concerning lake protection. Several other specific actions were directed, including a phosphorus control limitation on domestic detergents. Special emphasis is placed on identification of actions needed to prioritize watersheds for phosphorus loading management.

B. **State and Local Coordination**: Regulations are applied at two levels: State and local (municipal). Because of the geographical extent of the state and the varied nature of threats to water quality, limited state staff must concentrate on high priority problems, compliance inspections and enforcement. In the case of lakes, ensuring compliance with current state regulations to control nonpoint source pollution often receives lower priority than major point source discharges to rivers and marine waters. However, watersheds of lakes which have restoration projects or histories of water quality problems receive substantial attention from DEP staff.

Because the majority of land use decisions affecting lake water quality are regulated locally, the DEP relies on the application of municipal ordinances to be the first line of defense. DEP provides guidance to towns and landowners for individual land use decisions. DEP experiences have shown that the effectiveness of ordinances and regulations rely on two things: the availability of technical information to town officials, developers, and individual landowners, and the education of the public in general. Because of these observations, we have emphasized planning for watershed management (particularly phosphorus control) over the long term - usually a ten to fifty year period.

In addition to the above, the Land Use Regulatory Commission currently operates under a comprehensive plan which places lakes in its jurisdiction into one of five categories. These categories define the goals for managing development, and set standards for density and compatible uses which reflect sensitivity to water quality changes.

C. **Comprehensive Planning Legislation**
Contact: DEP BLWQ, Division of Watershed Management, (207) 287-3901.

In 1991, the Maine Legislature repealed the comprehensive planning mandate and related funding. This mandate has been replaced with a voluntary comprehensive planning bill. Towns that receive funds under the voluntary program are required to protect water quality in great pond watersheds from long-term and cumulative increases in phosphorus related to development. These towns must also develop management goals for great ponds with regard to shoreline character, surface water use, public access and protection of resources of State significance. The DEP technical assistance unit is available to towns interested in the comprehensive planning process. The DEP provides planning manuals, watershed maps, and the water quality data needed for towns to pursue the planning process for their lakes. The staff stresses inter-community communications in this process, especially where towns share lake watersheds.

A number of towns not currently experiencing high growth rates which may not be currently revising their plans have or will soon adopt the technical methodology for phosphorus control in development review. Some of these towns are considering adopting model ordinances aimed at a variety of land uses in an effort at long-range preservation of water quality.

D. **Lake Watershed Management In Unorganized Territories**
Contact: Land Use Regulation Commission, Planning Division, (207) 287-2631.

In 1990, LURC implemented a new lake management program by adopting an "Amendment to the Comprehensive Land Use Plan Regarding the Development and Conservation of Lakes in Maine's Unorganized Areas" and associated rule changes. This program includes more explicit consideration of lake water quality protection and focuses on limiting phosphorus loading to lakes from future development. The lake management program also enables development of "Lake Concept Plans". These plans provide a cooperative and integrated view of landowners' future development plans. The overall goal of concept plans is to encourage long-range planning, based on resource characteristics and suitability, thereby providing an opportunity to manage the cumulative impacts of development, including water quality, while also enabling expedited permitting of approved components of the Plan. Several lake concept plans are currently being developed with different landowners.

III. Technical Assistance and Guidelines

Almost every State agency with natural resources program responsibility has one or more technical assistance functions which directly or indirectly protect lake water quality.

A. Best Management Practices

Contact: DEP BLWQ, Division of Watershed Management, (207) 287-3901.

In addition to standards for development review, Maine has developed a variety of BMPs under the Nonpoint Source Management Program which will be of substantial benefit to lake water quality. Completed BMPs include: 1) Erosion and Sediment Control Handbook for Maine Timber Harvesting Operations, 2) Best Management Practices, Strategy for Managing Nonpoint Source Pollution from Agricultural Sources and Best Management System Guidelines, 3) Best Management Practices for Maine Agricultural Producers, Protecting Groundwater from Nutrients and Pesticides, 4) Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices, 5) Stormwater Quality BMPs, 6) Erosion and Sediment -Transportation, and 7) Marina BMP's (marinas/boating). Many of these BMPs may eventually be incorporated into regulations and ordinances. In addition to the BMP manuals developed, DEP now has a Nonpoint Source Training and Resource Center that provides training and resources to Maine's development and natural resource-based industries, governmental agencies and the general public. Initially the center will work with groups who have a high potential for contributing to non-point source pollution.

B. Androscoggin River Pollution Prevention Project

Contact: Katherine Metzger, DEP, (207) 287-8125.

The DEP is currently conducting a Pollution Prevention pilot project within the Androscoggin River Basin. The goal of the Androscoggin River Watershed Project is to reduce pollution through coordination among agencies and towns. Key to this effort is the 15 member DEP Watershed Management Team, which assists community teams in the identification and resolution of local pollution problems.

C. Education and Outreach

Contact: Barbara Welch, DEP Bureau of Land and Water Quality, (207) 287-7682.

The future of Maine's lake water quality depends in great measure on how well DEP promotes evolving guidance for protection. Recognizing that public outreach and education are the cornerstones of water quality protection, an educational campaign begun in 1989 emphasizes lake related issues. Completed brochures include: Protecting Maine Lakes; An Overview, Controlling Lake Phosphorus from Existing Sources; Protecting Maine Lakes from Phosphorus Pollution; A new planning guide for Cities and Towns, Comprehensive Planning for Lake Protection, Town Ordinances for Protecting Maine Lakes, and Acid Rain and Maine Lakes. Three recent additions are Septic Systems; How

They Work and How to Keep Them Working, Maine Lakes Protection; Using the Phosphorus Control Method to improve a Subdivision, and Maine's Lakes Plants. This ambitious brochure production program has already reached thousands of people.

Each year DEP hosts a Water Quality Monitoring Fair for over a hundred monitors in conjunction with the Cooperative Extension Service and State Planning Office . The Fair offers classes on QA/QC, how to set up watershed surveys, options for invertebrate surveys, and much more.

Cooperative projects with Maine Soil and Water Conservation Districts (SWCDs) for education and landowner contacts in lake watersheds are increasingly important. One such project with the Cumberland County SWCD produced a very popular and useful series of Fact sheets on erosion and sedimentation control and BMPs. Included in the series are the following: 1) Water Quality: How it works, 2) Erosion on Shorefront Property, 3) Erosion Control for Homeowners, 4) Vegetative Streambank Stabilization, 5) Vegetated Phosphorus Buffer Strips, 6) Trees, Shrubs, Vines and Groundcovers, 7) Fertilizer Basics, 8) Riprap for Shoreline Protection, 9) Riprap for Streambank Protection, 10) Temporary Check Dams, 11) Silt Fencing and Hay Bale Barriers, and 12) Vegetative Stabilization for Sand Dunes and Tidal Areas, and 15) Stormy Day Survey. Other SWCDs have also produced special purpose pamphlets aimed at water quality protection.

Water quality videos and curriculum materials are also distributed to schools across the State. DEP has formed a coalition with 27 other non-profit organizations, state agencies, university faculty and businesses to promote environmental education in Maine, and to develop better delivery systems to teachers and schools. In addition to educational work, a technical assistance unit has been formed to work with municipalities and developers to ensure future developments are designed to limit negative effects on lake water quality. Eight to ten interactive television workshops for teachers on environmental issues are aired through the University of Maine. Topics for this series, which is entitled "Earthminders", have included lake related elements and nonpoint source pollution control.

Water Festivals are another avenue DEP uses to reach students and teachers. Twice a year hundreds of grammar school children and their teachers attend day long events centered around water: its value and function and how to protect it. The festivals are staffed and funded by up to 25 different groups-government business and non profits. DEP also participates in regional and state Envirothons for High School students.

D. **Phosphorus Control**

Contact: Jeff Dennis, DEP BLWQ, Division of Watershed Management, (207) 287-7847.

Methods to control phosphorus export from development, such as installation of phosphorus control wet-ponds, infiltration systems and vegetated buffer strips, are gaining acceptance. Maine has developed a method for addressing phosphorus loading impacts to lakes (Phosphorus Control in Lake Watersheds: A Technical Guide to Evaluating New

Development, Revised September 1992). This method is utilized for reviewing development projects under the Site Location of Development Law, and is also being used by a number of towns. The technology has been developed by the DEP into a workable system for adoption by municipalities and developers in all lake watersheds. A unique feature is the ability of this system to target the necessary level of nutrient control in individual developments by incorporating long-term water quality protection goals for each waterbody. The methods manual and technical training program are available on a state-wide basis through the DEP, participating Regional Planning Agencies and SWCDs.

A pilot project was carried out in the Town of Dedham using the phosphorus method from the planning stage to tracking implementation of phosphorus controls. The project is detailed in a report entitled "Lake Watershed Evaluation and Tracking system, Dedham, Maine" (May 1992). The report includes recommendations on projecting and planning for growth, tracking and analyzing patterns of development, incorporation of the phosphorus method into ordinances, and long-term maintenance of phosphorus controls.

Effective control of pollutant sources in lake watersheds requires the exercise of local governmental authority. Small developments and cumulative land use changes which are not under State jurisdiction comprise the majority of new nonpoint impacts on lakes. DEP has developed a comprehensive lake vulnerability database and corresponding watershed maps to assist municipalities, developers, and other agencies in the implementation of the phosphorus control methodology. A packet of information is available for most of the lakes in the state, and is provided to towns along with technical assistance on request. In addition to the above mentioned phosphorus control design standards, a comprehensive planning manual for lake watersheds and model ordinances have been designed to aid in local phosphorus control efforts and to complement the Maine municipal comprehensive planning process.

E. **Stream Assessment Methodology**
Contact: Jeff Dennis, DEP BLWQ, Division of Watershed management, (207) 287-7847.

The DEP recently completed a proposal for the development of a new assessment method for small streams and embayments to estimate potential risks from nonpoint source pollution. The method will be used as a screening tool to focus limited resources on those watersheds which are most at risk. The nonpoint source pollution potential index will make use of existing Geographic Information System (GIS) data layers supplemented by field data and an estimate of resource value. The first pilot project using the index is proposed in the Casco Bay Watershed.

F. **Erosion Control for Road Construction and Maintenance**
Contact: Maine Department of Transportation (MDOT), Office of Environmental Services, (207) 287-5735.

The Maine Department of Transportation (MDOT), Office of Environmental Services now emphasizes project planning for erosion control in sensitive lake watersheds. The

Rural Roads Center offers training and information to municipal officials, not only in the traditional areas of road construction and maintenance, but also in planning for erosion control and resource protection. Current work by the MDOT on alternative seed mixes, application techniques and application timing is an example of changes in customary procedures needed to safeguard water quality in sensitive watersheds. The MDOT funded a study during the last reporting cycle, to determine the phosphorus export coefficient for runoff from rural Maine highways, and to compare run-off from paved/medium use roads and gravel/low use roads. The study was conducted by the United States Geological Survey in conjunction with DEP and the final report is in preparation.

G. Agricultural Management

The Agricultural Stabilization and Conservation Service (ASCS) of the United States Department of Agriculture (USDA) manages Federal financial assistance to private landowners through the Agricultural Conservation Program. Funds are available for erosion and sediment control practices, and nutrient and agricultural waste management systems related to NPS threats to surface and groundwater, water management and water conservation. Technical assistance is supplied by USDA Natural Resources Conservation Service (NRCS) personnel in cooperation with each local Soil and Water Conservation District.

The 1985 Farm Bill contained provisions known as the Food Security Act. The bill required landowners receiving USDA money to develop a conservation plan for erosion control on highly erodible land by 1992, and to implement that plan by January 1, 1995. Noncompliance with this bill meant a loss of all USDA funds. In 1990, the Farm Bill was amended by the Food, Agriculture, Conservation and Trade Act to update various requirements, especially those related to wetlands. In Maine, management practices to control soil erosion and manure, nutrient and pesticide runoff are included in every conservation plan. Planning is emphasized in heavily farmed lake watersheds.

Examples of agricultural controls in lake watersheds include advanced management systems for collecting, storing and spreading manure. The management and spreading of nutrients is done according to a specific management plan in such a way and at times that the crop can make maximum use of the nutrients applied. Manure, soil and crop tissue tests are used to monitor the status of the soil, and to update the management plan if necessary. These integrated crop management practices are being demonstrated in many counties. Additional practices, such as pasture management and livestock exclusion from streams, have been added to the host of established erosion control methods. Economical alternative livestock watering sources need to accompany pasture management proposals to be viable to farmers.

Through the Conservation Reserve Program, a substantial acreage of highly erodible land has been removed from potato production for ten year periods. Most of these ten year contracts were signed between 1986 and 1990. In addition, crop rotations with oats and other grains, along with runoff management practices such as nutrient control basins, have resulted in significant decreases in the discharge of silt, nutrients and pesticides.

It is a continuing challenge to find innovative and economical ways to control nonpoint source pollution in the farm community, and to increase the number of farmers cooperating with their local SWCDs. Effective new or revised practices need to be constantly demonstrated on real farms under today's conditions to overcome the deep reluctance of farmers to abandon practices passed down through generations. This is the objective of CWA Section 319 demonstration grants. Contacts: U.S Department of Agriculture Natural Resources Conservation Service, Maine Department of Agriculture, or local Soil and Water Conservation District.

H. **Watershed Protection Grants**
Contact: DEP BLWQ, Division of Watershed Management, (207) 287-3901.

Additional projects bearing on lake water quality are funded under Section 604(b) of the CWA through the competitive grants program of DEP. Projects funded in 1993 included the Range Ponds Watershed NPS/BMP Project, Norway Lakes Special Assessment Protection District, Lake Christopher Watershed Survey, Long Pond NPS Assessment Network, Lincolnville Lakes Evaluation Project, and vegetated buffer strip educational material. Projects selected for 1994 include the Thompson Lake Watershed NPS Survey and Assessment, and the Volunteer Lake Monitoring Program.

In 1995, projects included NPS surveys of Crystal and No Name Ponds, a Septic System Phosphorus Loading to Lakes Project, and the Volunteer Lake Monitoring Program. In 1996, projects will include NPS Surveys of Little Wilson, Pleasant, and Round Ponds, and Tripp Lake, and the volunteer Lake Monitoring Program.

In addition to these projects, Section 604(b) funds a lakes Biologist at the DEP who provides technical assistance and information to the public and develops and undertakes lakes projects for the Department.

I. **Maine Lake Restoration and Protection Fund**

In the past, the Maine Lake Restoration and Protection Fund has supported nonpoint source inventories in the Damariscotta Lake, Canton Lake, North Pond and Forest Lake watersheds, utilizing methods and experience gained in the China Lake and Taylor Pond projects. The fund also provided partial support for two current NPS inventories in Rangeley and Island Falls. While still authorized, the Maine Lake Restoration and Protection Fund has been zero funded. If fiscal support is restored, the Maine Lake Restoration and Protection Fund will be an excellent vehicle to support small watershed assessment projects. This is especially true because it can promote local matching and is flexible as a funding mechanism. It also could provide assessment work needed to plan nonpoint source projects which are not supported under current Section 319 program policy.

Table 3-4.6. Lake Rehabilitation Techniques*.

Rehabilitation Technique	# Lakes	Acres
In-lake Treatments		
Phosphorus Precipitation/Inactivation (alum treatment)	4	3,344
Dilution/Flushing	3	7,451
Watershed Treatments		
Sediment Traps/Detention Basins	2	8515
Shoreline Erosion Control/Bank Stabilization	4	6,868
Conservation Tillage Used	2	8515
Animal Waste Management Practices Installed	10	17,832
Road or Skid Trail Management	3	5,359
Land Surface Roughening for Erosion Control	1	3,845
Riprapping Installed	3	5,359
Unspecified Type of BMP	13	29,768
Other Lake Protection/Restoration Controls		
Local Lake Management Program in Place	9	22,793
Public Information/Education Program/Activities	7	12,982
Local Ordinances/Zoning/Regs to Protect Lake	7	13,478
Point Source Controls	4	10,845

*techniques used in restoration project lakes listed in Tables 3-4.7 and 3-4.8.

Restoration and Rehabilitation Efforts

Contact: Roy Bouchard, DEP BLWQ, Division of Environmental Assessment, (207) 287-7798.

The DEP selects restoration projects based on the severity of problems, feasibility (technical and financial) of alternatives and on local support. This last element has been increasingly important as projects become more complex, require more volunteer effort, focus on nonpoint source control, and involve the development of municipal policies. Each of the current projects has an active lake association working on education and fund raising. Recent projects have included nonpoint source surveys carried out by volunteers under the direction of the DEP. Agricultural NPS control has been the focus of the NRCS and SWCDs in several restorations. Increasingly, District staff expertise has been utilized for non-agricultural technical assistance, as in the case of the current China Lake project, in close cooperation with the NPS Control Program.

Table 3-4.6 summarizes rehabilitation techniques used in past and current restoration project lakes. It should be noted that both "Watershed Treatments" and "Other Lake Protection/Restoration Controls" include practices used to abate pollution in many lake watersheds before water quality declines to such a point where restoration is initiated. For example, a property owner may obtain a permit under the State's Natural Resources Protection Act - Permit by Rule program to apply riprap to 100 feet of shoreline.

Table 3-4.7 lists completed restoration projects and Table 3-4.8 lists current restoration projects. It should be noted that completion of restoration projects is only meant to imply that the tasks originally envisioned in the Maine workplan have been carried out. Our experiences, however, have illustrated that lake restoration is not a permanent, complete or irreversible process. In a number of instances (i.e., Annabessacook Lake, Lovejoy Pond, and Threemile Pond), refinements in assessment techniques or changes in watershed conditions may prompt re-examination of these projects for future additional work. Under "Type", Phase I projects are Diagnostic Feasibility Studies, Phase II projects are Restoration Implementation Projects and Phase III projects are Post Restoration Monitoring Projects.

Currently, Maine's primary management emphasis is placed on lake protection and technical assistance rather than restoration (see previous section, 'Control Methods'). With no support from either State funds or Section 314 of the CWA, no new restoration efforts have been undertaken during the 1994-95 period. Even if restoration funds were available, projects that benefit one or two lakes would divert resources from more vital work. The use of NPS funds for expensive in-lake projects is also difficult to justify given the statewide need for nonpoint source projects. Maine continues to promote and support watershed remediation and local planning/pollution prevention for lakes as a restoration tool.

Table 3-4.7. Completed Maine Lake Restoration Projects.

Annabessacook Lake, Cobbossee Lake and Pleasant Pond (Litchfield, Manchester, Monmouth, West Gardiner & Winthrop)
Type: Phases I and II

Chickawaukie Lake (Rockland & Rockport)
Type: Phases I and II

Cochnewagon Lake (Monmouth)
Type: Phases I, II and III

Estes Lake (Alfred & Sanford)
Type: Other

Haley Pond (Dallas Plantation & Rangeley)
Type: Other

Lovejoy Pond (Albion)
Type: Phase I

Madawaska Lake (Westmanland & T16 R4 WELS)
Type: Phase I

Sabattus Pond (Greene, Sabattus & Wales)
Type: Phases I and II

Salmon Lake (Belgrade & Oakland)
Type: Phases I and II

Sebasticook Lake (Newport)
Type: Phases I and II

Togus Pond (Augusta)
Type: Phase I

Table 3-4.8. Active Maine Lake Restoration Projects.

China Lake (China & Vassalboro)

Type: Phases I and II

Funding: EPA Clean Lakes Program ($313,375), Maine Lake Restoration and Protection Fund, USDA/ASCS cost-sharing, Town and local contributions, including the China Lake Association, Maine Soil and Water Conservation Commission (Challenge Grant), MDOT (ISTEA), CWA Section 319, Maine State Board of Education, HUD Community Block Grant, NSF/Crest Program and in-kind services by the DEP, Kennebec County Sheriff's Department, the local Soil and Water Conservation District, and by volunteers.

Problems: Nonpoint source pollution related to development and land use practices, shoreline and streambank erosion, internal phosphorus recycling, algal blooms

Management Measures: This project, as designed in 1988, consisted of three phases: reduction of major nonpoint sources of erosion (and resultant phosphorus loading), adoption of a long-term lake protection strategy and the reduction of internal phosphorus loading through nutrient precipitation/inactivation. The first phase incorporates the results of a citizen survey followed up by professionals contacting landowners to offer technical assistance and cost-sharing to reduce external nutrient loading. The second phase stresses public awareness and analysis of local land use practices including Town policies on code enforcement, road maintenance, etc., for long-term water quality protection. Substantial progress has been made in remediation of nonpoint sources in the watershed. A large number of sources have been corrected by means of innovative labor sources (Town Conservation Corps., Kennebec County Sheriff's Dept. use of short-term prisoners etc.) and a variety of funding sources multiplying local dollars to complement CWA Section 314 funding support. The Town was awarded a $250,000 MDOT/ISTEA grant for road-related phosphorus control and a CWA Section 319 grant for innovative stream stabilization technique demonstrations. The Town of China has adopted a Phosphorus Control Ordinance and the Town of Vassalboro Comprehensive Plan calls for the implementation of an ordinance in the near future. The sediment phosphorus precipitation/inactivation portion of the project will be removed from the workplan due to the very high cost and uncertain long term effectiveness. In addition, several questions regarding the technical feasibility were raised in a recent project review by DEP staff.

A regional group, The China Region Lakes Alliance (CLRA) has been formed to promote non-point source control and lake protection in the watersheds of China Lake and Webber-Threemile ponds. Member of this consortium include the three lake associations, the Towns of Vassalboro, China and Windsor and the Kennebec Water District. Workplans for 1996 and 1997 have been drawn up as an extension of the original China Lake Restoration Project. In addition to watershed activities, education/outreach and establishment of a permanent staff and local support are part of the work plan.

Table 3-4.8. (continued) Active Maine Lake Restoration Projects.

Long Lake and Cross Lake (St. Agatha, T16 R5 WELS, T17 R3 WELS, T17 R4 WELS, & T17 R5 WELS)

Type: Regional diagnostic work complete. Minor Project elements continue.

Funding: USDA/ASCS Special Watershed Project, EPA 319 Nonpoint Source Control Program, Maine Lake Restoration and Protection Fund, the University of Maine, the St. John Valley SWCD, the Fish River Lakes Water Quality Association, the Aroostook County RC&D, and USGS and Town of New Canada.

Problems: Agricultural NPS pollution, shoreline development, Town of St. Agatha wastewater discharge

Management Measures: Agricultural and shoreline development nonpoint sources have been identified as primary sources of water quality problems in these watersheds. The Conservation District has designated more than 40 high priority agricultural sites in the watersheds. At least 12 of these agricultural sites have received installation of innovative nutrient control wetland/pond systems. A research project assessing their design and effectiveness has been completed. An aggressive educational campaign by the area lakes association has been conducted over the last three years and continues render guidance of an Americorps volunteer. The DEP has designated staff with nonpoint source pollution control expertise to work in these watersheds. Water quality of Long Lake has been stable or slightly improved over that last several years, and Cross Lake, although still impaired, appears stable. NPS technical support continues to be provided by DEP, and selected NPS projects will be supported.

The Conservation District will continue building nutrient control structures, although in only a few sites, due to technical difficulties with several sites and limited staff resources. Lake monitoring has been curtailed for several years due to fiscal constraints and currently relies on volunteers. The Town of St. Agatha has constructed a diversion to eliminate wastewater discharge into Long Lake. In addition a limited cooperative diagnostic study of conditions in Daigle Pond (New Canada) was begun in 1995 and one 319 NPS project has been completed.

Threemile Pond (China, Vassalboro & Windsor)

Type: Phases I and II

Funding: EPA Clean Lakes Program ($130,000), State Lake Restoration and Protection Program, USDA Watershed Protection and Flood Prevention Act, local contributions and DEP in-kind services.

Problems: Agricultural nonpoint source pollution, road erosion, internal phosphorus recycling

Management Measures: This restoration project involved control of nonpoint sources of phosphorus and a phosphorus precipitation/inactivation alum treatment of the lake sediments in 1988 to control internal recycling of phosphorus. DEP continues to work with the towns and the lake association to resolve remaining major non-agricultural sources of phosphorus in the watershed, particularly from road erosion problems. Though water quality in the summer of 1989, following the alum treatment was very good, evidence suggests that internal recycling has returned to pre-treatment levels. The long-term effectiveness of the treatment was assessed in the final project report (January 1993), and additional analysis of the alum treatment was provided in a progress report on the China Lake project (November 1993). Monitoring will continue in 1996-97. Threemile Pond watershed will see continuing non-point source reductions as part of CRLA project. (See China Lake Narrative)

Table 3-4.8. (continued) Active Maine Lake Restoration Projects.

Webber Pond (Vassalboro)

Type: Phases I and II

Funding: EPA Clean Lake Program ($89,625), State Lake Restoration and Protection Fund, USDA Watershed Protection and Flood Prevention Act, Local contributions and DEP in-kind services.

Problems: Agricultural nonpoint source pollution, shoreline erosion, internal phosphorus recycling, algal blooms

Management Measures: Restoration project included control of agricultural nonpoint sources of phosphorus, reduction of shoreline erosion problems and control of internal recycling of phosphorus by enhanced seasonal drawdown, (requiring dam reconstruction). Since dam reconstruction in 1985, the lake has exhibited reduced duration, frequency and intensity of algal blooms. Continued annual drawdown by the Lake Association should result in further improvement of water quality. Monitoring will continue in 1996-97. Webber pond watershed will be continuing non-point source reductions as part of CRLA project (see China Lake narrative).

Assessment of Attainment Status

Contact: Linda Bacon, DEP BLWQ, Division of Environmental Assessment, (207) 287-7749.

A determination of impairment is based on failure to attain Clean Water Act goals or State Statutory goals (Class GPA and support of designated uses). Assessment for the Clean Water Act interim goals of fishable and swimmable has been combined with assessment of designated uses. The fishable goal is now reported under the designated uses of fish consumption, shellfishing, and aquatic life support. Likewise, the swimmable goal is reported under swimming and secondary contact. Other designated uses assessed in this report include drinking water supply and agriculture. The Maine Water Classification Law specifically designates all of these uses for lakes except shellfishing and agriculture. State standards also specify suitability for the designated uses of industrial process and cooling water, hydroelectric power generation, and navigation. All significant lakes are assumed to support these designated uses because there has been no indication of impairment or potential impairment. Therefore, no specific assessment has been pursued with respect to these last three uses.

The State of Maine lake classification standards indicate that lakes "shall have a stable or decreasing trophic state". Thus, we are including 'Trophic Stability' under State-defined uses. Although this category is technically a condition rather than a designated use, lakes failing to support this condition are considered impaired and are treated the same as lakes having designated use impairments.

Attainment of designated uses common to both State and Federal programs in lakes, based on chemical data and other indicators, has been assessed as follows:

I. Fish Consumption

Supporting: No fish consumption advisories in effect.

Supporting but threatened: Statistical modeling predicts that a particular type of lake or geographical area is more likely than other types of lakes or lakes in other areas, to have a fish consumption advisory in the future.

Partially Supporting: "Restricted Consumption" fish advisory or ban in effect during the reporting period for the general population or a subpopulation that could be at potentially greater risk (e.g., pregnant women, children). Restricted consumption is defined as limits on the number of fish of one or more species consumed per unit time. The limit on number consumed often varies with fish size.

Not Supporting: "No Consumption" advisory or ban in effect for the general population, or a subpopulation that could be at potentially greater risk, for one or more fish species.

Not Attainable: "No Consumption" advisory or ban in effect for the entire human population and all fish species; no practical remediation for the source of contamination in the foreseeable future.

II. Aquatic Life Support

Supporting: Lakes that exhibit no dissolved oxygen (D.O.) impairment, turbidity or extreme water level fluctuations that would reduce the viability of an indigenous fishery or other aquatic life.

Supporting but Threatened: Lakes indicated by vulnerability modeling to be at risk for phosphorus enrichment, and thus an increasing trophic trend, are also considered at risk for dissolved oxygen impairment if the lakes are sufficiently deep.

Partially Supporting: Lakes that exhibit oxygen impairment that would reduce the viability of an indigenous fishery or other aquatic life. D.O. impairment is defined as greater than 50% of the metalimnion/hypolimnion (total depth of > 5 meters) having D.O. concentrations of less than 3 parts per million (ppm) during a monitored period. Further work needs to be done to identify lakes that naturally develop anoxic profiles, such as highly colored lakes, kettle hole ponds or moderately productive lakes with a small metalimnion/hypolimnion volume and little watershed disturbance. Regardless of whether these lakes experience natural or culturally induced oxygen deficits, this condition can promote internal phosphorus recycling, making such lakes particularly sensitive to increased nutrient loading. Also considered partially supporting are lakes having severe turbidity and lakes that experience extreme water level fluctuations.

Not Supporting: Lakes that have experienced complete loss of an indigenous species due to severe D.O. depletion, severe turbidity, or extreme water level fluctuations.

Not Attainable: Lakes that have experienced complete loss of all indigenous species due to severe D.O. depletion, severe turbidity, or extreme water level fluctuations where remediation is not practicable.

III. Swimming

Supporting: Lakes that do not exhibit repeated (at least two seasons) intense algal blooms.

Supporting but Threatened: Lakes indicated by vulnerability modeling to be at risk for algal blooms due to anthropogenic activity, and, lakes that have experienced one recorded algal bloom.

Partially Supporting: Lakes in which swimming is impaired during part of the recreational season due to culturally induced algal blooms. Bloom conditions are defined as Secchi Disk Transparency measurements of less than 2 meters in lakes having color less than 30 Standard Platinum Units (SPU). Lakes having color of 30 SPUs or greater are considered impaired if other trophic data or professional judgment indicates that elevated productivity is due to anthropogenic alterations.

Not Supporting: Lakes in which the use of swimming is totally lost due to culturally induced algal blooms.

Not Attainable: Lakes having algal blooms that are so severe that remediation is not practicable.

IV. Secondary Contact

Secondary Contact is considered to be fully supported as a designated use in all Maine lakes. There has not been any evidence to the contrary, therefore no specific attainment criterion for assessment exists.

V. Drinking Water Supply

Maine lakes fully support the designated use of drinking water supply. No drinking water supply closures or advisories have been in effect during the reporting period and no treatment beyond "reasonable levels" has been necessary.

Additional State Designated Uses:

VI. **Trophic Stability**

Supporting: Lakes exhibiting stable or decreasing trends in trophic state.

Supporting but Threatened: Lakes whose trophic stability is indicated by vulnerability modeling to be at risk due to anthropogenic activities.

Partially Supporting: Lakes exhibiting an increasing trend in trophic state.

Not Supporting: N/A

Not Attainable: N/A

VII. **Industrial Process and Cooling Water, Hydroelectric Power Generation, Navigation**

The suitability of lake water for the designated uses of industrial process and cooling water, hydroelectric power generation (quality not quantity) and navigation is considered to be fully supported in all Maine lakes. Because there has not been any reason to assume otherwise, no specific attainment criterion for assessment of these uses exists.

Impaired Lakes
Contact: Linda Bacon, DEP BLWQ, Division of Environmental Assessement, (207) 287-7749.

Evaluation of attainment status is based on occurrence of repeated algal blooms, evidence of hypolimnetic D.O. depletion, increasing trophic trend, or habitat alteration. Lakes which have bloomed during only one season have not shown a definite decline in water quality and thus are not considered impaired due to algal blooms. To date, 25.0% of the total lake surface area only partially supports Maine classification standards for uses other than fish consumption. This is a slight increase over the 1994 level of 24.4%. All Maine's lakes are considered as not supporting fish consumption due to mercury contamination.

Summaries for designated use support are included in Tables 3-2.1 and Tables 3-2.2 in Part III, Chapter Two: Assessment Methodology and Summary Data. Causes and Sources of non-attainment are listed in Tables 3-2.3 and 3-2.4 of the same section.

Table 3-4.9. Attainment Status for Designated Uses (other than fish consumption)[5] in Significant Lakes by Major Drainage Basin: number (acreage).

Basin	Lakes Fully Supporting Designated Uses	Lakes Partially Supporting Designated Uses[1]		
		Swimming[2]	Aquatic Life Support	Increasing Trophic Trend
St. John	223(64,098) 2 (85)[3]	11 (10,986)	20 (24,310)	2 (2,583)
Penobscot	702 (238,651) 6 (1,370)[3]	3 (646)	23 (16,008)	0 (0)
Kennebec	381 (145,132) 7 (1,095)[3]	23 (27,303)	48 (47,847)	4 (18,467)
Androscoggin	161 (56,822) 4 (413)[3]	4 (2,348)	30 (25,746)	1 (432)
E. Coastal	423 (164,418) 6 (2,264)[3]	6 (8,390)	38 (43,577)	1 (1,702)
W. Coastal	177 (49,794) 5 (586)[3]	4 (288)	50 (25,568)	3 (2,250)
All Basins	**2,066 (719,298)[4]** **31 (6,174)[3]**	**51 (49,961)**	**209 (183,056)**	**10(23,732)**

[1] Lakes assessed as partially supporting any designated use are considered Impaired. This includes lakes with multiple impairments, but does not include lakes impaired due to habitat alteration.
[2] Lakes that have experienced two or more seasons with algal blooms.
[3] Subset of lakes that have experienced only one season of algal bloom(s) is included in parentheses.
[4] Four lakes not currently assigned to any drainage basin are included in the total.
[5] All Maine lakes are designated as not supporting fish consumption due to a statewide fish consumption advisory that includes a consumption ban for sub-populations.

Table 3-4.9 summarizes attainment status of significant lakes by major drainage basin. Lakes are considered Impaired if they are assessed as partially supporting for any designated use. Lakes with multiple impairments may be listed in more than one column in Table 3-4.9, therefore the three columns listing Impaired lakes are not additive. Lakes Impaired by habitat modification are not included in Table 3-4.9.

Table 3-4.10 includes detail on current water quality trends for the 5.2% of lake acreage supporting repeated algal blooms (trend analysis does not include D.O. evaluations). Assignment of trends is done by professional inspection and evaluations of the data set. Previous statistical trend analyses of changes in transparency have not been significant, in part due to the large variability of seasonal/yearly data and, in some cases, due to small data sets. At this time, it is not possible to separate out those lakes which are highly productive by nature and would not necessarily violate Maine designated use standards. However, given the location of many of the

51 lakes having repeated algal blooms, and the degree to which their watersheds have been disturbed, it is likely that relatively few of these lakes are naturally eutrophic.

Table 3-4.10. Detailed Breakdown of Designated Use Attainment Status in Maine (uses other than fish consumption).

Category	Trend	Number of Lakes	Acreage	% of Total Acreage
Repeated Algal Blooms	Deteriorating	6	7,656	0.8%
	Stable	25	21,506	2.2%
	Improving	3	4,595	0.5%
	Unknown	17	16,204	1.7%
	Subtotal	51	49,961	5.2%
Hypolimnetic D.O. Depletion[1]		187	158,996	16.6%
Increasing Trophic Trend[2]		3	4,205	0.4%
Habitat Alteration/ Hydropower Drawdown		2	26,748	2.8%
Subtotal Partially Attaining GPA		243	239,910	25.0%
Subtotal Attaining GPA[3]		2,066	718,866	75.0%
Total Assessed for GPA Attainment		**2,314**	**958,886**	**100.00%**

[1] Trends for lakes having D.O. depletions are not enumerated; lakes having algal blooms as well as D.O. depletion are included in "Repeated Algal Blooms".
[2] Lakes exhibiting an increasing trophic trend in addition to algal blooms or D.O. depletion are included in either "Repeated Algal Blooms" or "Hypolimnetic D.O. Depletion", rather than here.
[3] Number and acreage from Table 3-4.9, above.

All Maine lakes are considered as not supporting fish consumption due to mercury contamination. On May 18, 1994, the Maine Department of Human Service's Bureau of Health issued an advisory warning pregnant women, nursing mothers, women who may become pregnant, and children under 8 years of age not to consume fish from lakes and ponds in the state. Other people are advised to limit consumption of fish from these waters to 6-22 meals per year, depending on fish size. This advisory was issued following the assessment of fish from 125 lakes in 1993 and 1994 under the EPA funded Regional Environmental Monitoring and Assessment Program (REMAP).

The REMAP project was undertaken by the DEP with help from the Maine Department of Inland Fisheries and Wildlife, the Maine Department of Human Services, the University of Maine at Orono and EPA. The study lakes were selected from a population of about 1800 surveyed lakes and ponds with significant sport fisheries using EPA's EMAP protocol. The experimental design was such that results could be applied to the entire population of surveyed lakes. Eighty-one of the 125 lakes (65%) had fish tissue mercury levels of 0.43 ppm, the state level of concern, or greater. The results are being examined further in attempt to refine the advisory. Contact: Barry Mower, DEP BLWQ, Division of Environmental Assessment, (207) 287-7777.

The largest percentage of lake acreage classified as partially attaining designated uses, 16.6% (19.1% if lakes also supporting algal blooms are included), is attributed to anoxic conditions, presumably due to allochthonous organic loading or algal productivity. It is important to note that this group may contain a substantial number of lakes which, due to morphometry or natural watershed characteristics, develop hypolimnetic anoxia in late summer. Further analysis is needed to distinguish these lakes from those in watersheds significantly altered by cultural activity. For example, when the direct watersheds of 681 lakes with some dissolved oxygen data were examined for their degree of human influence, about 460 had low or very low disturbance ratings. This was done by examination of topographic maps combined with some professional knowledge of the watersheds. It is thus a limited basis for evaluation and cannot adequately account for such effects as agricultural impacts or recent disturbance for which adequate geographic data are not available. Approximately half (111) of the 212 lakes (183,030 acres) currently assessed as being impaired due to low oxygen conditions have been thus rated for their degree of watershed disturbance. Of those, 36 watersheds have been rated as having very little, and 15 as having slight, human disturbance (16,671 and 7,515 acres respectively). This suggests that a significant number of these lakes experience at least some natural occurrence of low oxygen conditions. This is the topic of current research funded in part through Section 104(b)(3) which is expected to be completed in early 1997.

Of the 209 lakes assessed as partially attaining use support for fisheries due to summertime hypolimnetic anoxia (including those supporting algal blooms), 61 (23,028 acres) are managed by DIFW for warm water fisheries only. DEP has not determined to what extent these lakes might support cold water fisheries if D.O. depletion were not a factor, however, it is assumed that habitat for benthic invertebrates has been reduced.

An analysis of the causes and sources of water quality impairment of these lakes is summarized in Part III, Chapter 2 of this report and by waterbody in Chapter 6, Table 5, of Appendix I. It should be noted that in most cases this is based on personal knowledge of staff and as such does not reflect detailed evaluations of each lake or waterbody. Furthermore, assignment of nonpoint source categories to "high" or "moderate" status can obscure the true level of impact of a particular source category. This is especially true for those lakes for which several sources, including natural ones, are unknown at this time. In several watersheds, notably those having diagnostic studies or restoration projects conducted, fairly detailed assessments have revealed the diverse nature of nonpoint source impacts and their changing nature through time. A number of non-attainment lakes are substantially affected by internal nutrient recycling which may be the result of historic, but not necessarily current, land use effects.

Of all significant lakes, six (110 acres) have not been assessed for designated use support due to lack of data and four lakes (61 acres) are not currently assigned to any major drainage basin. Of the 5,785 lakes in the state, 3,471 have not been assessed in this report, regardless of significance.

Despite the large number, the "unassessed" lakes make up only 2.8% of the 986,776 acres of all Maine lakes. Most of the lakes which have not been assessed are very likely to fully attain GPA standards and fully support their designated uses. This is due to low rates and densities of development in many of the watersheds, especially those of the more remote lakes. The extent to which water quality is altered by transient land use changes (e.g., clear-cut forestry practices) has not been assessed, particularly in remote areas. Most of the 5,785 lakes are believed to attain bacteriological standards for the protection of swimmers and biological standards for the protection of habitat with the possible exception of low dissolved oxygen due to natural causes.

Threatened Lakes

Contact: Linda Bacon, DEP BLWQ, Division of Environmental Assessement, (207) 287-7749.

Threatened Maine lakes are listed by major drainage basins in Table 3-4.11. Threatened status is applied to lakes that have experienced one algal bloom or are categorized as Threatened by use of the Vulnerability Index. The Vulnerability Index is a broad-based predictive model which uses the hydrological characteristics of a lake and rate of watershed development to predict the rate at which mean lake phosphorus concentration will increase over time as a result of watershed development. Since the index relies on many broad assumptions, its information is of limited value on a lake-specific basis. It does, however, evaluate a large number of lakes with a limited database. Since its assumptions are consistent, it gives a valuable relative indication of how significant the future cumulative impact of development on Maine lakes may be.

Table 3-4.11. Threatened Lakes by Major Drainage Basin: number(acreage).

Basin	All Threatened Lakes	Significant Threatened Lakes	Significant Unimpaired Threatened Lakes
Unknown[1]	4 (42)	2 (37)	2(37)
Saint John	3 (164)	3 (164)	0 (0)
Penobscot	58 (13,477)	52 (13,450)	39 (10,444)
Kennebec	86 (21,795)	77 (21,742)	51 (5,840)
Androscoggin	50 (17,564)	46 (17,538)	27 (6,056)
East Coastal	124 (25,532)	113 (25,466)	87 (8,883)
West Coastal	170 (29,602)	137 (29,448)	94 (7,151)
All Basins	**495 (108,176)**	**430 (107,845)**	**300 (38,411)**

[1] not currently assigned to any drainage basin.

Maine uses the VI to identify, for the purposes of this assessment, a subset of lakes where water quality is most threatened. The lakes that are assigned Threatened status are those for which the index predicts a "perceivable" increase in trophic state over a 50 year period, and hence potential for violation of class GPA standards. In past assessments, DEP had defined "perceivable" increase in trophic state as a 1 ppb increase in mean lake phosphorus concentration. Since 1990, that definition has expanded to consider current water quality and morphometry of each lake.

Maine lakes have been classified into one of six water quality categories based on both current water quality and sensitivity to change (Table 3-4.12). The sensitivity of the trophic state of a lake to absolute increments in lake phosphorus concentration is assumed to be different for each of these categories. For example, Moderate/Sensitive lakes are considered more sensitive than Moderate/Stable because of their high potential for internal recycling of phosphorus and hence, the higher risk of an algal bloom. Lakes with inadequate data were assigned the default category of "Moderate/Sensitive". Lakes in each of these categories are considered threatened if the predicted increase in mean phosphorus concentration over a 50 year period is equal to or greater than the following:

Outstanding	0.50 ppb
Good	1.50 ppb
Moderate/Stable	1.25 ppb
Moderate/Sensitive	1.00 ppb
Poor/Restorable	0.50 ppb
Poor/Non-restorable	---

The Vulnerability Index, as currently structured, does not assess rates of change in nutrient loading attributable to land use alterations other than development, because the index is based on the rate of increase of tax-assessed structures during the 1984-86 period. Recently, the greatest change in many Maine watersheds has been in cottage lot and residential development. Lack of an adequate, accessible data base on land use changes in such categories as agriculture and silviculture makes modeling nutrient budgets for these components difficult on a per-watershed basis and virtually impossible on a statewide basis. Future model refinements may include these and other land use categories as well as non-cultural watershed features. In addition, the local planning process will frequently incorporate new information which will refine the status of a number of lakes. This, coupled with a re-evaluation of post-1986 development, will result in continuing revision of the Threatened category.

Of the 44 lakes (17,007 acres) with only one recorded season of algal bloom(s), 21 are rated as Threatened by either the VI criterion (16 lakes) or are impaired by hypolimnetic anoxia (11 lakes). The remaining 23 lakes (11,686 acres) were documented through the volunteer monitoring system.

Of the 242 lakes listed as Impaired, only 102 (42%) are also assessed as Threatened under the vulnerability criteria detailed above. This is an indication that, while rates of development and attendant nutrient loading may be important predictors of future eutrophication, more detailed knowledge of the watershed of each lake is necessary to predict the occurrence of such problems.

Table 3-4.12. Water Quality Categories of Maine Lakes for Planning Purposes.

Outstanding: Lakes in this category are very clear with an average secchi disk transparency (SDT) greater than 9.1 meters (30 feet), have very low algae levels (chlorophyll a < 2 ppb) and have very low phosphorus concentrations (2 to 5 ppb). These lakes are rare and unique resources which are particularly sensitive to small increases in phosphorus concentration.

Good: Lakes in this category are clear with average SDT of 6.1 to 9.1 meters (20 to 30 feet) with relatively low algae levels (chlorophyll a of 2 to 4 ppb) and phosphorus concentrations ranging from 5 to 10 ppb. This water quality type is common, particularly among the larger lakes in the state.

Moderate/Stable: These lakes are less clear with average SDT of 3.1 to 6.1 meters (10 to 20 ft.) but do not have summer algal blooms (minimum SDT is greater than 6.6 feet). Algae levels are moderate (chlorophyll a of 4 to 7 ppb) as are phosphorus concentrations (10 to 20 ppb). Despite their relatively high nutrient and algae levels, lakes in this category do not appear to have a high risk of developing algal blooms because of (1) high water color (>30 SPU), (2) consistently high summer oxygen levels in the metalimnion, and/or (3) very stable algae and nutrient levels with little seasonal variation.

Moderate/Sensitive: These lakes exhibit clarity, algae and nutrient levels similar to the moderate/stable lakes, but have a high potential for developing algal blooms because of significant summertime depletion of dissolved oxygen levels in the hypolimnion and/or large seasonal fluctuations in algae and nutrient levels. Many lakes fall into this category because of their high risk of having significant water quality changes due to small increases in phosphorus concentration.

Poor/Restorable: Lakes in this category support obnoxious summer algal blooms, have minimum SDT less than 2 meters (6.6 feet) and are candidates for restoration. Land use practices in their watersheds should be treated very conservatively because any additional phosphorus loading will reduce the feasibility of restoration. There are 20 to 30 lakes in the state which fall into this category.

Poor/Non-restorable: These lakes have a long history of obnoxious summer algal blooms and little public interest in recreation. Restoration is not considered feasible because they are small lakes with very large, highly agricultural watersheds where the only possibility for restoration would require elimination of agricultural activities throughout much of the watershed. To date, no lakes have been placed in this category and assignment to this group of any lake would require significant study.

It is also recognized that current conditions often reflect historic land use patterns. Time lags in lake response make vulnerability assessments extremely valuable as a general planning tool. Lake-specific information concerning Threatened lakes is listed in Chapter 6, Table 6, of Appendix I.

Acid Effects on Lakes

Contact: Linda Bacon, DEP BLWQ, Division of Environmental Assessment, (207) 287-7749.

Estimates place the number of non-dystrophic Maine lakes which are currently acidic (Acid Neutralizing Capacity or ANC < 0 microequivalents $CaCO_3/l$) at less than 100. Although all Maine surface waters that have had their acid-base chemistry analyzed show increased non-marine sulfate concentrations resulting from acidic deposition, only a portion of known acidic lakes can be considered as having been predominantly affected by atmospheric deposition.

During the 1980s, the effects of acidic deposition were the focus of numerous projects. The 1984 EPA Eastern Lake Survey (ELS) population (225 lakes) was chosen such that statistical inferences about the extent of acidic deposition effects could be made for lakes throughout the state. ELS projected that between 8 and 21 Great Ponds were acidic in the State of Maine. The DEP has evaluated lake populations (pH and ANC) potentially susceptible to the effects of acidic precipitation: 91 high elevation lakes in chemically resistant bedrock were assessed in the High Elevation Lakes Monitoring (HELM) project, and 128 seepage lakes in or associated with mapped aquifers were assessed in the Aquifer Lakes Pilot Survey (ALPS) project. Data have also been obtained from the EPA Long Term Monitoring (LTM) lakes at the University of Maine/DEP Tunk Watershed Site (8 lakes including lakes in adjacent sites) and from numerous University of Maine projects focusing on effects of acidic precipitation (188 lakes). In addition, the DEP has evaluated alkalinity data on 520 lakes as part of routine sampling to assess trophic status.

It is important to note that assessment of lakes for acidity has not been a priority for this state's limnological investigations over the past 6 years. Data collected from investigations done in the past reside in numerous files at various locations across the state, so it is difficult to report any numbers or acreage that are better than estimates. We have not made any effort to enumerate lakes vulnerable to acidity other than focusing the HELM and ALPS studies on lake populations at high risk. It is likely, however, that we would categorize all lakes situated in areas of bedrock and surficial geology having low to no acid neutralizing capacity, as being vulnerable to acidity.

Approximately 1,005 lakes (an estimated 713,397 acres) have been assessed for acidity, predominantly by using measures of pH and ANC. There are about 60 acidic lakes (ANC < 0) comprising a total surface area of 707 acres (1.0% of the lakes and 0.06% of the lake surface area in the state). Twenty acidic lakes are at least ten acres or greater in size and are considered "significant"; the remainder are at least 1 acre in size. According to the Eastern Lake Survey, there are probably only a few unsampled acidic lakes greater than ten acres in size. There are likely some (probably less than 50) additional non-dystrophic acidic drainage and seepage lakes in the 1 to 10 acre size range. Table 3-4.13 summarizes acid effects on lakes.

Sources of acidity include acidic deposition, naturally occurring organic acids and a combination thereof, as determined by an assessment of dissolved organic carbon (DOC) and non-marine sulfate concentrations. Acidic, low DOC (< 5 mg/L) drainage and seepage lakes are acidic largely due to acidic deposition and account for approximately 60% of acidic lakes. Acidic, high DOC drainage lakes are acidic due to a combination of naturally occurring organic acids and acidic deposition, and account for approximately 10% of acidic lakes. Acidic, high DOC seepage lakes (approximately 30%) are acidic primarily due to naturally occurring organic acids. No low DOC lakes are known with a pH less than 4.9 suggesting that organic acidity is necessary to depress pH to values of less than 5.0. Table 3-4.14 illustrates source estimates for high acidity in Maine lakes.

Table 3-4.13. Acid Effects on Maine Lakes*.

	Number of Lakes	Acreage of Lakes
Assessed for Acidity	1005	713,397
Impacted by High Acidity	60	707
Vulnerable to Acidity	unknown	unknown

*Totals include all lakes in the state, not only 'significant' lakes.

Table 3-4.14. Sources of High Acidity in Maine Lakes*.

	Lakes Impacted	
Source	Number	Percent
Acid Deposition	36	(60%)
Natural Sources	18	(30%)
Combination of Acid Deposition and Natural Sources	6	(10%)

*Totals include all lakes in the state, not only 'significant' lakes; total area impacted is estimated as 707 acres - we have not attempted to determine acreage for each source category due to the unavailability of data.

The extent of aluminum mobilization due to increased acidity is dependent on the presence or absence of substances which bind aluminum such as, DOC and fluorine. Greatest aluminum toxicity has been observed between a pH of 5 and 6 and only a few of the numerous ionic species are biologically toxic. Table 3-4.15 lists 58 acidic lakes categorized by the total aluminum concentration in ug/l.

Table 3-4.15. Aluminum Distribution in Acidic Lakes in Maine.

Total Aluminum (ug/l)	Number of Acidic Lakes
< 100	39
100 - 200	4
200 - 300	5
> 300	10

Total aluminum was determined on filtered (0.4 um), acidified samples according to EPA protocols established for the ELS/LTM projects. No consideration is given to the form of aluminum, however, and a significantly lesser amount would be considered biologically available. Since 40% of the acidic lakes have high levels of DOC, it can be inferred that biologically available aluminum is less likely to attain toxic levels in those lakes.

Historical data on fisheries is limited for all but a handful of the acidic lakes. Temporal shifts in fish populations have been observed in some lakes, but there is no clear association between these shifts and acidic deposition. Although a number of the acidic lakes are fishless, none have been shown to have lost their fish due to acidification. Thus all are considered to be fully supporting uses. Many of the fishless lakes are small and isolated, or exist at high elevations, with poor breeding habitat.

Paleolimnological investigations in New England have shown that some lakes apparently have become acidified within the past 20 to 50 years. Most are inferred to have had a pH of less than 6 in prehistoric times. Therefore, only lakes that currently have a pH less than 6 are considered to be at risk. Existing data suggest that at current levels of acidic deposition, fewer than 100 Maine lakes are potentially at risk of further acidification. However, the only long-term data from lakes with a pH between 5 and 6 suggests that their acid neutralizing capacity has increased since 1982. Thus it is possible that even fewer than 100 lakes are at risk.

A comprehensive treatise on the effects of acidic deposition on Maine's waters can be found in the EPA-sponsored text: "Acid Deposition and Aquatic Ecosystems: Regional Case Studies", edited by Donald Charles and published in 1991 by Springer-Verlag (ISBN 3-540-97316-8).

No attempt has been made to mitigate the effects of acidic deposition or potential toxic mobilization for the following reasons: 1) only a small percentage of surface water has been acidified by acidic deposition, 2) lakes affected by acidic deposition are typically small in surface area, 3) paleological evidence suggests that those lakes with depressed pH attributable to acidic deposition were historically low in pH as a result of inherent watershed characteristics, 4) no alteration of fish populations can be attributed to acidic deposition at this time, and 5) since a significant number of the acidic lakes are dominated by organic acidity, alteration of the buffering system (e.g., by the addition of lime) would drastically change the natural ecosystem.

Toxics

Contact: Barry Mower, DEP BLWQ, Division of Environmental Assessment, (207) 287-7777.

Fish, water and sediment samples were collected from 125 Maine lakes and ponds (108,423 acres) in 1993 and 1994 as part of the EPA funded Regional Environmental Monitoring and Assessment Program (REMAP). The study lakes were selected from a population of about 1800 surveyed lakes and ponds with significant sport fisheries using EPA's EMAP protocol. Significant levels of mercury were found in both warm and cold water fish. The average concentration was 0.45 ppm with fish from several lakes exceeding the US Food and Drug Administration action level of 1.0 ppm and 81 (83,071 acres or 77% of the sampled lake acreage) exceeding the state level of concern of 0.43 ppm.

Consequently on May 18, 1994, the Maine Department of Human Service's Bureau of Health issued an advisory warning pregnant women, nursing mothers, women who may become pregnant, and children under 8 years of age not to consume fish from lakes and ponds in the state. Other people were advised to limit consumption of fish from these waters to 6-22 meals per year, depending on fish size. Larger older fish generally have higher contaminant levels; a meal is considered to be 8 ounces. The level of concern of 0.43 ppm was determined from a risk based assessment conducted by a state toxicologist. Additional data for cadmium, lead, PCBs, DDT and derivatives and about 20 other pesticides are still being evaluated.

Trends

Contact: Linda Bacon, DEP BLWQ, Division of Environmental Assessement, (207) 287-7749.

The entire lakes data set has been evaluated for trends in water quality based on best professional judgment. Based on the quality, quantity and duration of data collected (primarily Secchi Depth Transparency), a trend statement was assigned to each of the 670 lakes in the data set. Table 3-4.16 summarizes the trend statement assignments. The trend statements categories are described as follows:

1. Inadequate data to determine trends

2. Improving trend:
   a. inadequate data/indication of improvement
   b. reasonable data/possible improvement
   c. strong data/probable improvement

3. Stable water quality:
   a. inadequate data/indication of stability
   b. reasonable data/possible stability
   c. strong data/probable stability

4. Declining trend:
   a. inadequate data/indication of decline
   b. reasonable data/possible decline
   c. strong data/probable decline

Table 3-4.16. Water Quality Trend Determinations for 670 Significant Maine Lakes.

Category	Number(%)	Acres	% Significant Lake Area
Data inadequate to determine trends	381(56.9)	304,501	31.8%
Improving trend	22(3.3)	14,014	1.5%
Stable water quality	241(36.0)	415,018	43.3%
Declining trend	24(3.6)	19,928	2.1%
Total Assessed for Trends	**670 (100)**	**753,461**	**78.7%**

The "strong data/probable decline" category (increase in trophic state) includes 6 lakes which are considered as not attaining Class GPA standards. This number has increased by 1 since the previous reporting cycle. The DEP staff is confident that trends exhibited by lakes in this category are real and these lakes appear on the 1996 Impaired list. Four of the six would have been on the Impaired list regardless of their trend; the remaining 1 still supports its designated uses yet would otherwise have been on the threatened list. Six lakes were categorized as having "reasonable data possible decline". Four of these are on the 1996 Impaired list, the remaining 2 are on the 1996 threatened list.

Summary

The majority of Maine's lakes continue to be Mesotrophic, maintaining a moderate level of productivity. Major threats to the trophic state of Maine's lakes continue to be from Non Point Source pollutants. A fish consumption advisory issued in 1994 banned consumption for certain subpopulations and restricted consumption for all others due to elevated levels of mercury found in fish tissue. As a result, all Maine lakes are classified as not supporting fish consumption for the first time in the history of 305(b) reporting. This contamination was discovered in 1994 however the likelihood is that it existed prior to this. No attempt has been made to compare mercury levels in Maine's game fish to mercury levels in commercially available species of fish.

The percent of lake acreage partially supporting designated uses other than fish consumption, has increased from 24.4% in 1994 to 25.0%. Most of the lakes that make up the 0.6% difference just barely satisfied the impairment criteria. State lake biologists have been aware that the impairment criteria is in need of refinement when time and resources become available. For the most part, water quality in Maine lakes appears to be stable, however long term trends in lake water quality are difficult to assess. Maine's lake management efforts will continue to focus on preventative aspects such as education and regulation. Presumably lake assessment will return to higher levels when resources become available.

Chapter 5: Estuary and Coastal Assessment

Contact: John Sowles, Director, Marine Environmental Monitoring and Research Program, (207) 287-6110

Background

Assessment of estuarine and coastal water quality is done primarily by two state agencies; the Department of Marine Resources (DMR) and Department of Environmental Protection (DEP). The DMR conducts an extensive program that to monitor pathogen indicators and phytotoxins. The purpose of this program is to manage the risk of human illness due to consumption of contaminated fish or shellfish. The DEP's Marine Environmental Monitoring Program monitors and researches other water quality issues within the 5,500 miles of near-coastal waters. Three other projects also collect water quality information, although at a scale different than the State of Maine, generally on a site specific or project specific basis. The Casco Bay Estuary Project has supported several monitoring projects within Casco Bay. Maine's Shore Stewards Program supports a diverse array of volunteer monitoring groups that operate in specific embayments and estuaries. The Gulf of Maine Council's Gulfwatch Project surveys toxic contamination in coastal waters from Cape Cod to Yarmouth Nova Scotia. In addition to these, miscellaneous studies are conducted as part of permit applications, theses, special projects and academic instruction along the coast.

Five coastal health topics, including eutrophication, habitat modification, changes in living resources, toxics contamination and pathogen contamination, are discussed below.

Eutrophication

Eutrophication and the threat of eutrophication of Maine's coastal waters is controversial with inadequate empirical evidence available for assessment. Information regarding nutrient enrichment is needed throughout the state before intelligent decisions can be made with respect to nutrient management. Anecdotal evidence continues to suggest that Maine should be placing more emphasis in this area of research. For example, mass mortality of shellfish occurred in Maquoit Bay, Brunswick during 1988. Phytoplankton blooms in the Harraseeket Estuary, Freeport and Sheepscot River have been noted periodically. Hypoxia that resulted in lobster mortality was documented in Saco Bay in 1990.

In 1995, dissolved oxygen and salinity regimes were surveyed in 19 estuaries representing various combinations of tidal flushing and landside organic loading. This project is the first phase of a larger proposal to assess the threat of eutrophication in Maine coastal waters. Continuation and completion of this project should help predict water quality changes in reponse to changing hydrodynamic and human activities.

The Casco Bay Estuary Project

Contact: Casco Bay Estuary Project (207) 828-1043.

Background: Casco Bay is showing signs that population growth and rapid development in its watershed have damaged fragile habitats and lowered water quality. In 1990, the Bay was included in the National Estuary Program, which seeks to protect nationally significant estuaries threatened by pollution, development or overuse. The Casco Bay Estuary Project (CBEP) was established as a basin-wide approach to environmental management, focusing on problems including toxic pollution, habitat disruption and loss, nutrient enrichment and pathogen contamination..

Mission and Goals: The mission of the CBEP is to preserve the ecological integrity of Casco Bay and to ensure compatible human uses of the Bay's resources through public stewardship and effective management. With the help of state and federal agencies, municipalities, businesses, industries, researchers and concerned citizens, the CBEP is developing a Comprehensive Conservation and Management Plan which will protect and restore Casco Bay. The major goals of the project are:

1. To minimize adverse environmental impacts from the use and development of land and marine resources.

2. To minimize adverse environmental impacts from stormwater runoff and combined sewer overflows.

3. To minimize adverse environmental impacts from individual wastewater disposal systems.

4. To determine the effect of existing sediment contamination on the health of Casco Bay.

5. To promote responsible stewardship of Casco Bay and its watershed through increased public involvement.

Project Management: The CBEP seeks to involve a broad spectrum of interests, including the public, in environmental planning and decision -making. To achieve this participation, the Project has established a Management Committee which will oversee the Project, decide the specific work that will take place, and develop the Comprehensive Conservation and Management Plan. In addition to representatives from State agencies and the U.S. Environmental Protection Agency, the management committee includes members from each of three advisory committees; the Citizens Advisory Committee (CAC), the Technical Advisory Committee (TAC), and the Local Government Advisory Committee (LGAC).

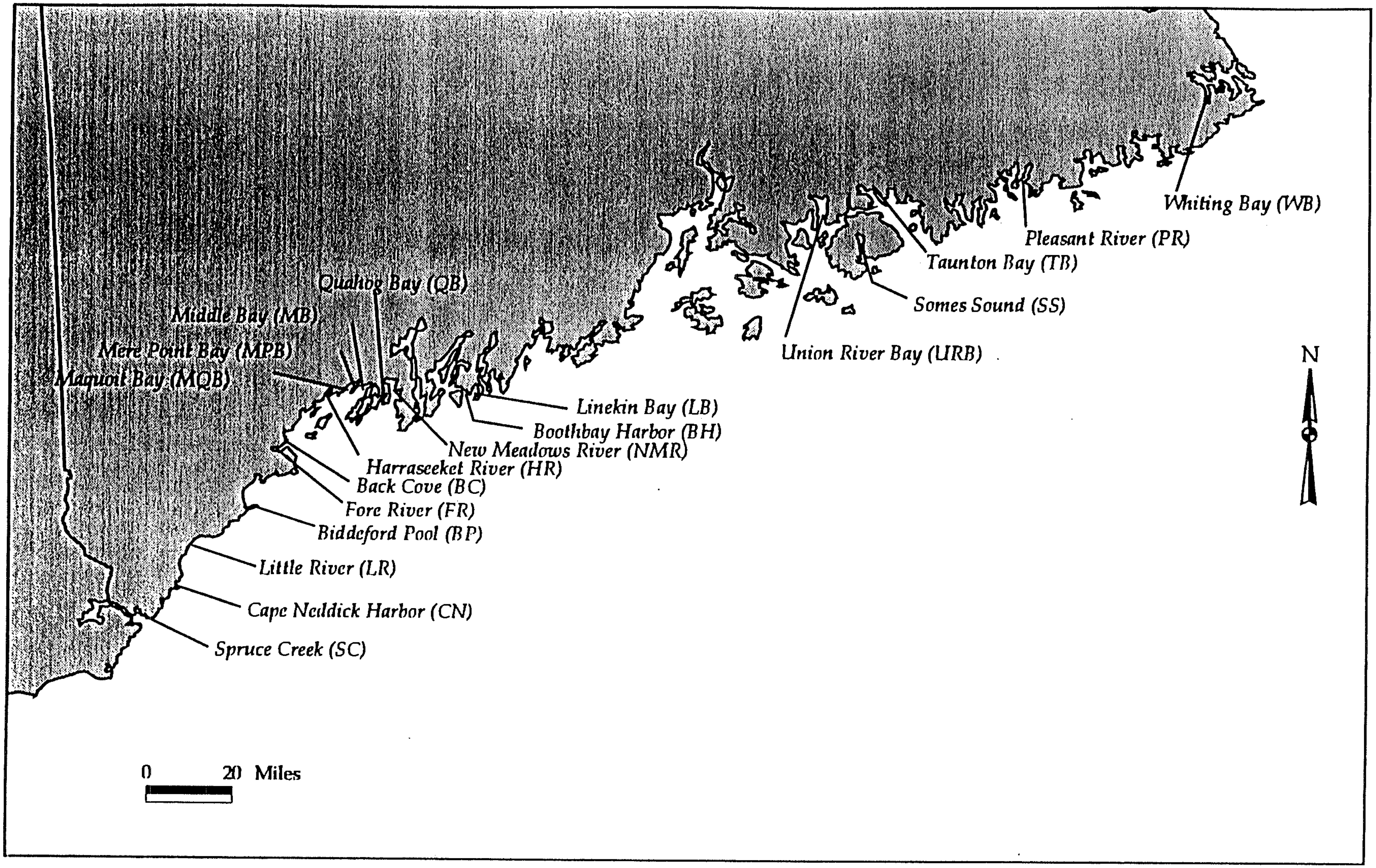
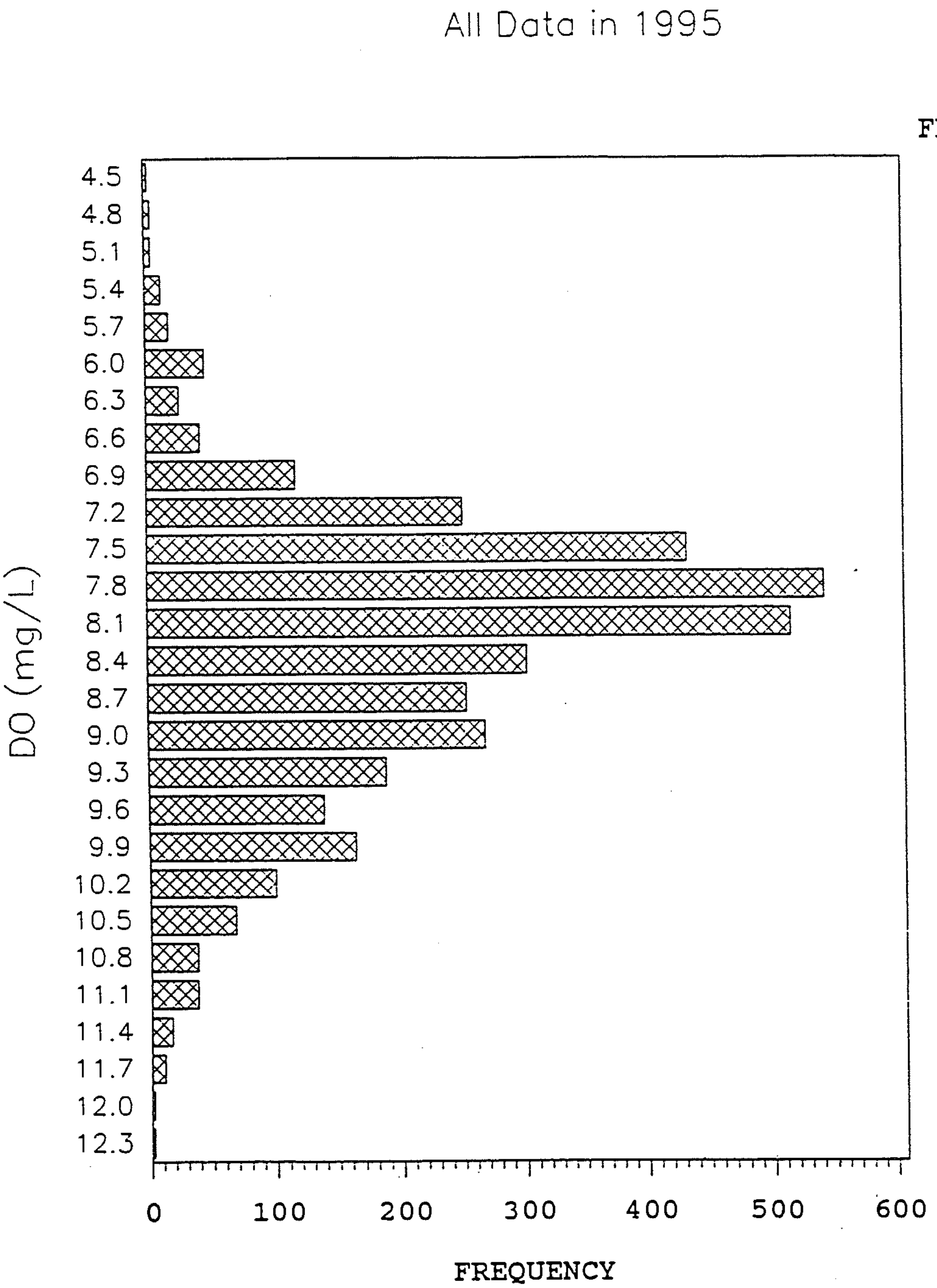


Figure 3-5.1. Maine Estuaries and Embayments: Selected Study Areas 1995.
Source: "Dissolved Oxygen in Maine Estuaries and Embayments", Draft Report, Task 3, byJohn R. Kelley and P. Scott Libby, Battelle Ocean Sciences, Duxbury, MA, January, 1996.



	FREQ.	PCT.
4.5	3	0.08
4.8	5	0.14
5.1	5	0.14
5.4	13	0.36
5.7	19	0.53
6.0	47	1.30
6.3	27	0.75
6.6	43	1.19
6.9	118	3.27
7.2	251	6.95
7.5	433	11.99
7.8	542	15.01
8.1	515	14.26
8.4	302	8.36
8.7	253	7.01
9.0	268	7.42
9.3	188	5.21
9.6	139	3.85
9.9	164	4.54
10.2	100	2.77
10.5	68	1.88
10.8	38	1.05
11.1	38	1.05
11.4	17	0.47
11.7	11	0.30
12.0	2	0.06
12.3	2	0.06

Figure 3-5.2. Frequency Distribution of all Dissolved Oxygen (mgL^{-1}) Data in 1995. Source: "Dissolved Oxygen in Maine Estuaries and Embayments", Draft Report, Task 3, byJohn R. Kelley and P. Scott Libby, Battelle Ocean Sciences, Duxbury, MA, January, 1996.

Case Study: Mousam River Estuary Project

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Background: An intensive water quality survey was conducted by DEP staff on the Mousam River Estuary during June, July and August 1995. Parameters included hydraulic measurements, dissolved oxygen/temperature/salinity profiles, chemical analyses of water samples, and biological oxygen demand (BOD). Treatment plant flows were provided by the Kennebunk Sewer District and river flows (hydro generation schedules) were provided by Kennebunk Light and Power and by Consolidated Hydro Inc. (CHI). These data were collected with the intention of developing a water quality model and subsequent waste load allocation.

Results: During the sample periods, the Kennebunk treatment plant was discharging below license limits for both flow and BOD5. Tides during the surveys were about midway between neap and spring. In spite of these conditions, dissolved oxygen standards were generally not attained at low tide. The results indicate a relationship among river flow, tide stage, algae concentration or attached plant density and dissolved oxygen in terms of percent saturation.

Recommendations: Under present river operations and at treatment plant discharge below existing license limits, dissolved oxygen standards for class SB are not being attained. Further work is required to determine acceptable loading scenarios. A change in river flow regime may result in some increase in assimilative capacity. Alternatives for determining assimilative capacity include complex modeling, simplified modeling (using average inputs and assumptions regarding minimum dissolved oxygen levels), and empirical approaches incorporating additional sampling under various "controlled" conditions (specifically river flow). Alternatives to a waste load allocation include relocation of the discharge and seasonal discharge.

Habitat Modification

Although Maine law strictly regulates alteration of coastal habitats, alteration is permitted contingent on mitigation. No assessment of alteration has ever been made nor has assessment of mitigation. Two recently completed projects may help with such assessement in the future. The Maine Intertidal Habitat Classification System uses a hierarchecal nomenclature based on physical habitat features. With such as system in place, it is possible to both quantify and qualify intertidal habitat thus making any alteration assessment more meaningful. Source: "A Clasification System of Marine and Estuarine Habitats in Maine: An Ecosystem Approach to Habitats. Part I: Benthic

Habitats", by Betsy Brown, Maine Natural Areas Program, Deptartment of Economic and Community Development, Augusta, Maine, 1993. The second project looked at wetland loss via the new Natural Resources Protection Act permitting system. Although this project focused on freshwater wetlands, it serves as a model for tracking coastal wetland loss. Source: "An Evaluation of Key Elements of Maine's Wetland Protection Program", by Francis Brautigam, Maine Department of Environmental Protection, Augusta, Maine, August 1995.

Changes in Living Resources

The Department of Marine Resources is responsible for commercial stock assessments. Assessment of non-commercial living resources is limited to occasional and specific academic studies, permit applications, and isolated anecdotal evidence. Although it appears that some areas of the coast, especially those in commercial navigation channels and/or near old industrial activity, have impacted biological communities, it is not known whether these apparent changes are due to physical habitat alteration or water quality changes. Furthermore, the State of Maine does not have biological community criteria to interprete its narrative water quality standards.

Toxics Contamination

Toxic contamination monitoring consists of that done by the Gulf of Maine Council on the Marine Environment, the Maine Dioxin Monitoring Program, the Casco Bay Estuary Project (CBEP), the Maine Coastal Program, and more recently the Surface Water Ambient Toxics Monitoring Program. Emphasis has been placed on collecting information on toxic contaminants in surficial sediment, blue mussel and lobster tissues. Currently, a consumption advisory for lobster tomalley is in effect for the entire Maine coast due to dioxin. The dioxin advisory is discussed more fully in Chapter 7 (Public Health and Aquatic Life Concerns).

Sediment: Although a quantitative characterization has never been done, some general patterns are obvious. With a few exceptions, these studies indicate that levels of heavy metals, chlorinated compounds, and hydrocarbons are higher in fined grained sediments and in areas below high human densities, such as the mouths of major rivers and ports. Polycyclic aromatic hydrocarbons (PAHs) are especially high where petroleum is handled: marine terminals, marinas, and urban areas. Polychlorinated biphenyls (PCBs), tributyl tins (TBT) from antifouling paints and DDT products, though not available for 20 years, continue to be present coastwide though more so near centers of commerce and industry. Dioxins in sediments have only been monitored in Casco Bay, where higher concentrations correspond to the mouth of the Presumpscot River and the eastern portion of the bay which appears to be a depostional area of the Kennebec River. Subtidal sediment quality has been described from various surveys (Table 3-5.1).

Biological effects from sediment contamination has been poorly assessed. From literature values, it appears that in a few areas (Table 3-5.2) levels are comparable to those in other studies where biological effects were noted (Long, Edward R. and L.G. Morgan, 1990. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NOS OMA 52, Seattle, Washington.).

Case Study: Contaminants in Casco Bay Sediments

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Background: When scientists first examined the sediments of Casco Bay in 1980, they discovered a broad array of toxic contaminants in what had been considered a relatively uncontaminated environment. Further studies of the Casco Bay floor were conducted in 1989, 1991, and 1994 to determine the types, sources, and locations of toxic pollutants.

Findings: Two classes of organic chemicals, PCBs and PAHs, are present at potentially toxic levels to bottom-dwelling animals in the inner Fore River of Casco Bay. Four heavy metals (lead, cadmium, mercury, and silver) are considered "high" in some locations, especially in Portland Harbor. DDT and chlordane, two banned pesticides, can still be found in the bay. Butyltins, dioxins, furans, and PCBs were detected in sediments from all areas of Casco Bay in 1994.

Bottom-Dwelling Animals: Bottom-dwelling ("benthic") animals that would be expected to occur in Back Cove are missing, potentially due to such factors as oil-related contaminants, heavy metals, combined sewer overflow discharges, sedimentary disturbances, or a combination of factors. Benthic life in the inner Fore River has been dramatically impaired.

Fisheries: Sediment contamination can have serious ramifications for fisheries and marine life in Casco Bay. Fish and crustaceans can absorb toxics directly by exposure to contaminants in the water, and indirectly by eating contaminated food, particularly bottom-dwelling organisms.

Wildlife: Mammals and birds that feed on benthic organisms or fish may absorb concentrated amounts of contaminants. Some of the tidal mudflats that represent the most important feeding areas for shorebirds, waterfowl, and wading birds also have the highest concentration of contaminated sediments in the bay.

Human Health: Various toxic pollutants concentrate in the liver, fat, and tissue of marine organisms, and may pose health risks to human consumers. With the exception of testing for dioxin in lobsters and mussels, there has been no risk assessment of potential health hazards from eating seafood from Casco Bay.

Table 3-5.1. Historic Sources of Data for Toxic Pollutants Along Maine's Coast

Location	Date	Matrix	Analytes	Sponsor	Notes
Montsweag Bay	early 70's	sediment	inorganics	Maine Yankee	License EIS
Blue Hill Area	1978	tissue/sediment	inorganics	DMR	Hurst et al. 1980 - found elevated levels around metal mines
Searsport	1978	tissue/sediment	hydrocarbons		follow up on Long Cove jet fuel spill
St. Croix Estuary	1979	mussels	inorganics	U. of Maine	Fink et al. - found elevated lead levels
Boothbay Harbor	1982	tissue	inorganics	NMFS	Serious lead contamination in crabs - no follow up
Casco Bay	1983-84	sediment	organics/inorganics	Bigelow Lab	Larson et al. - found hot spots of PAHs and metals
Penobscot Bay	1985	sediment	organics/inorganics	Bigelow Lab	Larson et al. - found hot spots of PAHs and metals
Saco Estuary	1984	tissue/sediment	inorganics	U. of Maine	M.S. thesis - focused on chromium
Boothbay Harbor	1986	tissue/sediment	inorganics	DEP	Maine Marine Monitoring Program - done in response to NMFS findings
Coastal	1980's	tissue	inorganics	DMR	20 miscellaneous sites for metals in clams, lobsters and mussels
50 coastal sites	1986-89	mussels	inorganics	DEP	Maine Marine Monitoring Program variability study
4 coastal sites	1986-88	sediment	inorganics	DEP	Maine Marine Monitoring Program
Portland	1988-91	mussels	TBT	Bowdoin	Gilfillan and Page - TBT gradient study in blue mussels
Bucksport	1990	tissue/sediment	organics/inorganics	AES	License EIS
Casco Bay	1991	sediment	organics/inorganics	Casco Bay NE	60 site characterization - confirmed DEP study of hot spots
Boothbay Harbor	1991	mussels	organics/inorganics	Gulfwatch	confirmed above studies - also found elevated DDE and PCBs
Medomak Estuary	1991	tissue/sediment	organics/inorganics	GTE	License EIS
Boothbay Harbor	1992	lobster	PCBs	DEP/DMR	follow up on PCBs in lobster meat and tomalley
Piscataqua Estuary	1992	tissue/sediment	organics/inorganics	U.S. Navy	Superfund activity
6 coastal sites	1991-92	mussels	organics/inorganics	Gulfwatch	Gulf of Maine Project
6 coastal sites	Ongoing	tissue/sediment	organics/inorganics	NOAA	Status and Trends/Benthic Surveillance

Tissues: Blue mussel soft tissue has been analysed from 63 sites along the Maine coast (Figure 3-5.3) over a period of ten years. Lobster muscle and hepatopancrease have been analysed from 18 sites along the coast (Figure 3-5.4) in 1994 and 1995. Results thus far have shown that levels of toxic contaminants measured are, with the exception of lobster tomalley for which a human health advisory has existed since 1992, well within the general human population screening values used to protect human consumers. Tomalley continues to contain levels of dioxins that exceed the DHS standard, and the recent SWAT results show that cadmium exceeds EPA screening values.

The Marine Environmental Monitoring Program has established *reference concentrations* for different contaminants in both mussel and lobster tissues. Sites that were tested because they were presumed to have elevated levels of toxic contaminants, were in fact found to be a mixture. Many sites indeed had levels of contamination above the Maine coastal norm yet many were not. Those that were elvevated generally were the most heavily developed ports and harbors and the mouths of major industrial rivers. Results continue to support the assessment that the Maine coast continues to have lower levels of contamination than other eastern states although localized areas of toxic contamination exist, especially around human population centers. Areas of concern are, at this point, limited to six areas of Maine's coast (Table 3-5.2).

Table 3-5.2. Marine and Estuarine Areas of Concern for Toxic Contamination.[1]

Location	Area
Piscataqua River Estuary	2,560 acres
Fore River	1,230 acres
Back Cove	460 acres
Presumpscot River Estuary	620 acres
Boothbay Harbor	410 acres
Cape Rosier	80 acres

[1] Based on professional judgement. Empirical evidence to conclude non-attainment or adverse impact is lacking. Biological standards must be developed to assess attainment and monitoring must be conducted to assess impact.

Pathogen Contamination

Contact: Paul Anderson, Department of Marine Resources, (207) 633-9500.

The Department of Marine Resources is responsible for ensuring the safety of harvested shellfish. They are responsible for closing areas of shoreline which have been determined to be contaminated with elevated levels of bacteria or toxics. These closings are based on water samples collected in shallow water along the shore. As of 1996, there were 230 closed shellfish areas, which is slightly less than in 1994. The closed areas encompass approximately 244,780 acres, (from high tide out to the three-mile limit), out of a total acreage of 1,825,008. The number of acres closed based on 1996 data represents 13.4% of all Maine tidal flats and waters with an additional 24,607 acres (1.3%) conditionally opened. Comparisons cannot be made with previous reports because DMR is now employing a new GIS system to audit shellfish closures. This has caused the baseline numbers to change significantly but should provide for much more consistnet tracking of closures in the future. See Table 4, Appendix II for more information on estuarine and marine waters with shellfishing impaired uses.

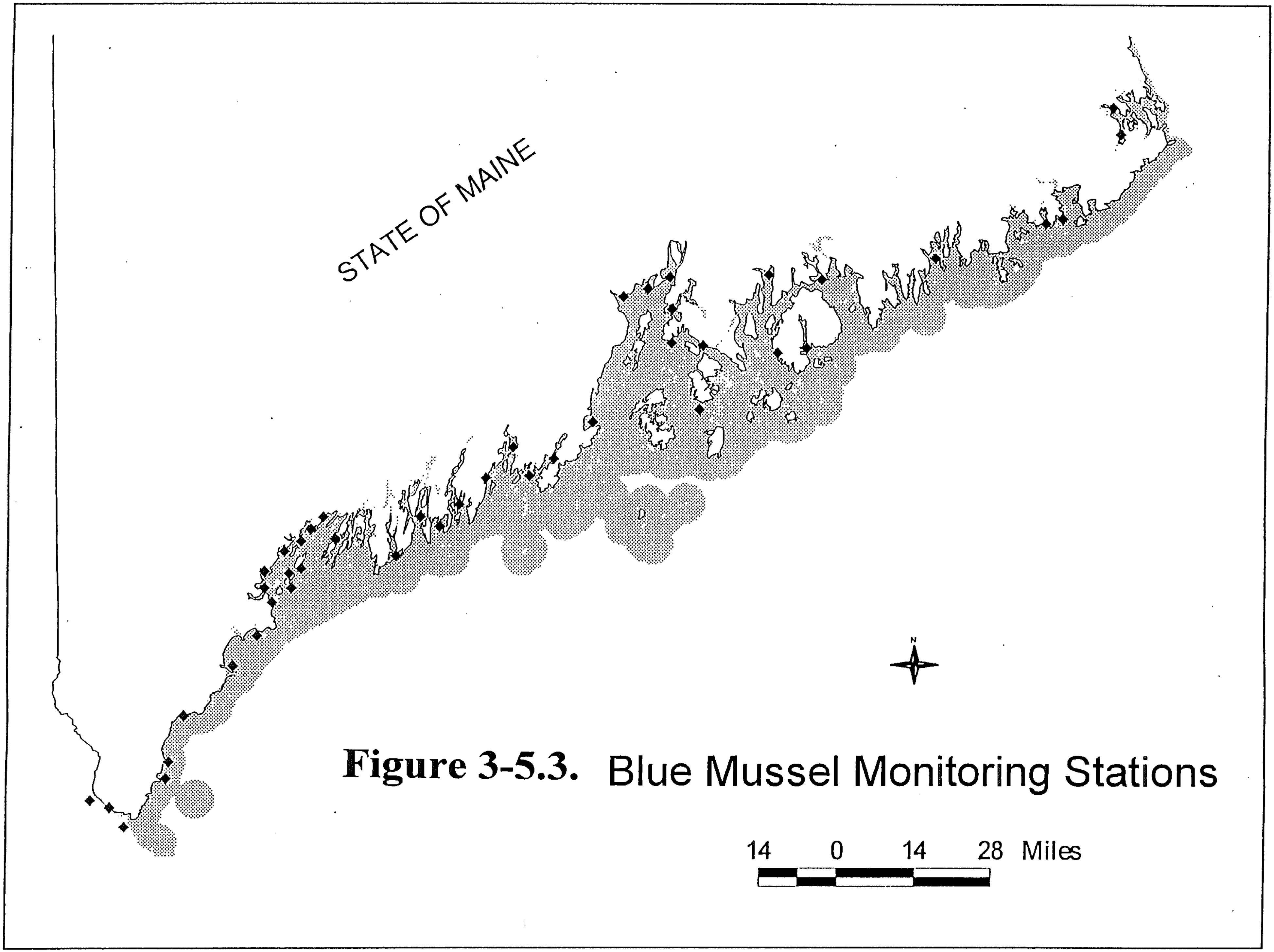


Figure 3-5.3. Blue Mussel Monitoring Stations

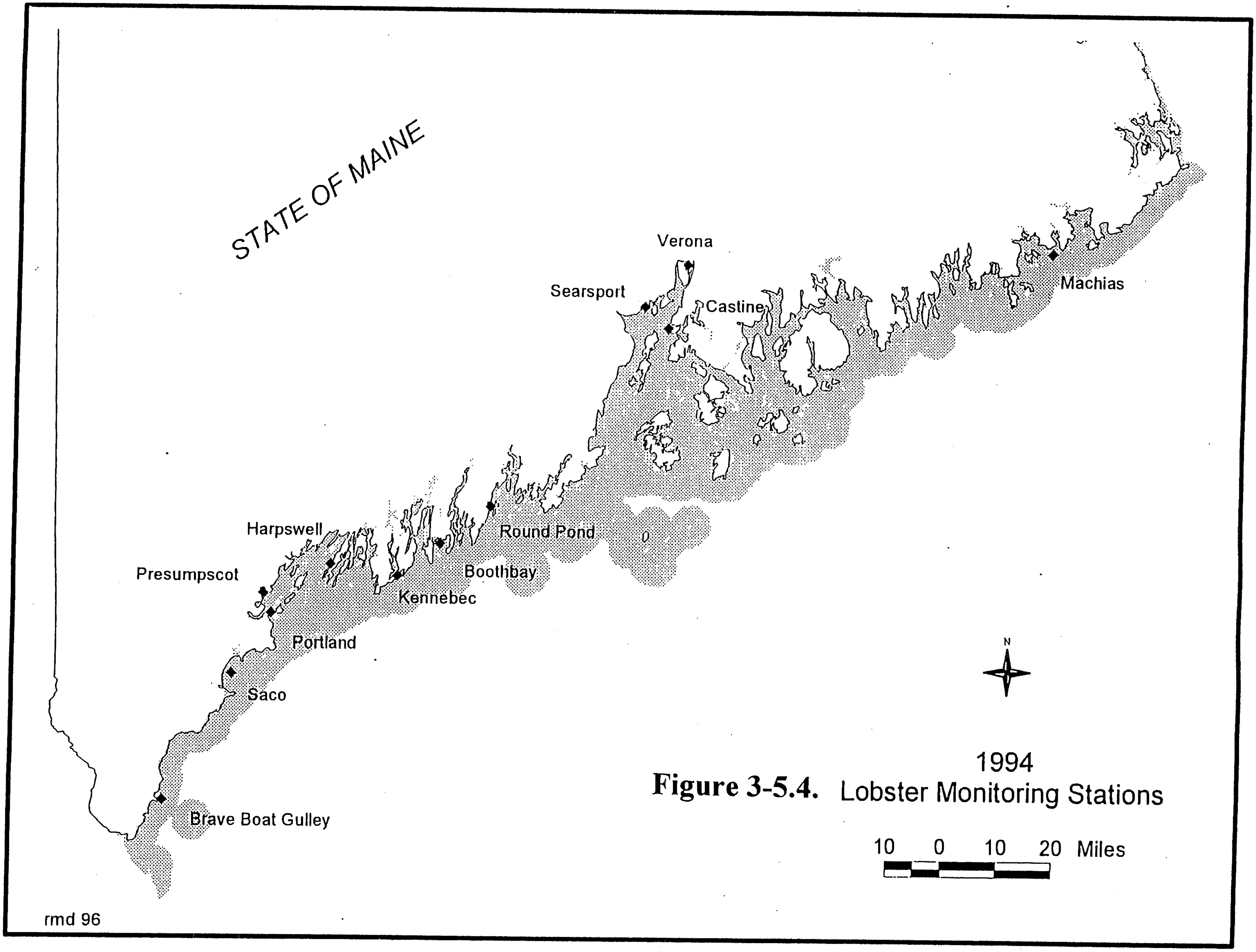


Figure 3-5.4. 1994 Lobster Monitoring Stations

Chapter Six: Wetlands Assessment

Contact: Don Witherill, Division of Watershed Management, Bureau of Land and Water Quality, (207) 287-7725

Background

Maine's wetlands are among its most diverse and valuable natural resources. Wetlands provide habitat for fish and wildlife, reduce flooding through storage of runoff water, and improve water quality by filtering out sediments and other harmful materials.

The State of Maine regulates activities in freshwater wetlands under the Natural Resources Protection Act (NRPA). Effective September 29, 1995, changes in this law make it more consistent with the Federal wetlands regulatory program administered by the U.S. Army Corps of Engineers (Corps) and the Environmental Protection Agency (EPA) under Section 404 of the Clean Water Act. Major points of the law, effective September 29, 1995 include the following:

- There is no longer a 10 acre size requirement for freshwater wetlands in the NRPA; all freshwater wetland areas are regulated. The state and federal programs are now consistent in regards to wetlands jurisdiction. The level of review required will be based on the *size of the alteration in the wetland*, rather than the *size of the wetland itself*. (Note: Wetlands subject to municipal shoreland zoning have not changed; they continue to be non-forested wetlands greater than 10 acres in size in most towns).

- Maine has established a tiered review process that provides an expedited, 30 day review for projects having less than 15,000 sq. ft. of wetland impact (Tier 1). Applications for Tier 1 projects make use of an abbreviated application form and are not subject to wetland compensation requirements. For projects having between 15,000 sq. ft. and 1 acre of impact (Tier 2), the review time is 60 days or less unless significant wetland functions would be affected.

- Projects not qualifying for Tier 1 or Tier 2 review because they might affect significant wetland functions include activities occurring in freshwater wetlands that:

  1. Are within 250 feet of coastal wetlands or great ponds;
  2. Are within 25 feet of a river, stream or brook;
  3. Contain at least 20,000 square feet (approx. 1/2 acre) of open water or marsh vegetation under normal circumstances;
  4. Are in a floodplain;
  5. Contain significant wildlife habitat as defined, and in some cases identified, in the law; or
  6. Consist of peatland.

- Projects having less than 4,300 sq. ft. (approx. 1/10 of an acre) of freshwater wetland impact and which do not occur in, on or over another protected natural resource are exempt from

NRPA permit requirements, unless the affected area of wetland is in a Shoreland Zone based on local Shoreland Zoning requirements.

- An exemption exists for forest management activities, including associated road construction or maintenance. This NRPA exemption, which has some restrictions, did not change under the new law.

- The exemption in state law for agricultural activities has been modified to be consistent with the federal exemption. The new exemption applies to altering a freshwater wetland for the purpose of "normal farming activities such as clearing of vegetation for agricultural purposes if the land topography is not altered, plowing, seeding, cultivating, minor drainage and harvesting, construction or maintenance of farm or livestock ponds or irrigation ditches, maintenance of drainage ditches and construction or maintenance of farm roads". The exemption does not apply to alterations of other protected natural resources such as rivers, streams and great ponds.

- Activities adjacent to a freshwater wetland no longer need a NRPA permit unless the wetland consists of or contains either peatlands, or at least 20,000 square feet of open water or marsh vegetation. These areas do not include artificial ponds or impoundments unless they are alterations of other protected resources, such as streams.

- The definition of significant wildlife habitat now includes significant vernal pools as defined and identified by the Department of Inland Fisheries & Wildlife.

As a result of the revisions to the NRPA described above, "one stop permitting" is now a reality for most wetland alteration projects. To achieve this, the Maine DEP and the Army Corps have adopted a joint permit application form. Applications only have to be filed by applicants with the DEP regardless of the project size. DEP coordinates with the federal agencies on screening and reviewing applications. It should be noted that the federal agencies are still involved in the review of wetland projects, and may impose restrictions or even deny an application. They do not, however, require separate applications, and for Tier 1 and Tier 2 projects, they have agreed to act within the state's review period.

The DEP must periodically report to the Maine Legislature on the overall success of the program with recommendations for any changes that would achieve further streamlining of the program.

Extent of Wetlands Resources

With the implementation of the changes to the Natural Resources Protection Act (NRPA), the State is now tracking all wetland losses through an application tracking system. When applications for freshwater wetland alterations are logged in, the amount of fill or area to be altered is also entered by wetland type and geographical location. This system will enable the Department to monitor and report on annual wetland losses.

In addtion to monitoring annual wetland losses throughout the organized towns in Maine, the U.S. Fish and Wildlife Service published a report in 1994 entitled: "Wetland Trends for Selected Areas of the Casco Bay Estuary of the Gulf of Maine (1974-77 to 1984-87)". The report was based on a study to identify the extent and nature of wetland alterations for selected areas of the Casco Bay Estuary. It was one of four study areas in the Gulf of Maine chosen by the Service for detailed wetland trends analysis.

The study area is located in southwestern Maine from Cape Elizabeth and Old Orchard Beach to Phippsburg and Richmond. It has a total land surface area of approximately 473 square miles and includes approximately 336 square miles of deepwater habitat, most of which is in Casco Bay, Merrymeeting Bay, and the Kennebec River. The study area has approximately 14.8% of its land mass covered by wetlands. Wetlands totaling 44,760 acres were identified from existing USFWS National Wetland Inventory maps. Freshwater wetlands were the dominant type and represented 46.2 % of the total. During the study period the area lost about 228 acres of vegetated wetlands and also gained about 69 acres of open water wetlands due to pond construction. Although this report documents recent wetland loss trends within the study area, it does not address changes in the quality of the remaining wetlands.

Development of Wetland Water Quality Standards

The Department currently has not developed wetland water quality standards in accordance with EPA's guidance document.

Additional Wetlands Protection Activities

During the period 1994 to 1996 the Department has been involved in three projects to improve the protection and management of the state's wetland resources. Each of these projects has been funded by EPA through the Section 104(b)3 wetlands grant program.

1. Wetlands Conservation Plan

The State is preparing a Wetlands Conservation Plan through an EPA grant to the State Planning Office (SPO). Initially, a Wetlands Conservation Plan Task Force was formed to guide the development and implementation of a statewide plan. The first priority of the Task Force was to respond to a 1993 Legislative Resolve to develop recommendations on the feasibility of applying to EPA to assume jurisdiction over federal wetlands regulation under Section 404 of the Clean Water Act.

In response to this requirement, the Task Force formed a Wetlands Regulatory Work Group (WRWG). The WRWG consisted of State and Federal agency staff and members from business and environmental groups. Its initial job was to respond to the Legislative Resolve on behalf of the Task Force. In addtion to evaluating the assumption of jurisdiction, the Resolve required a report on other options for reducing duplication and inefficiencies in the wetland permitting process. The efforts of the WRWG resulted in changes to the State's wetlands regulatory program which are outlined in Public Law 1995, Chapter 460. The highlights of Chapter 460 are summarized above.

2. An Evaluation Of Key Elements Of Maine's Wetland Protection Program

In 1992 the Maine Department of Environmental Protection was awarded a grant from EPA to evaluate Maine's wetland program which at the time had jurisdiction over freshwater wetlands of 10 or more acres in size. Alterations in these wetlands were regulated under the provisions of the Natural Resources Protection Act (NRPA). This 1988 law was supplemented in 1990 when the Wetland Protection Rules (Chapter 310) were adopted. Incorporated in these rules is a three tier system which serves as a screening tool and establishes a tiered level of scrutiny in the licensing process. Inherent in this classification is the assumption that wetlands possesssing Class 1 characteristics are functionally more valuable to society than wetlands possessing Class 2 or Class 3 traits. Permitting requirements were developed for each class of wetland, with Class 1 wetland impacts receiving the highest and Class 3 receiving the lowest level of scrutiny during project reviews. Classification has allowed Maine's extensive freshwater wetland resources which exceed 5 million acres and cover more than 20% of the State's surface area to be prioritized. Maine supports one of the only classification-based regulatory programs in the country.

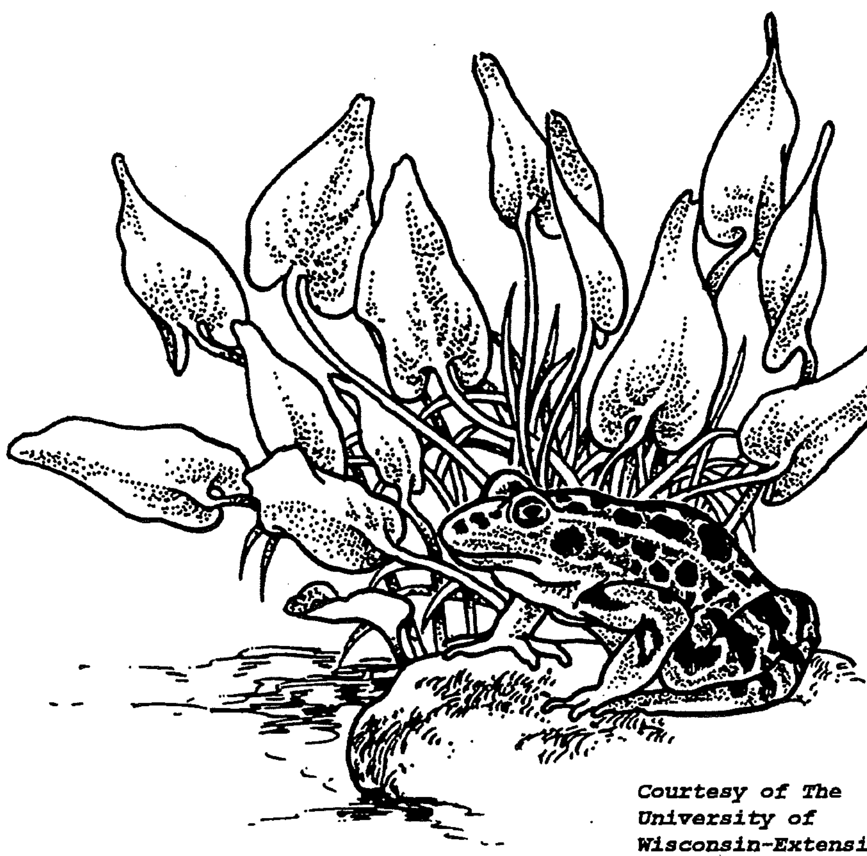
The purpose of this EPA funded study was to undertake a formal and objective evaluation of the effectiveness of Maine's wetland program. Five study questions were examined to investigate key elements of the program. Two data bases were developed to support this investigation. First a system to track wetland losses based on licenses issued by DEP from June 1990 to 1993 was developed. A second data base was developed to characterize and rank various types of freshwater wetlands for 18 functions and values using the "Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire". Results of this investigation showed that in general Class 1 wetlands were more valuable than Class 2 wetlands, which in turn were more valuable than Class 3 wetlands. There was, however, no evidence that non-regulated wetlands were more valuable than regulated wetlands nor was there any support that 10 acres is an appropriate jurisdictional threshold.

A review of permits issued during the study period found that the State's "no net loss" policy was generally attained through preferred forms of compensatory mitigation (restoration, enhancement, and creation). While preservation accounted for the majority of all approved compensation, (316 acres of wetland and 64 acres of upland), nearly all wetland impacts which required compensation (18.9 acres) were offset by preferred forms of compensation (18.6 acres). From 1990 through 1993, approximately 83.8 acres (82 acres freshwater and 1.8 acres coastal) of jurisdictional wetlands were licensed by MDEP to be filled. Nearly two thirds of licensed filling occurred in "drier end" Class 3 wetlands, with the least amount licensed in Class 1 wetlands. Source: "An Evaluation of Key Elements of Maine's Wetland Protection Program" by Francis Brautigam, Maine Department of Environmental Protection, August, 1995.

3. Development Of A Watershed Based Methodology To Inventory Potential Wetland Mitigation Sites

In 1995 MDEP received an EPA grant to develop a methodology to identify potential mitigation sites. Under the State's Wetland Protection Rules and Secton 404 of the Clean Water Act, it is the responsibility of applicants for permits to fill wetlands to locate mitigation sites to compensate for unavoidable wetland losses. This is often a time consuming and costly process whereby applicants attempt to locate a suitable site which provides for the replacement of lost values and functions. The proposed inventory of sites will provide a means to direct appplicants to the best sites for compenstaion early in the application process. In addition, a mitigation site inventory will facilitate the development of mitigation banking programs by identifiying approved sites for cost effective compensatory mitigation.

In order to assess the viablity of conducting a statewide inventory, a pilot study is proposed for southern Maine where development pressures have historically been high. Based on developed selection criteria, an intensive survey will be completed within two watersheds. A variety of techniques including aerial and ground reconnaisance surveys, map and photo interpretation, and contacts with municipalities and natural resource agencies will be conducted to complete this inventory.



Courtesy of The University of Wisconsin-Extension. Artist: Watkins.

Chapter 7: Public Health and Aquatic Life Concerns

Fish Consumption

Contact: Barry Mower, DEP BLWQ, Division of Environmental Assessment, (207) 287-7777.

Since 1982, DEP has been conducting fish tissue analyses to determine whether fish are safe for human consumption. The compound of greatest concern in Maine surface waters is dioxin. In 1984 through 1986 as part of the EPA National Dioxin Study, fish from several Maine rivers below industries were found to be contaminated with dioxin and furan (2367-TCDD and 2378-TCDF). Based on these limited data, fish consumption advisories were issued by the Department of Human Services. In 1988, the Maine Legislature established the Maine Dioxin Monitoring Program to assess the extent of the problem in Maine. This program required DEP to collect sludge and fish below no more than 12 industrial or municipal wastewater discharges to be monitored for dioxin and furan.

In past years, state toxicologists have warned that due to elevated dioxin levels, pregnant women should avoid eating fish from the Androscoggin, Kennebec below Skowhegan, Penobscot below Lincoln, Presumpscot below Westbrook, and the West Branch of the Sebasticook below Hartland. The general public was advised to eat no more than two meals of fish per year from the Androscoggin and five from that section of the Kennebec.

Fish tissue analysis in 1994 for dioxin and furan showed a decline from earlier levels in 12 samples, remained the same in 20 samples, and increased in 6 samples. Advisories remain on the Androscoggin River, Kennebec River below Skowhegan, and Penobscot River below Lincoln as well as for lobster tomalley along the entire Maine coast. In 1995 the Maine legislature re-authorized the Dioxin Monitoring Program through 1997. The 1995 results are not yet available.

As part of the EPA funded Regional Environmental Monitoring and Assessment Program (REMAP), fish, water and sediment samples were collected from 125 Maine lakes and ponds in 1993 and 1994. The REMAP project was undertaken by DEP with help from the Maine Department of Inland Fisheries and Wildlife, the Maine Department of Human Services, the University of Maine at Orono and EPA. The study lakes were selected from a population of about 1800 surveyed lakes and ponds with significant sport fisheries using EPA's EMAP protocol. There are about 4000 generally smaller ponds in Maine that were not included in the subsample.

Significant levels of mercury were found in both warm and cold water fish. The average concentration was 0.45 ppm, and fish from several lakes exceeded the US Food and Drug Administration action level of 1.0 ppm. One ten year old smallmouth bass from a coastal lake had a level of 3.5 ppm and another 2.7 ppm. On May 18, 1994, the Maine Department of Human Services issued an advisory warning pregnant women, nursing mothers, women who may become pregnant, and children under 8 years of age not to consume fish from lakes and ponds in the state. Others were advised to limit fish consumption to 6-22 meals per year, depending on fish size. Larger older fish generally have higher contaminant levels. A meal is considered to be 8 ounces. The health advisory was based on a level of concern of 0.43 ppm developed from a risk assessment conducted by a state toxicologist. Additional data for cadmium, lead, PCBs, DDT and derivatives and about 20 other pesticides are still being evaluated.

In 1994 the Maine legislature enacted Maine's Surface Waters Ambient Toxics (SWAT) monitoring program to determine human and ecological risk from toxic contaminants in both freshwater and marine ecosystems. With guidance of a Technical Advisory Committee, DEP has initially monitored toxic contaminants in fish, shellfish and sediments and direct effects on macroinvertebrate communities. Future monitoring planned includes participation in the Mercury Depostion Network designed to quantify national, regional, and local atmospheric deposition and evaluation of biomarkers, a new method of determining direct effects on aquatic ecosystems. It is expected to take through CY1998 to complete the initial monitoring of the entire state. This program is coordinated with other ongoing state and regional studies, such as Maine's Dioxin Monitoring Program, the National Atmospheric Deposition Program, and Gulf Watch.

Results from the first year indicate that Maine has more contamination than previously known. Mercury levels in fish from rivers and streams are only slightly less than in fish from lakes in the REMAP project. Concentrations of DDT and PCB exceeded EPA's risk based consumption limits in all samples of fish. Only 5 of 31 biomonitoring sites failed to meet the water quality standards due to toxic pollutants. Lobster tomalley has been found to be contaminated, but the meat is within background levels. The blueberry pesticide Velpar has been found in sediments of downeast clam flats. Contaminant levels are variable among coastal sites.

A 2.5 mile stretch of the Royal River in Gray and Yarmouth does not attain Maine's Water Quality Standards. The cause is contaminated groundwater leaching from the McKinn Site, a former waste oil and solvent collection and transfer site which operated between 1964 and 1977. The site is now a Maine Designated Uncontrolled Hazardous Substance Site and Superfund National Priorities List site. Despite operation of a Groundwater Extraction and Treatment System from 1990-1995, the Statewide Water Quality Criterion for trichloroethylene (TCE) for water and organisms are exceeded in the river.

A 20.5 mile stretch of the Little Madawaska River and tributaries from the Madawaska Reservoir Dam downstream to Grimes Road and Greenlaw Stream and tributaries (11.1 miles) do not meet Maine's Water Quality Standards due contamination at the former Loring Air Force Base. The designated use of fishing is not attained due to the existence of a Fish Consumption Advisory on these waters because of PCB contamination resulting from former activities at the Base.

SWAT monitoring stations and river segments with dioxin advisories are shown in Figure 3-7.1. Figure 3-7.2 summarizes mercury concentrations measured in predator fillets for the REMAP project. Table 3-7.1 lists fish consumption advisories presently in effect in Maine.

Another public health concern is shellfish consumption. The Maine Department of Marine Resources (DMR) regularly determines bacteria levels in shellfish harvesting areas as required by the National Shellfish Sanitation Program. Harvesting areas which are closed due to pollution are patrolled by State and local marine wardens to prevent illegal harvesting of shellfish, thereby protecting consumers (Appendix II, Table 4).

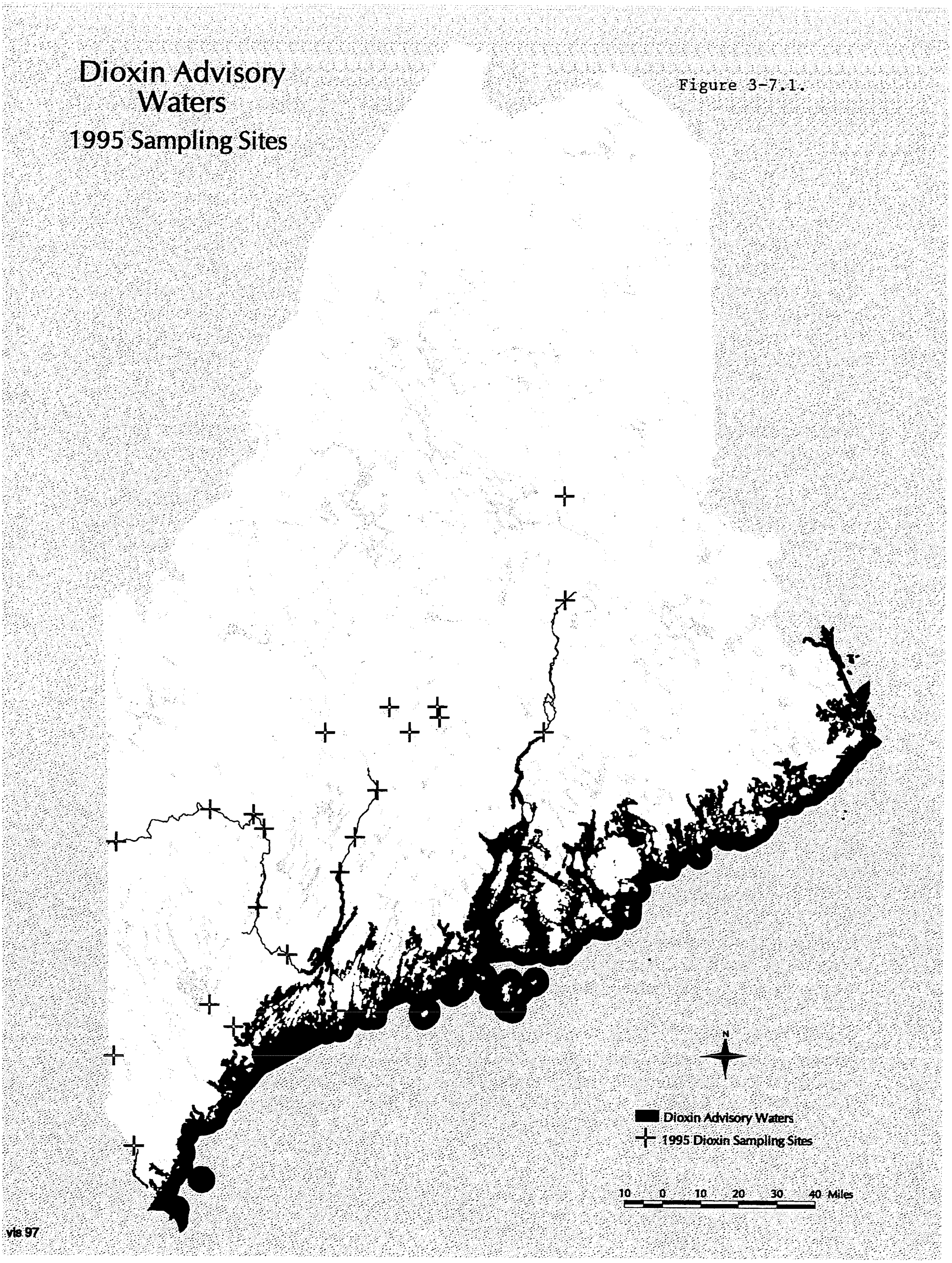

Dioxin Advisory Waters
1995 Sampling Sites
Figure 3-7.1.
N
Dioxin Advisory Waters
1995 Dioxin Sampling Sites
10 0 10 20 30 40 Miles
yls 97

Figure 3-7.2.

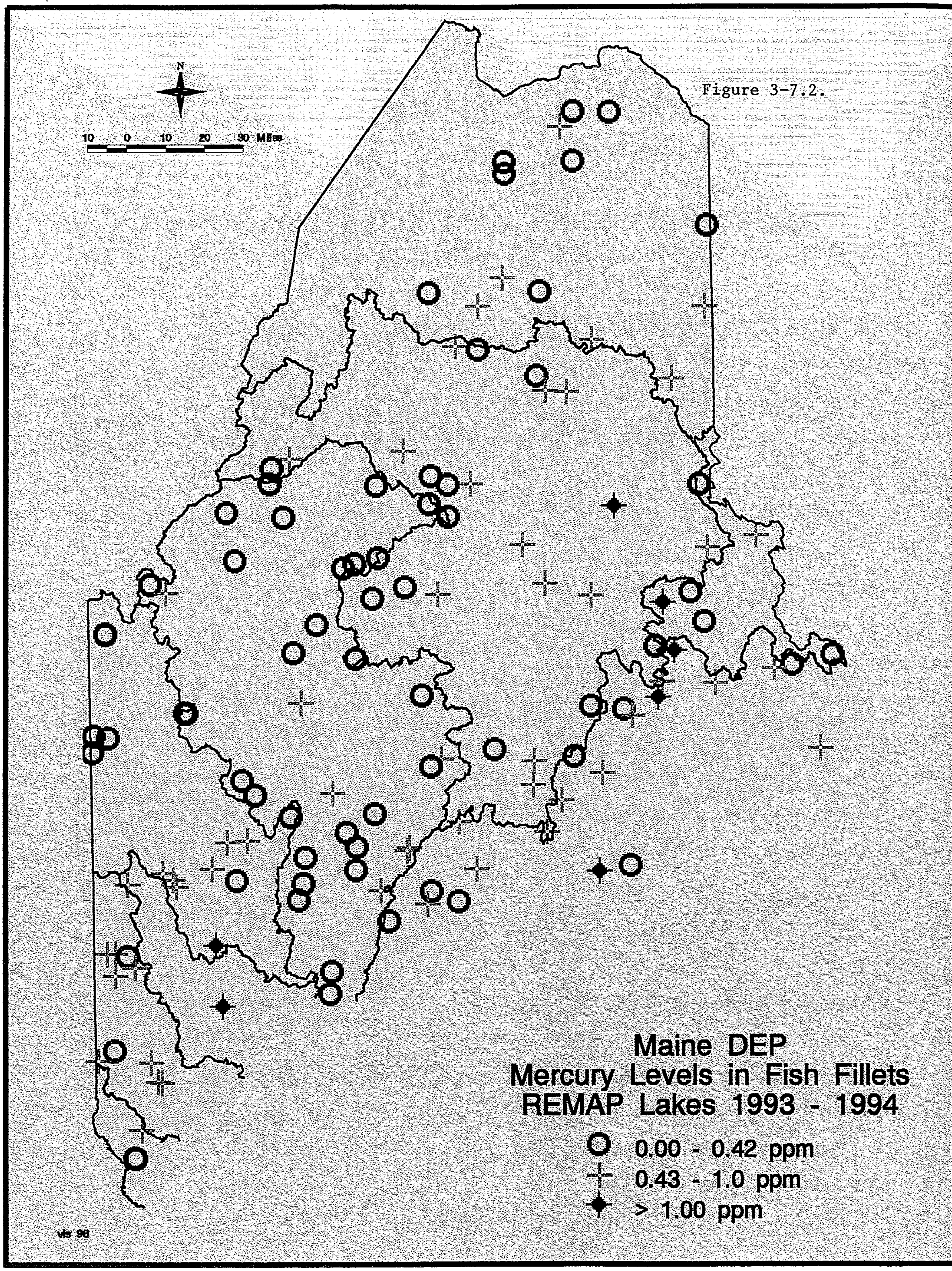

N
10 0 10 20 30 Miles
Maine DEP
Mercury Levels in Fish Fillets
REMAP Lakes 1993 - 1994
0.00 - 0.42 ppm
0.43 - 1.0 ppm
> 1.00 ppm
vis 96

Table 3-7.1. Fish Consumption Advisories in Effect in Maine.

Name of Waterbody	Pollutant(s) of Concern	Source(s) of Pollutants	Size Affected
Androscoggin River	Dioxin	Kraft Pulp & Paper Mills	124 miles
Kennebec River	Dioxin	Kraft Pulp & Paper Mill	56 miles
Penobscot River	Dioxin	Kraft Pulp & Paper Mills	56 miles
Greenlaw Brook	PCBs	Hazardous Waste Sites	11.1 miles
Little Madawaska River and tributaries	PCBs	Hazardous Waste Sites	20.5 miles
Maine coast[1]	Dioxin	Kraft Pulp & Paper Mills and non-point sources	entire Maine coast
Lakes and Ponds	Mercury	unknown	all lakes and ponds

1. Advisory pertains only to lobster tomalley.

Sediment Contamination

Contact: Barry Mower, DEP BLWQ, Division of Environmental Assessment, (207) 287-7777.

Waterbodies in Maine with sediments known to be contaminated by toxics are listed in Table 3-7.2. Although the sediments of these waterbodies are known to be contaminated with hazardous materials, the DEP is unsure of how this relates to the overall water quality of each. For this reason, the list of waterbodies contaminated by sediments is not reflected in the Water Quality Designations (Appendix I, Chapter 4).

Table 3-7.2. Waterbodies in Maine with Sediments Contaminated by Toxics.

Date Sampled	Waterbody	County	Extent	Pollutant	Source
1977	Silver Lake		16 acres	Copper	copper sulfate program
1985	Riggs Brook		0.5 mile	PCBs	salvage yard
1987	Dennys River		0.1 mile	PCBs	salvage yard
1987	Cooks Brook		2 miles	Cadmium	metal finishing and plating facility
1988	Annabessacook Lake	Kennebec	400 acres	Dimethyl formamide toluene & TCE	Winthrop Landfill (Superfund site)
1988	Quiggle Brook		6 miles	Chlorinated solvents	recycling facility (Superfund site)
1989	Piscataquis River		1.5 miles	TRIS & other organics	textile mill
1991	Androscoggin River		124 miles	Dioxin	bleached Kraft mills
1993	Embden Pond	Somerset	unknown	Lead [1]	unknown
1993	Portland Lake	Aroostook	unknown	Lead [1]	unknown
1993	Keewaydin Lake	Oxford	unknown	Lead [1]	unknown
1993	North Pond	Oxford	unknown	Lead [1]	unknown
1993	Varnum Pond	Franklin	unknown	Lead [1]	unknown
1993	Forest Lake	Cumberland	unknown	Lead [1]	unknown
1993	Lower Range Pond	Androscoggin	unknown	Lead [1]	unknown
1993	Knight Pond	York	unknown	Lead [1]	unknown
1993	Balch and Stump Ponds	York	unknown	Lead [1]	unknown
1993	Wells Pond	Oxford	unknown	Lead [1]	unknown
1993	Bauneg Beg Lake	York	unknown	Lead [1]	unknown
1993	Bubble Pond	Hancock	unknown	Lead [1]	unknown
1993	Long Pond	Hancock	unknown	Lead [1]	unknown
1993	Little Ossipee Lake	York	unknown	Lead [1]	unknown
1993	Togus Pond	Kennebec	unknown	Lead [1]	unknown
1994	Alligator Pond	Piscataquis	unknown	Lead [1]	unknown

1. Source: REMAP data for sediment samples equal to or exceeding NOAA effects range median (Long, Edward R. and L.G. Morgan, 1990. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NOS OMA 52, Seattle, Washington.)

Waterborne Diseases

Physicians and other health personnel are required by law to report the occurence of certain diseases to the Maine Bureau of Health. Nine of the diseases reported in 1994 and 1995 are potentially waterborne, although most may also be carried in food. The State does not have a comprehensive program to track swimming advisories and beach closures, which are currently handled on a local basis.

Giardiasis, caused by the the protozoan *Giardia lamblia*, was the most frequently reported waterborne disease in 1994 and 1995. This parasite is carried by several mammals, and is common in waters of the State. Giardia may cause prolonged enteric infection. Most cases were reported in the late summer and fall months, possibly due to increased public contact with surface waters through recreational activities such as swimming, boating and fishing.

Another protozoan parasite which is emerging as a public health problem in Maine is Cryptosporidium. Cryptosporidium is also primarily waterborne, and results in gastroenteritis. In the past, most cases have been associated with child care centers and public water supplies, however there was a large foodborne outbreak in 1993 attributed to contaminated apple cider. Excluding the 1993 outbreak, there was a slight increase in reported Cryptosporidium cases in 1994 and 1995 over previous years.

Table 3-7.3 summarizes potentially waterborne illnesses reported in 1994 and 1995. The number of cases includes those which may have been transmitted by other means, such as food. The Bureau of Health estimates that actual cases of waterborne illness are significantly higher than reported. Data for 1996 were not available at the time of printing. Source: "Reportable Diseases in Maine", Maine Department of Human Services, Bureau of Health, Division of Disease Control, 1994 and 1995 summaries.

Table 3-7.3. Waterborne Diseases Reported in 1994 and 1995.

Disease	Cases Reported		Percent of Total Reported Illnesses	
	1994	1995	1994	1995
Amebiasis*	10	8	0.7	0.4
Cryptosporidiosis*	22	26	1.5	1.2
E. Coli 0157:H7	22	64	1.5	2.7
Giardiasis*	335	294	22.7	13.1
Hepatitis A	25	30	1.7	1.3
Legionellosis	5	6	0.3	0.3
Listeriosis	2	5	0.1	0.2
Salmonellosis	191	171	13.0	7.6
Shigellosis	10	25	0.7	1.1

* Indicates diseases transmitted primarily through water. Other diseases listed may be either waterborne or foodborne.

Aquatic Life Impacts
Contact: Susan Davies, DEP BLWQ, Division of Environmental Assessment, (207) 287-7778.

The water quality standards for the State of Maine include explicit narrative criteria pertaining to the condition of the aquatic life. Aquatic life impacts are identified through the use of a multivariate statistical model developed by analyzing the State's large standardized database of samples of the benthic macroinvertebrate community. The protocol for data collection and analysis and for the detection of classification violations has been standardized and functional since 1993 but has yet to pass through all administrative procedures to become formal regulations. A detailed account concerning the use of biological information and the development of biological criteria in Maine may be found in "Maine Biological Monitoring and Biocriteria Development Program" by S.P. Davies, L. Tsomides, D.L. Courtemanch and F. Drummond, Maine Department of Environmental Protection, Augusta, Maine, 1995.

The specific aquatic life language in the standards is drafted in such a way as to provide for the use of existing benthic macroinvertebrate community assessment approaches in order to determine attainment of the narrative standards (Table 3-7.4). Linear discriminant functions have been developed to discriminate between three aquatic life classes, in terms of the aquatic biota they are capable of supporting. The decision-making protocol involves the computation of an array of indices and measures of benthic macroinvertebrate community structure and function. The resulting mosaic of information is then subjected to linear discriminant analysis, from which a probability of the likelihood of membership within one of four classes is computed. These classes correspond to the narrative standards of the three aquatic life classes in the water quality classification law, and a fourth "class" representing non-attainment of minimum standards.

Assessment Summary

The Biological Monitoring Program has established 260 biomonitoring stations on 84 rivers and streams, in 430 sampling events since 1983. Many of these stations have been assessed only once in the period of record, while several have been revisited annually. The State began a watershed based assessment stategy in 1994 which directs scheduling of sampling to coincide with the NPDES relicensing schedule. Ultimately, following full implementation, this approach will allow for re-visits to reaches of concern within major catchments every five years. Of these 260 stations, 72% attain and 21% exceed the aquatic life standards of their legal classification, according to results of the statistical biocriteria model. Included in stations exceeding their class are 34 locations on four major river mainstems. The Department has documented several remarkable instances of improvement in the condition of the aquatic community as a result of improvements in wastewater treatment practices. For example the Piscataquis River downstream of a textile mill in Guilford went from non-attainment of minimum Class C standards in 1984 through 1987, to attainment of Class A standards in 1989, following installation a new publicly owned treament works for the town. Clean-up activities at an uncontrolled hazardous waste site draining to Cooks Brook, a small southern Maine stream, have contributed to raising the aquatic life class from non-attainment of Class C in 1984 through 1987 to Class A after 1993.

The Biological Monitoring Program has also identified 66 stations on 37 different rivers and streams that do not attain the aquatic life standards of their assigned water quality classification according to results of the biocriteria model. Thirty one of these stations do not attain the State or federal minimum standards. Several of the non-attainment stations have planned water quality management interventions that are expected to remedy the aquatic life classification violations and so are not listed in Appendix I, Chapter 4. Major reasons for non-attainment include impoundment, low or manipulated flow, and point and non-point source pollution. Some type of flow alteration caused by human intervention accounts for 56% of all non-attainment of aquatic life class violations recorded. These interventions include, in order of importance: impoundment, variable releases downstream of dams, lake outlet modifications. The Department routinely requires changes in dam operating pratices for aquatic life non-attainment segments identified as part of water quality certification activities for in FERC relicensing.

Point and non-point sources of sediment and pollutants account for an additional 39% of the recorded classification violations. Uncontrolled hazardous waste and groundwater contamination sites account for 1/3 of these violations. Point source toxic industrial contamination and point and non-point nutrient sources make up the balance.

Table 3-7.4 . Maine's Water Quality Classification System for Rivers and Streams, With Associated Biological Standards.

Class	Management	Biological Standard
AA	High quality water for recreation and ecological interests. No discharges or impoundments permitted.	Habitat natural and free flowing. Aquatic life as naturally occurs
A	High quality water with limited human interference. Discharges restricted to non-contact process water or highly treated wastewater equal to or better than the receiving water. Impoundments allowed.	Habitat natural. Aquatic life as naturally occurs.
B	Good quality water. Discharge of well treated effluent with ample dilution permitted.	Habitat unimpaired. Ambient water quality sufficient to support life stagesof all indigenous aquatic species. Only non-detrimental changes in community composition allowed.
C	Lowest water quality. Maintains the interim goals of the Federal Water Quality Act (fishable/swimmable). Discharge of well treated effluent permitted.	Ambient water quality sufficient to support life stages of all indigenous fish species. Change in community composition may occur but, structure and function of the community must be maintained.

Fish Kills
Contact: David Courtemanch, DEP BLWQ, Division of Environmental Assessment, (207) 281-7789.

Fish kills in Maine have been on the decline for many years as treatment has been imposed and BMPs implemented for agricultural practices. In 1992, Maine finally achieved a perfect record with no pollution-related fish kills. The State has not been able to maintain that record and in 1994-95, 4 fish kills were reported (Table 3-7.5). Two of the kills were caused by pesticides. Two of the events were related to water withdrawal for irrigation during the 1995 summer drought. As a consequence of those withdrawal events, the Department has developed an agreement among natural resource agencies (Maine Department of Inland Fisheries and Wildlife, Maine Department of Agriculture, Food and Rural Resources, U.S. Fish and Wildlife Service, Natural Resource Conservation Districts) and affected growers to provide interim minimum flows of 7Q10, construction of water supply facilities and eventual protection of summer base flows in all waters. Elements of this agreement will be included in regulations currently being drafted by the DEP.

Table 3-7.5. Pollution-Related Fish Kills in Maine: 1994 and 1995.

Waterbody	Town	Date	Species	Estimated Number	Cause
Lavoie Brook	Caswell	8/6/94	mixed	>100	Manex/Asana
Trib. to Fowler Brook	Albion	8/1995	mixed	>100	Dewatering
Caribou Lake	Washburn	8/8/95	mixed	>100	Dewatering
Three Brook	Blaine	8/15/95	Brook Trout	~1000	Chlorothalonil

Section 303(d) Waters
Contact: Jeanne DiFranco, DEP BLWQ, Division of Environmental Assessment, (207) 287-7728.

Section 303(d) of the Clean Water Act requires that Maine identify waterbody segments which do not or will not meet state water quality standards even after the implementation of technology-based controls for both point sources and non-point sources of pollution. This list includes not only waterbody segments which do not attain water quality standards, but also those which are in attainment but are considered to be threatened. The 303(d) process subsequently requires the establishment of Total Maximum Daily Loads (TMDLs) or other control methods in order to assure the attainment of water quality standards.

The State is also required to identify priority waters for which it will develop TMDLs within the next two years. Considerations are primarily geographic, but pending NPDES permits and treatment plant construction proposals are also considered. TMDLs for point sources may consist of discharge limitations, while those for non-point sources may include activities that control factors causing non-attainment.

In the development of the 303(d) list, the 1996 305(b) Water Quality Assessment report, including the 304(l) lists, the 314(a) Clean Lakes list and the 319 State Non-Point Source Assessment were all reviewed. Some waterbodies included on these lists generally do not attain water quality standards because of activities that have no technology-based controls. Lakes selected for the list include those lakes identified on the water quality assessment as failing to meet GPA standards due to repeated blue-green algal blooms or a demonstrated trend of increasing trophic state. Also included are some lakes which are viewed as particularly threatened and for which a TMDL process may be appropriate.

Tables 1, 2 and 3 of Appendix II contain the lists of waterbodies needing TMDLs. The priority waterbodies are also identified. In addition to the listed lakes, TMDL-type areal phosphorus allocations for new development sources will be generated for a number of other lakes as part of the state technical assistance program. Many of these lakes will not be on the 303(d) list, but will be prioritized for action based on the need for protection and demonstrated local interest.

PART IV

GROUND WATER ASSESSMENT

Chapter 1 - Overview

Public interest in ground water focuses primarily on its use as a drinking water supply for humans and livestock and as a source of process water for industry. More than 60% of Maine households draw their drinking water from ground water supplied from private or public wells, or springs. Ground water is the source of approximately 98% of all the water used by households with individual supplies. In addition, nearly 60% of the water needed for Maine livestock is provided by ground water. Industrial ground water use is slightly less than the volume withdrawn for drinking water. Federal requirements for surface water treatment are increasing the shift to ground water use for public water supplies.

Ground water is withdrawn from two basic types of aquifers in Maine: unconsolidated glaciofluvial deposits (stratified drift or sand and gravel aquifers), and fractured bedrock. The stratified drift deposits are the most favorable for development of large volume water supply wells, but these deposits are limited in size and distribution (less than about 10% of the state). An estimated 44% of ground water withdrawals occur in the southern part of the state, in Cumberland and York counties, according to U.S. Geological Survey (USGS) figures in 1985. In these counties the geology is favorable (major sand and gravel aquifers), and water demand is high due to the heaviest concentration of people and businesses. Bedrock aquifers underlie the entire state. They are also used for domestic, commercial, industrial and agricultural purposes, and for small public supplies such as schools, restaurants, and summer camps.

Generally, the ground water supply in Maine is adequate. The total withdrawal of ground water by all water users is less than one percent of the annual ground water recharge each year. The remaining annual ground water recharge is lost through evapotranspiration or discharges to ponds, lakes, rivers, and streams.

A significant portion of Maine's ground water may be threatened by contamination, particularly in unforested areas (approximately 11% of the State). During the last decade, numerous wells in Maine have been made unpotable by nonpoint source pollution. As public concern about ground water quality increases, more widespread monitoring and detection of contamination can be expected. The Maine Environmental Priorities Project has identified drinking water quality, including private and public well supplies, as a high risk issue ("Maine Environmental Priorities Project, Report from the Steering Committee, Consensus Ranking of Environmental Risks Facing Maine", January, 1996). Because of slow ground water flow rates and low biological activity, ground water contaminants are extremely persistent. Centuries may be required for natural processes to restore some contaminated ground water to potable standards.

In 1989, the State adopted the Maine Ground Water Management Strategy to articulate its ground water protection policy. In 1990, the State also formulated its Nonpoint Source Pollution Management Plan. This plan identifies the major sources of nonpoint source pollution to Maine's ground water and surface water and proposes to implement pollution prevention programs.

Major impediments to effective ground water protection in Maine are (1) absence of an accurate ground water quality database to assess the extent of degradation, (2) lack of data to quantify the impact of some nonpoint pollution sources, (3) inadequate State and Federal funding for ground water research and ground water protection programs and (4) general public unfamiliarity with key ground water concepts and issues. Public misconception about ground water is probably the major factor contributing to degradation of this resource. The State of Maine will continue to work with the USEPA to address these issues through Maine's Comprehensive Ground Water Protection Program.

Chapter 2 - Assessment of Ground Water Quality

Ground water in Maine is classified by its suitability for drinking water purposes. Under the Maine Water Classification Program, ground water is classified as either potable (GW-A) or unpotable (GW-B). Water is unpotable when the concentrations of chemical compounds detected exceed either the Maximum Contaminant Levels (MCL) or the Maximum Exposure Guidelines (MEG) as defined in the Rules Relating to Drinking Water administered by the Maine Department of Human Services (DHS). Although there are many localities where ground water is unpotable and highly contaminated, no ground water is currently classified GW-B. The state is not currently attempting to designate non-attainment areas.

Detailed quantitative estimates of the statewide extent of ground water contamination are not currently available. In addition, current information about ground water contamination in Maine does not necessarily portray the situation accurately. This information reflects contaminants that have been looked for, where they have been looked for, and where they have been found. Further, the number of wells contaminated by a specific pollution activity does not necessarily reflect its overall ground water pollution potential since some activities (e.g. agriculture) occur in sparsely populated areas with few available wells to monitor.

Ground Water Monitoring

Monitoring of ground water in Maine is either site-specific or generalized. Monitoring at a particular site is generally done to gather data on water quality impacts of particular activities, and may or may not be research-related. Most of the ground water data collected in Maine is the result of permit conditions, enforcement agreements or impact assessments. This information is scattered in a number of state agencies including the DEP Bureaus of Land and Water Quality, and Remediation and Waste Management; the Department of Transportation, Water Resources and Hazardous Waste Section; the Department of Human Services (DHS), Division of Health Engineering, the DHS Environmental Health Unit, DHS Health and Environmental Testing Laboratory; and the Department of Agriculture, Food and Rural Resources, Board of Pesticide Control. Other information is collected by the Department of Conservation, the U. S. Geological Survey, and the Maine Geological Survey (MGS), (also known as the Natural Resource Information and Mapping Center/Geology). The data are stored on paper or in computer files. Many of these data are potentially useful for research purposes but are not easily accessed by either the public or by other agencies. This access problem is the subject of a three-phase study of ground water data management, the first two parts of which are completed. Phase II resulted in specific and detailed recommendations for a more efficient and accessible system. This effort is concurrent with the EPA - Maine data management pilot study aimed at improving data communication between the EPA, Maine, and other state or federal agencies.

The terms "generalized monitoring" or "ambient monitoring" are intended here to refer to large area, long-term monitoring conducted to obtain trend information on ground water quality or quantity. Such monitoring is generally carried out by the MGS and the U.S. Geological Survey

(USGS) under one of several cooperative agreements. The USGS maintains a statewide network of ground water observation wells to track changes in water quality and quantity. The data thus derived are incorporated into the maps and reports generated by the program and have proven invaluable to town planning boards and State efforts such as the registration of underground oil storage tanks and site reviews of various land use proposals.

Within the DEP, site-specific ground water monitoring data are obtained either by Department staff, permit-holders, or as a result of enforcement agreements. Ground water samples are generally tested in commercial laboratories according to EPA or DEP standard methods. The Bureau of Land & Water Quality requires ground water monitoring at project sites that are subject to its jurisdiction when the existing or proposed activity either poses a risk to ground water quality or quantity or an adverse impact has already occurred.

Activities that are considered a risk to ground water quality or quantity include: quarries, borrow pits, metallic mineral mines, fuel storage/handling areas (wood waste and petroleum), golf courses, infiltration basins and wastewater treatment lagoon/spray irrigation areas. Also of concern are subdivisions utilizing large-volume or community subsurface wastewater disposal systems, or nitrate-reduction (e.g. peat-matrix) systems. Geologic settings considered to be particularly susceptible to adverse impacts are those located over mapped sand and gravel aquifers, shallow-to-bedrock areas within sensitive lake watersheds are also generally required to monitor ground water.

While ground water monitoring data from these project sites have generally been reviewed on a case-by-case basis, efforts are underway to accomplish a comprehensive analysis and compilation of this information. Objectives of this analysis are to determine the consistency of monitoring program requirements between sites engaged in the same activity, to determine the extent of compliance with ground water quality/quantity standards, and to determine whether monitoring parameters required for a particular activity are appropriate. Based on these determinations, it is expected that required monitoring programs for project sites may be amended or eliminated. In addition, it is planned that ground water monitoring data for these facilities will be incorporated into a database to facilitate access to, and management of, this information.

Similarly, the DEP Bureau of Remediation and Waste Management (BRWM) requires periodic sampling and/or reports from hazardous waste storage facilities and generators. Additional sampling may also be required under the terms of enforcement agreements. The samples are generally tested in commercial laboratories according to EPA standards. BRWM field staff sample ground water to determine ground water quality impacts associated with uncontrolled hazardous waste sites, oil or fuel spills from stationary or mobile sources and from approved hazardous waste or hazardous materials storage facilities. BRWM requires ground water monitoring at all licensed landfills. Monitoring of upgradient and down gradient wells for detection parameters is required at a minimum. Detection parameters are considered reliable indicators of potential effects of the landfill on ground water. Facilities are required to monitor for an extensive list of compliance parameters whenever detection monitoring indicates a significant trend of change in ground water quality. Some BRWM ground water monitoring is intended to help locate new water supplies to replace those polluted by leaking underground storage tanks.

MGS sand and gravel maps will be useful in defining aquifer boundaries. Since the boundaries are in GIS, they can be combined with the DHS water supply data and the contaminant site and land use data available in DEP databases.

As far as characterizing the physical and chemical attributes of the stratified drift aquifers, the MGS is at the "average characteristics" stage. While site specific data do exist for some aquifers (primarily in the vicinity of ground water resource evaluation projects and contamination sites), complete physical pictures of an aquifer system do not exist. The USGS is working with the Town of Windham on just such a project, involving seismic work and drilling as well as geologic mapping. Similarly, MGS has some ambient water quality data but has not fully characterized any one aquifer system. Hard data on the exact natural chemical processes controlling ground water chemical evolution that occur along a flow path in a sand and gravel aquifer are also lacking.

Overview of Ground Water Contamination Sources

Almost all ground water contamination in Maine originates from nonpoint source pollution rather than point source pollution. Table 4-2.1 lists the contaminant sources that are the greatest threats to ground water quality.

The following discussion focuses primarily on nonpoint contamination sources that appear to be responsible for most ground water contamination in the State: agriculture, hazardous substance sites, spill sites, landfills, leaking underground and above-ground storage tanks, road-salt storage and application, septic systems, shallow well injection, saltwater intrusion, and waste lagoons. In addition to these major sources, diverse land uses such as sludge, septage and residual land applications, metallic mines, borrow pits and quarries, golf courses, dry cleaners, automobile service stations, cemeteries, and burned buildings are also potential threats to ground water.

Table 4-2.1. Major Sources of Ground Water Contamination

Contaminant Source	Ten Highest Priority Sources (X)	Factors Considered in Selecting a Contaminant Source	Contaminants
Agricultural Activities			
Agriculatural chemical facilities			
Animal feedlots			
Drainage wells			
Fertilizer applications	x	BCDE	EA
Irrigation practices			
Pesticide applications	x	AFGBE	ABD
Storage and Treatment Activities			
Land application			
Material stockpiles			
Storage tanks (above ground)	x	ACDE	DEC
Storage tanks (underground)	x	ADEC	DEC
Surface impoundments			
Waste piles			
Waste tailings			
Disposal Activities			
Deep injection wells			
Landfills	x	ACDE	EGHC
Septic systems	x	ABDC	EJCKL
Shallow injection wells	x	DC	
Other			
Hazardous waste generators			
Hazardous waste sites	x	ABCDEF	CDHAB M-non-halogenated solvents
Industrial facilities			
Material transfer operations			
Mining and mine drainage			
Pipelines and sewer lines			
Salt storage and road salting	x	ABCDFE	GH
Salt water intrusion			
Spills	x	ACEFD	ABCD
Transportation of materials			
Urban runoff			
Other sources			

Petroleum Product Spills and Leaking Storage Tanks

Underground Tanks
Contact: Bruce Hunter, DEP BRWM, (207) 287-7672.

Non conforming leaking underground storage tanks (LUST's) are viewed as the biggest threat to ground water quality in Maine. The most common petroleum product stored in underground storage tanks is fuel oil, followed by gasoline. Currently, 350 to 400 petroleum LUST sites or spill sites have been prirotized for remediation, according to the hazards they pose to water supply wells and the size of the potentially affected population using groundwater for a drinking water source. Two hundred and seventy wells are contaminated by petroleum products at these sites. Since 1980, LUST facilities have contaminated over 550 private drinking water supply wells. From 1988 to 1993, Maine's LUST remediation program has replaced 286 contaminated wells serving 1,154 people. An estimated 183 additional public and private water supply wells, serving 6,920 Mainers, have been saved by DEP-funded remediation.

Above Ground Tanks
Contact: David McCaskill, DEP BRWM, (207) 287-7056.

Home heating oil storage tanks, which are often above-ground storage tanks (ASTs), are a significant contributor to ground water contamination due the leakage of stored petroleum products. The State Fire Marshal's office lists 294 ASTs permitted since 1994. The number of tanks attached to heating systems, which would include homeowner tanks, is not tabulated by any state agency, but a rough estimate would number more than 300,000 tanks. ASTs represent an ongoing and increasing threat to ground water quality. In the four-year period of 1988 to 1992, over 784 spills were recorded. DEP staff respond to approximately 200 home heating oil spills a year; staff responded to 30 incidents in January of 1996 alone. AST related spills include ank overfills, ruptures, tip-overs and other mishaps. The Pollution Prevention Program and the Maine Oil Dealers Association have cooperated to educate vendors and owners on how to protect their tanks and operate them safely.

Although fuel oil and gasoline are not classified as hazardous substances, many of their constituent compounds, such as benzene, are carcinogens at very low concentrations. The data in Table 4-2.2 come from the sites on the LUST priority list:

Table 4-2.2. LUST Priority Sites - Contamination Summary

Number of Contaminated Wells*	Number of Contaminated Public Water Supplies	Number of Threatened Wells*	Number of Threatened Public Water Supplies
270	11	342	43

* Does not include public water supplies.

To control the LUST threat, in 1985 the Maine Legislature passed a law to regulate underground petroleum storage tanks. This law required that all tanks be registered with DEP by May 1, 1986, regardless of size, use, or contents. The law also established procedures for abandonment of tanks and prohibits the operation, maintenance, or storage of petroleum in any storage facility or tank that is not constructed of fiberglass, cathodically protected steel, or other non-corrosive material after:

A. October 1, 1989, if that facility or tank is more than 15 years old and is located in a sensitive geological area;

B. October 1, 1991, if that facility or tank is more than 25 years old, or if that facility or tank is more than 15 years old <u>and</u> is located in a sensitive geological area;

C. October 1, 1994, if that facility or tank is more than 20 years old, or if that facility or tank is more than 15 years old <u>and</u> is located in a sensitive geological area; and,

D. October 1, 1998, for all remaining unprotected facilities or tanks.

NOTE: A "sensitive geological area" means: 1) a significant groundwater aquifer; 2) a primary sand and gravel recharge area; 3) locations within 1,000 feet of a public drinking water supply; or, 4) locations within 300 feet of a private drinking water supply. Sensitive geological areas around surface water bodies include all areas within 1,000 feet of the intake of a public water system, except on rivers and streams where the term means areas within 1,000 feet of the intake and upstream on either shore. All areas within 300 feet of the intake point of a private water supply in a lake, pond, or other surface water body are sensitive geological areas, except on rivers and streams where the term means areas within 300 feet of the intake and upstream on either shore.

If the age of the underground tank(s) cannot be determined, it is presumed to be 20 years old as of October 1, 1989.

To date, approximately 39,850 tanks have been registered and an estimated 4,000 tanks remain unregistered. Since 1986, approximately 27,750 inactive or old tanks have been removed. Figure 4-2.1 shows the number of drinking water supply wells contaminated by LUST since 1986. Figure 4-2.2 shows the change in the type of tank making up the underground storage tank population in Maine. Figure 4-2.2 indicates a decrease in non-conforming UST's and an increase in protected replacement UST's, a trend which will help enhance ground water protection. For every $1 spent on preventative measures required by DEP regulations (Chapter 691), an estimated $3 of clean up and third-party damage claim costs are avoided.

A new database has been created for the LUST program. The database became operational in 1995, and data on current ground water contamination caused by LUST's are now accessible by computer to DEP staff.

Figure 4-2.1. Number of Private Drinking Water Supply Wells Contaminated by Leaking Underground Petroleum Storage Facilities: 1986-1993.

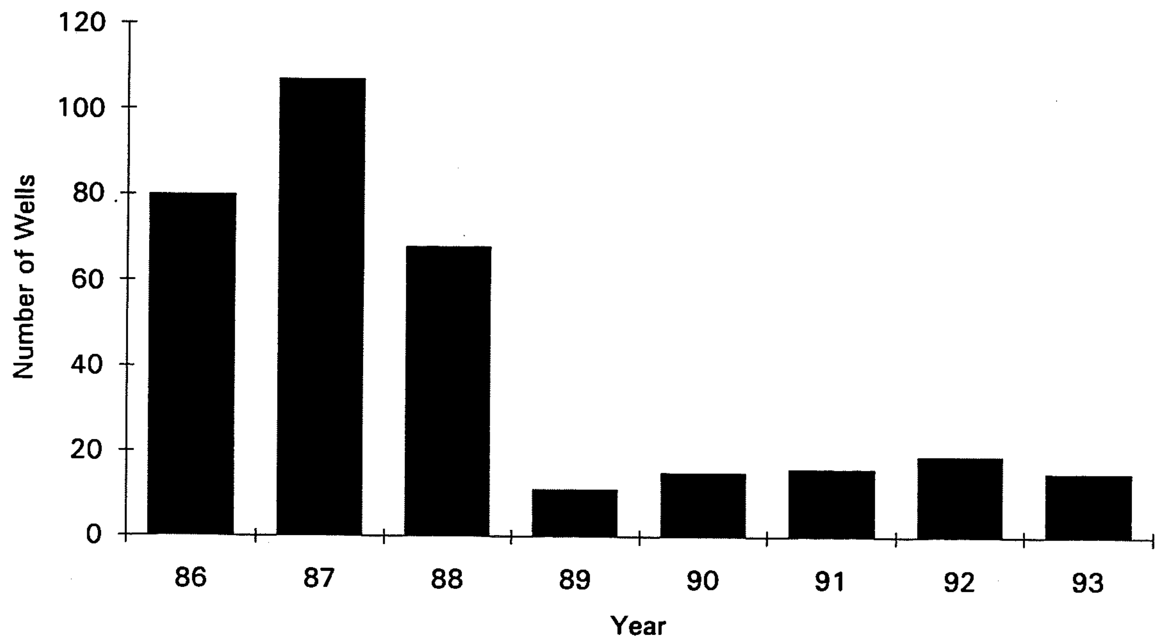
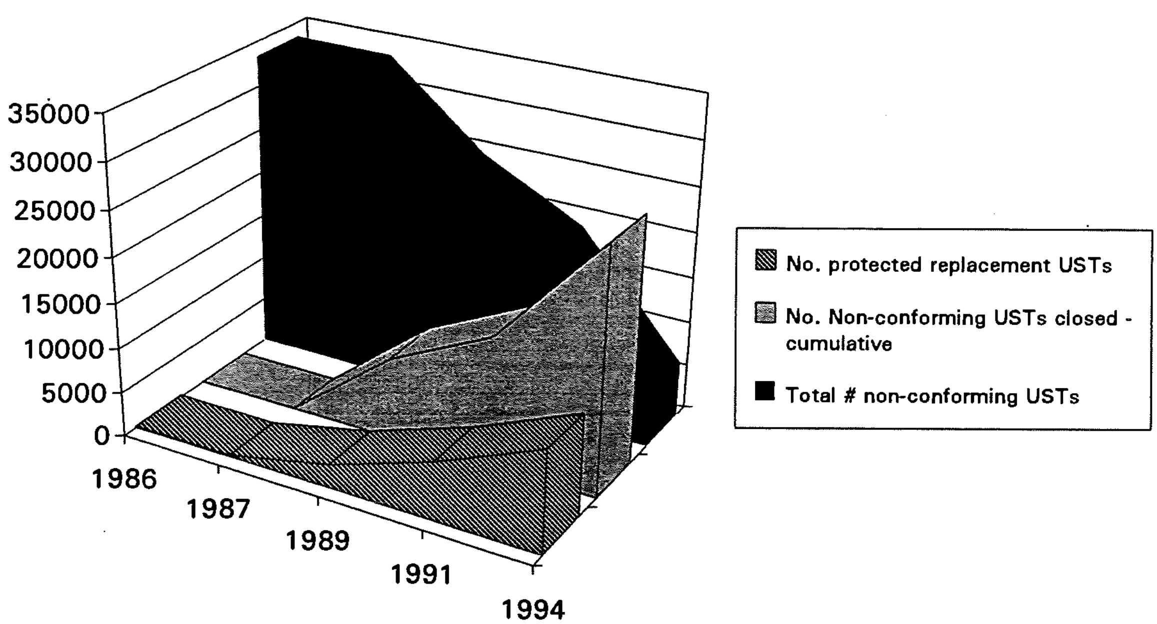


Figure 4-2.2. Changes in the Make-Up of the Maine UST Population.



Spills
Contact: Lyle Hall, DEP BRWM, (207) 287-7499.

The DEP BRWM responded to approximately 4,800 oil spills between January of 1993 and December of 1995 (1995 data are 85% complete). Over 80% of these responses involved discharges of petroleum products to soil and ground water. Between 1993 and 1995, discharges of petroleum products contaminated over 180 wells; sources of these discharges range from overturned tanker trailers to tank overfills (Table 4-2.3).

Table 4-2.3. Sources of Spills 1993 through 1995

Source	Percent of Total Spills
Industrial Sources	27%
Residential Sources	26%
Transportation	18%
Oil Terminals	16%
Other Sources	13%

Federal Facilities

Fuel spills or leaks occurred on 54 occasions at six different federal facilities during 1994 and 1995. Most spills in this time period were a gallon or less and probably didn't cause significant surface or ground water contamination. Two of the larger spills were 500 gallons at Portsmouth Naval Shipyard in Kittery and 2,500 gallons at the Loring Air Force Base (Loring AFB) in Limestone. These spill sites have not been studied to determine whether they have caused ground water contamination. Both of the major fuel pipelines in the State of Maine that were operated by the U.S. Government were decommissioned in 1994. One extended from Searsport to Limestone, serving Loring AFB; the second ran from Harpswell to Brunswick and served Brunswick Naval Air Station (Brunswick NAS). In the past, numerous leaks have occurred along these pipelines.

A Case Study: Brunswick Naval Air Station Ground Water Contamination.
Contact: Mark Hyland, DEP BRWM, (207) 287-7673.

Remediation of ground water contamination in the east Brunswick aquifer is ongoing. Thirteen sites (Figure 4-2.3) are currently part of the Remedial Investigation and Feasibility Study:

Site 1: Orion Street Landfill - North
Site 2: Orion Street Landfill - South
Site 3: Hazardous Waste Burial Area
Site 4: Acid/Caustic Pit
Site 5: Orion Street Asbestos Disposal Site
Site 6: Sandy Road Rubble and Asbestos Disposal Site
Site 7: Old Acid/Caustic Pit
Site 8: Perimeter Road Disposal Site

Site 9: Neptune Drive Disosal Site
Site 11: Fire Training Area
Site 12: Explosive Ordinance Dump Training Area
Site 13: Defense Reutilization and Marketing Office (DRMO)
Site 14: Old Dump Number 3

The U.S. Navy has constructed a water treatment plant at the base which treats contaminated ground water from Sites 1 and 3 and the Eastern Plume area. Site 1 and 3 were used by the Navy for approximately 30 years for the disposal of paint wastes, solvents, household waste, pesticides, petroleum products, airplane parts, and other wastes. The landfills are leaching contaminants into an adjacent stream and ground water in the area is contaminated with volatile organic compounds. Remediation of the landfills involves pumping contaminated ground water out of the waste and piping it to the ground water treatment plant. A slurry wall has been completed around the waste and keyed into a clay layer underlying the landfilled material. An engineered cap has been placed over Sites 1 and 3 to prevent infiltration of water into the waste. In December 1994, the Navy drilled two ground water extraction wells into the landfill and five wells into the Eastern plume of contaminated ground water that is moving toward Harpswell Cove. The wells in the Eastern Plume, located near the former base landfills, have been connected to the treatment plant pipeline and pumping of the contaminated ground water commenced in May 1995.

The Fire Training Area (FTA), Site 11, has been used for fire-fighting training since the 1950's. Fire-fighting exercises at the FTA introduced various liquids into the soils at the site, including waste oils, fuels, solvents, and other liquids. The FTA has contributed to the ground water contamination in the Eastern Plume. Reportedly, the only measure taken before 1987 to control infiltration of the liquids into the soils was to saturate the ground surface with water to float the product prior to a burn. In 1987, the FTA was upgraded with the installation of a 40 feet x 40 feet concrete liner and berms. Additionally, a collection system, including piping and a 6,000 gallon fiberglass underground storage tank, was installed north of the training area to contain unburned liquids. Information obtained in 1993 by NAS Brunswick personnel suggested that drums containing unknown liquids may have been buried at the FTA between 1970 and 1980. Field activities conducted at the FTA site included magnetometer and ground penetrating radar surveys, followed by test pitting of 14 anomalous target areas identified during the geophysical surveys. These investigations located buried drums and micellaneous containers at five of the fourteen test pit locations; drums containing solvents and petroluem compounds were found in various stages of deterioration. Metal debris, drums, and miscellaneous containers were excavated and consolidated into 18 drums and seven 1-cubic-yard containers in December of 1994. These wastes and 11 tons of contaminated soil were removed from the FTA site in June of 1995; contaminated soils were placed in the landfills at Sites 1 and 3 and capped. Samples collected from soils remaining at the test pit sites indicate the presence of low concentrations of organic compounds and inorganic analytes. A significant volume of metal debris also remains at the site; the average depth of the contaminated soils and metal debris is approximately five feet. The underground storage tank, associated piping and other elements of the collection system, including approximately 4,500 gallons of oily water contained in the tank, were also removed and disposed of offsite. Contaminated groundwater from the FTA is pumped and treated at the base water treatment plant.

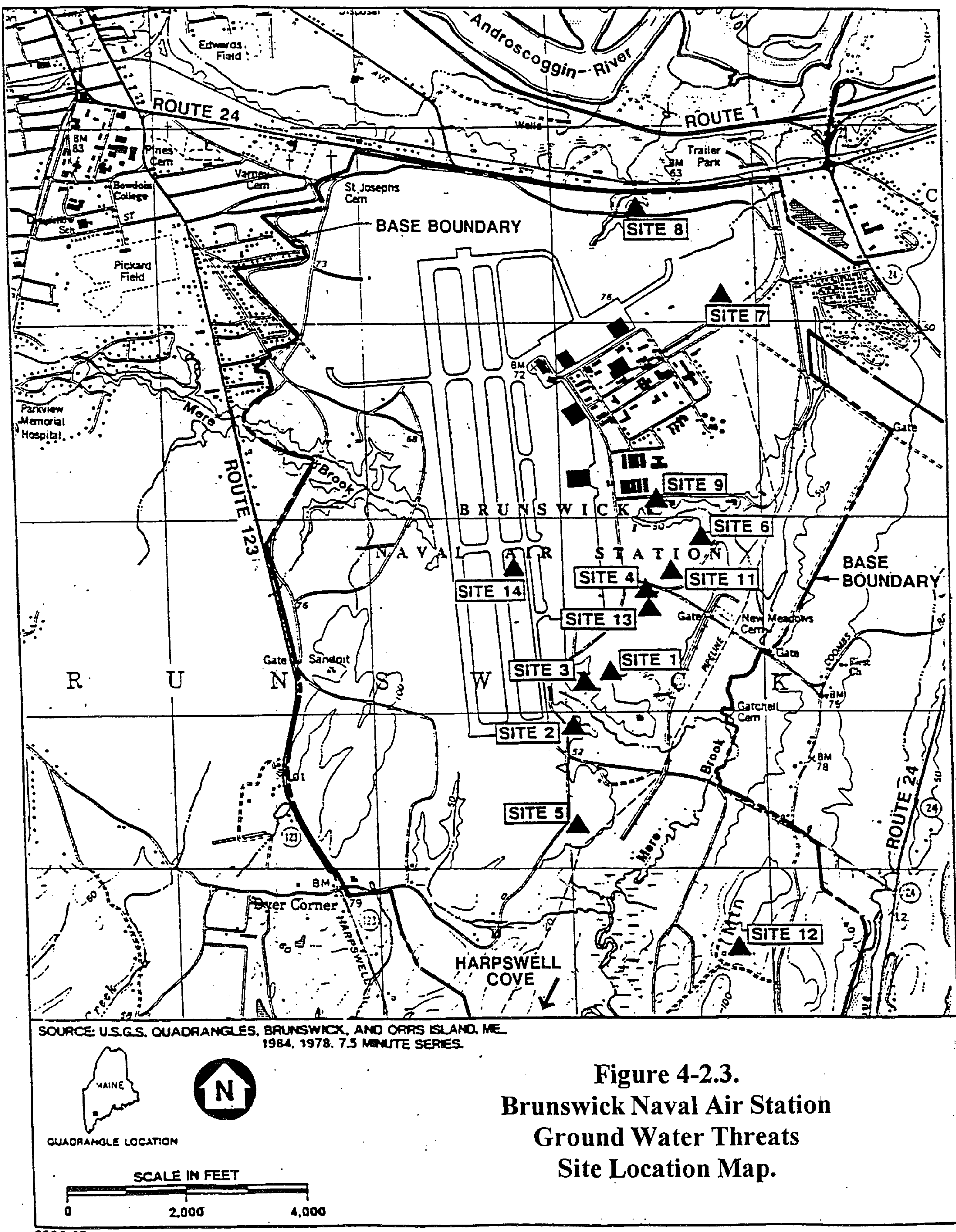


Figure 4-2.3. Brunswick Naval Air Station Ground Water Threats Site Location Map.

6836-05

Agriculture
Contact: Craig Leonard, Maine Department of Agriculture, (207) 287-3117.

In 1992, the total estimated cropland and pasture land in Maine was slightly greater than 660,000 acres, a decline of approximately 40,000 acres since 1987. The agricultural community uses chemicals for pest control and weed eradication; in addition, many farmers apply chemical fertilizers and manure. These are major potential sources of ground water contamination. Farmers apply over 58,000 tons of chemical fertilizers and 2.1 million tons of manure to agricultural land in Maine each year. In 1992 the Department of Agriculture estimates that chemical fertilizer was spread on over 250,000 acres. The major areas of chemical application include potato fields in Aroostook County, blueberry barrens in Hancock and Washington County, and apple orchards and forage cropland in Central Maine. Pesticides and nitrates are the main agricultural ground water contaminants.

Pesticides.
Contact: Tammy Gould, Maine Board of Pesticide Control, (207) 287-2731.

Although at high concentrations pesticides are known to have acute health effects, because they are generally present in low concentrations in ground water, most of the concern has been focused on their chronic health effects such as cancer and birth defects. In Maine, increased concern about the health effects of agricultural pesticides in ground water began in 1980 when the pesticide aldicarb (Temik) was found in private wells near potato fields. Forty-seven percent of the 304 wells sampled showed detectable amounts of the pesticide and its toxic derivatives. Subsequently, a study by researchers at the University of Maine at Orono detected traces of the pesticide azinphos methyl (Guthion) in ground water from blueberry regions in Washington and Hancock counties. A summary of pesticide studies follows:

1985: The Natural Resource Information and Mapping Center/ Geology (MGS) and the Maine Department of Agriculture, Food and Rural Resources (DAFRR) began a three-year evaluation of the effects of agricultural pesticides on ground water quality. The researchers collected 229 samples from 95 wells in potato, orchard, blueberry, and market garden/forage cropland areas and tested them for pesticides and nitrate. Fourteen percent of these samples tested positive (mostly at trace levels) for various pesticides. Seven different pesticides were detected in 19 out of 68 wells sampled in potato regions. Trace concentrations of hexazinone were detected in 2 of 21 samples in blueberry areas. The study results suggest that bedrock wells overlain by till in potato regions have the highest incidence of contamination by agricultural pesticides.

1989: MGS, DAFRR, and USEPA tested 51 private wells near potato fields in Aroostook County to assess ground water contamination vulnerability from agricultural chemicals. Water from twenty-two of these wells (42%) showed traces of pesticide.

1990: The University of Maine and the Board of Pesticides Control (BPC) conducted a study to evaluate the effectiveness of immunoassay testing for monitoring pesticides in ground water samples. The study sampled 58 wells on each of three separate occasions; analytical data showed that:

- 31% had detectable concentrations of atrazine at least once during three sample events. Most of these wells had less than 0.60 μg/l atrazine; only two wells demonstrated concentrations of atrazine higher than the MCL of 3.0 μg/l.

- 12% had detectable concentrations of alachlor at least once during three sample events. Concentrations in each of these wells exceeded the maximum contaminant goal level (MCGL) of 0 μg/l in one or more of each sampling event.

- 5% had detectable concentrations of carbofuran in one of the three sample events. None of these were near the MCL of 40 μg/l.

1992: The BPC and the University of Maine conducted the Maine Triazine Survey. The purpose of the study was two-fold. The first purpose was to verify the reliability and accuracy of immunoassay tests for the triazine pesticides. Second, data gathered during the project would provide insight into the quality of Maine's ground water and aid in the development of Maine's Ground Water Management Plan.

One hundred and fifty-two samples were collected and analyzed for the triazine herbicides. Approximately half of the samples were collected from sites near tilled corn fields. The remaining samples were collected from three non-tilled triazine use areas: orchards, Christmas tree plantations, and railroad rights-of-way. None of the sample results exceeded the health advisories for any of the pesticides tested. The highest atrazine sample results were 1.2 parts per billion (ppb), only 40% of the 3 ppb health advisory level.

Of the 152 samples subjected to immunoassay tests:

- 21% tested positive for the triazine immunoassay (which reacts to both atrazine and simazine). High-performance liquid chromatography (HPLC) analysis found 33 (22%) of samples showed a pesticide concentration above the 0.04 ppb HPLC detection limit. In summary:

- 20% of all sampled wells had confirmed atrazine detections. Of these 31 sites with confirmed detections, 25 were near forage corn, 3 were near railroad rights of way and 3 were near Christmas tree plantations.

- 3% of all sampled wells had confirmed simazine detections and only 1 sample (<1%) had a confirmed cyanazine detection.

1994: The large number of hexazinone detections in the 1994 BPC study was one piece of a growing body of information about its potential to contaminate ground water, One-hundred thirty-nine sites were sampled in blueberry growing areas for the herbicide. Detectable residues were found at 96 (69%) of the sites. In 1993, the highest level of hexazinone was detected, 29 ppb. The sample was taken from a two inch test well located in a blueberry field. The average concentration in all studies remains below 4 ppb, which is less than 2% of the USEPA lifetime health advisory for hexazinone. Because of these findings and public concern about the herbicide, the BPC is developing a state management plan for hexazinone. A committee was created in 1995 to draft the document which is based on the Maine Generic State Management Plan for Pesticides in Ground Water (June 1994) and EPA pesticide management plan program guidance. The Board will conduct review of the draft and rule making in 1996.

The BPC began an ambitious pesticides-in-ground water monitoring program. The goal was to assess the impact of highly leachable pesticides on Maine ground water across a variety of agricultural and non-agricultural use sites. Corn, potato, blueberry, Christmas tree, rights-of-way, oat, market garden, and orchard sites were included. Wells chosen for sampling were private domestic wells currently used for drinking water within 1/4 mile of an active pesticide use site and downgradient of or even with the use site.

Of the 129 sites sampled, 31 sites yielded detectable pesticide residues in the drinking water. Alachlor, atrazine, diazinon, dinoseb, ethoprop, hexazinone, metalaxyl and metolachlor were detected at quantifiable levels. Dinoseb, canceled by the EPA in the mid-1980's, was the only pesticide found which currently has no registered users. Only diazinon was detected at levels above established drinking water guidelines.

The BPC concluded that pesticide contamination of ground water appears to be prevalent in areas near active use sites, although at levels which do not currently present a health threat to the citizens of Maine when compared to the health-based standards established by the USEPA and the Maine Bureau of Health. Several areas of concern arose from this study:

- Three pesticides, metolachlor, metalaxyl, and ethoprop, were detected at quantifiable levels for the first time in Maine.

- The prevalence of hexazinone, albeit at levels well below established drinking water advisories, is a cause for concern. While health concerns may not be an issue, it is clear that this pesticide has a widespread impact on ground water.

- Triazine does not appear to be a great concern in Maine, unlike other areas of the country. Although atrazine was detected, neither the 1992 study nor this one detected atrazine above established drinking water advisories.

- Pesticide use and disposal of obsolete pesticides by homeowners may present a much larger risk to ground water than previously believed. Both diazinon and dinoseb were detected at only two sites. The contamination was directly linked to improper homeowner use and storage at both sites.

Nitrate. The documented adverse health effects of nitrate (potential methemoglobinemia in infants and complicity in producing carcinogenic nitrosamines), and its mobility in ground water, may make it the most significant agricultural contaminant in Maine ground water. Nitrate in agricultural areas results primarily from application of chemical fertilizers and manure to cropland. Most of the chemical fertilizer is used on potato cropland. Manure is spread primarily on corn and hay fields. In 1992, 755,000 tons of usable manure was produced on Maine farms. A breakdown of the percentage of manure produced by different domestic animals follows in Table 4-2.4:

Table 4-2.4. Domestic Animal Manure Production

Category of Domestic Animal	% of Manure Produced
Dairy cattle	41
Poultry	32
Beef cattle	17
Horses, hogs and pigs, sheep and lambs	10

Twenty-one of 100 wells tested for nitrate in the MGS/DAFRR three-year study cited above had nitrate concentrations exceeding the 10 mg/L drinking water standard. The percentage of wells in each crop type exceeding the drinking water standard was greatest in market garden/forage crop regions (40%) and potato regions (23%). Wells in orchard and blueberry areas did not exceed the standard. Mean nitrate concentrations were highest in market garden/forage crop regions (8.6 mg/L) followed by potato regions (6.7 mg/L), orchards (1.1 mg/L), and blueberry areas (0.1 mg/L). Results of the MGS, DAFRR, and USEPA study conducted in 1989 in the potato growing regions of Aroostook County showed a similar trend. Nineteen percent of the 211 wells (40 wells) exceeded the 10 mg/L primary drinking water standard for nitrate-N. It is important to note that the nitrate contribution from non-agricultural sources, such as septic systems, has not been evaluated at any of the sites.

The impact of typical manure storage and spreading practices on ground water quality is not well known but merits greater investigation. Documentation of nitrate ground water contamination from manure storage and spreading currently is limited to DEP and DAFRR case files; these probably represent "worst case scenarios". Some "worst case" examples include a poultry farm in Turner where manure disposal caused extensive ground water contamination (nitrate-N above 600 mg/L locally) in both the overburden and bedrock aquifers and in surface waters (see the section on ground water - suface water interactions); and domestic wells in Clinton and Charleston where leachate from nearby uncovered manure piles is alleged to have contaminated domestic wells with nitrate-N concentrations exceeding 100 mg/L.

In 1990, the Maine Legislature gave DAFRR primary responsibility for investigating complaints related to manure storage and spreading. Between 1993 and 1995, DAFRR investigated 146 complaints. Of 44 complaints related to drinking water well contamination, 16 concerned elevated nitrate in wells and 28 complaints concerned elevated bacteria. Fourty-eight complaints related to manure impacts to surface water bodies were investigated during this same period.

The extent of nitrate ground water contamination from manure is unknown but may be significant. The Maine Soil and Water Conservation Districts 1988 Manure Management Project found that the plow layer in approximately one-half of the 249 corn fields sampled had more than twice the level of soil nitrate needed to produce a normal 25 ton/acre crop yield. Although not all of the excess nitrate will leach into ground water (some will be bound by soil organic matter), the data show that a very high potential for ground water quality degradation exists beneath these fields. The Maine Cooperative Extension Service originally published manure utilization guidelines in July, 1972 (Miscellaneous Report 142). Revised non-regulatory guidelines were developed in 1990. The key elements include testing soil and plant nitrate levels prior to fertilizer application, and fertilizing according to realistic crop uptake rates.

DAFRR statistics for 1992 indicate that farm land available for manure spreading includes approximately 214,000 acres of hay, 24,300 acres of oats, 28,300 acres of silage corn, and 12,000 acres of vegetables and nursery crops. According to the agronomic spreading rates recommended in the 1980 Manure Management Project report, available hay and corn cropland can accept all of the manure generated annually in this state. However, because manure production is concentrated regionally, sufficient land for spreading may not be available in the areas of greatest manure production. Even when spreading areas are available locally, it is usually economically unfeasible for a farmer to haul manure more than two miles from where it is stored.

Cull Potato Disposal

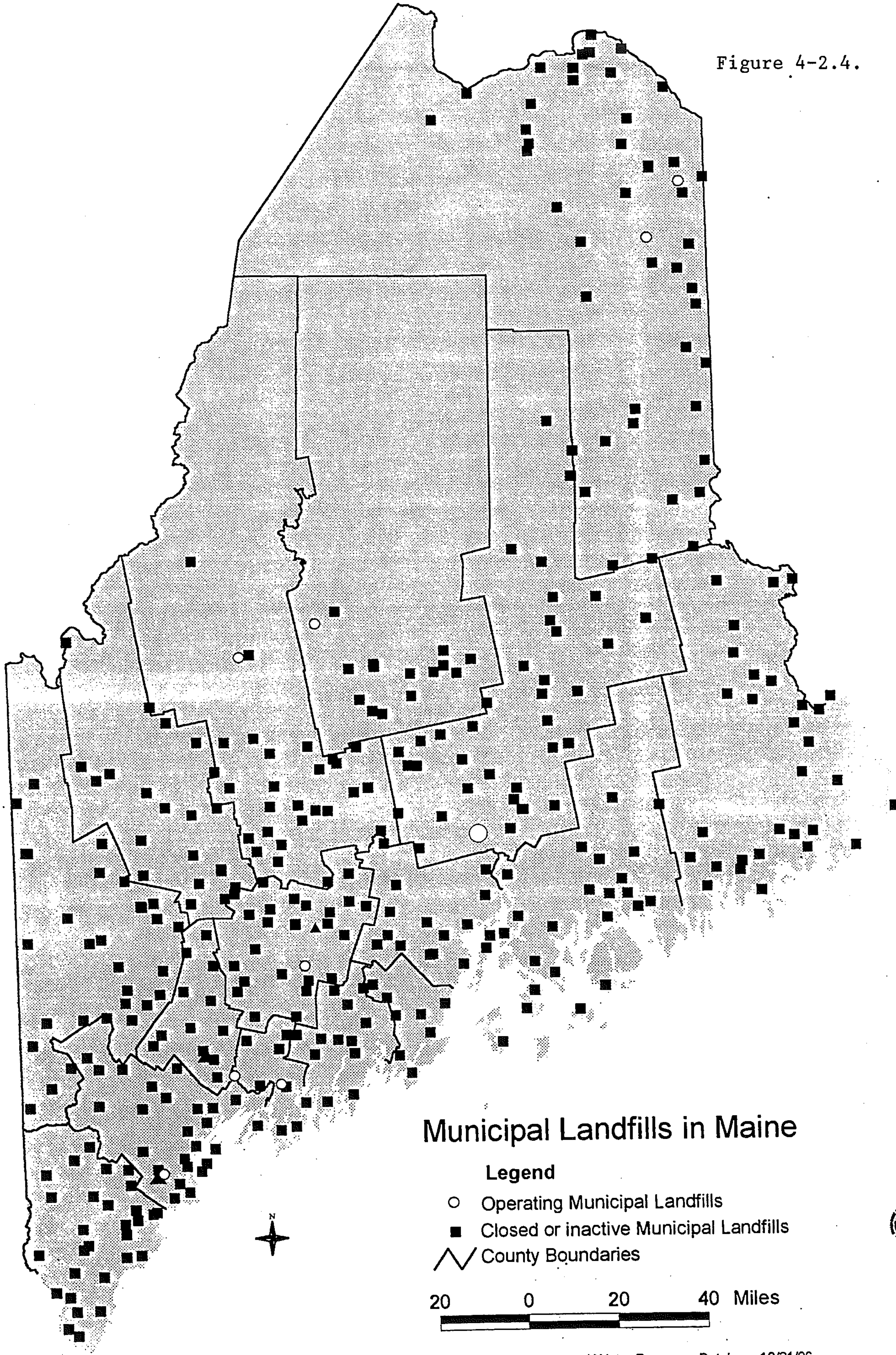
In 1995 the Maine Legislature passed "An Act Concerning Potato Blight Eradication and the Disposal of Cull Potatoes". This bill gave the Department of Agriculture the authority to require the use of best management practices when disposing of cull potatoes. Water quality problems arising from improper disposal of cull potatoes can include increased nitrate and ammonia, odor, color, and elevated bacteria counts. The Cooperative Extension issued guidelines for disposal of waste potatoes in September, 1974 (Miscellaneous Report 162). In 1992, a particularly bad year for the Maine potato industry, a billion pounds of the Aroostook County potato crop was unmarketable. That year there were four confirmed instances of private water well contamination as a result of cull potato disposal. An additional 24 disposal sites were suspected to have caused ground water contamination. Between 1993 and 1995, the Department of Agriculture investigated 42 cull potato cases. Three of these cases concerned potential contamination of ground water or drinking water wells, and seven complaints concerned surface water contamination.

Landfills

Contacts: Paula Clark, DEP BRWM, (207) 287-7718 and Ted Wolf, DEP BRWM, (207) 287-8552.

Approximately 1.6 million tons of solid waste were deposited in Maine's landfills in 1991 (Figure 4-2.4). This waste is generated by residential homeowners, municipalities, and commercial operations. The Maine DEP is directed by statute to regulate two major categories of municipal solid waste landfills, which include: (1) active landfills, and (2) inactive municipal landfills that were not closed prior to 1976. This second category contains landfills that may now be closed and capped, or are awaiting closure and remediation, and which pose the most serious threat to ground water quality. Leachate released from the landfills that have not been finally closed may contain a variety of toxic organic and inorganic contaminants that will degrade ground water if the leachate migrates beyond the landfill.

Figure 4-2.4.



Source: Ground Water Resource Database 10/21/96

Active landfills. Active landfills are required to be licensed by the Department of Environmental Protection. Currently 57 landfills are licensed to operate in Maine. Eight of these are licensed to accept municipal solid waste (MSW) only; 22 are licensed to accept special wastes (non-hazardous waste generated by sources other than domestic and typical commercial establishments); and 27 are approved to accept only construction and demolition debris. The landfills licensed to accept MSW and/or special wastes are secure landfills with leachate collection systems and treatment, significantly reducing the risk to ground water quality.

There are two landfills that are currently operating illegally; one is a small island landfill accepting municipal solid waste, and the other is a small-town landfill accepting construction and demolition debris. The Department is pursuing enforcement action to force closure of these landfills as quickly as possible.

Inactive landfills. A total of 391 municipal landfills have been identified in the state. As of December 1995, 206 of these landfills have been closed and capped. Seventeen landfills are partially closed and 168 remain to be closed. These include 45 currently active sites and 123 inactive sites which are no longer receiving solid waste. In all:

- 184 landfill sites are on sand and gravel aquifers and ground water contamination has been documented at 46 of these sites;

- Sixty other sites have contaminated surface water and/or ground water and are considered to be substandard; 37 of these sites have serious ground water contamination;

- Hazardous substances in ground water are confirmed or suspected at 41 municipal landfills. Public or private water supplies are potentially threatened at 13 of these sites. Public water supplies appear to be threatened by hazardous contaminants at three sites (Bucksport, Pittsfield, and Standish); contaminants at ten sites appear to threaten private water supplies;

- 135 sites have no reported or documented problems with surface water or ground water;

- 17 of these inactive sites appear to be accepting demolition debris; and,

- There are at least 65 sites where open burning occurred.

Maine's landfill closure and remediation program was established in 1987, with goals of closing and remediating solid waste landfills that are inadequately designed and constructed, or inappropriately sited. DEP has conducted evaluations of municipal landfills and developed closure procedures. As a result of new legislation in 1994, municipalities are allowed to determine for themselves (with proper documentation) whether their landfill meets the eligibility requirements for a "reduced procedure" closure. The reduced procedure is a further evolution of the Interim Cover and Grading (ICAG) procedure implemented by the Department in 1993.

Towns that determined that they were eligible for the reduced procedure, were able to proceed immediately with the implementation of their closure without obtaining an advance permit from the DEP. These changes were important in enabling many smaller Maine municipalities to reduce costs and expedite the closures of their landfills in 1995.

This legislation also made changes in the provision of State cost-sharing levels for closure/remediation work. In most cases the State pays 75% of eligible expenses. Municipalities were required to form an agreement with the State by July 1, 1994 in order to preserve this funding arrangement. Some municipalities that did file the necessary agreement were allowed to delay their final closure until 1996 if they showed progress towards final closure by implementing evaluation, design, or initial grading construction work. These municipalities are still eligible for the 75% state cost-share support. Municipalities who do not close their facilities by the end of 1996 will have this funding support reduced unless a license, closure order, or other written agreement is obtained.

A total of 153 landfill closing projects were completed under state guidance, using local and state funds, during the 1993-95 reporting cycle. A total of 241 municipalities have received state cost-share funding for past landfill closures or ongoing landfill closure planning activities. Seven bond issues to fund assessment, closure, and remediation of landfills have been approved by Maine voters. Fifty-nine million dollars have been made available for closure as of January 1996. Estimates for additional funds needed to evaluate, design, and complete capping, but not including remediation and evaluation, approach $40 million.

Sludge, Septage, and Residual Land Applications
Contact: David Wright, DEP BRWM, (207) 287-7676.

Land application or composting of solid waste, such as food waste, wood ash, sewage sludge, paper mill sludge, or fish waste is regulated by the DEP in Department Rules, Chapter 567, Rules for Land Application of Sludge and Residuals. Septage is regulated by Department Rules Chapter 420, "Septage Management Rules".These rules establish a framework to characterize residuals to determine potential agricultural benefit and harm if the residual is applied to the State's agricultural or forest lands. The rule also establishes siting criteria and management practices to protect public health and the environment at utilization sites.

There are about 200 active sewage sludge land application sites and 100 septage sites in Maine. There are no documented cases of significant contamination of soil, surface water, or ground water arising from the land application of municipal wastewater sludge or septage in Maine at land application sites.

Road Salt
Contacts: Jeff Canwell, DEP BLWQ, (207) 287-7684 or Christine Olson, Maine Department of Transportation, (207) 287-3323.

During the winter, more than 100,000 tons of salt are spread on Maine roads for deicing purposes. The salt is stored in over 700 registered sand-salt storage piles, most of which are uncovered. Leaching of sodium and chloride from uncovered sand-salt storage and spreading has caused substantial ground water degradation in Maine. DEP field investigations have documented over 130 drinking water wells in the State that have become unpotable (chloride in excess of 250 mg/L) as a result of contamination from sand-salt storage. Between 1994 and 1995, seven incidents of water wells contaminated by sand salt storage were recorded by the DOT. Elevated sodium concentrations may pose a health risk for people on sodium-restricted diets, e.g., people with hypertension. For the majority of the population, water will taste salty if the chloride concentration exceeds the State 250 mg/L secondary (aesthetic) standard.

Nearly every uncovered sand-salt storage pile is assumed to contaminate the ground water downgradient from the source. The impacts range from the Maine Department of Transportation (MDOT) site in Dixfield, where leachate from a sand-salt pile flows a few hundred feet before discharging to the Androscoggin River (where it quickly becomes diluted), to the Town of York's former sand-salt pile and leaky salt storage building that combined to contaminate nine wells and threaten at least 20 other downgradient wells.

An investigation conducted in the Province of New Brunswick, Canada, indicated that as much as 57% of the mass of salt stored may leach annually from uncovered sand-salt storage piles. A British study estimated that approximately 10% of the salt in a typical uncovered sand-salt pile may be lost in one year.

In 1985, the Maine Legislature directed the DEP to prioritize all known sand-salt storage areas according to the extent of their ground water contamination problems. Documentation of ground water contamination was based primarily on private well testing. The prioritization was completed in 1986, however funds do not exist for DEP to continue a monitoring program for all sand salt storage piles in the state. DEP assumes the existing uncovered piles have an impact on ground water quality, but investigations are currently carried out on a case-by-case basis in response to complaints. DOT does monitor ground water at its sand - salt storage sites to track ground water contamination.

In 1986, the Legislature passed two laws to protect ground water by dealing with sand-salt storage facilities. One statute established a state cost-share program for construction of municipal sand-salt storage facilities. The other statute established a compliance schedule for commercial sand-salt storage operations to construct sand-salt storage facilities. This bill required that all sand-salt be stored under building cover by January 1, 1996. Recent legislation has extended this date to January 1, 2003, because of state budget shortfalls and the lack of state cost-share funds. Through the end of 1994, MDOT has funded the construction of 29 sand/salt storage buildings throughout the state using these cost-share funds. Individual towns have also constructed storage facilities using their own funds, without State reimbursement.

MDOT files indicate that since 1969 at least 45 wells have been made unpotable by sand-salt spreading on roadways. Recent investigations of sand/salt applications in Massachusetts and urbanized areas of Canada have raised concerns that a large percentage of salt can be retained in shallow ground water. The potential result is an increase in chloride and sodium concentrations above the drinking water standards that can persist for many years. The likelihood of this occurring in Maine depends on the volume of applications and conditions within specific ground watersheds. To date, comprehensive studies of sand/salt spreading impacts in specific ground watersheds have not been undertaken in Maine.

Hazardous Substance Sites
Contacts: Hank Aho, (207) 287-4850 or Gordon Fuller (site investigation and remediation), (207) 287-4853, DEP BRWM.

There are numerous sites in Maine where hazardous substances have allegedly been discharged to the environment. As of January 1994, BRWM Division of Site Investigation and Remediation had 71 active uncontrolled hazardous substance sites under investigation, six of these are in the Operations and Maintenance (O&M) stage. Seven additional locations require further investigation to determine whether they should be listed as uncontrolled sites. The definition of an "uncontrolled hazardous substance site" or "uncontrolled site" is an area or location, whether or not licensed, at which hazardous substances are or were handled or otherwise came to be located. The term includes all contiguous land under the same ownership or control and includes without limitation all structures, appurtenances, improvements, equipment, machinery, containers, tanks and conveyances on the site.

Since 1983, 419 active and inactive uncontrolled sites have been or are currently being investigated. Naming a site as inactive means the state has determined no action is currently needed, action is pending, or action has been completed. Eleven sites are listed on the National Priority List of Superfund Sites, including the Brunswick NAS, McKin disposal site, O'Connor Salvage, Pinette Salvage Yard, Saco Tannery Waste Pits, the Union Chemical site, Winthrop Landfill, Loring AFB, Portsmouth Naval Shipyard West Site, Hows Corner in Plymouth, and the Saco Municipal Landfill. At least 97 drinking water wells have been contaminated above the MCL's or MEG's at 16 uncontrolled sites and numerous other wells are at risk. The database listing wells contaminated at uncontrolled sites has not been updated since 1991, so it likely underestimates the number of wells impacted.

Many of these sites are very small. However, because of the extreme health hazard they present, these sites receive a disproportionately large amount of the funds available for ground water protection, mostly for monitoring and remediation. Common hazardous substances found in the ground water at these sites include organic solvents, polychlorinated biphenyls (PCBs), pesticides, and metals. Most of these chemicals are carcinogenic, mutagenic, and/or teratogenic.

Resource Conservation and Recovery Act Sites
Contact: Peter Blanchard, DEP BRWM, (207) 287-7880.

The BRWM has 750 active generators of hazardous waste and 500 inactive generators in their tracking system. These facilities store or treat more than 100 kilograms per month of hazardous waste. Maine DEP currently lists approximately 60 sites with non-interim Resource Conservation & Recovery Act (RCRA) licenses and 60 sites with interim licenses. Over 40 sites with interim licenses will be investigated for possible groundwater contamination. Approximately 27 wells, both public and private, have been affected by ground water contamination. Forty-six sites licensed under RCRA have contaminated groundwater by discharges of hazardous substances; approximately 27 public and private water supply wells have been affected by this contamination. Nine of these twenty-seven facilities have ongoing, active remediation. .

Five domestic water supply wells became contaminated by solvents from lagoons and discharges to the septic system leachfield at the GTE facility in Standish. An additional 5 to 7 wells at this sitewere considered to be at risk from contamination, and existing public water supply lines had to be extended to seven homes. Pump-and-treat remediation is in progress at the leachfield and lagoon/ impoundment areas. Very little contaminant is being recovered at the leachfield, and the water pumped to the remediation system there meets drinking water standards for hazardous constituents. The water recovered at the impoundment area contains significant hazardous waste contamination. Plume control appears to be quite good. Remediation at the lagoon area will probably be a long term effort.

Solvents from the Maine Electronics Plant in Lisbon (Figure 4-2.7) have impacted the municipal water supply that serves over 8,000 customers. A pump-and-treat system has been installed to control migration of the contaminants in the Lisbon aquifer. Contaminant levels at the Lisbon town well have begun to fall. Several manufacturing facilities at the Sanford Industrial Park are suspected as the source of solvents contaminating the town well field, which serves over 6,500 customers.

Septic Systems
Contact: Department of Human Services, Division of Health Engineering, (207) 287-5338.

U.S. census data from 1990 indicate that there are in excess of 301,000 septic systems in Maine. The DHS Division of Health Engineering currently regulates septic system design and permitting. Of all the sources known to contribute to ground water contamination, septic systems directly discharge the largest volume of wastewater into the subsurface environment. The major contaminants of concern found in septic system effluent are nitrate, bacteria, and viruses. As discussed previously, high concentrations of nitrate may cause methemoglobinemia ("blue-baby syndrome") in infants. Correlations have also been shown between the incidence of stomach cancer and the concentration of nitrate in drinking water. The potential for disease transmission by the microbes discharged by septic systems is a public health concern.

Nitrate. Major factors affecting the potential of septic systems to contaminate drinking water are (1) the density of the systems per unit area, (2) hydrogeological conditions and, (3) water well construction and location. Areas with high septic system density may experience substantial ground water quality degradation partly because of the inability of the systems to adequately treat nitrates. Representative septic system effluent nitrate concentrations vary considerably according to the household lifestyle, diet, and water consumption. Studies have shown that the septic effluent reaching ground water contains approximately 40-80 mg/L nitrate-N. In Maine, estimates of the nitrate concentration from seotic systems range from 30-40 mg/L. Ground water quality monitoring conducted jointly by DEP and MGS in 1990 at four Maine septic system leachfields recorded total nitrogen concentrations (as nitrate-N, nitrite-N, and/or ammonia-N) ranging between 27 mg/L and 93 mg/L.

Examination of test data for nitrate-N from private wells in Maine can help identify the threat of conventional septic systems to ground water quality. The earliest ground water quality study performed in Maine to address water quality problems was done in 1973 and involved 523 private wells in York County. The study found nitrate-N concentrations exceeding the 10 mg/L standard in 2% of the wells tested. Approximately 33% of the wells sampled had nitrate-N concentrations in the 1.0 - 9.6 mg/L range. More recent studies have been conducted to document the impact of nitrate on private wells. Data from these studies are summarized in Table 4-2.5.

The Health and Environmental Testing Laboratory (HETL) database contains the results of water tests done on private wells. These tests are requested by homeowners or state or local officials on behalf of homeowners. This database provides the largest sample of private well nitrate concentrations in the state and includes sites impacted by a variety of nitrate sources including septic systems and agricultural activities. Assuming that the HETL database for nitrate-N represents Maine ground water quality, approximately 1% of private wells in Maine are unpotable because they exceed the 10 mg/L drinking water standard for nitrate-N and approximately 95% have concentrations below 5 mg/L, well below the standard.

The 1991 Hancock/Lincoln-Knox County (HLK) study focused on the impact of septic systems, but also examined the influence of agriculture on nitrate concentrations. The HLK study represents rural sites with both modern septic systems (post-1974) and older (pre-1974) septic system designs. The study found that 1.5% of the wells sampled exceeded the 10 mg/L nitrate-N primary drinking water standard. Statistical analysis was performed to identify principal factors affecting nitrate-N concentrations in wells. Results suggest that the highest nitrate-N concentrations would occur in dug wells or driven well points in surficial deposits or bedrock with short casing that are located near agricultural areas or a short distance from septic systems.

The DEP-MGS study focused on residential subdivisions with modern septic systems and associated well siting criteria. Site selection minimized the potential influence of agricultural practices on the ground water. This study, designed to represent modern residential development, demonstrated that ground water impacts with respect to nitrate-N may be expected to make less than 1% of private wells unpotable. Approximately 94% of the test wells were shown to have concentrations below 5 mg/L.

The HETL data and the data from the HLK study show similar percentages of wells with nitrate concentrations over the MCL(>1%). The DEP-MGS study shows a smaller percentage of wells exceeding the MCL (<.5%). The reason for the disparity may be the contribution of agricultural activities to increased nitrate concentrations, a factor in the HETL and HLK studies; the DEP-MGS study was designed to minimize or exclude agricultural impacts on ground water quality and focus on septic system impacts. Also, the differences may not be significant, depending on the variance and number of samples. Alternately, people who know or suspect they have problems with nitrate may tend to test more often, increasing the percentage slightly. Various other considerations might affect comparisons among the studies.

Table 4-2.5. Nitrate-N Frequency Distributions.

Nitrate-N (mg/L)	HETL Database[1] %	HLK Study[2] %	DEP-MGS Study[3] %
0.00 to 2.50	-	85.5	83.8
2.51 to 5.00	-	9.2	10.4
5.01 to 7.50	4.2*	2.5	4.1
7.51 to 10.00	*	1.3	1.4
Greater than 10.0	1.2	1.5	0.4
# Analyses	3,972	381	511

[1]HETL database for private well analyses between 1/1/94 and 12/31/95.
[2]Cooperative project between the Maine DEP and the Hancock and Lincoln-Knox County Soil and Water Conservation Districts. Project focused on private well testing for nitrate-N in unsewered regions of four towns.
[3]Cooperative project between the Maine DEP and MGS. Project designed to evaluate ground water/well water quality impact of septic systems in 20 residential subdivisions with respect to nitrate-N.
*This percentage is for wells testing >5.00 mg/L but less than 10 mg/L.

Bacteria. Private well testing for presence of bacteria identifies a greater contamination potential from bacteria than from nitrate. In public and private drinking water supplies, coliform bacteria are used as the indicator of microbial contamination. The Primary Drinking Water Standard for total coliform bacteria is 0 colonies per 100 ml.

HETL data for wells tested between 1960 and 1990 showed approximately 31% of the wells tested for total coliform exceeded the drinking water standard. Data for the period January 1994 and December 1995 shows that 34% of the 4057 well samples analyzed for total coliform tested positive. During the same time period, the HETL database indicates 37% of the 451 wells tested for fecal coliform tested positive. Twenty-six percent of the wells tested for total coliform bacteria in Hancock County as part of the Hancock/Lincoln-Knox County SWCD study had coliform bacteria. However, only 26% of these wells (7% of the wells tested in Hancock County) also tested positive for fecal coliform bacteria.

Fecal coliform bacteria originate inside the intestinal tract of mammals. The fecal coliform test is a better indicator of septic system contamination than total coliform because the total coliform test results may be affected by input from non-mammalian sources such as decaying vegetation. Surface water infiltration around poorly sealed well casings, especially dug well casings, may contribute to the disparity between detection of total coliform and fecal coliform. Examination of the HETL database for the period between 1960 and 1990 indicates that 52% of dug wells and 24% of drilled wells tested positive for total coliform bacteria; this lends support to the belief that dug wells are more susceptible to total coliform bacteria than drilled wells.

Shallow Well Injection
Contact: Pam Parker, DEP BLWQ, Division of Water Resource Regulation, 287-3901.

Discharge of pollutants underground by shallow well injection has been illegal in Maine since 1983 when the State adopted the Federal Underground Injection Control (UIC) regulations. Shallow injection wells are classified as Class IV or Class V "wells" under the UIC designation. No other classes of UIC wells are documented in Maine. Class V wells are usually gravity feed, low-technology systems which include cesspools, septic systems, pits, ponds, and lagoons. Industrial and commercial wastes discharged via Class V wells include petroleum products, cleaning solvents and degreasers, industrial and agricultural chemicals, storm water runoff, and a variety of other wastes.

Because of their high ground water contamination potential, the DEP has focused most of the UIC Program efforts on inventorying and eliminating automobile service station and manufacturing facility floor drains. Since 1988, the DEP has received over 3,391 responses to survey requests mailed to potential Class V facilities. Survey responses show 415 facilities with Class V wells discharging to soil or septic systems. Most of these facilities have been required to seal their floor drains or install oil/water separator systems that are connected to holding tanks. This effluent must be disposed of at a licensed disposal facility. No ground water quality monitoring has been performed at any of the facilities to assess ground water degradation.

Disposal of hazardous substances through floor drains has led to ground water contamination of at least two sites that are currently classified as uncontrolled hazardous waste sites.

In 1992, dry cleaning businesses were surveyed for their waste handling practices and the presence of injection wells. Photoprocessors were surveyed in 1993. Car and truck washes were surveyed in 1994. No new business categories were surveyed on a statewide basis in 1995; Facilities in the Androscoggin River Basin with the potential for having injection wells were targeted for inspection. Inspections were conducted at 160 facilities within a half-mile radius of public water supply wellheads. A total of 34 injection wells were discovered during these inspections. Other businesses handling hazardous materials will be targeted for future inspection. These include: funeral homes, auto body shops, rustproofers, boatyards, farms, and various laboratories.

Stormwater Infiltration
Contact: John Hopeck, DEP BLWQ, (207) 287-3901.

Infiltration of stormwater runoff has been practiced in Maine for many years, although primarily as a means of stormwater quality control, principally phosphorous control from residential developments in lake watersheds. Use of infiltration practices for control of stormwater quantity is, in contrast, a relatively recent development for large commercial/industrial developments, although infiltration is encouraged in sand and gravel mines by performance standards which allow less complex permitting procedures in pits which remain naturally internally drained throughout their development and reclamation.

The current generation of stormwater management systems using infiltration for quantity control provides minimal treatment prior to discharge of stormwater to the infiltration structure; most simply include oil - water separators at the bottom of each catch basin, with pipes from the separators directly to the infiltration facility. Only one site employs a wetpond for treatment prior to release to the infiltration area, while another site, which was to have constructed a grassed swale for treatment, used that area for additional parking space. Maine DEP's recently released Stormwater Best Management Practices manual specifies that additional pre-treatment, such as passage of runoff through a wetpond, a grassed filter strip, grassed swale, or equivalent treatment BMP, is required prior to discharge to an infiltration structure. These BMP's also require ground water quality monitoring in most situations, particularly if runoff is from a commercial/industrial area or other facility with a large connected impervious area.

A Case Study: Stormwater Infiltration

Maine DEP is currently attempting to identify all sites of deliberate infiltration of stormwater from commercial, industrial, or residential developments, in order to evaluate the performance of these structures and the potential for ground water contamination. In mid-1995 we were aware of only four DEP-permitted sites with engineered infiltration structures and required ground water monitoring; more projects have been identified since then, including several which were permitted only at the local level.

Of the four sites known at that time, one was under construction, and one had never submitted monitoring data; preliminary analysis of the data from the other two sites was presented at NEIWPCC's conference on ground water recharge for stormwater management, and is summarized here. Both sites show evidence of degradation of ground water quality, although there has been no consistent violation of drinking water standards. Neither site provides pre-treatment other than oil - water separators in the catch basins, and both infiltrate stormwater in excavated basins. The site which has not provided data discharges stormwater first to a wetpond above the infiltration area, and then to a series of level spreaders above an undisturbed forested area; this should minimize the pollutant load in the stormwater and the potential for ground water contamination, so that lack of data from this site is particularly unfortunate.

One site provided a nested pair of wells, with one well screened at 12.7 to 14.7 feet below ground surface, and the second screened between 52.7 and 54.7 feet below ground surface. The shallow and deep wells showed statistically significant differences in pH, specific conductance, nitrate, chloride, and sodium prior to operation of the infiltration system. Other parameters are detected infrequently, or have variances which do not allow resolution of shallow and deep ground water. Samples subsequent to operation of the system, allowing for some travel time to the wells, show no significant difference between shallow and deep ground water for these parameters. Both wells show increased specific conductance and sodium, and decreased nitrate and pH. Chloride increases significantly in the deep well, and decreases in the shallow well. At the time of a site inspection, water up to a depth of approximately two feet was ponded in the basin. This failure is probably related to the disposal of the excavated material adjacent to catch basin leading to the infiltration structure, and to the failure to install the grass swale above the basin shown on the site plans.

The second site has several wells upgradient and downgradient of the infiltration basins. Analysis of the data is complicated by the location of this particular site in an urbanized area with on-site wastewater disposal; the previous site located its basin in a relatively undisturbed forested area. Two infiltration basins were constructed at this site, one (the upper basin) adjacent to the parking area, and the second (lower basin) in a previously undeveloped area. Overflow from the upper basin is directed to the lower basin, which, in turn, has an overflow directed to a wooded area. Evidence at the site indicated that overflow from the lower basinoccurs fairly often, perhaps indicating infiltration rates lower than anticipated.

All wells at this site seem affected by the development to some extent. BTEX compounds and MTBE are detected, although rarely and at very low concentrations, in several of the wells. There is no evidence of a pattern, or association with the infiltration facility, in the wells showing positive detects, and this may reflect only a very low "background" level of organic contaminants in urbanized areas underlain by sand and gravel deposits. A weak positive trend in total organic carbon concentrations is found in all wells except one near a major pre-existing roadway, at which no trend is evident.

All wells showed increasing concentrations of sodium, with trends significant at greater than 95% downgradient of both infiltration areas; no clear trend was evident for chloride, however. All wells show decreasing concentrations of dissolved oxygen, with the strongest trend (significant at > 95%) downgradient of the lower basin; significance of the trend in the developed area ranges from 87% near the other infiltration basin to 73% at a downgradient well near the pre-existing road. Nitrate concentrations increase at all wells except the lower basin; the trend is significant at greater than 95% both upgradient and downgradient of the upper basin. All wells except that upgradient of the upper basin show weak increasing trends for total dissolved solids, and all wells show weak negative trends for total phosphorous. The data show no consistent trend for copper, lead, manganese, zinc, iron, pH, or specific conductance. In general, the wells show that ground water throughout the development is becoming more like ground water in the vicinity of the major pre-development road; it is not clear whether or not this would have occurred if infiltration had not been used for stormwater management.

Surface Impoundments

Storage, treatment, and disposal of liquid and semi-liquid materials in surface impoundments have long been suspected as major sources of ground water contamination. Currently, the DEP has authority under different statutes (e.g., the UIC Program, Waste Discharge Law, Site Location of Development Law) to regulate a variety of activities and materials related to surface impoundments. In 1979, the DEP conducted a study to characterize and inventory surface impoundments in the State. The Surface Impoundment Assessment was funded by EPA. Although the inventory probably was incomplete, the study identified at least 173 impoundment sites with a total of 453 individual pits, ponds, and lagoons (both active and abandoned). Materials stored at these sites included municipal sewage, industrial wastewater (including hazardous wastes), and animal wastes.

Some of the important facts revealed in the 1979 DEP study include the following:

1. surface water and ground water have been contaminated by surface impoundments at many sites in Maine;

2. approximately 75% of the assessed surface impoundments did not have impermeable liners;

3. approximately 45% of the surface impoundments are located on highly permeable soils (sandy, gravelly deposits);

4. approximately 50% of the assessed abandoned impoundments were not closed properly to prevent future waste migration;

5. approximately 18% of the impoundment site operators may generate potentially hazardous wastes which could enter the surface impoundments;

6. site monitoring wells were present at only 14 of the impoundment sites assessed and ground water contamination was detected at 6 of these sites; and,

7. most surface impoundments in Maine pose a high potential for ground water and surface water contamination.

Since the 1979 study was completed, no follow-up work has been performed to complete the initial surface impoundment inventory, to update the inventory with new sites, or to assess the degree of ground water contamination at the various sites. Improperly operated and abandoned sites probably continue to degrade ground water quality today, but some may not be a threat. A systematic evaluation of all open and abandoned surface impoundments would facilitate a more comprehensive assessment of their ground water impacts. Presently, new facilities proposing to utilize surface impoundments must demonstrate through proper siting and design that there will be no unreasonable adverse effects on ground water quality. These facilities must also conduct ground water quality monitoring, as illustrated in the following section.

Municipal Facilities
Contact: William Brown, DEP BLWQ, (207) 287-7804.

Since 1990 the BLWQ, Division of Engineering and Technical Assistance has authorized the construction of 13 wastewater treatment facilities that use lagoons to treat or store treated wastewater before discharging to surface water or prior to land application (spray irrigation). The authorization to fund these treatment facilities with State grant funds comes from Section 411 MRSA Title 38. In these lagoons, biological treatment of domestic wastewater occurs. Oxygen, which is necessary for the treatment, is introduced naturally in facultative lagoons or artificially introduced by blowers in aerated lagoons.

To minimize leakage, lagoons at 10 of the 13 facilities were constructed using a hypalon or high-density polyethylene synthetic liner. Lagoons at the remaining three facilities were constructed of compacted native soil materials. All 13 facilities installed monitoring wells to monitor any leakage that may result in contamination of the ground or surface water. If contaminants are noted in the monitoring wells, or if excessive leakage is confirmed by other testing (e.g. lagoon underdrain discharge), the lagoon is taken off-line as soon as possible and repaired. Potential contaminants typically required to be monitored include nitrate-nitrogen, ammonia-nitrogen, TKN, TOC, COD, hardness, pH, chloride, alalinity and fecal coliform. Metals typically monitored include arsenic, cadmium, zinc, lead, mercury, selenium, silver and nickel. The DEP has realized that required ground water monitoring parameters have not always been established consistently at wastewater treatment facilities. Accordingly, an effort is underway to to determine the most appropriate and cost-effective parameters for these facilities, and to require these parameters to be monitored at all facilities, where appropriate.

Salt-water Intrusion
Contact: Marc Loiselle, Natural Resource Information and Mapping Center/Geology (MGS), (207) 287-2801.

In coastal areas, excessive ground water withdrawals and well placements too close to the shoreline may lead to saltwater intrusion. This is particularly significant considering that Maine has approximately 3500 miles of coastline and development pressures are great along most of it. Saltwater intrusion is particularly common on coastal peninsulas and off-shore islands that rely primarily on private drilled bedrock wells for drinking water. For example, a 1982 hydrogeologic study conducted in the peninsular town of Harpswell found approximately 70 wells that were being affected by saltwater intrusion. As development pressure along the Maine coast continues, the incidence of saltwater intrusion is expected to increase.

Metallic Mining
Contact: Mark Stebbins, DEP BLWQ, (207) 287-7810.

Maine does not have any operating metallic mines at this time. In August of 1991, metallic mining rules were adopted by the State of Maine to be administered by the DEP. The purpose of these rules is to protect land and water quality while allowing for metallic mineral exploration and property development. Currently, no new permit applications are pending. One permit was issued in November 1992 to BHP Utah for advanced exploration.

Historical metallic mining sites such as the Callahan Mine site in Brooksville are known to degrade surface water quality by acid rock drainage from tailings ponds. Impacts to ground water at the Callahan site have not been observed.

Gravel Pits
Contact: Mark Stebbins, DEP BLWQ, (207) 287-7810.

Four-hundred nineteen gravel pits 5 acres or greater have been licensed by the State. The number of unlicensed (illegal) pits and gravel pits falling below licensing thresholds is unknown. Recent changes to performance standards include a variance provision for excavation into ground water. Previously, a separation distance of at least two feet was required between the base of the excavation and the seasonal high water table.

Impacts to ground water from gravel pit operations include contamination by spillage or spraying of petroleum products in or near the pits, and dewatering of local surficial aquifers. Improper use, storage, or handling of petroleum products is known to have caused ground water contamination in three gravel pits. The State does not have any record of the number of wells or surface water resources such as wetlands adjacent to gravel pits that have been dewatered due to mining activities. Another threat to ground water indirectly related to gravel pits is dumping into pits that do not adequately restrict unauthorized access. Unreclaimed sand and gravel pits are too often sites of illegal dumping. At the present time, 16 abandoned gravel pits are listed as uncontrolled hazardous waste sites. Ground water in the area of these pits contain a variety of pollutants such as solvents and PCBs.

Radioactive Waste Storage and Disposal Sites
Contact: Dale Randall, Department of Human Services, Division of Health Engineering, (207) 287-5338.

Maine has two high-level radioactive waste generators, Maine Yankee in Wiscasset and Portsmouth Naval Shipyard in Kittery. Portsmouth Naval Shipyard currently ships spent nuclear fuel to interim storage at the Idaho National Engineering Laboratory. Maine Yankee continues to store its high level waste on-site.

Options for managing low-level radioactive waste have expanded over the past year. Maine generators now have two potential disposal options for low-level radioactive waste. On July 1, 1995, access to the low-level radioactive waste disposal site at Barnwell, SC was reopened to Maine generators, followingr the South Carolina legislature's vote to leave the Southeast Compact. Once departed from the Southeast Compact, South Carolina reopened access to Barnwell to all states and Compact regions, except North Carolina. The other low-level radioactive waste disposal option is Envirocare of Utah, which specializes in bulk shipments of low specific activity waste. Most of Maine's low-level radioactive waste generators continue to store waste on-site. However, Maine Yankee nuclear power plant in Wiscasset (Maine's largest generator by volume and radioactivity) has disposed of most of its low-level radioactive waste inventory at Barnwell.

In 1993, Maine voters approved an agreement with Texas to accept and dispose of Maine's waste. The bill that would grant congressional approval of this Compact is currently awaiting floor debate in the U.S. House of Representatives. Approval of the Compact would allow Maine to begin sending low-level radioactive waste to Texas as soon as the proposed disposal facility is built, expected to be 1997 at the earliest. The proposed Texas facility is in the advanced stages of licensing. This disposal facility continues to be developed independent of the Compact's legislative status.

Maine has one confirmed low-level radioactive waste site in Greenbush. Other sites may exist, but they have not been located. Ground water monitoring wells have been installed at the Greenbush site and on adjacent property. As of November 1995, no contamination had been detected in the monitoring wells. The former Loring Air Force Base once had a low-level radioactive waste site containing small quantities of weakly radioactive material associated with the maintenance of first-generation nuclear weapons. The material was distributed in a small number of discrete trenches in a compacted earth matrix. The trenches were excavated in late 1994, and all material in them was shipped to Envirocare and disposed of as radioactive waste. Underground storage tanks near the trenches were also removed, and were later determined to be uncontaminated. During early 1995, the empty trenches were confirmed clean of radioactive contamination and backfilled.

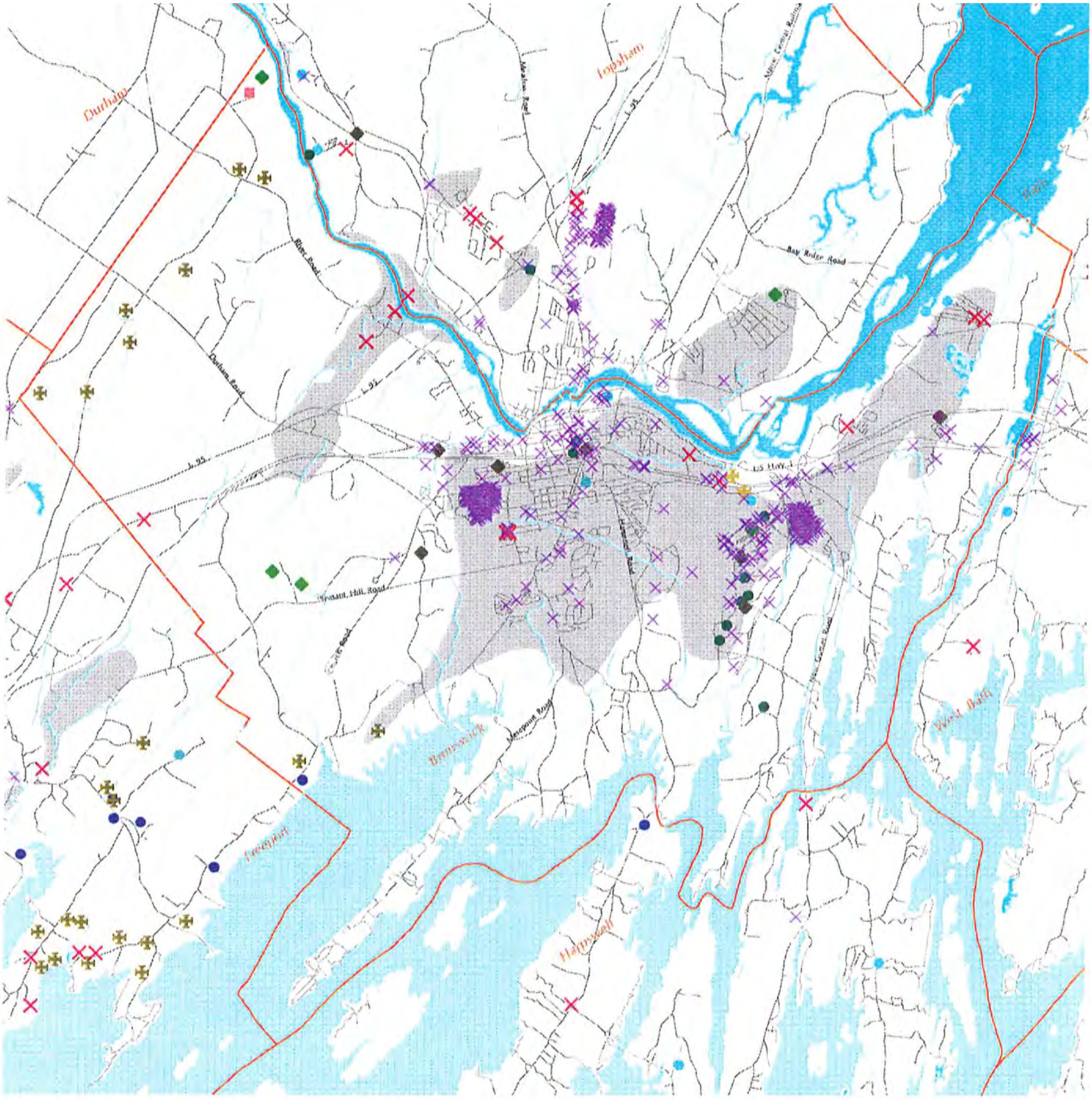
Summary of Ground Water Quality

For 1996, DEP has selected two stratified drift aquifers and one bedrock aquifer to put into the EPA format for assessing ground water quality. These three units were chosen based on hydrogeologic setting; sand and gravel aquifers are often high yield and are often found in developed areas, and are therefore vulnerable to contamination; bedrock aquifers, though not hydrologically connected, underlie the whole state and are mostly used as private water supplies. Since Maine is early in the process of prioritizing ground water on use and vulnerability criteria, it is premature to choose specific aquifers based on these criteria. Because of our ongoing efforts at ground water threat database management linked with ground water use and vulnerability assessment, we expect to be able to accomplish this type of prioritization during the next round of reporting. Therefore, the three examples which follow are an attempt to utilize the format requested by EPA and help the Ground Water Program determine where we can improve our data management to provide better coverage in the future. Figures 4-2.5 through 4-2.7 and Table 4-2.6 summarize aquifer data and threats to ground water in selected aquifers. Table 4-2.7 lists the status of actions being taken to address ground water contaminant problems in these aquifers. This attempt has uncovered three areas that pose a difficulty in reporting information as requested by EPA:

1. The data are stored differently (hard copy vs. electronic) and are collected from numerous programs having different sampling reporting periods.

2. Aquifer description and setting: private well information from the HETL database does not always clearly identify as bedrock or stratified drift.

3. The ground water database site information, i.e. type of site, location, owner information, remediation status, etc. are available, but ground water quality monitoring information is not yet accessible for many categories.



DEP Mapped Threats to Groundwater
- LUST
- LAST
- Landfill Municipal
- Landfill Commercial
- Landfill Special Waste
- Compost
- Demo Debris / Junkyard
- Ash
- Septage
- Haz Waste - CERCLA
- Sand / Salt
- Surface Spill
- Haz Waste - RCRA
- Residuals
- Haz Waste - Uncontrolled Site

- DEP Mapped UST Sites
- DHS Mapped Public Water Supplies
- Streams
- Transportation Routes
- Political Jurisdictions
- MGS Mapped Aquifer Boundaries
- Rivers, Lakes, & Ponds
- Coastal Waters

0.5 0 0.5 Miles

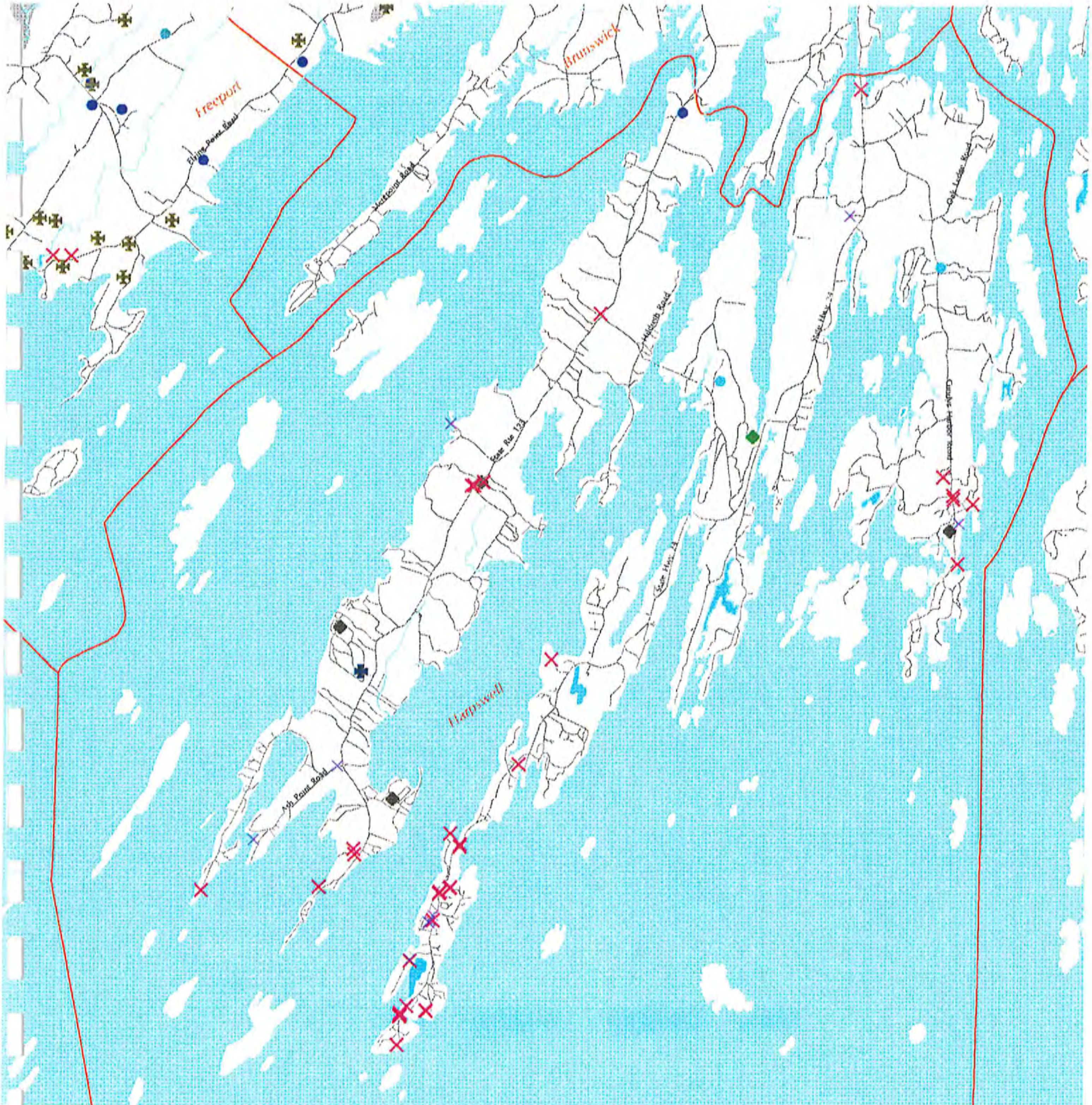
Figure 4-2.5.

N

Town of Brunswick ME

Aquifer Data and Threats to Groundwater

Created for the Maine Dept. of Environmental Protection
Bureau of Land & Water Quality
EPA 305b Report 1996



DEP Mapped Threats to Groundwater
- LUST
- LAST
- Landfill Municipal
- Landfill Commercial
- Landfill Special Waste
- Compost
- Demo Debris / Junkyard
- Ash
- Septage
- Haz Waste - CERCLA
- Sand / Salt
- Surface Spill
- Haz Waste - RCRA
- Residuals
- Haz Waste - Uncontrolled Site

- DEP Mapped UST Sites
- DHS Mapped Public Water Supplies
- Streams
- Transportation Routes
- Political Jurisdictions
- MGS Mapped Aquifer Boundaries
- Rivers, Lakes, & Ponds
- Coastal Waters

0.5 0 0.5 1 Miles

Figure 4-2.6.

N

Town of Harpswell ME

Aquifer Data and Threats to Groundwater

Created for the Maine Dept. of Environmental Protection
Bureau of Land & Water Quality
EPA 305b Report 1996

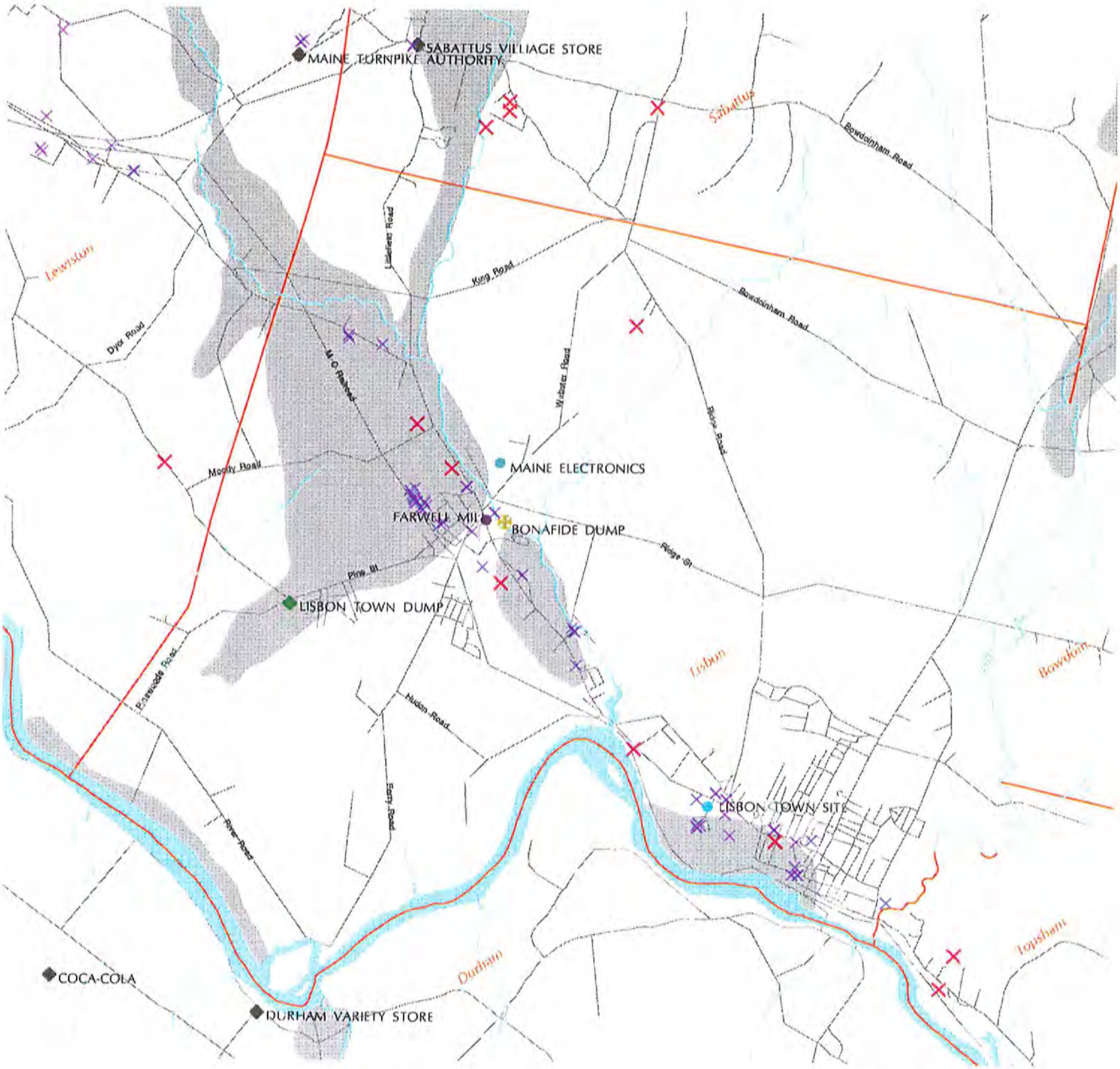


Figure 4-2.7.

DEP Mapped Threats to Groundwater
- LUST
- LAST
- Landfill Municipal
- Landfill Commercial
- Landfill Special Waste
- Compost
- Demo Debris / Junkyard
- Ash
- Septage
- Haz Waste - CERCLA
- Sand / Salt
- Surface Spill
- Haz Waste - RCRA
- Residuals
- Haz Waste - Uncontrolled Site

- DEP Mapped UST Sites
- DHS Mapped Public Water Supplies
- Streams
- Transportation Routes
- Political Jurisdictions
- MGS Mapped Aquifer Boundaries
- Rivers, Lakes, & Ponds

0.5 0 0.5 Miles

N

Town of Lisbon ME

Aquifer Data and Threats to Groundwater

Created for the Maine Dept. of Environmental Protection
Bureau of Land & Water Quality
EPA 305b Report 1996

Table 4-2.6. Aquifer Monitoring Data.

Aquifer Description: East Brunswick Aquifer **County:** Cumberland
Aquifer Setting: Fine sand, 15-7100 feet thick (some private wells in bedrock) **Data Reporting Period:** Jan. 1994-Dec. 1995, not continuous

Monitoring data type [1]	Parameter groups	Total number of wells used in assessment	No detections of parameters above MDLs or background levels	No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5 mg/l	Parameters are detected at concentrations exceeding the MDL, but are less than or equal to MCLs and/or nitrate ranges from greater than 5 to less than or equal to 10 mg/l	Parameters are detected at concentrations exceeding MCLs
Finished water quality data from public water supply wells	VOC	33	22	0	11	0
	SOC	50	50	0	0	0
	NO3	28	14	13	1	0
	Other	0	0	0	0	0
Raw water quality data from private or unregulated wells (Maine Health and Environmental Testing Laboratory)	VOC	0	0	0	0	0
	SOC	0	0	0	0	0
	NO3	42	0	42	0	0
	Other	0	0	0	0	0
Other sources (BNAS monitoring wells)	VOC	71	19	0	25	27
	SOC	0	0	0	0	0
	NO3	0	0	0	0	0
	Other	0	0	0	0	0

Major uses of aquifer or hydrologic unit: X Public water supply ___ Irrigation ___ Commercial ___ Mining ___ Baseflow
___ Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

Uses affected by water quality problems: ___ Public water supply ___ Irrigation ___ Commercial ___ Mining ___ Baseflow
___ Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

1. Department of Human Services does not collect raw water quality data from public water supply wells.

Table 4-2.6 (continued). Aquifer Monitoring Data.

Aquifer Description: Harpswell bedrock aquifer
Aquifer Setting: bedrock, primarily metasedimentary with some igneous

County: Cumberland
Data Reporting Period: 1985-1995

Monitoring data type[1]	Parameter groups	Total number of wells used in assessment	No detections of parameters above MDLs or background levels	No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5 mg/l	Parameters are detected at concentrations exceeding the MDL but are less than or equal to MCLs and/or nitrate ranges from greater than 5 to less than or equal to 10 mg/l	Parameters are detected at concentrations exceeding MCLs
Finished water quality data from public water supply wells	VOC	5	4	0	1	0
	SOC	8	8	0	0	0
	NO3	33	9	24	0	0
	Other	0	0	0	0	0
Raw water quality data from private or unregulated wells (Maine Health and Environmental Testing Laboratory)	VOC	12	10	0	2	0
	SOC	0	0	0	0	0
	NO3	31	0	31	0	0
	Other	0	0	0	0	0
Other sources	VOC	0	0	0	0	0
	SOC	0	0	0	0	0
	NO3	0	0	0	0	0
	Other	0	0	0	0	0

Major uses of aquifer or hydrologic unit: ___ Public water supply ___ Irrigation X Commercial ___ Mining ___ Baseflow
X Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

Uses affected by water quality problems: ___ Public water supply ___ Irrigation ___ Commercial ___ Mining ___ Baseflow
X Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

1. Department of Human Services does not collect raw water quality data from public water supply wells.

Table 4-2.6 (continued). Aquifer Monitoring Data.

Aquifer Description: Lisbon sand and gravel aquifer
Aquifer Setting: stratified drift (some private wells in bedrock)

County: Androscoggin
Data Reporting Period: 1985-1995

Monitoring data type[1]	Parameter groups	Total number of wells used in assessment	No detections of parameters above MDLs or background levels	No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5 mg/l	Parameters are detected at concentrations exceeding the MDL, but are less than or equal to MCLs and/or nitrate ranges from greater than 5 to less than or equal to 10 mg/l	Parameters are detected at concentrations exceeding MCLs
Finished water quality data from public water supply wells	VOC	144	29	0	115	0
	SOC	22	22	0	0	0
	NO3	9	1	8	0	0
	Other	0	0	0	0	0
Raw water quality data from private or unregulated wells (Maine Health and Environmental Testing Laboratory)	VOC	0	0	0	0	0
	SOC	0	0	0	0	0
	NO3	9	0	8	1	0
	Other	0	0	0	0	0
Other sources	VOC	0	0	0	0	0
	SOC	0	0	0	0	0
	NO3	0	0	0	0	0
	Other	0	0	0	0	0

Major uses of aquifer or hydrologic unit: _X_ Public water supply ___ Irrigation _X_ Commercial ___ Mining ___ Baseflow
___ Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

Uses affected by water quality problems: _X_ Public water supply ___ Irrigation ___ Commercial ___ Mining ___ Baseflow
___ Private water supply ___ Thermoelectric ___ Livestock ___ Industrial ___ Maintenance

1. Department of Human Services does not collect raw water quality data from public water supply wells.

Table 4-2.7. Ground Water Contamination Summary.

Aquifer Description: East Brunswick Aquifer **County: Cumberland**
Aquifer Setting: stratified drift **Data Reporting Period: 1985-1995**

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed	Number of sites with corrective action plans	Number of sites with active remediation	Number of sites with cleanup completed
NPL										
CERCLIS (non-NPL)	Yes	2	2	2	PAHs, 111 TCE	2				
DOD/DOE	Yes	17	17	2	MTBE, TPH, fuel oil, gasoline	10				11
LUST	Yes	15	15	10	fuel oil, gasoline	2			4	2
RCRA Corrective Action	No									
Underground Injection	Yes	9				1		9 cemented floor drains		
State Sites	Yes	1	1	1	lead, PCBs					
Nonpoint Sources										
Surface Spills	Yes	36	36	1	BTEX, MTBE		23		1	27
Above-ground tanks	Yes	2	2		fuel oil, TPH					
Municipal landfills	Yes	3			As, Pb, Cr, Hg, Se, VOC, SVOC		2			
De-icing	Yes	3	1		Chloride, Na		1		1	
Biomass ash utilization	Yes	9	n/a		Na					
Residuals						53				
TOTALS		97	74	16		68	26	9	6	40

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

Table 4-2.7 (continued). Ground Water Contamination Summary.

Aquifer Description: Harpswell bedrock aquifer **County: Cumberland**
Aquifer Setting: bedrock, primarily metasedimentary with some igneous **Data Reporting Period: 1985-1995**

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed	Number of sites with corrective action plans	Number of sites with active remediation	Number of sites with cleanup completed
NPL										
CERCLIS (non-NPL)	No									
DOD/DOE	Yes	2	1	1	hydrocarbons	9	2	1 pending	1	0
LUST	Yes	4	4	4			1		2	1
RCRA Corrective Action	No									
Underground Injection	No									
State Sites	No									
Nonpoint Sources										
Surface Spills	Yes	3	3	2			2		1	1
Above-ground tanks	Yes	1	1	1					1	
Municipal landfills	Yes	1								
De-icing	Yes	2	2	1						
Biomass ash utilization										
Residuals						7				
TOTALS		13	11	9		16	5	1	5	2

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

Table 4-2.7 (continued). Ground Water Contamination Summary.

Aquifer Description: Lisbon sand and gravel aquifer **County: Androscoggin**
Aquifer Setting: stratified drift **Data Reporting Period: 1985-1995**

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed	Number of sites with corrective action plans	Number of sites with active remediation	Number of sites with cleanup completed
NPL										
CERCLIS (non-NPL)	No									
DOD/DOE	No									
LUST	Yes	6	6	2			2			
RCRA Corrective Action	Yes	1	1	1	VOCs, arsenic			1	1	
Underground Injection	Yes	1						1 connected to POTW		
State Sites	Yes	2	2	2	fuel oils, PCBs					
Nonpoint Sources										
Surface Spills	Yes	16	2	2			1			1
Above-ground tanks										
Municipal landfills	Yes	1	1	1			1			
De-icing										
Biomass ash utilization										
Residuals	yes	4								
TOTALS		35	12	8			4	2	1	1

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

Resources for Aquifer Delineation and Ground Water Prioritization
Contact: Marc Loiselle, Natural Resource Information and Mapping Center/Geology (MGS), (207) 287-2801.

For the future, we see a major challenge in defining all aquifers in the State. At this point, the goal will be to define the aquifer boundaries of stratified drift aquifers as either ground water divides or major surface water bodies (i.e. real hydrogeologic boundaries). For the bedrock flow system we envision using surface drainage divides as opposed to a town or similar unit. While it is not clear that bedrock ground water flow will be controlled by surface drainage divides, it will be a closer approximation than a political boundary and will be a more realistic scenario with respect to collecting data from a variety of local sources. Also for the bedrock system we can identify the principal basins of interest. With current data coverage we should be able to identify reasonable sized drainage basins.

To support this effort, we will use the sand and gravel aquifer maps and the significant aquifer maps that have been published and digitized by the Natural Resource Information and Mapping Center/Geology (formerly the Maine Geological Survey). We do not have an ongoing ambient monitoring program for ground water with an established network of wells. The MGS is developing plans for an ambient water quality survey; this would be an extension of the Bedrock Ground Water Resources basic data program. This bedrock well database consists of information on bedrock wells supplied by water well drillers in Maine. Many of these wells have been located through field visits to town offices and reference to property tax records and tax maps. The basic data on well yield, well depth, and estimated overburden thickness, including some information on fracture depth and yield, have been published as a series of Maine Geological Survey Open-File maps.

This database can serve as the starting point for an ambient bedrock ground water quality database. To study ambient ground water quality, a subset of wells in a variety of hydrogeologic settings and geologic units would be selected for sampling and analysis of major cations and anions, trace elements, pH, Eh, dissolved oxygen, and an organic contaminant screen. The data would be examined for correlations between ambient water quality and hydrogeologic setting and or geologic unit. The information would be published as part of the MGS bedrock ground water resources basic data map series, and be accessible through an electronic Ground Water Resource Database. This database will eventually contain all state information on groundwater usage, availability, ambient quality, monitoring data and threats to quality.

The advantage of using the existing bedrock well database is the ability to first screen the database for wells with as much information on yield, depth, etc., as possible. At this point the GIS can be used to select a subset of wells in varied hydrogeologic settings and geologic units with the knowledge that it will be possible to obtain current ownership information with minimum effort. This process would significantly reduce the amount of field work needed to identify wells for sampling and analysis.

The information reporting system requested by EPA does not work well for characterizing overall ground water quality in the state. Therefore in this report, DEP has relied on the previous narrative section entitled "Overview of Ground Water Contamination Sources" to indicate ground water quality problems and the sections on ground water protection programs to indicate progress in protecting ground water quality and to identify areas that still need improvement.

Ground Water - Surface Water Interaction
Contact: John Hopeck, DEP BLWQ, (207) 287-3901.

No single program addresses the water quality concerns that arise from ground water- surface water interactions. Evaluating priority ground water areas or approximations of surface watersheds, as described above, enable risks to surface water from contamination or over-exploitation of ground water to be evaluated. However, contamination, or potential contamination, of surface water through baseflow of contaminated ground water is being evaluated at several locations. This section presents information on three closely monitored sites.

1. Mixed Organic Waste and Wastewater Disposal, Turner, Maine

Excessive land spreading of chicken manure, hen carcass disposal, septage disposal, and various other pollution sources related to egg production at a single large facility have resulted in the contamination of large areas of a sand and gravel aquifer. Concentrations of nitrate in ground water exceed the drinking water standard at many monitoring points, and nitrate concentrations over 1000 mg/l have been recorded (Table 4-2.8). Licensing of the facility and related enforcement actions have limited new nitrogen sources to on-site wastewater disposal from egg-washing plants and fertilizer for hay crops, but the widespread sources predating the 1990 licensing cannot be removed in any practical way, and so are continuing to release nitrogen to ground water. Speciation of nitrogen in ground water at the site is complex, possibly reflecting the variety of different sources, ages and concentrations of the sources, and various other factors. Concentrations of organic nitrogen in at least some sources were sufficiently high that nitrification of some wastes was incomplete, and ammonia concentrations exceed those of nitrate in many wells.

Table 4-2.8. Ground Water-Surface Water Interactions -Contamination of Surface Water by Ground Water

Aquifer Description: Sand and gravel/glaciofluvial delta
Aquifer Setting: Underlain by discontinuous till over bedrock
Name of Surface Water Body: Lively Brook
County: Androscoggin
Data Reporting Period: 1989-present

Contaminant	Concentration in Surface Water (mg/l) [1]		Concentration in Ground Water (mg/l) [2]	
	Average	**Range**	**Average**	**Range**
NH3	1.78	ND-4.22	4.45	ND-25.4
NO3	4.52	0.55-12.9	38.02	1.95-100
Organic N	2.29	ND-9.3	3.08	ND-28.4

1. Composite of several stations along worst polluted reach.
2. Highly variable around site, with no wells immedialtely upgradient of surface water points. Data from closest well to degraded reach.

The majority of the shallow ground water at the site discharges to streams on the east and west sides of the property; monitoring points have been established on these streams in order to evaluate the effects of past practices and current wastewater disposal on surface water quality. Nitrogen species in surface water upgradient of the property are principally nitrate and organic nitrogen; nitrite and ammonia are frequently below detection limits and never present in a concentration greater than five-to-ten percent of either nitrate or organic nitrogen. Surface waters within the property and along the property boundary, however, show evidence of sources of reduced nitrogen. In particular, a smaller stream on the eastern side of the property shown concentrations of ammonia which average approximately 2.0 mg/l; these concentrations are frequently 40 to 50 percent of the nitrate concentration, and often exceed the organic nitrogen concentration.

The data described above are from grab samples of surface water; there is no regular monitoring of baseflow water quality. A single round of sampling of shallow ground water adjacent to the stream was conducted at relatively large intervals along the affected reach. Discrete areas of elevated conductivity were identified along the reach, with the highest conductivity found in the areas seen to have the greatest ammonia concentration in the surface water grab samples. Numerous potential sources exist in the affected area, and the high conductivity areas have not yet been associated with specific sources. Figure 4-2.8 shows the location of the Turner study site. Figure 4-2.9 shows the location of Turner with respect to other towns in the State of Maine.

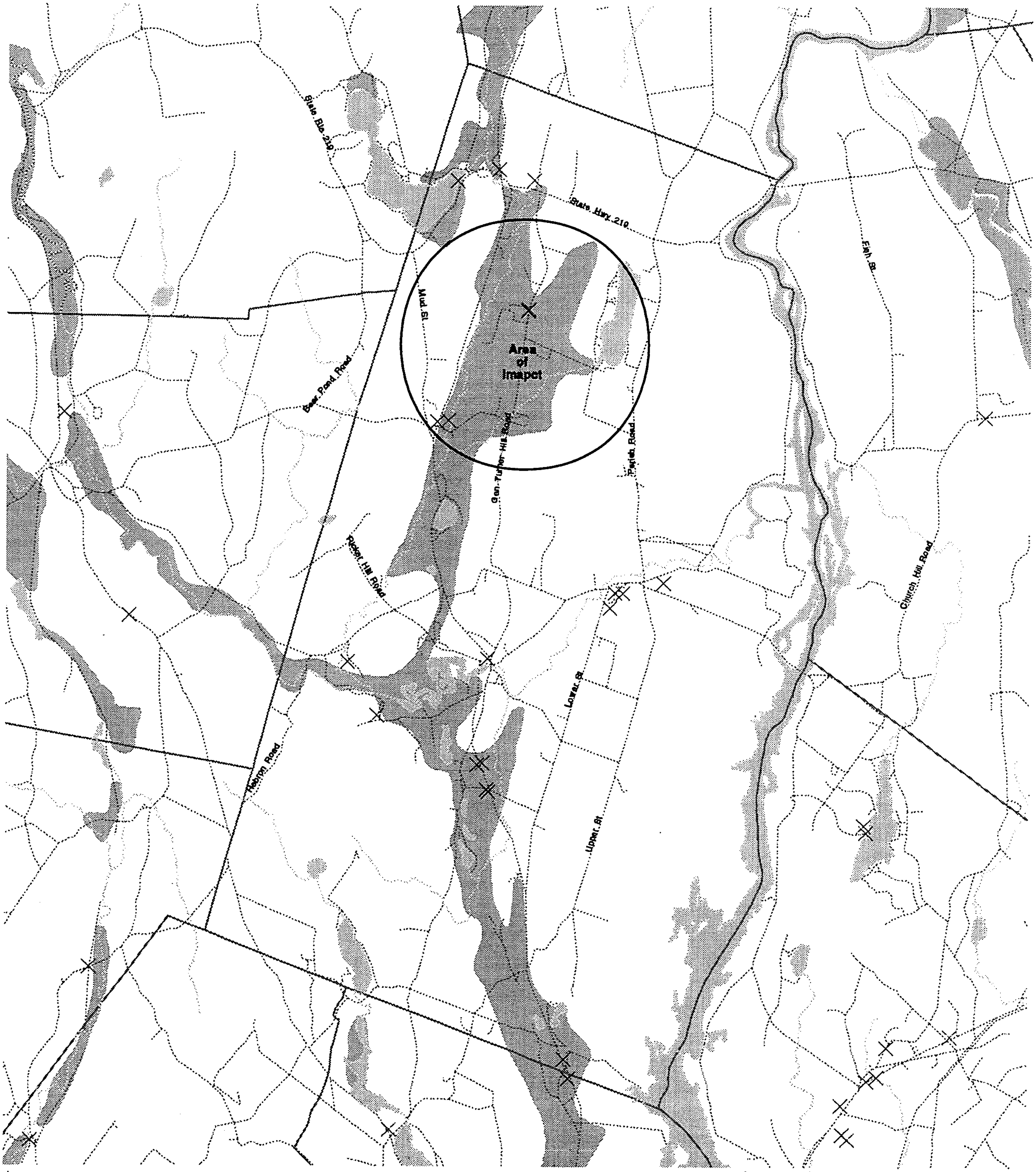


Figure 4-2.8.

Town of Turner ME

DeCoster Area of Impact

Aquifer Data and Threats to Groundwater

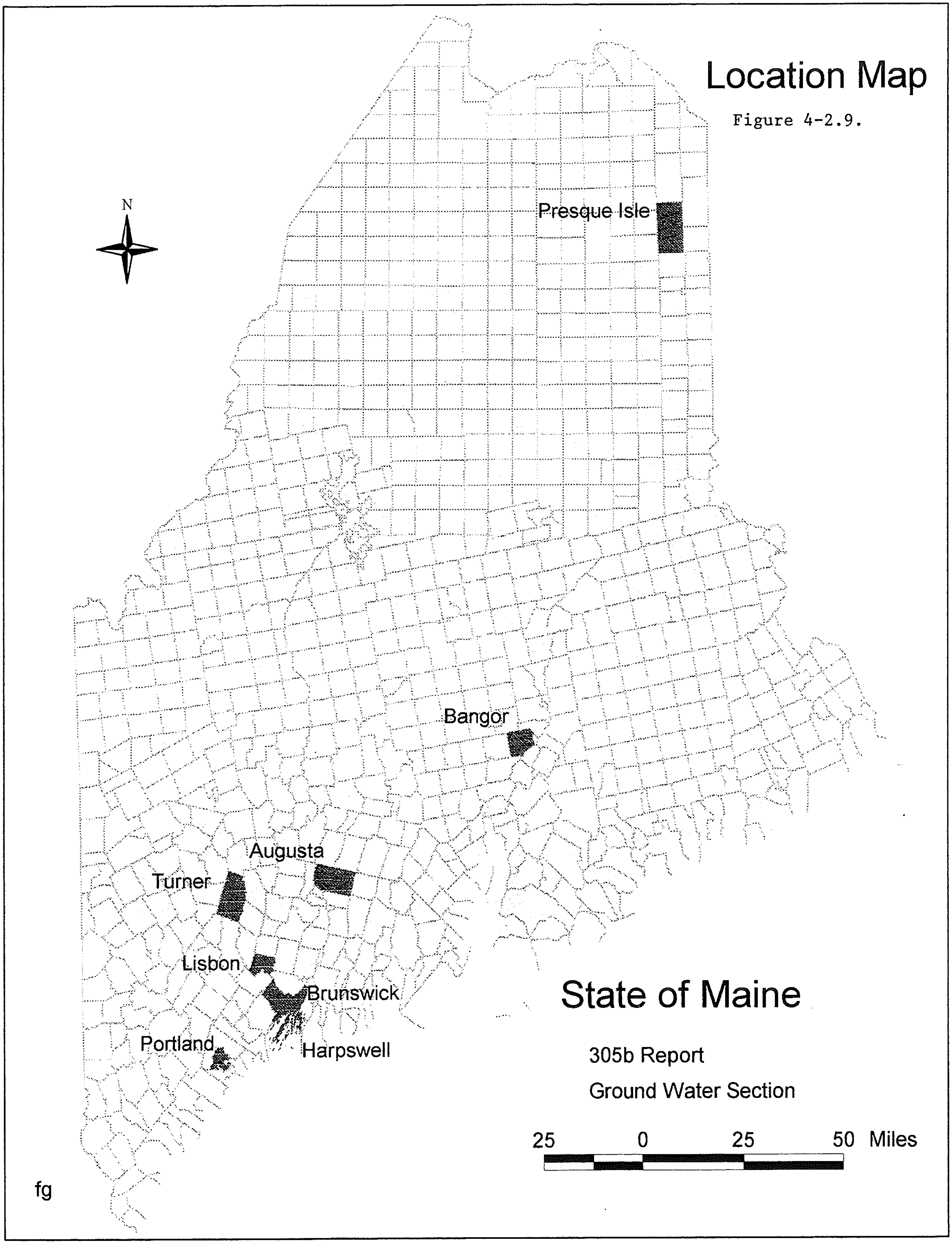
Created for the Maine Dept. of Environmental Protection
Bureau of Land & Water Quality
EPA 305b Report 1996

- DHS Mapped Public Water Supplies
- Streams
- Transportation Routes
- Political Jurisdictions
- MGS Mapped Aquifer Boundaries
- Rivers, Lakes, & Ponds

N

0.78 0 0.78 Miles

vb 96


Location Map
Figure 4-2.9.
N
Presque Isle
Bangor
Augusta
Turner
Lisbon
Brunswick
Portland
Harpswell
State of Maine
305b Report
Ground Water Section
25
0
25
50
Miles
fg

2. Sanitary Wastewater Disposal

A recent development with numerous residential units has proposed an experimental wastewater treatment system which, although to be developed in phases, will ultimately dispose of at least 60,000 gallons per day into a lot with large areas of wetlands and only two surface water outlets. At full build-out, this flow may amount to several percent of the pre-development flow currently leaving the wetland watershed. Soils at the site are ablation till over bedrock, and the water table is relatively shallow at most points on the lot. It is anticipated that effluent from the components of the disposal system will flow downwards and then laterally to the wetlands, with a travel path of less than 100 feet in some cases. Although work has been done in Maine and other states on the use of constructed wetlands for wastewater treatment, and natural wetlands for secondary or tertiary treatment, MDEP does not know of other locations at which natural wetlands will be providing treatment for baseflow comprising large volumes of septic effluent.

A monitoring program has been established at this site to evaluate the long-term impacts of system operation on water quality in the wetland system. Surface water at the outlets from the parcel will be sampled quarterly for temperature, pH, specific conductance, nitrate, nitrite, total nitrogen, and ammonia. Monitoring wells downgradient of the first component of the system and located between the system and the wetland will be monitored for the same parameters and at the same frequency. Construction of the first phase of the system and installation of the monitoring wells should be completed in the spring and summer of 1996.

3. Cumulative Impacts of Development on Ground Water Quality and Quantity

Maine DEP is working with two high schools in southern Maine to establish a monitoring network to collect data on surface water and ground water quality and quantity from a watershed undergoing significant changes in land use. This project is funded through a Section 319 Nonpoint Source Pollution Control grant to MDEP. Planned road construction will open a small (approximately 2.5 km^2), largely undeveloped watershed to commercial and industrial uses. Field mapping and review of the engineering and environmental studies prepared for the road construction project show the surficial deposits in the watershed to be principally glaciomarine sand and gravel overlying marine rock flour clay; these discontinuously overlie igneous, metaigneous, and metasedimentary bedrock.

Mt. Ararat High School in Topsham, which is partially within the affected watershed, and Brunswick High School in Brunswick, are working with MDEP, with the cooperation of local landowners and the Maine Department of Transportation, to develop a program where students will participate in the installation of monitoring wells and other sampling points, and collect and analyze water samples and stream flow, stream cross-section, and baseflow data. MDEP staff will provide technical support and training in sampling techniques, and supplement classroom instruction in geology and hydrology.

The short-term goals are to instruct students in practical applications of ground water and surface water hydrology, elementary geochemistry, basic statistics, and writing skills. Continuation of this project over several years is intended to allow students and teachers the opportunity to see and demonstrate changes in the watershed which may be related to land-use patterns, and develop an understanding of geologic and anthropogenic changes in natural systems. Thus far, seven monitoring wells have been installed at various points in the watershed, and surface water stations have been flagged along the length of the stream draining the watershed. Systematic ground water sampling has not begun, but preliminary sampling of surface water has shown areas of elevated conductivity near construction areas and culvert outlets to the stream.

Public Health and Environmental Concerns

Contaminants found in ground water have numerous adverse human health and environmental impacts. Public health concerns arise because some of the contaminants are individually linked to numerous toxic effects ranging from allergic reactions and respiratory impairment to liver and kidney damage, and damage to the central nervous system. Additional public health concerns also arise because information is not available about the health impacts of many contaminants found in ground water. Because of uncertainties about the relationship between exposure to contaminants and impacts on human health, public health efforts are based on identifying the probabilities of impacts (i.e. risk assessment). Conducting a risk assessment for combinations of contaminants that are commonly found in ground water is difficult because there are no generally accepted protocols for testing the effects of contaminant interactions. The primary route of exposure to contaminants is through ingestion of drinking water, although exposure is also possible through contact with skin and inhalation of vapors from ground water sources (bathing, food preparation, industrial processes, etc.)

Because ground water generally provides base flow to streams and rivers, environmental impacts include toxic effects on benthic invertebrates, fish, wildlife and aquatic vegetation. This also presents a public health concern if the surface waterbody is a source of food and recreation. In some areas of the State there is probably a link between low-level, long-term ground water quality degradation and the water quality of streams and brooks during low-flow conditions. (See the previous section on ground water - surface water interaction.)

Radon

Contact: Bob Stillwell, Department of Human Services, Division of Health Engineering, (207) 287-5743.

Not all ground water public health concerns are related to pollutants caused by human activities. The presence of naturally occurring radioactive radon gas in ground water drawn from granite bedrock aquifers and overlying soils has recently raised concerns regarding ground water that had previously been regarded as safe. The average concentration of radon in private residential water supplies is 5,000 picocuries/liter. Based on studies of miners, medical researchers have shown that high radon levels in air are associated with increased incidence of lung cancer. The question remaining is whether radon levels found in some Maine homes and in drinking water can have a similar health effect. Future research in Maine should increase understanding of the nature and extent of this water quality problem.

Arsenic

Contacts: Marc Loiselle, Maine Geological Survey (MGS), (207) 287-2801, and David Braley, Department of Human Services, Division of Health Engineering, (207) 287-5338.

Wells showing high levels of arsenic have been found in a number of areas in Maine. In the fall of 1993, occurrences of arsenic concentrations in well water above the 50 ppb MCL in York and Cumberland Counties came to public attention. In this area, approximately 13% of nearly 1,200 well water samples tested greater than the MCL. HETL records show that of 356 private wells tested statewide between January 1, 1994 and December 31, 1995, 12.4% had levels of arsenic greater than .05 mg/L. Additionally, MDEP records indicate that 27 public water supplies are contaminated with arsenic.

A source or sources for the arsenic is unknown. However, preliminary work by the MGS, MDEP and the DHS indicate that the problem is of statewide significance and that the arsenic concentration of ground water is most likely the result of both natural processes and human activity. It is possible that agricultural and industrial activities have contributed to some cases of contamination, although arsenic is known to occur naturally in soils and bedrock in Maine, and may also be a source. To determine the extent of the problem and discover the sources of the contamination, the MGS, the DHS Drinking Water Program, and the Maine DEP will continue to study the problem by testing more wells and conducting additional geologic mapping. Affected towns in southern Maine are also researching historical land uses to find possible anthropogenic sources.

Wellhead Protection Program

Contact: David Braley, Department of Human Services, Division of Health Engineering, (207) 287-5338.

The DHS, Division of Health Engineering, administers the Maine Wellhead Protection Program. Public water suppliers voluntarily participate in this program. The goals of the program are to educate the public and water suppliers on the need for protecting ground water supplying their drinking water, and to assist water suppliers in preparing a wellhead protection plan (WHPP). The complexity of a wellhead protection plan depends on the volume of water supplied, the number of people served, duration of service, and the known threats to the water system.

Waivers granted for testing of Phase II and Phase IV contaminants are available only to systems with approved wellhead protection programs. All community systems must have an approved WHPP by December 31, 1995 to be eligible for waivers in 1996 and beyond. The remaining systems will be phased in between 1996 and 1998. To date, more than 400 WHP plans have been received. Future benefits available to systems will also be tied to wellhead protection whenever appropriate. These benefits may include reduced monitoring and application of new programs, such as groundwater under the influence of surface water and the groundwater disinfection rule.

Ground Water Indicators
Contact: David Braley, Department of Human Services, Division of Health Engineering, (207) 287-5338.

Table 4-2.9 shows the number of exceedences of MCLs for public water supplies using ground water and gives a relative indication of the condition of the ground water resource used as a drinking water supply.

Table 4-2.9. Summary of Public Water Supplies with MCL Exceedances and Wellhead Protection Programs.

Ground Water-Based or Partial Ground Water-Supplied Community Public Water Supplies with MCL Exceedences for Selected Contaminants:

Contaminant group	Number of MCL Exceedences	Number of Samples
Metals, VOC's, Pesticides	49	3105
Nitrate	0	366

Ground Water-Based or Partial Ground Water-Supplied Community Public Water Supplies with MCL Exceedences:

	Number of MCL Exceedences	Total Number
Number of PWS's	365	364
Population Served	unknown	216,955

Ground Water-Based or Partial Ground Water-Supplied Community Public Water Supplies that have Local Wellhead Protection Programs (WHPP's) in Place:

	Total Number of Public Water Suplies (PWSs)	Population Served
Community PWSs	364	216,955
Non-Community PWS's	1724 (approximate)	variable
PWS's with Local WHPP's in Place (Community and Non-Community)	408	215,229

Ground Water Quality Trends

Maine's complex hydrogeologic setting makes representative ground water quality sampling difficult. The hilly topography, complex geology, and general shallow water table have created numerous localized ground water flow basins, "ground watersheds", which are similar to and often coincide with surface watersheds. As a result, water quality data obtained from monitoring wells indicate only the water quality at a specific location and depth in an aquifer. The data reflect the ground water quality in the immediate vicinity of the monitoring well, but they are not indicators of ground water quality elsewhere, either inside or outside a particular "ground watershed". Current information about State ground water contamination problems may not describe the actual situation as much as it reflects the reason for the investigation and the manner in which it is conducted, i.e., the contaminants tested for, where the monitoring occurred, and how it was performed.

New occurrences of ground water contamination are documented in Maine each year. Although discovery of existing contamination is expected to continue, future reports of contamination are expected to decline substantially as State ground water protection initiatives continue to be implemented. These programs stress contamination prevention rather than remediation. Key aspects of these programs include:

1. Stricter underground storage tank installation and monitoring standards, removal of old and substandard tanks, and registration of all active and abandoned tanks should continue to reduce discharges from underground storage tanks.

2. In light of the increasing number of AST-related ground water threats, better tank standards and a statewide spill protection program need to be developed to protect ground water; also, more outreach is needed to make the public aware of weather and overhead dangers as threats to home heating oil ASTs.

3. Continued development and implementation of a strategy to protect ground water from agricultural chemicals will diminish the impact of pesticides and fertilizers on ground water quality. In 1995, the BPC received concurrence from EPA New England Region on the *Maine Generic State Management Plan for Pesticides in Ground Water* and is currently using it as a platform for development of a pesticide-specific management plan for hexazinone.

4. Development of new manure application guidelines that reflect agronomic nutrient utilization rates will decrease the adverse impact of the poultry and dairy farms on ground water quality.

5. Investigation and final closure of the older, polluting landfills will reduce one of the most prominent sources of contamination in the State. In 1995 the State Legislature abolished the Maine Waste Management Agency (MWMA), certain MWMA responsibilities were transferred to the State Planning Office and to the DEP. It is not

anticipated that these actions will have significant impact on landfill policy in the state. Further emphasis on recycling would reduce the waste stream and decrease landfill capacity needs, however with the abolition of the Maine Waste Management Agency, it is not clear how recycling will be promoted in the future.

6. Storing sand-salt mixtures for road maintenance in water-tight storage buildings will prevent highly concentrated salty leachate from contaminating ground water. However, this solution is still nearly a decade from full implementation. Elevated concentrations of sodium and chloride will persist in the ground water adjacent to roadsides unless an economical substitute for sodium chloride can be found.

7. The emphasis of the UIC Program on inventory and elimination or control of shallow injection wells will undoubtedly aid ground water protection efforts. Although the extent of contamination from shallow well injection in Maine is unknown, studies in other states indicate the potential ground water quality impacts resulting from routine and accidental discharges of toxic and hazardous substances is serious.

8. The Maine Nonpoint Source Pollution Program will have the most impact toward reducing ground water contamination. The program develops best management practices (BMP's) for activities contributing to nonpoint source pollution. Despite the paucity of data to quantify the extent of ground water contamination from many of those sources, the deleterious ground water quality impacts from many of the activities are well documented. Development of BMP's for those activities can proceed concurrently with ground water monitoring. Developing public awareness of BMP's is one of the most important aspects of the Nonpoint Source Pollution Program.

9. The Maine Geological Survey (MGS), is developing plans for an ambient water quality survey of bedrock wells as an extension of the Bedrock Ground Water Resources basic data program. This program is based on well driller information submitted from new well installations from around the state. This would add to our rather limited knowledge of ambient ground water quality.

10. Recent changes to Site Location of Development Act strengthen erosion and sedimentation control and stormwater management, and place emphasis on defining and protecting sensitive watersheds. These changes may help protect drinking water quality in developed areas of the State.

Chapter 3 - Overview of State Ground Water Protection Programs

Background

The protection of Maine ground water is an issue of concern at the local, regional, state and federal levels. Serious ground water pollution problems that have occurred throughout the State and elsewhere have heightened the need for protecting ground water supplies. A few municipalities and regional planning agencies have conducted ground water quality assessment studies, but programs for effective assessment of the quality of ground water resources are needed in many areas of the State. Maine's ground water protection program (Table 4-3.1) emphasizes three areas of effort:

1. State interagency coordination of ground water programs through the development and implementation of a Comprehensive State Ground Water Protection Program;

2. Assessment of ground water protection problems, including development of a ground water resource database;

3. Statutory changes and building upon implemented state ground water protection programs to increase ground water protection and risk reduction.

Comprehensive State Ground Water Protection Program (CSGWPP)

Contact: John Hopeck, DEP BLWQ, (207) 287-3901.

Maine is developing a core CSGWPP program through preparation of a summary and assessment of existing programs and by developing legislative and non-statutory initiatives to improve measures of ground water quality and vulnerability, better coordinate ground water-related programs on the state level, and more effectively deliver services to the public and other agencies. A document assessing Maine's existing programs and recommending possible actions was completed by outside consultants in the spring of 1995, with financial support from EPA. Actions of the state legislature have required frequent modification of this document since its completion by the consultant, but the final draft will be distributed for agency comment in June of 1996.

Table 4-3.1. Summary of State Ground Water Protection Program

Programs or Activities	Check (X)	Implementation Status	Responsible State Agency
Active SARA Title III Program		authority not delegated	
Ambient ground water monitoring system	x	in development	MGS
Aquifer vulnerability assessment	x	continuing efforts	DHS
Aquifer mapping	x	stratified drift in progress	MGS
Aquifer characterization	x	stratified drift in progress	MGS
Comprehensive data management system	x	under development	DEP, DHS, MGS
EPA-endorsed Core Comprehensive State Ground Water Protection Program (CSGWPP)	x	under development	DEP
Ground water discharge permits	x	continuing efforts	DEP
Ground water Best Management Practices	x	continuing efforts	DHS
Ground water legislation	x	continuing efforts	DHS
Ground water classification	x	fully established	DEP
Ground water quality standards	x	continuing efforts	DHS
Interagency coordination for ground water protection initiatives	x	continuing efforts	DEP, DHS, MGS, DOT, DOA
Nonpoint source controls	x	under development	DEP
Pesticide State Management Plan	x	generic plan completed; PSMP under development	BPC
Pollution Prevention Program	x	fully established	DEP
Resource Conservation and Recovery Act (RCRA) Primacy	x	fully established	DEP
State Superfund	x	fully established	DEP
State RCRA Program incorporating more stringent requirements than RCRA Primacy	N/A		
State septic system regulations	x	fully established	DHS
Underground storage tank installation requirements	x	fully established	DEP
Underground Storage Tank Remediation Fund	x	fully established	DEP
Underground Storage Tank Permit Program	x	fully established	DEP
Underground Injection Control Program	x	fully established	DEP
Vulnerability assessment for drinking water/wellhead protection	x	continuing efforts	DHS
Well abandonment regulations	N/A		
Wellhead Protection Program (EPA-approved)	x	fully established	DHS
Well installation regulations	x	under development	DHS, MGS

Ground Water Prioritization and Vulnerability Assessment
Contact: John Hopeck, DEP BLWQ, (207) 287-3901.

Although CSGWPP stresses prevention of contamination whenever possible as the first priority in ground water protection, it also recognizes that all human activity has impact on ground water, and that the degree of protection afforded should be based on the relative vulnerability of the resource and, where necessary, the ground water's use and value. The lack of a comprehensive, GIS-linked, database has been identified as one of the major obstacles to Maine's efforts to developing an effective CSGWPP. Linkage of known contamination sites, sites presenting risks to groundwater quality, populations served by public and private water supply wells, and the quality of surface waters, among other factors, through the GIS, will allow the state to focus resources where the potential for adverse impacts on the environment and human health and welfare is the greatest, and help in designing and improving regulatory and non-regulatory programs by better defining the risks and preventive measures needed in particular circumstances. The methodology to be used will incorporate available GIS data layers in three categories: (1) intrinsic vulnerability; (2) potential sources of contamination; (3) ground water use and value.

1. Intrinsic Vulnerability: Intrinsic vulnerability includes those physical characteristics of an aquifer which make it susceptible to contamination introduced at or near the land surface. Review of the literature indicates that the most significant controls on this are soil type or vertical soil permeability and depth to the saturated surface. Soils maps are available at a very coarse level on GIS. For some areas, these can be supplemented by maps of surficial geology and overburden thickness, and data from the MGS well database, but there is not statewide coverage for these layers.

2. Potential Sources of Contamination: Maine's ground water quality is threatened or impaired by a variety of point and non-point pollutant sources, as detailed in this report. While many of these sources are located on the existing GIS system, many are not, and the coverage of large areas of the state remains poor. Linkage among the existing GIS database, land use patterns, water quality data, surface water quality, and resource and habitat values is, at best, preliminary. MDEP has received funding through a grant under Section 319 to improve the existing ground water resource database of point sources of potential ground water contamination by completing data QA/QC and entry of locational data onto the GIS system. Work on this project will proceed through 1996 and 1997. Nonpoint sources of pollutants will need to be inferred from combining other GIS data layers, such as population density and extent of water utilities, to define areas with on-site wastewater disposal, and LANDSAT imagery to define agricultural and urban areas. For more information on the Ground Water Resource Database see the section with that title below.

3. Ground Water Use and Value: Use and value reflect the role of ground water to support ecological systems and existing and potential water supplies, together with public concerns about ground water quality and quantity. The Maine Environmental Priorities Project identified public concern for private water supplies as high, but only a medium level of concern was found for public water supplies and ground water in general.

Ecological value can be addressed by use of the GIS surface water classification and National Wetlands Inventory data layers. We will need to assess completeness of data layers for other wetlands, critical habitat areas and other locations in which ground water quality and quantity are essential to habitat values.

Ground water usage by humans may be divided into public water supplies, private water supplies, and other uses, such as irrigation and process water. Public water supplies are or soon will be completely located on GIS; it is not yet practical to locate all private water supplies, and there is no record of water supply wells for other (commercial/industrial/agricultural) purposes. A method for locating these latter wells has not yet been determined, however the Maine Geological Survey does require well drillers to submit information on newly drilled private water supply wells. Future use can be projected from census data and State Planning Office information, and the locations of expected growth can be used to make inferences about whether public or private water will be used to support that growth.

Ground Water Resource Database
Contact: Florence Grosvenor, DEP BLWQ, (207) 287-7745.

A ground water quality database, which links site characteristics and ground water quality information to a spatial database, has been in development within the DEP for the last seven years. The work includes identification and location of various activities which may affect ground water quality, known contamination sites, and populations served by public and private water supply wells. This effort is part of a statewide GIS-linked ground water database project, which when fully developed, can be used to: (1) achieve understanding of the spatial interrelationships between natural resources and population as they relate to potential or known pollution sources; (2) assess the flow and transport interrelationships between surface and ground water quality, in order to evaluate ground water impacts on surface water bodies, and ground water dependent habitat; (3) assist in prioritizing protection of sensitive ground water and surface water bodies, wetlands, and other environmental resources; and, (4) plan development to provide for the protection of public health and safety.

The project is the outgrowth of findings published in 1989 in *The Ground Water Strategy for the State of Maine*. The strategy was the culmination of a 3-year study of the state's ground water data management methods by the Land and Water Resources Council, in conjunction with the State Planning Office. Shortcomings of the state's efforts were identified, and recommendations made to address these shortcomings. Unmet needs included access to comprehensive, up-to-date ground water quality information; ability to answer inquiries and satisfy requests for data; assessment of trends in regional ground water quality and quantity; rapid access to information on ground water uses for emergency response to hazardous materials spills; and automated analysis and map-making capability.

Current activities include quality assurance checks and corrections of the information currently contained in the database. With a few exceptions, work will proceed in three phases: Phase I includes listing and defining site activities which may affect ground water quality; identification and listing of sites within each activity category; acquisition of basic site, ownership and spatial data information about each site; and entry of this information into the ground water resource database. Spatial data files can then be created, for use in mapping relationships among these activities, natural resources, and population centers.

This information will be used to prioritize Phase II activities, which include the gathering of detailed information and data entry activities for specific geographic areas of critical interest. Although entry of ground water quality monitoring information for selected sites is underway in the Bureau of Remediation and Waste Management, the gathering and entry of most of this detailed site-specific information, including geology, well design and construction information, and sampling and analytical data will be conducted during the second phase of the project.

Phase III of the project will include ongoing issues of implementation, database maintenance, and evolution. Continuing activities will focus on collection and entry of geological data, well data, and water quality data. Quality assurance activities are focusing on data and location accuracy, consistency in expressing data, and the ability to link related data. Spatial data quality will be managed by DEP-GIS and OGIS.

Continuous progress is being made in completing spatial data acquisition for underground tanks sites, surface spills, hazardous waste and municipal landfills and other waste management activities, as well as sanitary and industrial wastewater treatment facilities, engineered subsurface wastewater disposal facilities, large nonpoint sources of pollution, such as industrial complexes, underground injection sites, mining activities, highway deicing-related activities, and others. The spatial data-gathering phase for public water supplies in the State is virtually complete.

Approximately 4000 sites in 27 individual site types have been entered into the Groundwater Resource Database. The site types (as of December 1995) include:

Ash Utilization Sites
Automobile Graveyards
CERCLA Sites
Compost Facilities
Construction/Demolition Debris Disposal Sites
Engineered Subsurface Wastewater Disposal Systems (>2000 gallons per day)
Industrial Parks
Commercial Landfills
Municipal Landfills
Special Waste Landfills
LAST Sites

LUST Sites
Mining and Beneficiation Activities
Non-Point Sources (highways, golf courses, etc.)
RCRA Sites
Residuals Utilization Sites
Sand/Salt Storage Sites
Sanitary and Industrial Wasewater Treatment Facilities
Septage Storage and Disposal Sites
Sludge Utilization Sites
Surface Impoundments
Surface Spills
Tank Farms
Transfer Stations
Uncontrolled Sites
Underground Injection Wells
Woodyards, Lumberyards, Biomass Fuel Piles

The locations of all sand/salt storage sites and most municipal landfills are currently within the database. Quality assurance checks and corrections, and completion of basic data records for each site, are within a month of being complete (as of February, 1996). Continuous progress is being made in completion of spatial data for underground tanks, surface spills, hazardous waste landfills, municipal landfills, and other waste management activities; lists of sites in each waste management site type have been completed. Spatial data entry for all public waer supply wells has been completed by the Department of Human Services.

Proposed Statutory Changes
Contact: John Hopeck, DEP BLWQ, (207) 287-3901.

Several measures were undertaken by MDEP in the spring and summer of 1995 to improve coordination of ground water regulation among state agencies, water utilities, and other interested parties. The most significant of these involved proposals to replace or significantly amend the Site Location of Development Act, a state environmental impact law dealing with large commercial and industrial facilities, non-metallic mineral extraction, large residential subdivisions, and similar developments. Analysis of the "Site Law" in comparison to other existing regulatory programs revealed that it addressed four issues with regard to ground water quality and quantity which were not addressed in other DEP regulatory programs:

1. Subsurface sanitary wastewater disposal (except publicly owned treatment plants;
2. Ground water withdrawal;
3. Non-point source pollution, and;
4. Ground water protection plans.

A work group including representatives of state agencies, water suppliers, and municipal and commercial/industrial interests, was formed to discuss how these issues could be addressed in the absence of the Site Law, and how the State's approach to these areas could be improved.

1. **Sanitary Wastewater Disposal:** Design of subsurface disposal systems for sanitary wastewater is regulated by the Maine Department of Human Services through the Subsurface Wastewater Disposal Rules. Certain developments which utilize on-site sanitary wastewater disposal are licensed under the Site Law, and DEP has generally required these developments to assess the environmental impact of this on-site disposal. In general, this assessment has been limited to a hypothetical demonstration that the plume(s) from the disposal field(s) would meet the drinking water standard for nitrate at the project boundary; many municipalities use this criterion or a similar one for subdivision review. Until recently, little or no concern has been given to impacts of subsurface disposal fields on baseflow quality.

Research by DEP and the Maine Geological Survey on drinking water quality within residential developments, described in the earlier section on "Major Sources of Ground Water Contamination" in this report, found that nitrate concentrations in wells within residential subdivisions generally met drinking water standards. However, nitrate concentrations in dug or driven-point wells were significantly greater than wells drilled into bedrock with deeper soil cover. This suggests that the thickness of saturated overburden is critical to the protection of water supply wells from on-site wastewater disposal systems. This, in turn, influenced draft DEP regulations for impact of subdivisions on water quality which specified greater setbacks for septic systems from downgradient property lines in shallow-to-bedrock and coarse-textured (sandy/gravelly) soils.

The ground water work group recognized that developments which discharge sanitary wastewater to ground water present the potential for degradation of water quality, although there was not clear consensus on the magnitude of the impact. In some cases, particularly on islands, which tend to have thin soils and few alternate sources of drinking water, this may represent one of the most significant restrictions on the maximum allowable density of development. In other cases, large-volume (i.e. "engineered") subsurface wastewater disposal systems may significantly affect the quality of surface water in smaller watersheds, as discussed above in the section on ground water-surface water interactions. Residential subdivisions above a certain size currently require Site Law review; disposal of solely sanitary wastewater into large systems is not reviewed by DEP unless the disposal system is an element of a development meeting one or more area-dependent thresholds, regardless of the volume of wastewater generated and the proximity of the disposal area to other water users and protected resources. It was thought to be important that uniform standards be applied to all wastewater disposal systems, regardless of the development's status under the Site Law.

Under recent changes to the Site Location of Development Act, the DEP and the DHS are required to identify changes to the subsurface wastewater disposal rules and other relevant rules and statutes needed to address the potential for adverse impacts on ground water quality from engineered disposal systems. The DHS will adopt such changes into its rules, and DEP and DHS will enter into a memorandum of agreement under which the DEP will provide review of potential water quality impacts from engineered disposal systems.

It was concluded that residential developments could, in the absence of the Site Law, be dealt with through modifications to the Subsurface Wastewater Disposal Rules. Specifics include: (1) explicitly addressing ground water quality by requiring more stringent setbacks from downgradient property boundaries; (2) design changes and provisions for better inspection of system installation; (3) giving credit in reducing lot sizes or system variances for nitrate reduction systems; and (4) providing for environmental impact review of large-volume disposal systems.

Any changes to current programs need to accompanied by a long-term education and technical assistance program to support municipal subdivision review. A first step in this program would be the identification of towns and programs which have standards equivalent to or better than those used currently used by DEP. While this program could be administered through other agencies, the group found that the technical assistance capability for assessment of ground water impact should remain within DEP. In the long-term, watershed water balances should be considered in evaluation of the build-out capabilities of a watershed; this level of planning will involve many municipalities, and there was concern that this could not be immediately implemented. However, this would be the only practical means of evaluating cumulative impact.

2. Ground Water Withdrawal: The existing Site Law regulations recognize that "depletion of ground water resources can result in intrusion of salt water into potable ground water supplies and can affect the hydrologic characteristics of surface water bodies...resulting in adverse effects on their assimilative capacity and recreational use, as well as on certain wildlife habitats. Additionally, new wells can cause a lowering of the ground water supply to the point where existing wells run dry, particularly during the late summer and early fall (06-096 CMR 375.8(A)). The thresholds which bring developments under review, however, are all related to number of lots or area disturbed, and not directly to the volume of water to be withdrawn.

The work group found that there was a need to protect the investments of well owners and operators in their water supplies, and to provide protection of public health and the natural environment against the effects of excessive ground water withdrawal. The group also found that the cumulative volume of ground water to be withdrawn by the development was a more appropriate criterion to use in deciding the potential impact of any particular development on ground water availability; reductions in infiltration due to increase in impervious surface were thought to be better approached at the watershed scale. Any withdrawal above a certain limit would trigger state interest; the radius from the point or points of ground water withdrawal to an existing or proposed water supply, or to a ground water-dependent protected resource, would be compared to the proposed withdrawal rate to determine the level of review required. Work to further define proposed statutory changes and regulations for this program will be developed during 1997.

3. Non-point Source Pollution: Some general categories of development present the potential for significant non-point source pollution of ground water. These include residential developments, developments which infiltrate stormwater, and various developments which use pesticides, fertilizers, or other materials with the potential to contaminate groundwater, such as golf courses, truck stops, highways, and biomass plants. Although most nonpoint source problems can be dealt with through a combination of BMPs and monitoring, some can be dealt with specifically. Much of the groundwater NPS pollution from residential development is from on-site wastewater, and this can be addressed through improvements in the plumbing code and in municipal understanding of groundwater issues. Fertilizer and pesticide use issues may be approached through requiring development and implementation of an Integrated Pest Management Plan, with monitoring of groundwater quality or, if conditions are suitable, benthic macroinverebrate populations to determine the impacts of contaminated baseflow. The Department's licensing and technical review staff will continue to analyze the various options available to developments as part of the licensing process and technical assistance to municipalities.

4. Ground Water Protection Plans: Recent changes to Site Law require the Land and Water Resources Council to form a committee of certain state agencies, affected industries, and municipal and public interests to discuss and study the requirements of a uniform system for the registration, storage and handling of petroleum products, hazardous materials, and other substances with the potential to contaminate ground water. Recommendations must be submitted to the Legislature by January 10, 1998.

Certain developments regulated under the Site Law, particularly commercial and industrial developments, handle or use in the course of their operation a variety of materials with the potential to contaminate ground water. These developments have been required to demonstrate that they had measures in place to minimize the risk to the environment posed by these substances. In the course of researching the potential impact of changes to the Site Law, the work group found that the storage, use, and handling of petroleum products, hazardous materials, and certain other substances with the potential to contaminate ground water, was addressed through the Site Law and the Waste Discharge Law, as well as through regulations of the DEP BRWM, the State Fire Marshal's Office, the Board of Pesticides Control, and the Maine Emergency Management Agency (MEMA), and also various federal agencies, including the USEPA and the U.S. Coast Guard. There is no consistent state oversight for storage of these materials, and neither federal nor MEMA standards specifically address ground water protection; federal standards alone do not provide uniform guidance for design of ground water protection plans (spill prevention, control, and countermeasures).

The consensus of the work group was that there should be a uniform registration system for storage and handling of these materials, and for review, approval, and inspection of these plans and facilities. The program should be administered by a single state agency, with input from other agencies to address their unique concerns. Storage and handling of potential contaminants in normal household quantities was found to be best addressed through outreach and education activities, rather than through a regulatory program. Discussions regarding the requirements of any regulatory program for larger volumes of storage will be undertaken during 1997. Specific language dealing with ground water protection plans for fuel, lubricants, and other potential contaminants at mining sites has already been incorporated in legislation dealing with those facilities, and so they will not be included in the facilities under discussion.

APPENDICES

STATE OF MAINE

1996 WATER QUALITY ASSESSMENT

TABLE OF CONTENTS

LIST OF TABLES

APPENDIX I

STATE OF MAINE 1996 WATER QUALITY ASSESSMENT

THE MAINE WATERBODY SYSTEM

Chapter 1. INTRODUCTION

The collection and analysis of water quality data is essential to the effective management of both Federal and State water pollution control programs. This information is necessary to determine workloads and plan expenditures; establish priorities and focus efforts on areas where water quality problems actually exist; evaluate the effectiveness of pollution control programs; and report to the public on progress toward achieving environmental goals.

The basic requirements for developing and reporting water quality information are set forth in Sections 305(b) and 106(a)(1) of the Clean Water Act (CWA). The reporting process involves preparation of a biennial status report called the 305(b) Report, by each State, Territory, and Interstate Commission which is then sent to the U.S. Environmental Protection Agency (EPA). EPA analyzes the individual reports, compiles a national assessment and transmits both the national and state reports to Congress.

The USEPA has developed a water quality information management system. This system, known as the Section 305(b) Waterbody System (WBS) manages information concerning the water quality status of specific waterbodies. WBS summarizes the assessments that have been done to characterize water quality conditions, the causes (pollutants and sources) of poor water quality, and program activities related to improving water quality. WBS is intended to fill the information gap between the analytical data generated from monitoring activities and the program implementation data managed in various systems such as the Permits and Compliance System and the Grants Information Construction System.

Table 1 presents the numbering system which was used to divide the State into major basins and geographic areas. These six major basins were assigned number three-digit waterbody code number, with the first digit corresponding to the third digit of the sub-region identifier of the United States Geological Survey (USGS) Hydrologic Unit Code. Although WBS guidance from USEPA does not explicitly require it, all waterbodies established by a state must be sub-units of the basins and sub-basins already defined by USGS.

This complicates the process of defining the geographical limits of waterbodies because the USGS system combines some major river basins, portions of minor coastal basins, estuarine waters and marine waters which must be grouped differently for State reporting purposes. This limitation of the USGS hydrologic unit code has been overcome by adding regrouping instructions, where required, as a note to the waterbody descriptions. It should be noted that basin codes 4 and 6, as presented in Table 1 are sub-units of the boundaries defined by USGS for those basins. This partitioning was necessary because basins 4 and 6 extend into the State of New Hampshire.

Table 1. Major Basin Codes for Use With Maine's Waterbody System.

Code#	Basin or Geographic Area
1	Saint John River Basin, those waters lying in Maine,
2	Penobscot River Basin,
3	Kennebec River Basin,
4	Androscoggin River Basin, those waters lying in Maine,
5	Minor basins entering tidewater east of Small Point, those waters lying in Maine,
6	Minor basins entering tidewater west of Small Point, those waters lying in Maine,

Within each of the major basins listed as 1 through 6 in Table 1, two to five sub-basins (21 in all) have been delineated by the USGS. A description of the sub-basins used for development of the WBS in Maine is presented in Table 2.

Also presented in Table 2 are the number of sub-sub-basins established for WBS within each sub-basin. These 159 sub-sub-basins are one of two cataloging units used in Maine's Waterbody System. These sub-sub-basins were established according to the following protocols:

(1) Waterbodies were made as large as possible consistent with there being similarities of land use and ambient water quality within a waterbody.

(2) For waterbodies which are in major river basins, waterbodies in each sub-basin were numbered from the basin's headwaters to its mouth.

(3) For waterbodies which are Minor Coastal Basins or groups of these basins, waterbodies were numbered from east to west.

Because the EPA Waterbody System cannot group lacustrine and riverine waters in the same waterbody the suffixes L and R have been added to the code numbers identifying sub-sub-basins, resulting in the establishment of 318 waterbodies.

The second cataloging unit type consists of river main stems or segments thereof. Segments of most major river main stems were established as separate waterbodies to reflect existing differences in ambient water quality and point source discharge patterns. These 53 main stem segments (reaches) are presented in Table 3. Forty-one of these segments are riverine in nature and one is lacustrine. Eleven of the river segments include both lacustrine and riverine waters, requiring the establishment of 22 waterbodies for these eleven segments. Thus, 64 waterbodies are used to track water quality conditions in these 53 river segments.

Three river main stem segments which would be grouped with riverine waters by USGS hydrologic unit boundaries are actually estuarine/marine in nature. While the USGS hydrologic unit boundaries, however arbitrary, must be adhered to in setting up the WBS, the description of attainment status for these three waterbodies is included in Chapter 5 of this Appendix, with the rest of Maine's estuarine/marine waterbodies. Maine currently has insufficient resources to establish estuarine/marine management units (waterbodies) similar to those established for fresh waters. The major impediment to establishing estuarine/marine waterbodies is that there is no information on the area of State waters or the area of shellfish closures for appropriately sized management units. Consequently, Maine has grouped most estuarine/marine waters outside the three USGS-delineated areas into one waterbody (#900M). This waterbody should be considered as temporary. Hopefully, sufficient resources will become available to allow waterbody #900M to be subdivided into appropriate management units.

Descriptions of the 387 waterbodies (318 drainage area waterbodies, 64 river main stem waterbodies and 5 estuarine/marine waterbodies) are presented in Chapter 4 of this Appendix, along with information about land use and hydrologic characteristics present in the waterbody, water quality classifications assigned in the waterbody, and the status of classification attainment in the waterbody. The designated uses ascribed to Maine's water quality classifications are presented in Table 4. It should be noted that the goals of all these classifications are equal to or higher than the interim goals of the CWA. A map showing the location and boundaries of these waterbodies is available for inspection at the Augusta offices of the Bureau of Land and Water Quality .

Although the initial reason for establishing these waterbodies was to facilitate the setup of WBS they also serve other purposes. The code numbers for sub-sub-basins will be used by the United States Department of Agriculture, Soil Conservation Service for inventories of nonpoint pollution sources. The sub-sub-basin and river reach code numbers are also used as first three digits of a six-digit number identifying all present and prospective surface water monitoring stations located in a waterbody. This six-digit monitoring station number is used as a secondary station code in the STORET system. This additional use of the waterbody code numbers will facilitate powerful WBS-based data retrieval and analysis in the STORET system.

Table 2. Sub-Basin Codes for Use With Maine's Waterbody System.

Sub-basin#	Sub-basin description	# of Sub-sub-basins
	SAINT JOHN RIVER BASIN	44
11	St. John River and its minor tributaries entering above the confluence of Limestone Stream, those waters lying in Maine	13
12	Allagash river and its tributaries	1
13	Fish River and its tributaries	8
14	Aroostook River and its tributaries and Limestone Stream and its tributaries, those waters lying in Maine	17
15	Minor tributaries of the St. John River entering below the confluence of the Aroostook River, those waters lying in Maine	5
	PENOBSCOT RIVER BASIN	22
21	West Branch and its tributaries	2
22	East Branch and its tributaries	1
23	Mattawamkeag River and its tributaries	5
24	Piscataquis River and its tributaries	5
25	The Penobscot River and its minor tributaries	9
	KENNEBEC RIVER BASIN	26
31	Kennebec River, main stem, above the confluence of the Dead River and tributaries of the Kennebec River entering above the confluence of the Dead River	4
32	Dead River and its tributaries	4
33	The Kennebec River, main stem, below the confluence of the Dead River and tributaries of the Kennebec River entering below the confluence of the Dead River	18
	ANDROSCOGGIN RIVER BASIN	18
41	Tributaries of the Androscoggin River entering above where the Androscoggin River crosses the Maine - New Hampshire boundary, those waters lying in Maine	5

Table 2. (Cont'd). Sub-Basin Codes for Use With Maine's Waterbody System.

Sub-basin#	Sub-basin description	# of Sub-sub-basins
42	Androscoggin River, main stem, and its tributaries entering below where the Androscoggin River crosses the Maine - New Hampshire boundary, those waters lying in Maine	13
	MINOR BASINS ENTERING TIDEWATER EAST OF SMALL POINT	27
51	St. Croix River Basin, those waters lying in Maine	4
52	Minor basins entering the tidewater between the St. Croix River Basin and Marshall Point	15
53	Minor basins entering the tidewater between Marshall Point and Small Point	8
	MINOR BASINS ENTERING TIDEWATER WEST OF SMALL POINT	22
61	Minor basins entering the tidewater between Small Point and the Saco River Basin	10
62	Saco River Basin, those waters in Maine	5
63	Minor basins entering tidewater between the Saco River Basin and the Maine - New Hampshire boundary	7
	TOTAL NUMBER OF SUB-SUB-BASINS	**159**

Table 3. Main Stem Waterbodies (Reaches).

Sub-basin Code #	# of Segments	Main Stem Name
11	5	St. John River
12	1	Allagash River
13	1	Fish River
14	2	Aroostook River
21	3	West Branch of the Penobscot River
22	1	East Branch of the Penobscot River
23	1	Mattawamkeag River
24	1	Piscataquis River
25	6	Penobscot River
31	1	Moose River
31	1	Kennebec River
32	1	Dead River
33	1	Wilson Stream
33	1	Sandy River
33	1	Messalonskee Stream
33	1	East Branch of the Sebasticook River
33	1	West Branch of the Sebasticook River
33	1	Sebasticook River
33	5	Kennebec River
42	2	Little Androscoggin River
42	7	Androscoggin River
51	1	St. Croix River
52	1	Union River
61	2	Presumpscot River
62	2	Saco River
63	1	Mousam River
63	1	Great Works River
63	1	Salmon Falls River
TOTAL NUMBER	53	

Table 4. Designated Uses Ascribed to Maine's Water Quality Classifications.

RIVERINE WATERS

Class AA -	Drinking water supply, recreation in and on the water, fishing, navigation and a natural and free flowing habitat for fish and other aquatic life.
Class A -	Drinking water supply, recreation in and on the water, fishing, industrial process and cooling water supply; hydroelectric power generation, navigation, and a natural habitat for fish and other aquatic life.
Class B -	Drinking water supply, recreation in and on the water, fishing, industrial process and cooling water supply, hydroelectric power generation, navigation, and an unimpaired habitat for fish and other aquatic life.
Class C -	Drinking water supply, recreation in and on the water, fishing, industrial process and cooling water supply; hydroelectric power generation, navigation, and a habitat for fish and other aquatic life.

LACUSTRINE WATERS

Class GPA -	Drinking water supply, recreation in and on the water, fishing, industrial process and cooling water supply, hydroelectric power generation, navigation and a natural habitat for fish and other aquatic life.

ESTUARINE & MARINE WATERS

Class SA -	Recreation in and on the water, fishing, aquaculture, propagation and harvesting of shellfish, navigation, and a natural and free flowing habitat for fish and other estuarine and marine life.
Class SB -	Recreation in and on the water, fishing, aquaculture, propagation and harvesting of shellfish, navigation and an unimpaired habitat for fish and other estuarine and marine life.
Class SC -	Recreation in and on the water, fishing, aquaculture, propagation and harvesting of shellfish, navigation and a habitat for fish and other estuarine and marine life.

Chapter 3. DOCUMENTATION OF MAINE'S WATERBODY SYSTEM

Determination of the number of stream miles in each waterbody was based on the Reach File Version 2.0 (RF2). Drainage area and reach boundaries were delineated on a RF2 plot of Maine and then reach indexed by the Research Triangle Institute. The resulting computation of stream miles through reach indexing was 11,000 miles. This presented a problem since an earlier, non-computerized study by the Maine Department of Inland Fisheries and Wildlife had determined that there were 31,672 miles of riverine habitat in Maine. This conflict was resolved by multiplying non-reach mileages by a factor of 2.7 to more closely approximate the actual number of stream miles in Maine.

Drainage area determinations, although not a required statistic for loading of WBS, were obtained from the USGS publication "Drainage Areas in Maine." Because some of the waterbodies used in WBS comprise portions or aggregations of USGS drainage area data, drainage areas have not been provided for all waterbodies. When resources allow, the remaining drainage areas will be calculated. Another planned addition to the WBS database is a description of land use characteristics and point source discharges affecting water quality.

Determination of the surface area of lakes and ponds in each lacustrine waterbody was accomplished through use of the Maine DEP lakes database. Much effort was put into determining which lakes were in which waterbody. When the lists of lake numbers were completed, waterbody numbers were entered as a sortable attribute into the lake database and waterbody lacustrine acreages determined. Assessments of attainment were based on the protocols specified in Part III, Chapter 2 of Maine's 1996 Water Quality Assessment.

Chapter 4. NON-ATTAINMENT RIVERS AND STREAMS

Because this document does not specify exactly where classifications change within the described waterbodies, or list the names of the lakes and ponds within the waterbodies, the most effective results for specific streams will be obtained by using it with the Maine Water Classification Program Statute, and for lakes and ponds by use of either Chapter 6, Table 5. Non-attainment Lakes in the State of Maine - 1996 Assessment, in this appendix, or a comprehensive list of the Great Ponds of Maine. Assignment of Water Quality Classifications to specific streams and coastal waters can be found in Title 38 M.R.S.A. Sections 467 - 469. The following riverine waterbodies contain segments which do not meet designated water quality classifications:

Waterbody
Code #

SAINT JOHN RIVER BASIN

SUB-BASIN 11 **

116R St. John River, **main stem**, from the confluence of the Fish River to the international bridge in Madawaska, those riverine waters lying in Maine.

Classifications assigned in waterbody - B
Total length of riverine waters in waterbody - 20 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

A one mile segment below Ft Kent does not attain bacterial standards due to 6 CSOs.

117R St. John River, **main stem**, from the international bridge in Madawaska to the downstream end of La Grande Isle, those riverine waters lying in Maine.

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 14 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Two miles (1 mile below Madawaska and 1 mile below Van Buren) do not attain bacterial standards due to 3 CSOs.

118R St. John River, **main stem**, from the downstream end of La Grande Isle to where the international border leaves the river in Hamlin, those riverine waters lying in Maine.

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 21 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification.

140R Presque Isle Stream, main stem below the confluence of Alder Brook, and its tributaries entering below the confluence with Alder Brook (riverine waters only).

Classifications assigned in waterbody - A & B
Drainage area of waterbody - 83 mi^2
Total length of riverine waters in waterbody - 67.7 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Presque Isle Stream (Class B; Mapleton; 5.0 miles)
Water quality sampling indicates that this waterbody segment does not attain the dissolved oxygen standard for its classification. Most of the dissolved oxygen deficit seems to be due to treated wastewater from the municipal treatment plant and water draw-down for agricultural irrigation.

Presque Isle Stream (Class B; Presque Isle; 1.0 mile)
Water quality sampling indicates that this segment does not attain the dissolved oxygen standards for Class B but does attain Class C standards. Water quality does not attain bacterial standards due to 1 CSO.

Dudley Brook (Class A, Chapman, 2.0 miles)
Sampling indicates that it does not attain aquatic life criteria due to agricultural nonpoint sources.

142R Caribou Stream and its tributaries (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 50 mi^2
Total length of riverine waters in waterbody - 78.2 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Caribou Stream (Class B; Caribou; 1.5 miles)
Past water quality sampling indicated that this waterbody segment does not attain the aquatic life and bacteria standards of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater, urban runoff and habitat modification.

143R Minor tributaries of the Aroostook River entering from the south below the confluence of Presque Isle Stream, those riverine waters lying in Maine.

Classifications assigned in waterbody - A & B
Drainage area of waterbody - 96 mi^2
Total length of riverine waters in waterbody - 87.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Everett Brook (Class B; Fort Fairfield; 4 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this

waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

145R Little Madawaska River and its tributaries (riverine waters only).

Classifications assigned in waterbody - A & B
Drainage area of waterbody - 243 mi^2
Total length of riverine waters in waterbody - 301.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Little Madawaska River and tributaries (Class B, Caribou, 20.5 miles)
A fish consumption advisory exists due to the presence of PCBs from hazardous waste sites in the watershed.

Greenlaw Brook (Class B, Limestone, Caribou, 11.1 miles)
A fish consumption advisory exists due to the presence fo PCBs from hazardous waste sites in the watershed.

146R Limestone Stream and its tributaries, those riverine waters lying in Maine.

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 69 mi^2
Total length of riverine waters in waterbody - 54 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Webster Brook (Class B; Fort Fairfield and Limestone; 2.5 miles)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater.

SUB-BASIN 15 ***

149R Prestile Stream and its tributaries entering above the dam in Mars Hill (riverine waters only).

Classification assigned in waterbody - A
Drainage area of waterbody - 68 mi^2
Total length of riverine waters in waterbody - 91.7 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Prestile Stream (Class A,Mars Hill, 8 miles)
Sampling indicates that an 8 mile segment below Mars Hill does not meet aquatic life standards of Class A but does meet standards of Class B.

152R Meduxnekeag River and its tributaries except the North Branch and the South Branch, those riverine waters lying in Maine.

Classification assigned in waterbody - B
Drainage area of waterbody - 220 mi^2
Total length of riverine waters in waterbody - 296.5 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Meduxnekeag River (Class B; Houlton; 6 miles)
Water quality model indicates that this waterbody segment does not attain the Class B but does attain Class C dissolved oxygen standard. The causes of non-attainment are the discharge of industrial wastewater, municipal wastewater and agricultural activities within the watershed.

PENOBSCOT RIVER BASIN

SUB-BASIN 21 **

205R West Branch of the Penobscot River, **main stem**, below the outlet of Quakish Lake, including that segment of Millinocket Stream lying below the outlet of the West Branch Canal (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 16 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Millinocket Stream (Class C; Millinocket; 3 miles)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater.

West Branch of the Penobscot River, so called Back Channel (Class C; Millinocket; 4 miles)
Water quality sampling indicates that this waterbody segment does not attain the aquatic life standard of its classification. The cause of non-attainment is the dewatering of this segment due to hydroelectric power generation.

A 0.5 mile segment (located in a backwater of Dolby Pond) of this waterbody does not attain the Class C dissolved oxygen standard. The causes of low dissolved oxygen levels in this waterbody segment are the discharge of industrial wastewater which receives Best Practical Treatment and the existence of an impoundment used for hydroelectric power generation.

SUB-BASIN 23 **

213R Mattawamkeag River, **main stem** (riverine waters only).

Classifications assigned in waterbody - AA & B
Total length of riverine waters in waterbody - 48 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Mattawamkeag River (Class B, Mattawamkeag, 1 mile)
This segment does not attain bacterial standards due to untreated wastes.

SUB-BASIN 24 ***

219R Piscataquis River, **main stem**, below the Route 6 bridge in Guilford (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 47 miles
Total length of riverine waters in waterbody - 47 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Piscataquis River (Class B, Dover Foxcroft, 1 mile)
This segment does not attain bacterial standards due to CSOs.

SUB-BASIN 25 ***

221R Passadumkeag River and its tributaries (riverine waters only).

Classifications assigned in waterbody - A & B
Drainage area of waterbody - 399 mi^2
Total length of riverine waters in waterbody - 310.3 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Passadumkeag River (Class B, Passadumkeag, 1 mile)
This segment does not attain bacteria standards due to untreated wastes

222R Minor tributaries of the Penobscot River entering between the confluence of the Piscataquis River and the confluence of Sunkhaze Stream (riverine waters only).

Classifications assigned in waterbody - A & B
Drainage area of waterbody - 127 mi^2
Total length of riverine waters in waterbody - 155.5 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Costigan Stream (Class B; Milford; 0.5 miles)
Water quality sampling in 1993 indicates that this segment does not attain water quality standards for dissolved oxygen and bacteria for either Class B or C.

224R Kenduskeag Stream and its tributaries (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 215 mi^2
Total length of riverine waters in waterbody - 189.4 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Burnham Brook (Class B; Garland; 3 miles)
Water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicates that this waterbody segment does not attain the dissolved oxygen standard of its classification but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Unnamed Brook (Class B; Corinth; 2 miles)
Water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this brook does not attain the Class B dissolved oxygen standard but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Kenduskeag Stream (Class C; Bangor; 1.5 miles)
Water quality sampling indicates that this waterbody segment does not attain the bacteria standard of its classification. The cause of the high bacteria levels is discharge of untreated municipal wastewater from CSO(s).

226R Sunkhaze Stream, Reed Brook and other minor tributaries of the Penobscot River entering between the confluence of Sunkhaze Stream and the confluence of Reed Brook (riverine waters only).

Classifications assigned in waterbody - A, B & C
Drainage area of waterbody - 328 mi^2
Total length of riverine waters in waterbody - 378.7 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Otter Stream (Class B; Bradley; 1 mile)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. Non-attainment is caused by discharge(s) of untreated residential wastewater.

Boynton Brook (Class B; Bradley; 0.5 mile)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. Non-attainment is caused by discharge(s) of untreated residential wastewater.

228R Non-tidal Portions of Penobscot River tributaries entering from the west between the confluence of Reed Brook and the south end of Verona Island (riverine waters only).
NOTE: For State reporting purposes, this waterbody is to be grouped with Minor Coastal Basins, not with the Penobscot River Basin.

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 103 mi^2
Total length of riverine waters in waterbody - 188.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Unnamed Brook (Class B; Frankfort; 1 mile)
Past water quality sampling indicated that this brook does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater.

231R Penobscot River, **main stem**, from the confluence of Cambolasse Stream to the Route 6 bridge between Enfield and Howland (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 14 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

A fish consumption advisory has been issued due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (14 miles)

A one mile segment below Lincoln does not attain bacteria standards due to 1 CSO.

232R Penobscot River, **main stem**, from the Route 6 bridge between Enfield and Howland to the confluence of Sunkhaze Stream (riverine waters only).

Classification assigned in waterbody - B & C
Total length of riverine waters in waterbody - 20 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

A fish consumption advisory has been issued due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (20 miles)

233R Penobscot River, **main stem**, from the confluence of Sunkhaze Stream to the Veazie dam (riverine waters only).

Classification assigned in waterbody - B
Total length of riverine waters in waterbody - 12.4 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

A fish consumption advisory has been issued due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (12.4 miles)

234R Penobscot River, **main stem**, from the Veazie dam to the confluence of Reed Brook in Hampden (riverine waters only).

Classification assigned in waterbody - B & C
Total length of riverine waters in waterbody - 10.1 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

The lower portion of this segment does not attain the Class C bacteria standard. Non-attainment is caused by discharges of untreated municipal wastewater from CSOs in Bangor and Brewer. (8.0 miles)

A fish consumption advisory has been issued for this waterbody due to the presence of dioxin in fish tissues. Thus this waterbody is not fully attaining its designated use of fish consumption. (10.1 miles)

KENNEBEC RIVER BASIN

SUB-BASIN 32 **

311R Dead River, **main stem** (riverine waters only).

Classifications assigned in waterbody - AA & A
Drainage area of waterbody -
Total length of riverine waters in waterbody - 22.4 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Dead River (Class AA/A, T3R4 BKP, 2 miles)
This segment does not attain Class A aquatic life standards due to the effects of flow alteration from hydropower, but does attain Class B.

SUB-BASIN 33 **

314R Wesserunsett Stream and its tributaries (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 142 mi^2
Total length of riverine waters in waterbody - 148.4 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except as follows:

Wesserunsett Stream (Class B; Athens and Cornville; 2 miles).
Water quality sampling in 1991 indicates this segment does not attain bacteria standards of any class presumably due to untreated residential wastewater.

316R Sandy River, main stem, between the Route 145 bridge in Strong and the Route 2 bridge in Farmington and Sandy River tributaries entering below the Route 145 bridge in Strong except for Wilson Stream and its tributaries (riverine waters only).

Classifications assigned in waterbody - B
Drainage area of waterbody - 268 mi^2
Total length of riverine waters in waterbody - 290.8 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Barker Stream (Class B; Farmington; 4 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the Class B dissolved oxygen standard but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to rural residential runoff in the watershed.

Tannery Brook (Class B; Farmington; 1.5 miles)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater.

Unnamed Brook (Class B; New Sharon; 0.2 miles)
This brook (Monitoring Network Station #226) has an impoundment which received wastes from a vegetable canning facility prior to 1960. Currently, the impoundment has marsh-like characteristics which contribute to low dissolved oxygen levels. Water quality sampling, however, indicates that nearly anaerobic conditions occur below the impoundment.

317R Wilson Stream and its tributaries above Wilson Pond (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 108 mi^2
Total length of riverine waters in waterbody - 56.4 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Meadow Brook (Class B; Wilton; 1 mile)
Past water quality sampling indicated that this brook does not attain the bacteria standard of its classification. Water quality sampling also indicates that this brook does not meet the Class B dissolved oxygen standard but does meet the Class C standard. The cause of non-attainment is discharge(s) of untreated residential wastewater.

320R Minor tributaries of the Kennebec River entering between the confluence of the Carrabassett River and the confluence of the Sebasticook River (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 267 mi^2
Total length of riverine waters in waterbody - 158.4

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Whitten Brook (Class B; Skowhegan; 1 mile).
Water quality sampling in 1991 indicates this segment does not attain bacteria standards of its class; presumably due to urban runoff.

Currier Brook (Class B; Skowhegan; 1 mile).
Water quality sampling in 1991 indicated this segment does not attain bacteria standards of any class presumably due to urban runoff.

Carrabassett Stream (Class B; Canaan; 11 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

322R Tributaries of Messalonskee Stream entering below Messalonskee Lake dam (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 30 mi^2
Total length of riverine waters in waterbody - 20.1 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Fish Brook (Class B; Fairfield; 7 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

323R Messalonskee Stream, **main stem** (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 10 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Messalonskee Stream (Class C; Oakland; 1.0 miles)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. The cause of non-attainment is 1 CSO.

324R West Branch of the Sebasticook and its tributaries except for the main stem of the West Branch of the Sebasticook River below the Route 23 bridge in Hartland (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 317 mi^2
Total length of riverine waters in waterbody - 276.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Thompson Brook (Class B; Hartland; 4 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the Class B dissolved oxygen standard but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

325R East Branch of the Sebasticook River and its tributaries except for the main stem of the East Branch of the Sebasticook River below the Sebasticook Lake dam (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 221 mi^2
Total length of riverine waters in waterbody - 160.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

East Branch of the Sebasticook River (Class C; Corinna; 2 miles)
Water quality sampling indicates that this waterbody segment does not attain the aquatic life standard of its classification. Non-attainment is caused by the discharge of municipal wastewater which, although receiving Best Practical Treatment, still causes toxicity problems in this low-flow segment. This segment does not attain bacteria standards due to the presence of 5 CSOs.

Mulligan Stream (Class B; St. Albans; 2 miles)
Past water quality sampling and an analysis of watershed characteristics including land uses, the effects of point source discharges (if present) and the extent of marshes and bogs indicates that this waterbody segment does not attain the Class B dissolved oxygen standard but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Brackett Brook (Class B; Palmyra; 2 miles)
Water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicate that this waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed. Highway runoff also may be contributing to low dissolved oxygen levels in this brook.

327R Fifteenmile Stream and its tributaries (riverine waters only).

Classification assigned in waterbody - B
Number of lakes and/or ponds in waterbody - 70 mi^2
Surface area of lacustrine waters in waterbody - 79.7 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Mill Stream (Class B; Albion; 2.5 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed. This stream is the outlet of Lovejoy Pond. Low dissolved oxygen levels in this stream are largely a result of the algal blooms that occur in Lovejoy Pond.

329R Minor tributaries of the Sebasticook River (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 144 mi^2
Total length of riverine waters in waterbody -81.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Farnham Brook (Class B; Pittsfield; 3 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Twelvemile Brook (Class B; Clinton; 7 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Unnamed Brook (Class B; Benton; 2 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this brook (Monitoring Network Station #310) does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

330R West Branch of the Sebasticook River, **main stem**, below the Route 23 bridge in Hartland (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 13 miles

ATTAINMENT STATUS: The quantity of chromium discharged by the Town of Hartland exceeds the allowable dilution capability of this waterbody, indicating that the USEPA "Quality Criteria for Water 1986" are not met. Thus, this waterbody does not attain its designated use of habitat for fish and other aquatic life. (13 miles)

331R East Branch of the Sebasticook River, **main stem**, below the Sebasticook Lake dam (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 9 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

East Branch (Class C, Newport, 3 miles)
This segment does not attain dissolved oxygen standards due to excessive algae discharged from Sebasticook Lake.

332R Sebasticook River, **main stem** (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 28 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except the following:

Sebasticook River, below Burnham impoundment (Class C; Burnham; 3 mile)
Water quality sampling indicates that this waterbody segment does not attain the dissolved oxygen standard of its classification. The cause of the low dissolved oxygen is nonpoint source pollution and reduced water levels from hydropower impoundment.

Sebasticook River, below Fort Halifax impoundment (Class C; Winslow; 3 mile)
Water quality sampling indicates that this waterbody segment does not attain the dissolved oxygen standard of its classification. The cause of the low dissolved oxygen is nonpoint source pollution and reduced water levels from hydropower impoundment.

333R Minor tributaries of the Kennebec River entering between the confluence of the Sebasticook River and the confluence of Cobbosseecontee Stream (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 356 mi^2
Total length of riverine waters in waterbody - 92.3 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Riggs Brook (Class B; Augusta; 0.2 mile)
Past water quality sampling indicates that this waterbody segment does not attain the bacteria standard of its classification. The cause of the high bacteria levels is discharge of untreated municipal wastewater from CSO(s) and/or urban runoff.

Whitney Brook (Class B; Augusta; 0.5 mile)
Water quality sampling indicates that this waterbody segment does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater and 1 CSO.

Bond Brook (Class B & C; Augusta; 2 miles).
Water quality sampling in 1991 indicates that this segment does not attain Class C bacteria standards due to urban runoff and 4 CSOs.

334R Cobbosseecontee Stream and its tributaries (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 217 mi^2
Total length of riverine waters in waterbody - 77.2 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Cobbossee Stream (Class B, Winthrop, 0.5 miles)
This segment does not attain aquatic life standards due to urban nonpoint source.

Tingley Brook (Class B; Readfield; 2 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Mud Mills Stream (Class B; Monmouth; 5 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Potters Brook (Class B; Litchfield; 2.5 miles)
Past Water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the Class B dissolved oxygen standard but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

335R Minor tributaries of the Kennebec River entering below the confluence of Cobbosseecontee Stream (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 141 mi^2
Total length of riverine waters in waterbody - 148.1 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Togus Stream (Class B; Chelsea; 2 miles)
Water quality sampling in 1991 and modeling indicates that this waterbody segment does not attain the Class C dissolved oxygen standard. Non-attainment in this water quality-limited segment is caused by a discharge of sanitary wastewater which although receiving Best Practical Treatment, still contributes to naturally low dissolved oxygen deficit in this low-flow segment.

Kimball Brook (Class B; Pittston; 3 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

337R Kennebec River, **main stem**, from Wyman dam in Bingham to the Route 201A bridge between Anson and Madison (riverine waters only).

Classification assigned in waterbody - A
Total length of riverine waters in waterbody - 14 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Kennebec River, from Wyman Dam to below Jackson Brook (Class A; Bingham; 0.2 miles).
This segment below Wyman Dam does not attain aquatic life standards for its class due to effects of flow modification from the dam.

338R Kennebec River, **main stem**, from the Route 201A bridge between Anson and Madison to the Fairfield - Skowhegan boundary (riverine waters only).

Classification assigned in waterbody - B
Total length of riverine waters in waterbody - 21 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Kennebec River (Class B, Norridgewock, 4 miles)
This segment does not attain aquatic life standards due to the effects of flow alteration for hydropower.

339R Kennebec River, **main stem**, from the Fairfield - Skowhegan boundary to Edwards dam in Augusta (riverine waters only).

Classifications assigned in waterbody - B & C
Total length of riverine waters in waterbody - 30 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

The Class B dissolved oxygen standard is not attained for an 8 mile segment upstream of the Augusta - Sidney boundary. The principal causes of non-attainment are the discharge of industrial wastewater which is receiving Best Practical Treatment and impoundments used for hydroelectric power generation.

A fish consumption advisory has been issued for this waterbody due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (30.0 miles)

During classification hearings conducted in 1987, testimony was received that this waterbody is unsuitable for its designated uses of recreation in and on the water due to excessive color, odor, foam and turbidity.

The lower segment of the Edwards impoundment does not attain aquatic life standards for Class C.

The river below Skowhegan does not attain bacteria standards due to the presence of 8 CSOs in Skowhegan and 3 CSOs in Fairfield.

340R Kennebec River, **main stem**, from Edwards dam in Augusta to The Chops, including tidal portions of tributaries (riverine waters only).
NOTE: For State reporting purposes, waterbody #427 is to be grouped with waterbodies #337 - #340.

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 26 miles

ATTAINMENT STATUS: Water quality sampling indicates that the upper 3 miles of this waterbody does not attain the Class C bacteria standard due to discharges of untreated municipal wastewater from CSOs in Augusta.

A fish consumption advisory has been issued for this waterbody due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (26 miles).

During classification hearings conducted in 1987, testimony was received that this waterbody is unsuitable for its designated uses of recreation in and on the water due to excessive color, odor, foam and turbidity.

ANDROSCOGGIN RIVER BASIN

SUB-BASIN 42 **

410R Minor tributaries of the Androscoggin River entering between the confluence of the Ellis River and the confluence of the Nezinscot River (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 390 mi^2
Total length of riverine waters in waterbody - 102.3 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Spears Stream (Class B; Peru; 1.5 miles)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater.

412R Nezinscot River and its tributaries (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 180 mi^2
Total length of riverine waters in waterbody - 179.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Nezinscot River (Class B; Buckfield; 14 miles)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated and/or inadequately treated residential wastewater.

House Brook and Lively Brook (Class B; Turner; 2 miles)
Aquatic life monitoring indicates that this segment does not attain standards of its classification due to effects of a poultry operation affecting ground water inflow quality and riparian habitat changes.

413R Minor tributaries of the Androscoggin River entering between the confluence of the Nezinscot River and the confluence of the Little Androscoggin River (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 81 mi^2
Total length of riverine waters in waterbody - 76.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Logan Brook (Class B; Auburn; 1 mile)
Past water quality sampling indicated that this brook does not attain the bacteria or dissolved oxygen standards of its classification. The cause of non-attainment is unknown.

Penley Brook (Class B; Auburn; 0.7 mile)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to urban runoff in the watershed.

Stetson Brook (Class B; Lewiston; 0.5 mile)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria or dissolved oxygen standards of its classification. Non-attainment is caused by the discharge of untreated municipal wastewater from a CSO.

Jepson Brook (Class B; Lewiston; 1 mile)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. Water quality sampling also indicates that this brook does not attain the Class B dissolved oxygen standard but does attain the Class C standard. Non-attainment is caused by the discharge of untreated municipal wastewater from CSO(s).

414R Little Androscoggin River, main stem, above the Route 26 bridge in Paris and tributaries of the Little Androscoggin River entering above the confluence of Bog Brook in Minot (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 252 mi^2
Total length of riverine waters in waterbody - 43.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Pennesseewassee Lake Outlet (Class B; Norway; 1 mile)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria and dissolved oxygen standards of its classification. The cause of non-attainment is discharge(s) of untreated residential/municipal wastewater.

Thompson Lake Outlet (Class C; Oxford; 0.6 mile)
Aquatic life monitoring indicates that this segment does not attain the aquatic life standards of its class due to industrial discharge.

415R Bog Brook and other tributaries of the Little Androscoggin River which enter below the confluence of Bog Brook (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 102 mi^2
Total length of riverine waters in waterbody - 96.3 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Morgan Brook (Class B; Minot; 2.3 miles)
Water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicate that this waterbody segment does not attain the Class B dissolved oxygen standard but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Davis Brook (Class B; Poland; 1 mile) Water quality sampling and analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicate that this waterbody segment does not attain the Class B dissolved oxygen standard but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Unnamed Brook (Class B; Auburn; 1 mile)
Water quality sampling indicates that this brook (Monitoring Network Station #658) does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater.

416R Little Androscoggin River, **main stem**, from the Route 26 bridge in Paris to the Route 121 bridge in Oxford (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 10 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Little Androscoggin River (Class C, South Paris, 3 miles)
This segment does not attain bacteria standards due to 1 CSO.

417R Little Androscoggin River, **main stem**, below the Route 121 bridge in Oxford (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 21 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Little Androscoggin River (Class C, Mechanic Falls, 1 mile)
This segment does not attain bacteria standards due to 3 CSOs.

Little Androscoggin River (Class C; Auburn; 1 mile)
Water quality sampling indicates that this waterbody segment does not attain the bacteria standard of its classification. The high bacteria levels are caused by the discharge of untreated municipal wastewater from 2 CSOs.

418R Sabattus River and its tributaries (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 74 mi^2
Total length of riverine waters in waterbody - 94.5 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

No Name Brook (Class B; Lewiston and Lisbon; 3 miles)
Water quality sampling indicates that this waterbody segment does not attain the bacteria or dissolved oxygen standards of its classification. Non-attainment is caused by nonpoint source discharges.

420R Minor tributaries of Merrymeeting Bay, entering between an extension of the Bath - Brunswick boundary in a northwesterly direction and The Chops (riverine waters only).
NOTE: Although located in USGS hydrologic unit 01040002, this waterbody, which includes the Abagadasset and Cathance Rivers, is to be grouped with minor tributaries of the Kennebec River, not with minor tributaries of the Androscoggin River.

Classification assigned in waterbody - B
Drainage area of waterbody - 90 mi^2
Total length of riverine waters in waterbody - 37.2 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Abagadasset River (Class B; Richmond; 9 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

421R Androscoggin River, **main stem**, from the Maine - New Hampshire border to Virginia bridge in Rumford (riverine waters only).

Classification assigned in waterbody - B & C
Total length of riverine waters in waterbody - 34.9 miles

ATTAINMENT STATUS: A fish consumption advisory has been issued for this waterbody due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (34.9 miles).

422R Androscoggin River, **main stem**, from Virginia bridge in Rumford to the upstream end of Bean Island in Jay (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 22.5 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody attain Class C standards except for the following:

A fish consumption advisory has been issued due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (22.5 miles).

During classification hearings conducted in 1987, testimony was received that this waterbody is unsuitable for its designated uses of recreation in and on the water due to excessive color, odor, foam and turbidity.

423R Androscoggin River , **main stem**, from the upstream end of Bean Island in Jay to the confluence of the Nezinscot River (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 21.1 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody attain Class C standards except for the following:

A fish consumption advisory has been issued due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (21.1 miles).

A one mile segment below Livermore does not attain bacteria standards due to CSOs.

A 5 mile segment below Jay does not attain aquatic life standards due to the combined effects of industrial discharge and impoundments.

424R Androscoggin River, **main stem**, from the confluence of the Nezinscot River to Great Falls in Lewiston (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 13.6 miles

ATTAINMENT STATUS: A 3.0 mile segment in Gulf Island Pond was found to have low dissolved oxygen in the deeper waters of the impoundment in 1993 following construction of an oxygen injection system.
A fish consumption advisory has been issued for this waterbody due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (13.6 miles).

425R Androscoggin River, **main stem**, from Great Falls in Lewiston to the Brunswick dam (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 22.8 miles

ATTAINMENT STATUS: This segment does not attain the Class C bacteria standard caused by the discharge of untreated municipal wastewater from CSOs in Auburn and Lewiston.

A fish consumption advisory has been issued for this waterbody due to the presence of dioxin in fish tissues. Thus, this waterbody is not fully attaining its designated use of fish consumption. (22.8 miles).

426R Androscoggin River, **main stem**, from the Brunswick dam to the extension of the Bath - Brunswick boundary across Merrymeeting Bay in a northwesterly direction (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 6.0 miles

ATTAINMENT STATUS: A fish consumption advisory has been issued for this waterbody due to the presence of dioxin in fish tissues. Thus, this waterbody is not attaining its designated use of fish consumption. (6.0 miles).

427R Merrymeeting Bay, including tidal portions of tributaries, from the extension of the Bath - Brunswick boundary across Merrymeeting Bay in a northwesterly direction, to The Chops (riverine waters only). NOTE: Although located in USGS unit 01040002, this waterbody is to be grouped with the main stem of the Kennebec River, not the main stem of the Androscoggin River.

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 3.0 miles

ATTAINMENT STATUS: A fish consumption advisory has been issued for this waterbody due to the presence of dioxin in fish tissues. Thus, this waterbody is not attaining its designated use of fish consumption. (3.0 miles).

MINOR BASINS ENTERING TIDEWATER EAST OF SMALL POINT

SUB-BASIN 51 ***

505R St. Croix River, **main stem**, from its confluence with Woodland Lake to head of tide, those waters lying in Maine (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 29.7 miles

ATTAINMENT STATUS: Available information indicates that a portion of this waterbody does not attain aquatic life standards due to industrial discharge and the exceedence of temperature standards. (3.0 miles).

SUB-BASIN 52 ***

508R Minor drainage entering tidewater in Washington County between Robbinston and the East Machias River (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody -
Total length of riverine waters in waterbody - 686.4 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Unnamed Brook (Class C; Calais; 1 mile)
Past water quality sampling indicated that this brook (Monitoring Network Station #S16) does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater.

Pottle Brook (Class B; Perry; 0.5 mile)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater.

511R Pleasant River and its tributaries (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 96 mi^2
Total length of riverine waters in waterbody - 142.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except as follows:

Bog Brook (Class B; Deblois; 2 miles)
Biological sampling in 1990 indicates this segment does not attain the aquatic life standards for its class. Low dissolved oxygen levels and solids from a fish hatchery are the suspected causes of non-attainment.

512R Narraguagus River and its tributaries (riverine waters only).

Classifications assigned in waterbody - AA, A & B
Drainage area of waterbody - 227 mi^2
Total length of riverine waters in waterbody - 272.8 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

McCoy Brook (Deblois; Class B; 1 mile)
Biological sampling in 1993 indicates this segment does not attain the aquatic life standards for its class. Discharge of peat and low pH water from a peat mine site are the suspected causes of non-attainment.

Narraguagus River (Class B, Cherryfield, 1 mile)
This segment does not attain aquatic life standards due to the presence of industrial and residential nonpoint source discharges.

513R Minor drainages entering tidewater in Washington County between the East Machias River and the Washington County - Hancock County boundary including Whitten Parritt Stream and its tributaries (riverine waters only).

Classifications assigned in waterbody - A, B & C
Drainage area of waterbody - 300 mi^2
Total length of riverine waters in waterbody - 867.2 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Unnamed Brooks (Class B; Cherryfield; 1.5 miles)
Past Water quality sampling indicated that four brooks (Monitoring Network Stations #N23, N24, N25 & N26) running through the town center have segments which do not attain the bacteria standard of their classification. The cause of non-attainment is discharges of untreated residential wastewater.

520R Minor drainages entering tidewater in Hancock County between the Union River and the South end of Verona Island except for those Hancock County islands lying in Blue Hill Bay and Hancock County islands in areas to the south and east of Blue Hill Bay (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 120 mi^2
Total length of riverine waters in waterbody - 595.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Carleton Stream (Class C; Blue Hill; 1.4 miles)
Biological monitoring in 1991 indicates this stream does not attain the aquatic life standard of its classification due to runoff from tailings piles which contain heavy metals. The copper mining operations which produced the tailings were discontinued in 1981.

521R Minor drainages entering tidewater in Waldo County between the south end of Verona Island and the Waldo County - Knox County boundary (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 202 mi^2
Total length of riverine waters in waterbody - 331.0 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Warren Brook (Class B; Belfast; 2 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

522R Minor drainages entering tidewater in Knox County between the Waldo County - Knox County boundary and Marshall Point (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 54 mi^2
Total length of riverine waters in waterbody - 446.2 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Megunticook River (Class B; Camden; 0.1 mile)
Past water quality sampling indicated that this waterbody segment does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater and/or urban runoff.

Unnamed Brook (Class B; Camden; 0.7 mile)
Past water quality sampling indicated that this brook (Monitoring Network Station #A13) does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater and/or urban runoff.

Unnamed Brook (Class C; Rockport; 0.5 mile)
Past water quality sampling indicated that this brook (Monitoring Network Station #A11) does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater and/or urban runoff.

Unnamed Brook (Class C; Rockland; 0.5 mile)
Past water quality sampling indicated that this brook (Monitoring Network Station #A10) does not attain the bacteria standard of its classification. The cause of non-attainment is discharge(s) of untreated residential wastewater and/or urban runoff.

SUB-BASIN 53 ***

524R Minor drainages entering tidewater in Knox County between Marshall Point and the Knox County - Lincoln County boundary including the Goose River and its tributaries (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 110 mi^2
Total length of riverine waters in waterbody - 245.7 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Unnamed Brook (Class B, North Cushing, 0.5 mile)
This segment does not attain bacteria standards due to unknown sources.

527R Damariscotta Lake outlet and its tributaries entering above tidewater (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 57 mi^2
Total length of riverine waters in waterbody - 24.3 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Damariscotta River (Class B, Newcastle, 0.2 mile)
This segment does not attain aquatic life standards due to flow alteration below a hydropower dam.

528R Sheepscot River and its tributaries (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 160 mi^2
Total length of riverine waters in waterbody - 173.0 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

West Branch of Sheepscot River (Class AA, Windsor, 4 miles)
This segment does not meet dissolved oxygen or bacteria standards due to agricultural nonpoint sources. This segment does attain Class C standards.

Sheepscot River (Class AA, Whitefield, 4 miles)
This segment does not attain aquatic life standards due to agricultural nonpoint sources. This segment does attain Class B standards.

Dyer Brook (Class B, Alna, 1 mile)
This segment does not attain dissolved oxygen or bacteria standards due to unknown sources.

MINOR BASINS ENTERING TIDEWATER WEST OF SMALL POINT

SUB-BASIN 61 ***

602R Minor drainages entering tidewater in Cumberland County between the Sagadahoc County - Cumberland County boundary and the outlet of the Royal River <u>and</u> those minor drainages of Cumberland County islands lying easterly of the towns of Yarmouth and Cumberland (riverine waters only).

Classifications assigned in waterbody - A, B & C
Drainage area of waterbody -
Total length of riverine waters in waterbody - 141.1 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Mare Brook (Class B; Brunswick; 2 miles)
Aquatic life monitoring indicates that this water does not attain the standards of its classification due to habitat alteration and contamination from the Naval Air Station.

Frost Gully Brook (Class A; Freeport; 3 miles)
Water quality sampling and an analysis of watershed characteristics, including land uses, in 1991, indicate that this waterbody segment does not attain the bacteria and dissolved oxygen standards of its classification but does attain the Class C standards. Non-attainment is due to runoff from roads and residential development.

Concord Gully (Class A, Freeport, 1 mile)
This segment does not attain aquatic life standards due to urban nonpoint sources

603R Royal River and its tributaries (riverine waters only).

Royal River (Class B, Gray and North Yarmouth, 2.5 miles)
This segment does not attain water and organisms statewide water quality criteria due to the presence of TCE.

Classifications assigned in waterbody - B
Drainage area of waterbody - 143 mi^2
Total length of riverine waters in waterbody - 93.0 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Chandler River (Class B; North Yarmouth and Pownal; 13 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this waterbody segment does not attain the dissolved oxygen standard of its classification but does attain the Class C standard. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Unnamed Brook (Class C; North Yarmouth and Yarmouth; 2 miles)
Past water quality sampling and an analysis of watershed characteristics including land use, the effects of point source discharges (if present) and the extent of marshes and bogs indicated that this brook (Monitoring Network Station #R310) does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural activities in the watershed.

Eddy Brook (Class B, New Gloucester, 1 mile)
This segment does not attain aquatic life standards due to a fish hatchery discharge. This segment does attain Class C standards.

Hatchery Brook (Class B, Gray, 1 mile)
This segment does not attain aquatic life standards due to a fish hatchery discharge. This segment does attain Class C standards.

607R Tributaries of the Presumpscot River entering below the outlet of Sebago Lake (riverine waters only).

Classifications assigned in waterbody - B
Drainage area of waterbody - 201 mi^2
Total length of riverine waters in waterbody - 92.9 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Otter Brook (Class B; Windham; 2 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit may be due to agricultural activities in the watershed.

Thayer Brook, a tributary of the Pleasant River (Class B; Gray; 3 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit may be due to agricultural activities in the watershed.

Black Brook (Class B; Windham; 5 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit may be due to agricultural activities in the watershed.

Colley Wright Brook (Class B; Windham; 5 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification but does attain the Class C standard. Most of the dissolved oxygen deficit may be due to agricultural activities in the watershed.

Mosher Brook (Class B; Gorham; 2 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit may be due to agricultural activities in the watershed.

Inkhorn Brook (Class B; Westbrook; 4 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit may be due to agricultural activities in the watershed.

Hobbs Brook, a tributary of the West Branch, Piscataquis River (Class B; Cumberland; 1.5 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification but does attain the Class C standard. Most of the dissolved oxygen deficit may be due to agricultural activities in the watershed.

East Branch of the Piscataqua River (Class B; Falmouth; 2 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification but does attain the Class C standard. Most of the dissolved oxygen deficit may be due to agricultural activities in the watershed.

Piscataqua River (Class B, Falmouth, 3 miles)
This segment does not attain Class B bacteria standards due to unknown causes. This segment does attain Class C standards.

Pleasant River (Class B, Windham, 4 miles)
This segment does not attain bacteria standards due to untreated wastes.

609R Presumpscot River, **main stem**, below Sacarappa Dam (riverine waters only).

Classification assigned in waterbody - C
Total length of riverine waters in waterbody - 7.9 miles

ATTAINMENT STATUS: Water quality sampling indicates that the lower 7 miles of this waterbody do not attain the Class C bacteria or aquatic life standards. Water quality modeling indicates the lower 2.0 miles does not attain the dissolved oxygen standard. The causes of non-attainment seem to be discharge(s) of CSOs, and inadequately treated industrial wastewater.

610R Minor drainages entering tidewater in Cumberland County from the mainland between the Presumpscot River and the South Portland - Cape Elizabeth boundary (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody -
Total length of riverine waters in waterbody - 60.7 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Capisic Brook (Class C; Portland; 3 miles)
This water does not attain dissolved oxygen or bacteria standards due to the presence of 7 CSOs and urban nonpoint sources.

Clark Brook (Class C; Westbrook; 1 mile)
This waterbody segment does not attain the dissolved oxygen standard of its classification. Source of the dissolved oxygen deficit is presumed to be urban nonpoint discharges.

Stroudwater River (Class B; Gorham; 4 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification but does attain the Class C standard. Most of the dissolved oxygen deficit may be due to urban runoff in the watershed.

Long Creek (Class C; South Portland and Westbrook; 3 miles)
This waterbody segment does not attain the dissolved oxygen or bacteria standards of its classification. This may be due to urban runoff in the watershed.

611R Minor drainages entering tidewater in Cumberland County between the South Portland - Cape Elizabeth boundary and the Cumberland County - York County boundary (riverine waters only).

Classifications assigned in waterbody - A, B & C
Drainage area of waterbody -
Total length of riverine waters in waterbody - 86.1 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Alewife Brook (Class A; Cape Elizabeth; 1 mile)
This waterbody segment does not attain the bacteria and dissolved oxygen standard of its classification. Non-attainment may be due to agricultural activities in the watershed.

Phillips Brook (Class C; Scarborough; 1.5 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit may be due to urban runoff in the watershed.

612R Minor drainages entering tidewater in York County between the Cumberland County - York County boundary and the Saco River Basin. (riverine waters only)

Classifications assigned in waterbody - B & C
Drainage area of waterbody -
Total length of riverine waters in waterbody - 25.6 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Goosefare Brook (Class B; Saco; 3.0 miles)
Water quality sampling indicates that this waterbody segment does not attain the dissolved oxygen or aquatic life standards of its classification. The dissolved oxygen deficit seems to be due to the discharge of treated municipal wastewater from the Town of Old Orchard Beach.

SUB-BASIN 62 **

613R Minor tributaries of the Saco River entering above the confluence of the Little Ossippee River, those riverine waters lying in Maine.

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 824 mi^2
Total length of riverine waters in waterbody - 247.3 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Wards Brook (Class C; Fryeburg; 1.5 miles)
This brook has an impoundment which was formerly used as a log holding pond. Past water quality sampling indicated that this highly colored brook does not attain the dissolved oxygen standard of its classification.

616R Minor tributaries of the Saco River entering between the confluence of the Little Ossippee River and tidewater (riverine waters only).

Classification assigned in waterbody - B & C
Drainage area of waterbody - 150 mi^2
Total length of riverine waters in waterbody - 49.9 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Deep Brook (Class C; Saco; 2.5 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit seems to be due to agricultural or residential development activities in the watershed.

619R Saco River, **main stem**, below the confluence of the Little Ossippee River (riverine waters only).

Classifications assigned in waterbody - B & C
Total length of riverine waters in waterbody - 25 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Past water quality sampling indicated that a 0.5 mile segment of the Saco River just above tidewater does not attain the Class C bacteria standard. The cause of high bacteria levels is discharges from CSOs. Additionally, a 0.2 mile segment below the Bonny Eagle impoundment and a 0.2 mile segment below the Skelton impoundment do not meet aquatic life standards due to hydrologic modification from these hydroelectric power facilities.

SUB-BASIN 63 ***

622R Kennebunk River and its tributaries (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 56 mi^2
Total length of riverine waters in waterbody - 3.8 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except as follows:

Kennebunk River (Class B; Kennebunk and Arundel; 3 miles).
Water quality sampling in 1991, indicates non-attainment of class B bacteria standards but attainment of Class C standards. This is attributed to stormwater runoff.

623R Mousam River, main stem, above the Route 224 bridge in Sanford and all tributaries of the Mousam River (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody - 113 mi^2
Total length of riverine waters in waterbody - 43.0 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Carpenter Brook (Class B, Waterboro,1 mile)
This segment does not attain aquatic life standards due to a former tannery.

624R Minor drainages entering tidewater in York County between the Kennebunk River and the Ogunquit - York boundary (riverine waters only).

Classifications assigned in waterbody - B & C
Drainage area of waterbody -
Total length of riverine waters in waterbody - 70.7 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Stevens Brook (Class B; Ogunquit; 1.0 miles)
Water quality monitoring indicates that this segment does not meet the dissolved oxygen standard for Class B but does attain Class C, probably due to nonpoint source runoff and untreated residential wastewater.

625R Great Works River, main stem, above the Route 9 bridge in North Berwick and all tributaries of the Great Works River (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody - 87 mi^2
Total length of riverine waters in waterbody - 42.7 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Adams Brook (Class B; Berwick; 1.5 miles)
This waterbody segment does not attain the dissolved oxygen standard of its classification. Most of the dissolved oxygen deficit may be due to agricultural activities in the watershed.

626R Minor drainages entering tidewater in York County between the Ogunquit - York boundary and the Salmon Falls River (riverine waters only).

Classification assigned in waterbody - B
Drainage area of waterbody -
Total length of riverine waters in waterbody - 34.9 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Smelt Brook (Class B, York, 1 mile)
This segment does not attain dissolved oxygen standards due to an impoundment.

628R Mousam River, **main stem**, below the Route 224 bridge in Sanford (riverine waters only).

Classifications assigned in waterbody - B & C
Total length of riverine waters in waterbody - 19 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Mousam River (Class B; Sanford; 4 mile)
Water quality sampling indicates that this segment does not attain the dissolved oxygen, bacteria or aquatic life standards. The causes include the discharge of treated municipal wastewater, CSOs, and stream flow modification for hydropower generation, urban nonpoint sources and hazardous waste from a former municipal dump.

630R Salmon Falls River, **main stem**, those riverine waters lying in Maine.

Classification assigned in waterbody - B
Total length of riverine waters in waterbody - 37 miles

ATTAINMENT STATUS: Available information indicates that all riverine waters in this waterbody are attaining the standards of their assigned classification except for the following:

Salmon Falls River (Class B; Berwick and South Berwick; 5 miles)
Water quality sampling indicates that the segment from Berwick to the Route 101 bridge does not meet the dissolved oxygen, bacteria, or aquatic life standards for its classification. Non-attainment is caused by inadequate treatment of municipal wastewater which includes industrial wastes and/or hydrologic modification.

Sturgeon Creek (Class B; Eliot; 1 mile)
Water quality sampling indicates that this segment does not attain the dissolved oxygen standard of its classification. The dissolved oxygen deficit is due to inadequately treated sanitary wastewater.

Chapter 5. NON-ATTAINMENT ESTUARINE AND MARINE WATERS

Portions of the following estuarine and marine waters do not meet designated water quality classifications:

235M Penobscot River Estuary, from Reed Brook in Hampden to the south end of Verona Island and tidal portions of tributaries entering between the confluence of Reed Brook and the south end of Verona Island.
NOTE: Although located in USGS hydrologic unit 01020005, this waterbody is to be grouped with estuarine and marine waters, not with the Penobscot River Basin.

Classification assigned in waterbody - SC
Total area of estuarine/marine waters in waterbody - 12.2 mi^2

ATTAINMENT STATUS: Past water quality sampling indicates that the northerly 0.5 mi^2 segment of this waterbody does not attain the Class SC bacteria standard for water-contact recreation. Water quality sampling also indicates that this entire waterbody does not attain the Class SC bacteria standards for shellfish harvesting. Non-attainment is caused by discharges of untreated municipal wastewater from CSOs in Bangor and Brewer.

506M St. Croix River Estuary, from head of tide to Robbinston, those estuarine and marine waters lying in Maine.
NOTE: Although located in USGS hydrologic unit 01050001, this waterbody is to be grouped with estuarine and marine waters, not the St. Croix River Basin.

Classifications assigned in waterbody - SC & SB
Surface area of estuarine/marine waters in waterbody - 5.8 mi^2

ATTAINMENT STATUS: Water quality sampling indicates that this entire waterbody does not attain the Class SC bacteria standards for shellfish harvesting. The cause of non-attainment is discharges of treated and untreated municipal and industrial wastewater.

523M St. George River estuary from head of tide to Thomaston.

Classification assigned- SB
Surface area of estuary waters- 3 mi^2.

ATTAINMENT STATUS: Water quality sampling in 1992 and 1993 revealed non-attainment of dissolved oxygen and shellfishing standards for a 3.0 mi^2 mile segment of this estuary.

620M Saco River Estuary, from head of tide to Camp Ellis.
NOTE: Although located in USGS hydrologic unit 0106002, this waterbody is to be grouped with estuarine and marine waters, not the Saco River Basin.

Classification assigned in waterbody - SC
Surface area of estuarine waters in waterbody - 0.9 mi^2

ATTAINMENT STATUS: Past water quality sampling indicates that the northerly 0.4 mi^2 of this waterbody does not attain the Class SC bacteria standard for water-contact recreation. Water quality sampling also indicates that this entire waterbody does not attain the Class SC bacteria standard for shellfish harvesting. The causes of non-attainment are discharges of treated and untreated municipal and industrial wastewater and hydrologic modification. Water quality sampling also indicates that this waterbody does not attain the dissolved oxygen or aquatic life support standards of its classification.

900M Territorial estuarine and marine waters lying within three miles of Maine except for estuarine and marine waters within USGS hydrologic units 0102005, 01050001 and 01060002.

Classifications assigned in waterbody - SA, SB, & SC
Total area of estuarine/marine waters in waterbody - 2,830 mi^2

ATTAINMENT STATUS: Water quality sampling indicates that 3.9 mi^2 (0.3 mi^2 Sheepscot River Estuary, 0.1 in Rockland, 0.1 in Cape Elizabeth, 0.1 in Eliot, 3.0 around Portland and 0.3 in Yarmouth) of this waterbody do not attain the bacteria standard of the assigned classification for water-contact recreation. Water quality sampling also indicates that 360.6 mi^2 of this waterbody do not attain bacteria standards for shellfish harvesting.

Further, 38.4 mi^2 of this waterbody partially attains its designated use of shellfish harvesting because it is classified as restricted or conditional under the National Shellfish Sanitation Program.

Water quality sampling also indicates that 2.6 mi^2 (1.0 mi^2 Medomak River Estuary, 0.3 mi^2 Mousam River Estuary, 0.5 mi^2 Royal River Estuary, 0.5 mi^2 Piscataqua River Estuary, 1.2 mi^2 in the Fore River Estuary, and 0.1 mi^2 in the Ogunquit River Estuary) of this waterbody do not attain the dissolved oxygen or aquatic life support standards of their assigned classification.

Chapter 6. IMPAIRED AND THREATENED LAKE DESIGNATIONS

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment

Nonattainment lakes in the State of Maine are listed below by Waterbody # (WB #), Lake #, lake name, town and acreage. IFW MGT indicates the fishery managed for by the Maine Department of Inland Fisheries and Wildlife: CW = coldwater fishery, WW = warmwater fishery and BT = bait species. A "Y" in the column labeled LOW DO indicates that the lake experiences late summer dissolved oxygen depletion in more than half of the hypolimnion. The codes in the OTHER column indicates lake impairment due to a) algal blooms (trend indicated: IMPR = improving, STAB = stable, DETE = deteriorating, UNKN = unknown, and ONE = no trend - only one bloom to date), b) an increase in trophic state (GPA), or c) habitat impairment resulting from water level drawdown (HAB). Nonattainment causes, sources and their respective relative magnitudes (MAG: S = slight, M = moderate and H = high), are indicated in the four rightmost columns.

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSES	MAG	NONATTAINMENT SOURCES	MAG
109	1560	PELLETIER B L (3RD)	T16 R09 WELS	83	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
119	2814	HAYMOCK L	T07 R11 WELS	704	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
119	2866	INDIAN P	T07 R12 WELS	1222	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
119	1914	MUSQUACOOK L (1ST)	T12 R11 WELS	698	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
119	1920	MUSQUACOOK L (4TH)	T10 R11 WELS	749	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
120	1892	LONG L	T11 R13 WELS	1203	CW	Y		ORGANIC ENRICH/DO	M	AGRICULTURE	M
		"						NUTRIENTS	S	SILVICULTURE	S
		"						SILTATION	S	SHORELINE DEVEL	S
120	1470	ROUND P	T13 R12 WELS	697	CW	Y		ORGANIC ENRICH/DO	H	SILVICULTURE	H
120	1896	UMSASKIS L	T11 R13 WELS	1222	CW	Y		NUTRIENTS	M	UNKNOWN	H
		"						ORGANIC ENRICH/DO	H	SILVICULTURE	S
123	1682	LONG L	T17 R04 WELS	6000	CW		STAB	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	INTERNAL P RECYCL	S
		"						ORGANIC ENRICH/DO	S	SILVICULTURE	S
		"						-	-	SHORELINE DEVEL	S
124	1666	BLACK L	FORT KENT	51	CW		UNKN	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SILVICULTURE	S
		"						ORGANIC ENRICH/DO	S	-	-
124	1674	CROSS L	T17 R05 WELS	2515	CW	Y	DETE	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SILVICULTURE	S
		"						ORGANIC ENRICH/DO	S	SHORELINE DEVEL	S
124	1665	DAIGLE P	NEW CANADA	36	CW		STAB	NUTRIENTS	M	AGRICULTURE	H
		"						SILTATION	S	-	-
		"						ORGANIC ENRICH/DO	S	-	-
125	1672	SQUARE L	T16 R05 WELS	8150	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
130	3004	MILLIMAGASSETT L	T07 R08 WELS	1410	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
130	4156	MILLINOCKET L	T07 R09 WELS	2701	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
130	4152	MOOSE P (LITTLE)	T07 R10 WELS	25		Y		NUTRIENTS	M	UNKNOWN	H
		"						ORGANIC ENRICH/DO	M	-	-
140	409	ARNOLD BROOK L	PRESQUE ISLE	395	CW		STAB	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SHORELINE DEVEL	S
		"						ORGANIC ENRICH/DO	S	-	-
140	1776	ECHO L	PRESQUE ISLE	90	CW		STAB	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SHORELINE DEVEL	S

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment (continued)

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSE CAUSES	MAG	NONATTAINMENT SOURCE SOURCES	MAG
		"						ORGANIC ENRICH/DO	S	-	-
140	9767	HANSON BROOK L	MAPLETON	118	CW	Y	STAB	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SHORELINE DEVEL	S
143	1808	FISCHER L	FORT FAIRFIELD	10	BT		STAB	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SHORELINE DEVEL	S
143	1820	MONSON P	FORT FAIRFIELD	160	CW		STAB	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SHORELINE DEVEL	S
145	1802	MADAWASKA L	T16 R04 WELS	1526	CW	Y	UNKN	NUTRIENTS	M	SILVICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	S
		"						SILTATION	S	AGRICULTURE	S
146	9779	TRAFTON L	LIMESTONE	85	CW	Y	UNKN	NUTRIENTS	H	SHORELINE DEVEL	M
		"						-	-	AGRICULTURE	S
151	1018	CONROY L	MONTICELLO	25	CW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICHMENT	M	SHORELINE DEVEL	M
		"						SILTATION	M	-	-
151	1008	PORTLAND L	BRIDGEWATER	41	CW	Y		NUTRIENTS	M	AGRICULTURE	H
		"						ORGANIC ENRICH/DO	M	-	-
152	1744	COCHRANE L	NEW LIMERICK	79	CW/WW	Y	ONE	ORGANIC ENRICH/DO	H	UNKNOWN	H
152	1736	DREWS(MEDUXNEKEAG) L	LINNEUS	1057	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
201	2920	PINE P (BIG)	T03 R13 WELS	164	CW	Y		ORGANIC ENRICH/DO	M	UNKNOWN	H
		"						-	-	SILVICULTURE	L
201	4048	SEBOOMOOK L	SEBOOMOOK TWP	6448	CW		HAB	OTHER HABITAT ALT	H	HYDROMODIFICATION	H
202	84	JO-MARY L (LOWER)	T01 R10 WELS	1910	CW	Y		ORGANIC ENRICH/DO	H	SILVICULTURE	H
202	716	KIDNEY P	T03 R10 WELS	96	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
202	76	POLLYWOG P	T01 R11 WELS	147	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
206	2202	SHIN P (UPPER)	MT CHASE	544	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
206	2704	THIRD L	T07 R10 WELS	474	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
		"						-	-	SILVICULTURE	L
208	1686	MATTAWAMKEAG L	ISLAND FALLS	3330	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
209	1750	SPAULDING L	OAKFIELD	125	WW	Y		ORGANIC ENRICH/DO	H	AGRICULTURE	H
211	3056	PLUNKETT P	SILVER RIDGE PLT	435	WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
214	260	MAYFIELD P	MAYFIELD TWP	140	CW/WW	Y		NUTRIENTS	M	UNKNOWN	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	S
		"							-	SILVICULTURE	L
214	298	PIPER P	ABBOT	420	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
215	894	ONAWA L	ELLIOTTSVILLE	1344	CW	Y	STAB	NUTRIENTS	M	SILVICULTURE	M
		"						ORGANIC ENRICH/DO	S	CONSTRUCTION	S
215	780	RUM P	GREENVILLE	245	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
215	410	WILSON P (UPPER)	BOWDOIN COL GR WEST	940	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
216	438	LYFORD P (BIG)	SHAWTOWN TWP	152	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
218	4132	GARLAND P	SEBEC	28	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
218	758	MANHANOCK P	PARKMAN	420	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
220	2216	CARIBOU,EGG,LONG P	LINCOLN	825	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
221	2146	COLD STREAM P	ENFIELD	3628	CW	Y		ORGANIC ENRICH/DO	H	SILVICULTURE	M
		"						-	-	SHORELINE DEVEL	M

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment (continued)

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSE CAUSES	MAG	NONATTAINMENT SOURCE SOURCES	MAG
224	4128	GARLAND P	GARLAND	102	WW		UNKN	NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	RESIDENTIAL DEVEL	M
225	2294	HAMMOND P	HAMPDEN	83	WW		STAB	NUTRIENTS	M	AGRICULTURE	H
		"						SILTATION	S	-	-
		"						ORGANIC ENRICH/DO	S	-	-
225	2286	HERMON P	HERMON	461	WW		STAB	NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	S	SHORELINE DEVEL	S
226	4282	FIELDS P	ORRINGTON	182	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	M
		"						-	-	AGRICULTURE	L
		"						-	-	RESIDENTIAL DEVEL	L
227	4316	LONG P	BUCKSPORT	222	WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
227	5544	SWETTS P (SWEETS)	ORRINGTON	125	WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
227	5538	WILLIAMS P	BUCKSPORT	112	WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
301	2682	ATTEAN P	ATTEAN TWP	2745	CW	Y		ORGANIC ENRICH/DO	H	SILVICULTURE	H
302	2524	FISH P	THORNDIKE TWP	211	CW	Y		ORGANIC ENRICH/DO	M	UNKNOWN	M
		"						-	-	SILVICULTURE	L
303	269	FITZGERALD P	BIG SQUAW TWP	550	CW		STAB	NUTRIENTS	H	LAND DISPOSAL	M
		"						-	-	SHORELINE DEVEL	S
		"						-	-	SILVICULTURE	S
303	404	SPENCER P	E MIDDLESEX CANAL GR	980	CW		UNKN	NUTRIENTS	H	UNKNOWN	H
304	328	NOTCH P (BIG)	LITTLE SQUAW TWP	12	CW		STAB	NUTRIENTS	M	UNKNOWN	H
		"						ORGANIC ENRICH/DO	H	SILVICULTURE	S
307	5090	JIM P (LITTLE)	JIM POND TWP	64	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
309	5128	DEER P	KING & BARTLETT TWP	30	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
309	38	FLAGSTAFF L	FLAGSTAFF TWP	20300	WW		HAB	OTHER HABITAT ALT	H	HYDROMODIFICATION	H
310	5110	BAKER P	T05 R06 BKP WKR	270	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
310	5122	SPECTACLE P	KING & BARTLETT TWP	45	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
312	202	ROWE P	PLEASANT RIDGE PLT	205	CW	Y		NUTRIENTS	M	UNKNOWN	M
		"						ORGANIC ENRICH/DO	M	SILVICULTURE	L
		"						-	-	OTHER	L
		"						-	-	(MOOSE ACTIVITY UPSTREAM)	
313	12	PORTER L	STRONG	527	CW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
314	2580	WENTWORTH P	SOLON	213	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
315	2344	MOUNT BLUE P	AVON	134	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
315	3566	SANDY RIVER P (MID	SANDY RIVER PLT	70	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	M
		"						-	-	GENERAL DEVEL	L
		"						-	-	OTHER (MOOSE ACTIVITY)	L
315	2336	TOOTHAKER P	PHILLIPS	30	CW		UNKN	NUTRIENTS	M	AQUACULT-HATCHERY	H
		"						ORGANIC ENRICH/DO	S	-	-
		"						FLOW ALTERATION	S	-	-
316	5307	TORSEY (GREELEY) P	MOUNT VERNON	770	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
		"						-	-	OTHER NPS	S
320	608	LAKE GEORGE	CANAAN	335	CW/WW	Y		ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment (continued)

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSE CAUSES	MAG	NONATTAINMENT SOURCE SOURCES	MAG
		"						NUTRIENTS	S	AGRICULTURE	S
		"						-	-	SILVICULTURE	S
320	2592	MORRILL P	HARTLAND	134	CW/WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
320	2612	SIBLEY P	CANAAN	380	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
321	5349	EAST P	SMITHFIELD	1823	CW/WW		UNKN	NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						-	-	RESIDENTIAL DEVEL	M
		"						-	-	OTHER (INTERMIT.SED P)	M
321	5296	FAIRBANKS P	MANCHESTER	14	CW/WW	Y	STAB	NUTRIENTS	M	SHORELINE DEVEL	H
		"						ORGANIC ENRICH/DO	S	-	-
321	5294	FIGURE EIGHT P	SIDNEY	29	CW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
321	5290	GOULD P	SIDNEY	19	CW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
321	5274	GREAT P	BELGRADE	8239	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
		"						-	-	SILVICULTURE	S
		"						-	-	AGRICULTURE	S
321	5276	HAMILTON P	BELGRADE	19	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
321	5272	LONG P	BELGRADE	2714	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
		"						-	-	SILVICULTURE	S
321	5280	MESSALONSKEE L	BELGRADE	3510	CW/WW	Y		ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						NUTRIENTS	M	AGRICULTURE	S
		"						-	-	SILVICULTURE	S
		"						-	-	RESIDENTIAL DEVEL	M
321	5344	NORTH & LITTLE PONDS	ROME	2873	WW		GPA	NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
321	5352	SALMON L (ELLIS P)	BELGRADE	666	CW/WW	Y	STAB	NUTRIENTS	M	SHORELINE DEVEL	M
		"						SILTATION	S	INTERNAL P RECYCL	S
		"						ORGANIC ENRICH/DO	S	AGRICULTURE	S
		"						-	-	SILVICULTURE	S
322	8115	UNNAMED P	OAKLAND	76	NONE	Y	UNKN	NUTRIENTS	M	MUNIC POINT SOURCES	H
		"						ORGANIC ENRICH/DO	M	-	-
324	2590	MOOSE P	HARTLAND	3584	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
325	5460	HALFMOON P	ST ALBANS	36	WW		UNKN	NUTRIENTS	M	AGRICULTURE	H
		"						SILTATION	S	-	-
		"						ORGANIC ENRICH/DO	S	-	-
325	744	PUFFERS P (ECHO L)	DEXTER	96	CW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
325	2264	SEBASTICOOK L	NEWPORT	4288	WW	Y	IMPR	NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	S	MUNIC POINT SOURCES	S
		"						SILTATION	S	SHORELINE DEVEL	S
		"						-	-	INTERNAL P RECYC	M
		"						-	-	INDUS POINT SOURCES	S
326	5174	SANDY (FREEDOM) P	FREEDOM	430	WW		STAB	NUTRIENTS	M	AGRICULTURE	H
		"						SILTATION	S	-	-
		"						ORGANIC ENRICH/DO	S	-	-
326	5172	UNITY P	UNITY	2528	WW		UNKN	NUTRIENTS	M	AGRICULTURE	M

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment (continued)

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSE CAUSES	MAG	NONATTAINMENT SOURCE SOURCES	MAG
		"						SILTATION	S	SHORELINE DEVEL	S
327	5724	DUTTON P	CHINA	57	WW	Y	ONE	ORGANIC ENRICH/DO	H	AGRICULTURE	M
		"						-	-	SILVICULTURE	M
327	5176	LOVEJOY P	ALBION	324	WW	Y	STAB	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SHORELINE DEVEL	S
		"						ORGANIC ENRICH/DO	S	-	-
328	5448	CHINA L	CHINA	3845	CW/WW	Y	STAB	NUTRIENTS	M	INTERNAL P RECYCL	M
		"						ORGANIC ENRICH/DO	M	AGRICULTURE	S
		"						SILTATION	S	SHORELINE DEVEL	S
		"						TASTE AND ODOR	S	SILVICULTURE	S
329	5458	PATTEE P	WINSLOW	712	WW		IMPR	NUTRIENTS	H	SHORELINE DEVEL	M
		"						-	-	AGRICULTURE	S
333	5424	THREECORNERED P	AUGUSTA	182	WW	Y	STAB	NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	S	AGRICULTURE	S
		"						-	-	SILVICULTURE	S
333	5416	THREEMILE P	CHINA	1162	CW/WW	Y	DETE	NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	AGRICULTURE	S
		"						SILTATION	S	SILVICULTURE	S
333	5408	WEBBER P	VASSALBORO	1201	CW/WW	Y	IMPR	NUTRIENTS	M	SHORELINE DEVEL	M
		"						SILTATION	M	INTERNAL P RECYCL	S
		"						ORGANIC ENRICH/DO	S	AGRICULTURE	S
334	9961	ANNABESSACOOK L	MONMOUTH	1420	WW	Y	DETE	NUTRIENTS	M	INTERNAL P RECYCL	M
		"						ORGANIC ENRICH/DO	M	AGRICULTURE	S
		"						SILTATION	S	SHORELINE DEVEL	S
		"						-	-	HAZARDOUS WASTE	S
		"						-	-	URBAN RUNOFF	S
334	3828	BERRY P	WINTHROP	174	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
334	5242	BUKER P	LITCHFIELD	75	WW	Y		NUTRIENTS	M	RESIDENTIAL DEVEL	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
334	5310	CARLTON P	WINTHROP	207		Y		ORGANIC ENRICH/DO	H	AGRICULTURE	M
		"						-	-	SHORELINE DEVEL	S
334	8065	COBBOSSEECONTEE (LT)	WINTHROP	75	WW	Y	STAB	NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	AGRICULTURE	S
		"						SILTATION	S	-	-
334	5236	COBBOSSEECONTEE L	WINTHROP	5543	CW/WW	Y	STAB	NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	S	AGRICULTURE	S
334	5244	JIMMY P	LITCHFIELD	40	WW	Y		NUTRIENTS	M	UNKNOWN	H
		"						ORGANIC ENRICH/DO	H	-	-
334	5312	MARANACOOK L	WINTHROP	1673	CW/WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	RESIDENTIAL DEVEL	M
		"						-	-	URBAN RUNOFF	M
		"						-	-	SHORELINE DEVEL	M
334	103	NARROWS P (LOWER)	WINTHROP	255	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
		"						-	-	SILVICULTURE	S
334	98	NARROWS P (UPPER)	WINTHROP	279	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
		"						-	-	SILVICULTURE	S

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment (continued)

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSE CAUSES	MAG	NONATTAINMENT SOURCE SOURCES	MAG
334	5254	PLEASANT (MUD) P	GARDINER	746	WW		IMPR	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	S	-	-
334	5238	SAND P (TACOMA LKS)	LITCHFIELD	177	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
334	3832	WILSON P	WAYNE	582	CW/WW	Y	ONE	ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
334	5240	WOODBURY P	LITCHFIELD	436	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
335	9931	TOGUS P	AUGUSTA	660	CW/WW	Y	STAB	NUTRIENTS	M	INTERNAL P RECYCL	M
		"						ORGANIC ENRICH/DO	S	SHORELINE DEVEL	S
		"							-	SILVICULTURE	S
335	5428	TOGUS P (LITTLE)	AUGUSTA	93	WW	Y		ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						NUTRIENTS	S	SILVICULTURE	S
401	3104	STURTEVANT P	MAGALLOWAY PLT	518	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
404	3532	GULL P	DALLAS PLT	281	CW	Y		NUTRIENTS	M	SILVICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
404	3534	HALEY P	DALLAS PLT	170	CW		STAB	NUTRIENTS	M	MUNIC POINT SOURCES	M
		"						ORGANIC ENRICH/DO	S	SHORELINE DEVEL	S
404	3526	QUIMBY P	RANGELEY	165	CW		STAB	NUTRIENTS	M	SHORELINE DEVEL	H
		"						SILTATION	S	-	-
405	3316	SUNDAY P	MAGALLOWAY PLT	30	REM-CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
		"						-	-	SILVICULTURE	L
405	3102	UMBAGOG L	MAGALLOWAY PLT	7850	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
406	3460	NORTH P	WOODSTOCK	284	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	SILVICULTURE	M
407	3504	ELLIS (ROXBURY) P	BYRON	920	WW	Y		NUTRIENTS	M	SILVICULTURE	M
		"						ORGANIC ENRICHMENT	H	SHORELINE DEVEL	M
409	3672	WEBB (WELD) L	WELD	2173	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
410	3604	ANASAGUNTICOOK L	HARTFORD	568	CW/WW	Y	ONE	ORGANIC ENRICH/DO	H	UNKNOWN	H
411	3836	ANDROSCOGGIN L	LEEDS	3980	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	H
		"						ORGANIC ENRICH/DO	H	GENERAL DEVEL	M
		"								OTHER (BKFL FROM ANDRO)	M
411	5182	FLYING P	VIENNA	360	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
411	5186	PARKER P	FAYETTE	1513	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
412	3624	BEAR P (BIG)	HARTFORD	432	WW		GPA	NUTRIENTS	H	UNKNOWN	H
412	3608	BRETTUN'S P	LIVERMORE	165	CW/WW	Y	ONE	ORGANIC ENRICH/DO	H	UNKNOWN	H
412	3626	CRYSTAL (BEALS) P	TURNER	47	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
		"						-	-	AGRICULTURE	M
412	3616	NORTH P	SUMNER	164	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
412	3822	PLEASANT P	TURNER	189	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
412	3800	ROUND P	TURNER	12	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	H
		"						ORGANIC ENRICH/DO	H	GENERAL DEVEL	M
413	3788	ALLEN P	GREENE	183	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
413	3748	AUBURN L	AUBURN	2260	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
413	3784	WILSON P (LITTLE)	TURNER	111	CW/WW	Y	ONE	ORGANIC ENRICH/DO	H	UNKNOWN	H
414	3464	BRYANT P	WOODSTOCK	278	CW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
414	3770	HOGAN P	OXFORD	177	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	GENERAL DEVEL	M

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment (continued)

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSE CAUSES	MAG	NONATTAINMENT SOURCE SOURCES	MAG
414	3434	PENNESSEEWASSEE L	NORWAY	922	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
414	3760	RANGE P (LOWER)	POLAND	290	WW	Y		NUTRIENTS	M	OTHER (GOLF COURSE)	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						-	-	RESIDENTIAL DEVEL	M
		"						-	-	GENERAL DEVEL	M
414	3762	RANGE P (MIDDLE)	POLAND	366	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	RESIDENTIAL DEVEL	M
414	3688	RANGE P (UPPER)	POLAND	391	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
414	3432	SAND P	NORWAY	141	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
414	3758	TRIPP P	POLAND	768	WW	Y		ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						NUTRIENTS	M	AGRICULTURE	M
		"						-	-	RESIDENTIAL DEVEL	M
		"						-	-	GENERAL DEVEL	M
414	3478	TWITCHELL P	GREENWOOD	179	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	SILVICULTURE	M
415	3780	HALLS P	PARIS	51	CW		UNKN	NUTRIENTS	H	SHORELINE DEVEL	H
415	3776	MARSHALL P	HEBRON	142	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
415	3750	TAYLOR P	AUBURN	625	CW/WW	Y	ONE	ORGANIC ENRICH/DO	H	UNKNOWN	H
418	3802	NO NAME P	LEWISTON	143	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	H	GENERAL DEVEL	S
		"						-		RESIDENTIAL DEVEL	H
		"						-		URBAN RUNOFF	M
418	3796	SABATTUS P	GREENE	1962	WW		IMPR	NUTRIENTS	M	AGRICULTURE	M
		"						SILTATION	S	SHORELINE DEVEL	S
501	121	SPEDNIK L	VANCEBORO	17219	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
502	4702	BOTTLE L	LAKEVILLE	281	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	SILVICULTURE	M
502	4708	JUNIOR L	T05 R01 NBPP	3866	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
502	4700	KEG L	LAKEVILLE	378	WW	Y		NUTRIENTS	M	SILVICULTURE	H
		"						ORGANIC ENRICH/DO	M	-	-
502	1332	LAMBERT L	LAMBERT LAKE TWP	605	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
502	4690	LOMBARD L	LAKEVILLE	25	WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SILVICULTURE	M
502	4688	SYSLADOBSIS L (UP)	LAKEVILLE PLT	142	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
502	135	TOMAH L	FOREST TWP	56	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
504	1418	NASHS L	CALAIS	627	CW/WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						-	-	SILVICULTURE	S
512	1228	SPRUCE MOUNTAIN L	BEDDINGTON	448	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
514	4624	ECHO L	MOUNT DESERT	237	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
514	4612	HADLOCK P (UPPER)	MOUNT DESERT	35	CW	Y		NUTRIENTS	M	UNKNOWN	H
		"						ORGANIC ENRICH/DO	H	GENERAL DEVEL	S
515	4498	ALLIGATOR L	T34 MD	1159	CW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
517	4350	GRAHAM L	MARIAVILLE	7865	WW		UNKN	SILTATION	M	OTHER NPS	M
		"					HAB	HABITAT ALT	M	HYDROMODIFICATION	S
517	441	SECOND P	DEDHAM	64	WW	Y		NUTRIENTS	M	UNKNOWN	H

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment (continued)

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSE CAUSES	MAG	NONATTAINMENT SOURCE SOURCES	MAG
		"						ORGANIC ENRICH/DO	M	-	-
517	4540	SPRINGY P (LOWER)	OTIS	114	CW/WW	Y		NUTRIENTS	M	UNKNOWN	H
		"						ORGANIC ENRICH/DO	H	SHORELINE DEVEL	S
518	4328	BRANCH L	ELLSWORTH	2703	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
		"						-	-	AGRICULTURE	S
520	4342	PATTEN P (UPPER)	SURRY	361	WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						-	-	RESIDENTIAL DEVEL	M
520	4640	WALKER P	BROOKSVILLE	697	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
521	4846	COLEMAN P	LINCOLNVILLE	223	WW	Y		ORGANIC ENRICH/DO	M	SHORELINE DEVEL	H
		"						NUTRIENTS	S	-	-
521	5496	PASSAGASSAWAKEAG	BROOKS	118	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	AGRICULTURE	M
521	5492	SWAN L	SWANVILLE	1370	CW/WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELLINE DEVEL	M
		"						-	-	RESIDENTIAL DEVEL	M
522	83	LILLY P	ROCKPORT	29	WW	Y	STAB	NUTRIENTS	M	LAND DISPOSAL	M
		"						ORGANIC ENRICH/DO	S	SHORELINE DEVEL	S
522	4852	MEGUNTICOOK L	CAMDEN	1305	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
522	4850	NORTON P	LINCOLNVILLE	133	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
523	4810	CRAWFORD P	WARREN	591	CW/WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
523	5690	NORTH P	WARREN	338	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
523	4832	QUANTABACOOK L	SEARSMONT	693	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
523	5682	SENNEBEC P	APPLETON	532	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
523	5686	SEVEN TREE P	UNION	523	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	GENERAL DEVEL	M
		"						-	-	AGRICULTURE	M
523	4886	STEVENS P	LIBERTY	336	WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
526	5710	BISCAY P	DAMARISCOTTA	377	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
526	5702	DUCKPUDDLE P	NOBLEBORO	293	WW		UNKN	NUTRIENTS	M	AGRICULTURE	H
		"						SILTATION	S	-	-
		"						ORGANIC ENRICH/DO	S	-	-
526	5706	LITTLE P	DAMARISCOTTA	80	NONE	Y	ONE	ORGANIC ENRICH/DO	H	UNKNOWN	H
526	5704	PEMAQUID P	NOBLEBORO	1515	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
527	5400	DAMARISCOTTA L	JEFFERSON	4381	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
		"						-	-	AGRICULTURE	S
		"						-	-	SILVICULTURE	S
528	5730	BELDEN P	PALERMO	24	WW	Y		NUTRIENTS	M	UNKNOWN	H
		"						ORGANIC ENRICH/DO	M	SILVICULTURE	L
528	5754	BRANCH P	CHINA	316	CW/WW	Y		ORGANIC ENRICH/DO	H	AGRICULTURE	M
		"						-	-	SILVICULTURE	M
529	5366	ADAMS P	BOOTHBAY	73	WW		IMPR	NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	S	OTHER NPS	S
529	5372	WEST HARBOR P	BOOTHBAY HARBOR	84	CW/WW	Y	STAB	NUTRIENTS	M	SHORELINE DEVEL	H
		"						ORGANIC ENRICH/DO	S	-	-

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment (continued)

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSE CAUSES	MAG	NONATTAINMENT SOURCE SOURCES	MAG
530	5222	NEQUASSET P	WOOLWICH	392	CW/WW	Y		ORGANIC ENRICH/DO	H	AGRICULTURE	H
		"						NUTRIENTS	M	SILVICULTURE	M
		"						-	-	RESIDENTIAL DEVEL	M
530	9943	SEWALL P	ARROWSIC	46	WW		UNKN	NUTRIENTS	M	OTHER NPS	M
	"							ORGANIC ENRICH/DO	S	-	-
603	3708	CRYSTAL L (DRY P)	GRAY	189	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
603	3700	SABBATHDAY L	NEW GLOUCESTER	340	CW/WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						-	-	RESIDENTIAL DEVEL	M
605	3396	ADAMS P	BRIDGTON	45	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	H
		"						ORGANIC ENRICH/DO	M	-	-
605	9685	BAY OF NAPLES	NAPLES	762	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
605	3420	BEAR P	WATERFORD	218	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	H
		"						ORGANIC ENRICH/DO	M	-	-
605	3454	HIGHLAND L	BRIDGTON	1401	CW/WW	Y	ONE	ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
605	3448	ISLAND P	WATERFORD	166	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
605	3272	KEEWAYDIN L	STONEHAM	307	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
605	3416	KEOKA L	WATERFORD	467	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	M
		"						-	-	AGRICULTURE	S
605	3418	LONG (MCWAIN) P	WATERFORD	473	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	SILVICULTURE	M
		"						-	-	RESIDENTIAL DEVEL	M
		"						-	-	AGRICULTURE	M
605	5780	LONG L	BRIDGTON	4867	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
606	3718	CHAFFIN P	WINDHAM	14		Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
606	3390	COFFEE P	CASCO	137	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
606	3376	COLD RAIN P	NAPLES	38	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	-	-
606	3696	CRESCENT L	RAYMOND	716	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
606	3692	NUBBLE P	RAYMOND	23	CW/WW	Y	UNKN	NUTRIENTS	M	OTHER NPS	H
		"						ORGANIC ENRICH/DO	M	-	-
606	3694	PANTHER P	RAYMOND	1439	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	H	RESIDENTIAL DEVEL	H
		"						-	-	GENERAL DEVEL	M
606	3374	PEABODY P	SEBAGO	735	CW/WW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						-	-	RESIDENTIAL DEVEL	M
606	3716	PETTINGILL P	WINDHAM	42	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	URBAN RUNOFF	M
606	3690	RAYMOND P	RAYMOND	346	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	RESIDENTIAL DEVEL	M
606	3392	THOMAS P	CASCO	442	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	GENERAL DEVEL	M
607	3712	FOREST L	WINDHAM	210	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
607	3734	HIGHLAND (DUCK) L	FALMOUTH	634	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
607	3714	SEBAGO L (LITTLE)	WINDHAM	1898	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H

Table 5. Nonattainment Lakes in the State of Maine - 1996 Assessment (continued)

WB #	LAKE #	LAKE NAME	TOWN	ACRES	IFW MGT	LOW DO	OTHER	NONATTAINMENT CAUSE CAUSES	MAG	NONATTAINMENT SOURCE SOURCES	MAG
613	3136	BARKER P	HIRAM	206	WW	Y	ONE	ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
613	5582	BEAVER P	BRIDGTON	66	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	H
		"						ORGANIC ENRICH/DO	M	-	-
613	5572	BURNT MEADOW P	BROWNFIELD	63	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
613	3174	CLEMONS P (BIG)	HIRAM	85	CW/WW	Y		NUTRIENTS	M	SHORELINE DEVEL	H
		"						ORGANIC ENRICH/DO	M	-	-
613	3132	HANCOCK P	DENMARK	858	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
613	3232	KEYS P	SWEDEN	192	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
613	3254	LOVEWELL P	FRYEBURG	1120	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
613	3134	MOOSE P	DENMARK	1694	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
613	3130	SAND (WALDEN) P	DENMARK	256	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
615	3898	BALCH & STUMP PONDS	NEWFIELD	704	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
615	3942	HOLLAND (SOKOKIS) P	LIMERICK	192	WW	Y		NUTRIENTS	M	HABITAT MODIFICATION	S
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
		"						-	-	URBAN RUNOFF	M
615	3408	HORNE P (PEQUAWKET)	LIMINGTON	166	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
615	5024	OSSIPEE L (LITTLE)	WATERBORO	564	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
615	3950	SHAPLEIGH P (NORTH)	SHAPLEIGH	80	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
615	3892	SYMMES P	NEWFIELD	36	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
616	5016	DEER P	HOLLIS	32	CW/WW	Y		ORGANIC ENRICH/DO	H	UNKNOWN	H
616	5040	WATCHIC P	STANDISH	448	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
623	3980	BUNGANUT P	LYMAN	280	WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
623	3838	MOUSAM L	ACTON	900	CW/WW		GPA	NUTRIENTS	M	SHORELINE DEVEL	M
		"						ORGANIC ENRICH/DO	M	RESIDENTIAL DEVEL	M
		"						SILTATION	M	-	-
623	3916	SQUARE P	ACTON	910	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
625	3992	BAUNEG BEG L	NORTH BERWICK	200	WW	Y	ONE	ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
625	119	ELL (L) P	WELLS	32	CW	Y	STAB	ORGANIC ENRICH/DO	H	CONSTRUCTION	H
625	5584	WARREN P	SOUTH BERWICK	45	CW	Y		NUTRIENTS	M	AGRICULTURE	M
		"						ORGANIC ENRICH/DO	M	SHORELINE DEVEL	M
626	5596	SCITUATE P	YORK	41	WW		STAB	NUTRIENTS	H	UNKNOWN	H
627	3920	WILSON L	ACTON	288	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
630	155	MILTON P	LEBANON	214	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H
630	3876	NORTHEAST P	LEBANON	778	WW	Y		NUTRIENTS	M	SHORELINE DEVEL	H
		"						ORGANIC ENRICH/DO	M	-	-
630	3874	TOWN HOUSE P	LEBANON	150	CW/WW	Y		ORGANIC ENRICH/DO	H	SHORELINE DEVEL	H

TOTAL: 244 LAKES 240,194 ACRES

Table 6. Threatened Lakes in Maine - 1996 Assessment

Threatened lakes in the State of Maine are listed below by waterbody (WBS#). The letters letters following Acres indicate whether the lake is Evaluated (E) or Monitored (M). The source of threatened status is indicated in the right column (VI = determined by the Vulnerability Index, BLOOM = one known algal bloom, RESTORED = recently restored, the long term effectiveness currently being assessed.)

WBS #	LAKE ID #	LAKE	TOWN	ACRES	E/M	THREAT SOURCE
	3771	UNNAMED P	OXFORD	20	E	VI
	7725	UNNAMED P	BURNHAM	17	E	VI
109	1554	HUNNEWELL L	ST JOHN PLT	64	M	BLOOM
150	1006	WHITEHEAD L	BRIDGEWATER	21	M	BLOOM
202	2126	PARTRIDGE B FLOWAGE	EAST MILLINOCKET	125	E	VI
204	2118	FERGUSON L	MILLINOCKET	250	E	VI
206	2822	BRANCH P (EAST)	T07 R11 WELS	45	M	BLOOM
206	2700	LEADBETTER P (LT)	T07 R11 WELS	147	M	BLOOM
212	2238	HOUSE P	LEE	12	E	VI
212	2242	MATTAKEUNK L	LEE	570	M	VI
212	2244	MERRILL P	LEE	62	E	VI
212	2246	MILL P	LEE	28	E	VI
215	0844	BENNETT P (BIG)	GUILFORD	61	M	BLOOM
215	0368	SPECTACLE PONDS	MONSON	177	M	BLOOM
215	9665	UNNAMED P	GREENVILLE	12	E	VI
218	4130	BRANNS MILL P	DOVER-FOXCROFT	271	E	VI
218	4138	DOW P	SEBEC	19	E	VI
220	2214	CAMBOLASSE P	LINCOLN	211	M	VI
220	2218	CENTER P	LINCOLN	192	M	VI
220	2220	CROOKED P	LINCOLN	220	M	VI
220	2222	FOLSOM P	LINCOLN	282	M	VI
220	2226	MATTANAWCOOK P	LINCOLN	832	M	VI
220	2228	SNAG (STUMP) P	LINCOLN	160	M	VI
220	9562	UNNAMED P	LINCOLN	15	E	VI
220	9564	UNNAMED P	LINCOLN	10	E	VI
221	2232	COLD STREAM P(UPPER)	LINCOLN	685	M	VI
221	4682	EGG P	LEE	20	E	VI
221	2258	MADAGASCAL P(LITTLE)	T03 R01 NBPP	40	E	VI
221	2224	ROUND P (LITTLE)	LINCOLN	75	E	VI
221	4684	WEIR P	LEE	45	E	VI
223	2278	MUD P	OLD TOWN	343	E	VI
223	2154	PUG P	ALTON	12	E	VI
223	0080	PUSHAW L	OLD TOWN	5056	M	VI
223	9622	ROLLINS MILL P	CHARLESTON	15	E	VI
224	4126	GARLAND P (WEST)	GARLAND	32	M	VI
225	2282	BEN ANNIS P	HERMON	25	M	VI
225	2274	ETNA P	ETNA	361	M	BLOOM
225	2284	GEORGE P	HERMON	46	E	VI
225	2292	PATTEN P	HAMPDEN	46	E	VI
225	2290	TRACY P	HERMON	52	E	VI
226	4284	BREWER L	ORRINGTON	881	M	BLOOM

Table 6 (continued). Threatened Lakes in Maine - 1996 Assessment.

WBS #	LAKE ID #	LAKE	TOWN	ACRES	E/M	THREAT SOURCE
226	4276	EDDINGTON (DAVIS) P	EDDINGTON	417	M	VI
226	2150	HOLLAND P	ALTON	92	E	VI
226	2152	PICKEREL P	ALTON	77	E	VI
226	5546	TROUT P	ORRINGTON	12	E	VI
227	4586	GEORGE P	HOLDEN	12	E	VI
227	4334	HOTHOLE P	ORLAND	51	E	VI
228	7655	JONES BOG	MONROE	10	E	VI
228	7727	UNNAMED P	BROOKS	10	E	VI
302	0317	RODERIQUE P	ROCKWOOD STRIP-WEST	44	E	VI
303	2954	DUCK P (BIG)	E MIDDLESEX CANAL GR	79	M	BLOOM
303	0400	MUD P (LITTLE)	GREENVILLE	13	E	VI
308	2356	REED P	EUSTIS	10	E	VI
309	2317	STRATTON BROOK P	WYMAN TWP	26	E	VI
312	0278	AUSTIN P	BALD MTN TWP T2R3	684	E	VI
313	0056	BUTLER P	LEXINGTON TWP	28	E	VI
313	0050	JEWETT P	PLEASANT RIDGE PLT	32	M	BLOOM
313	0036	REDINGTON P	CARRABASSETT VALLEY	64	M	BLOOM
314	0070	WESSERUNSETT L	MADISON	1446	M	VI
320	2614	OAKS P	SKOWHEGAN	102	M	VI
320	2616	ROUND P	SKOWHEGAN	15	E	VI
321	8105	BOG P	READFIELD	25	E	VI
321	5270	INGHAM P	MOUNT VERNON	50	E	VI
321	5284	JOE P	SIDNEY	40	M	BLOOM
321	5348	MCGRATH P	OAKLAND	486	M	VI
321	5268	MOOSE P	MOUNT VERNON	64	E	VI
321	5278	STUART P	BELGRADE	12	E	VI
321	5282	WARD P	SIDNEY	52	M	VI
321	5338	WATSON P	ROME	66	M	VI
321	5336	WHITTIER P	ROME	21	M	VI
324	2582	COMO L	HARMONY	80	E	VI
324	0742	LILY P	DEXTER	12	E	VI
324	5466	MAINSTREAM P	RIPLEY	208	E	VI
324	2584	PERRY P	HARMONY	20	E	VI
324	0746	RIPLEY P	RIPLEY	240	M	BLOOM
324	2596	STAFFORD P	HARTLAND	122	E	VI
325	2234	FAY SCOTT BOG	DEXTER	10	E	VI
325	5468	HICKS P	PALMYRA	25	E	VI
325	5480	NOKOMIS P	NEWPORT	199	M	VI
333	5422	ANDERSON (EVERS) P	AUGUSTA	12	E	VI
333	5418	DAM P	AUGUSTA	98	E	VI
333	5288	LILY P	SIDNEY	44	M	VI
333	9959	MUD P	WINDSOR	52	E	VI
333	5410	SPECTACLE P	VASSALBORO	139	M	VI
333	5420	TOLMAN P	AUGUSTA	62	E	VI
334	3834	APPLE VALLEY L	WINTHROP	99	E	VI
334	5306	BRAINARD P	READFIELD	20	M	VI

Table 6 (continued). **Threatened Lakes in Maine - 1996 Assessment.**

WBS #	LAKE ID #	LAKE	TOWN	ACRES	E/M	THREAT SOURCE
334	3814	COCHNEWAGON P	MONMOUTH	410	M	VI & BLOOM
334	5265	DESERT P	MOUNT VERNON	23	E	VI
334	3830	DEXTER P	WINTHROP	111	M	VI
334	5304	HUTCHINSON P	MANCHESTER	100	M	VI
334	5302	JAMIES (JIMMIE) P	MANCHESTER	107	M	VI
334	5316	KEZAR P	WINTHROP	18	M	VI
334	5246	LOON P	LITCHFIELD	26	E	VI
334	8147	MUD P	MONMOUTH	18	E	VI
334	5300	SHED P	MANCHESTER	37	E	VI
334	8137	UNNAMED P	MONMOUTH	35	E	VI
334	8151	UNNAMED P	LITCHFIELD	15	E	VI
335	5406	GARDINER P	WISCASSET	78	E	VI
335	5450	GIVENS(LONGFELLOW) P	WHITEFIELD	20	E	VI
335	5432	GREELEY P	AUGUSTA	51	M	VI
335	5378	NEHUMKEAG P	PITTSTON	178	E	VI
335	5436	TINKHAM P	CHELSEA	17	E	VI
335	5430	TOGUS P (LOWER)	CHELSEA	230	M	VI & BLOOM
335	8215	WELLMAN P	WINDSOR	20	E	VI
406	3520	HOWARD P	HANOVER	128	M	VI & BLOOM
410	3816	LONG P	LIVERMORE	208	M	VI
410	8797	UNNAMED P	JAY	11	E	VI
411	3812	BONNY P	MONMOUTH	20	E	VI
412	3820	BARTLETT P	LIVERMORE	28	E	VI
412	3798	LARD P	TURNER	14	M	BLOOM
412	3736	LILY P	TURNER	25	E	VI
413	3794	BERRY P	GREENE	31	M	VI
413	3744	MUD P	TURNER	12	E	VI
413	8969	UNNAMED P	LEWISTON	10	E	VI
414	8943	ESTES BOG	POLAND	30	E	VI
414	3768	GREEN P	OXFORD	38	M	VI
414	3438	MOOSE P	OTISFIELD	160	E	VI
414	3756	MUD P	OXFORD	19	E	VI
414	3500	NORTH P	NORWAY	175	M	VI & BLOOM
414	367	PENNESSEEWASSEE (LT)	NORWAY	96	M	VI & BLOOM
414	3428	ROUND P	NORWAY	15	E	VI
414	3440	SATURDAY P	OTISFIELD	179	M	VI
414	3444	THOMPSON L	OXFORD	4426	M	VI
414	3772	WHITNEY P	OXFORD	170	M	VI
415	3764	WORTHLEY P	POLAND	42	E	VI
418	3792	DEANE P	GREENE	10	E	VI
418	3806	LOON (SPEAR) P	SABATTUS	70	M	VI
418	3790	SABATTUS P (LITTLE)	GREENE	25	E	VI
419	5258	CAESAR P	BOWDOIN	60	E	VI
419	7801	UNNAMED P	BOWDOIN	18	E	VI
420	5220	BRADLEY P	TOPSHAM	34	E	VI
420	5256	MEACHAM P	BOWDOIN	16	E	VI

Table 6 (continued). Threatened Lakes in Maine - 1996 Assessment.

WBS #	LAKE ID #	LAKE	TOWN	ACRES	E/M	THREAT SOURCE
508	1404	BOYDEN L	PERRY	1702	M	BLOOM
509	1358	GARDNER L	EAST MACHIAS	3886	M	BLOOM
510	1226	HADLEY L #2	T24 MD BPP	36	M	BLOOM
512	4524	BEDDINGTON L	BEDDINGTON	404	M	BLOOM
514	4588	AUNT BETTY'S P	BAR HARBOR	34	E	VI
514	4460	BAY P (LOWER WEST)	GOULDSBORO	59	E	VI
514	4468	BIRCH HARBOR P	WINTER HARBOR	19	E	VI
514	4452	BUBBLE P	BAR HARBOR	32	M	VI
514	4462	CHICKEN MILL P	GOULDSBORO	27	E	VI
514	4606	EAGLE L	BAR HARBOR	436	M	VI
514	8477	ECHO L (LITTLE)	MOUNT DESERT	18	E	VI
514	4464	FORBES P	GOULDSBORO	208	E	VI
514	4668	GOOSE P	SWANS ISLAND	38	M	VI
514	4610	HADLOCK P (LOWER)	MOUNT DESERT	39	M	VI
514	8577	HAMILTON L	BAR HARBOR	51	E	VI
514	4628	HODGDON P	MOUNT DESERT	35	M	VI
514	4466	JONES P	GOULDSBORO	467	E	VI
514	4608	JORDAN P	MOUNT DESERT	187	M	VI
514	0435	LAKE WOOD	BAR HARBOR	16	M	VI
514	4470	LILY P	GOULDSBORO	19	E	VI
514	4622	LONG (GREAT) P	MOUNT DESERT	897	M	VI
514	0447	LONG P	MOUNT DESERT	38	M	VI
514	4616	RIPPLE P	MOUNT DESERT	12	E	VI
514	4620	ROUND P	MOUNT DESERT	38	M	VI
514	4618	ROUND P (LITTLE)	MOUNT DESERT	16	E	VI
514	4630	SEAL COVE P	TREMONT	283	M	VI
514	4614	SOMES P	MOUNT DESERT	104	M	VI
514	4458	WITCH HOLE P	BAR HARBOR	28	E	VI
517	4324	DUCK P (LITTLE)	ELLSWORTH	59	E	VI
517	4326	ROCKY P (LITTLE)	ELLSWORTH	61	M	VI
518	4376	BOG P	ELLSWORTH	10	E	VI
520	5556	BURNTLAND P	STONINGTON	20	E	VI
520	4654	FOURTH P	BLUE HILL	50	E	VI
520	5550	LILY P	DEER ISLE	37	M	VI
520	4656	NOYES (NORRIS) P	BLUE HILL	23	E	VI
520	4344	PATTEN P (LOWER)	SURRY	741	M	VI
520	5548	TORRY P	DEER ISLE	20	M	VI
521	5522	CAIN P	SEARSPORT	38	E	VI
521	5528	KNIGHT P	NORTHPORT	102	M	VI
521	5524	MCCLURE P	SEARSPORT	46	E	VI
521	4848	PITCHER P	NORTHPORT	367	M	VI
521	4844	TILDEN P	BELMONT	383	M	VI
522	5504	FRESH P	NORTH HAVEN	85	E	VI
522	4808	HOSMER P	CAMDEN	53	M	VI & BLOOM
522	4836	LEVENSELLER P	SEARSMONT	34	M	VI
522	4838	MOODY P	LINCOLNVILLE	61	M	VI

Table 6 (continued). **Threatened Lakes in Maine - 1996 Assessment.**

WBS #	LAKE ID #	LAKE	TOWN	ACRES	E/M	THREAT SOURCE
523	4884	CARGILL P	LIBERTY	69	E	VI
523	4802	FISH P	HOPE	142	M	VI
523	4812	GRASSY P	ROCKPORT	188	M	VI
523	4806	HOBBS P	HOPE	264	M	VI
523	4834	LAWRY P	SEARSMONT	83	M	VI
523	4796	LILY P	HOPE	29	E	VI
523	4842	MANSFIELD P	HOPE	40	E	VI
523	4914	MUD P	MONTVILLE	14	E	VI
523	4840	SHERMAN'S MILL P	APPLETON	36	E	VI
523	7521	UNNAMED P	SEARSMONT	11	E	VI
523	7839	UNNAMED P	WALDOBORO	14	E	VI
524	4822	CHICKAWAUKIE P	ROCKPORT	352	M	RESTORED
524	5718	HAVENER P	WALDOBORO	83	E	VI
524	4866	HOWARD P	ST GEORGE	12	E	VI
524	4820	MACES P	ROCKPORT	29	M	VI
524	4814	MIRROR L	ROCKPORT	109	M	VI
524	4816	ROCKY P	ROCKPORT	10	E	VI
524	4823	TOLMAN P	ROCKPORT	38	M	VI & BLOOM
525	0343	IRON P	WASHINGTON	11	E	VI
525	5692	MEDOMAK P	WALDOBORO	237	E	VI
525	8049	UNNAMED P	APPLETON	12	E	VI
525	4894	WASHINGTON P	WASHINGTON	551	M	VI
526	5364	BOYD P	BRISTOL	85	M	VI
526	0035	CLARK COVE P	SOUTH BRISTOL	31	M	BLOOM
526	7871	LITTLE P	BRISTOL	15	E	VI
526	5712	MCCURDY P	BREMEN	192	M	VI
526	5708	PARADISE (MUDDY) P	DAMARISCOTTA	166	M	VI
526	4858	ROSS P	BRISTOL	16	E	VI
526	4857	WEBBER P	BREMEN	219	M	VI
527	4904	SPRING (MUDDY) P	WASHINGTON	18	E	VI
528	5726	BEECH P	PALERMO	59	E	VI
528	4910	CHISHOLM P	PALERMO	41	M	VI
528	4898	COLBY P	LIBERTY	26	E	VI
528	5748	FOSTER (CROTCH) P	PALERMO	31	E	VI
528	5440	FOX P	WINDSOR	10	E	VI
528	5454	FRENCH P	SOMERVILLE	11	M	VI
528	0371	MILLPOND	SOMERVILLE	29	E	VI
528	5438	MOODY P	WINDSOR	32	E	VI
528	7663	MUD P	PALERMO	13	E	VI
528	5744	SABAN P	PALERMO	11	E	VI
528	4906	TURNER P	SOMERVILLE	193	M	VI
529	5368	KNICKERBOCKER P	BOOTHBAY	105	M	VI
529	5404	SHERMAN L	EDGECOMB	216	M	VI
529	5374	WILEY P	BOOTHBAY	18	M	VI
530	0277	CENTER P	PHIPPSBURG	82	M	VI
530	0039	LILY P	BATH	11	E	VI

Table 6 (continued). **Threatened Lakes in Maine - 1996 Assessment.**

WBS #	LAKE ID #	LAKE	TOWN	ACRES	E/M	THREAT SOURCE
530	5676	SILVER L	PHIPPSBURG	11	E	VI
601	5226	HOUGHTON P	BATH	14	E	VI
601	0299	WAT-TUH L	PHIPPSBURG	24	E	VI
603	3702	LILY P	NEW GLOUCESTER	38	E	VI
603	3706	NOTCHED P	RAYMOND	77	M	VI
603	3786	RUNAROUND P	DURHAM	91	E	VI
605	3450	BOG P	HARRISON	11	E	VI
605	3452	CRYSTAL(ANONYMOUS) P	HARRISON	461	M	VI
605	3436	LITTLE P	OTISFIELD	23	E	VI
605	3458	OTTER P	BRIDGTON	90	M	VI
605	3386	OWL P	CASCO	20	E	VI
605	3388	PARKER P	CASCO	166	M	VI
605	3492	SPECK P #2	NORWAY	14	M	VI
605	3456	WOOD P	BRIDGTON	442	M	VI
606	3698	DUMPLING P	CASCO	30	E	VI
606	3370	HOLT P	BRIDGTON	25	E	VI
606	3188	INGALLS (FOSTER'S) P	BRIDGTON	141	M	VI
606	3445	RICH MILL P	STANDISH	77	E	VI
606	3382	TRICKEY P	NAPLES	311	M	VI
606	0519	UNNAMED P	STANDISH	61	E	VI
606	0523	UNNAMED P	STANDISH	26	E	VI
606	8873	UNNAMED P	SEBAGO	15	E	VI
606	8897	UNNAMED P	CASCO	10	E	VI
607	3728	COLLINS P	WINDHAM	42	M	VI
607	3730	DUCK P (LITTLE)	WINDHAM	43	M	VI
607	5781	FARWELL BOG	RAYMOND	15	E	VI
607	3726	MILL P	WINDHAM	17	E	VI
607	3724	TARKILL P	WINDHAM	28	M	VI
611	5648	GREAT P	CAPE ELIZABETH	169	M	BLOOM
613	3176	CLEMONS P (LITTLE)	HIRAM	25	E	VI
613	3200	FARRINGTON P	LOVELL	89	M	VI
613	3372	INGALLS P	BALDWIN	25	E	VI
613	0401	PEQUAWKET L	BROWNFIELD	87	M	VI
613	3394	SAND P	BALDWIN	61	M	VI & BLOOM
613	3398	WATCHIC P (LITTLE)	STANDISH	55	E	VI
614	0351	BLACK P	PORTER	50	E	VI
614	3168	CHAPMAN P	PORTER	13	E	VI
614	3178	JAYBIRD P	HIRAM	14	M	VI
614	3166	PLAIN P	PORTER	16	E	VI
614	3170	SPECTACLE P #1	PORTER	57	M	VI
614	3172	SPECTACLE P #2	PORTER	45	M	VI
614	3180	TRAFTON P	PORTER	56	M	VI
615	3890	ADAMS P (ROCK HAVEN)	NEWFIELD	210	M	VI
615	5008	BOYD P	LIMINGTON	26	M	VI
615	5006	DOLES P	LIMINGTON	25	E	VI
615	3908	GRANNY KENT P	SHAPLEIGH	70	M	VI

Table 6 (continued). Threatened Lakes in Maine - 1996 Assessment.

WBS #	LAKE ID #	LAKE	TOWN	ACRES	E/M	THREAT SOURCE
615	3928	HANSEN P	ACTON	30	E	VI
615	5010	ISINGLASS P	WATERBORO	30	M	VI
615	3904	MANN P	NEWFIELD	11	E	VI
615	3926	MOOSE P	ACTON	27	E	VI
615	3938	NORTHWEST P	WATERBORO	38	E	VI
615	9715	OSSIPEE FLOWAGE(LIT)	WATERBORO	1005	E	VI
615	3940	PICKEREL P	LIMERICK	46	M	VI
615	3896	PINKHAM P (HIDDEN L)	NEWFIELD	49	E	VI
615	0157	POVERTY P (BIG)	NEWFIELD	166	M	VI
615	9697	POVERTY P (LITTLE)	SHAPLEIGH	13	E	VI
615	3914	SHY BEAVER P	SHAPLEIGH	25	E	VI
615	3932	SMARTS P	NEWFIELD	20	E	VI
615	3906	SPICER P	SHAPLEIGH	10	E	VI
615	3930	SWAN P	ACTON	11	E	VI
615	3894	TURNER P (MIRROR L)	NEWFIELD	32	M	VI
615	3410	WARDS	LIMINGTON	44	M	VI
615	6889	WEBSTER'S MILL P	LIMINGTON	40	E	VI
616	5026	BARTLETT P	WATERBORO	30	E	VI
616	5042	BONNY EAGLE L	STANDISH	211	M	VI
616	3982	BRIMSTONE P	ARUNDEL	12	E	VI
616	5014	KILLICK P	HOLLIS	45	M	VI & BLOOM
616	5036	PARKER (BARKER) P	LYMAN	26	E	VI
616	5034	ROBERTS & WADLEY PDS	LYMAN	203	M	VI
616	5032	SWAN P	LYMAN	147	E	VI
616	5030	TARWATER P	LYMAN	11	E	VI
622	3984	ALEWIFE P	KENNEBUNK	37	E	VI
622	3998	KENNEBUNK P	LYMAN	224	M	VI
623	3936	BRANCH P (MIDDLE)	WATERBORO	38	M	VI
623	0137	GOOSE P	SHAPLEIGH	50	E	VI
623	9695	LOON P	ACTON	94	E	VI
623	3848	NUMBER ONE P	SANFORD	100	E	VI
623	3976	SHAKER P	ALFRED	78	M	VI
623	6793	UNNAMED P	SANFORD	29	E	VI
623	6985	UNNAMED P	ALFRED	10	E	VI
625	6967	BEAVER DAM P	BERWICK	19	E	VI
625	3868	CIDER MILL P	NORTH BERWICK	10	E	VI
625	9875	COX P	SOUTH BERWICK	18	M	VI
625	3850	CURTIS P	SANFORD	11	M	VI & BLOOM
625	3884	KNIGHT P	SOUTH BERWICK	49	M	VI
625	3852	OLD FISHING P	SANFORD	18	E	VI
625	3856	PICTURE P	SANFORD	10	M	VI
625	3862	SAND P	SANFORD	29	M	VI
625	6869	UNNAMED P	NORTH BERWICK	10	E	VI
626	9713	YORK P	ELIOT	47	E	VI
627	3931	MURDOCK P	BERWICK	300	M	BLOOM
628	0007	ESTES L	SANFORD	387	M	RESTORED

Table 6 (continued). **Threatened Lakes in Maine - 1996 Assessment.**

WBS #	LAKE ID #	LAKE	TOWN	ACRES	E/M	THREAT SOURCE
628	3842	JAGGERS P	SANFORD	60	E	VI
628	3986	OLD FALLS P	SANFORD	100	E	VI
628	3846	STUMP P	SANFORD	50	E	VI
629	0117	LEIGH'S MILL P	SOUTH BERWICK	37	M	VI
630	3872	SPAULDING P	LEBANON	118	M	VI

TOTALS: 323 LAKES 47,576 ACRES

APPENDIX II

STATE OF MAINE 1996 WATER QUALITY ASSESSMENT

SUPPLEMENTARY DATA AND DOCUMENTATION

Section 303(d) Waters

Section 303(d) of the Clean Water Act requires that Maine identify waterbody segments which do not or will not meet state water quality standards even after the implementation of technology-based controls for both point sources and non-point sources of pollution. This list includes not only waterbody segments which do not attain water quality standards, but also those which are in attainment but are considered to be threatened. The 303(d) process subsequently requires the establishment of Total Maximum Daily Loads (TMDLs) or other control methods in order to assure the attainment of water quality standards.

The State is also required to identify priority waters for which it will develop TMDLs within the next two years. Considerations are primarily geographic, but pending National Pollutant Discharge Elimination (NPDES) permits and treatment plant construction proposals are also considered. TMDLs for point sources may consist of discharge limitations, while those for non-point sources may include activities that control factors causing non-attainment.

In the development of the 303(d) list, the 1996 305(b) Water Quality Assessment report, including the 304(l) lists, the 314(a) Clean Lakes list and the 319 State Non-Point Source Assessment were all reviewed. Some waterbodies included on these lists generally do not attain water quality standards because of activities that have no technology-based controls. Lakes selected for the list include those lakes identified on the water quality assessment as failing to meet GPA standards due to repeated blue-green algal blooms or a demonstrated trend of increasing trophic state. Also included are some lakes which are viewed as particularly threatened and for which a TMDL process may be appropriate.

Tables 1-3 contain the lists of waterbodies needing TMDLs. In addition to the listed lakes, TMDL-type areal phosphorus allocations for new development sources will be generated for a number of other lakes as part of the state technical assistance program. Many of these lakes will not be on the 303(d) list, but will be prioritized for action based on the need for protection and demonstrated local interest.

Table 1. Water Quality-Limited Rivers and Streams in Maine - 1996 Assessment.

WBS #	NAME	TOWN	CLASS	PRIORITY
124R	Dickey Br	St. Agatha	B	
	Daigle Br	St. Agatha	B	
140R	Presque Isle Str	Presque Isle	B	
	N Br Presque Isle Str	Mapleton	B	
	Dudley Bk	Chapman	B	
142R	Caribou Str	Caribou	B	
143R	Everett Bk	Fort Fairfield	B	
145R	Little Madawaska R	Caribou	B	
	Greenlaw Str	Caribou	B	
149R	Prestile Str	Mars Hill	A	
152R	Meduxnekeag R	Houlton	B	
205R	W Br Penobscot R	TA R7 WELS	C	
	W Br Penobscot R	Millinocket	C	
224R	Burnham Br	Garland	B	
	Kenduskeag Str	Bangor	C	X
	Unnamed Bk	Corinth	B	
231R	Penobscot R	Lincoln	C	X
232R	Penobscot R	Enfield	B/C	X
233R	Penobscot R	Old Town	B	X
234R	Penobscot R	Veazie	B/C	X
234R	Penobscot R	Bangor	C	X
235R	Penobscot R	Hampden	C	X
311R	Dead R	T3R4 BKP	AA/A	
316R	Baker Str	Farmington	B	
	Unnamed Bk	New Sharon	C	
320R	Carrabassett Str	Canaan	B	
	Currier Bk	Skowhegan	B	
	Whitten Bk	Skowhegan	B	
322R	Fish Bk	Fairfield	C	
323R	Messalonskee Str	Waterville	C	
324R	Thompson Bk	Hartland	B	
325R	E Br Sebasticook R	Corinna	C	
	Brackett Bk	Palmyra	B	
	Mulligan Str	St. Albans	B	
327R	Mill Str	Albion	B	
329R	Farnham Bk	Pittsfield	B	
	Twelvemile Bk	Clinton	B	
	Unnamed Bk	Benton	B	
332R	Sebasticook R	Burnham	C	X
	Sebasticook R	Winslow	C	X
333R	Riggs Bk	Augusta	C	X
	Bond Bk	Augusta	B/C	X
	Vaughn Bk	Hallowell	B	

Table 1 (continued). Water Quality-Limited Rivers and Streams in Maine - 1996 Assessment.

WBS #	NAME	TOWN	CLASS	PRIORITY
334R	Mud Mills Str	Monmouth	B	
	Potters Bk	Litchfield	B	
	Tingley Bk	Readfield	B	
	Cobbossee Str	Winthrop	B	
	Jock Str	Wales	B	X
335R	Kimball Bk	Pittston	B	
	Togus Str	Chelsea	B	
338R	Kennebec R	Norridgewock	B	
339R	Kennebec R	Fairfield	B/C	X
340R	Kennebec R	Augusta	C	X
413R	Jepson Bk	Lewiston	B	X
	Penley Bk	Auburn	B	
	Stetson Bk	Lewiston	B	X
	Logan Bk	Auburn	B	
414R	Thompson Lake Outlet	Oxford	C	X
415R	Davis Bk	Poland	B	
	Morgan Bk	Minot	B	
416R	Little Androscoggin R	Paris	C	
417R	Little Androscoggin R	Auburn	C	X
418R	Sabattus R	Sabattus	C	
	No Name Bk	Lewiston	C	
420R	Abagadasset R	Richmond	B	
421R	Androscoggin R	Gilead	C	X
422R	Androscoggin R	Rumford	C	X
423R	Androscoggin R	Jay	C	X
424R	Androscoggin R	Turner	C	X
425R	Androscoggin R	Lewiston	C	X
426R	Androscoggin R	Brunswick	C	X
427R	Merrymeeting Bay	Bath	C	X
505R	St. Croix R	Baileyville	C	
511R	Bog Bk	Deblois	B	X
512R	Narraguagus R	Cherryfield	B	
	McCoy Bk	Deblois	B	
520R	Carleton Str	Blue Hill	C	
521R	Warren Bk	Belfast	B	
525M	Medomak R Estuary	Waldoboro	SB	
527R	Damariscotta R	Newcastle	B	
528R	Sheepscot R	Whitefield	AA	X
	W Br Sheepscot R	Windsor	AA	X
	Dyer R	Alna	B	
602R	Frost Gully Bk	Freeport	A	X
	Mare Bk	Brunswick	B	
	Concord Gully	Freeport	A	X
603M	Royal River	Yarmouth	SB	
603R	Chandler R	N. Yarmouth	B	
	Unnamed Bk	N. Yarmouth	B	

Table 1 (continued). Water Quality-Limited Rivers and Streams in Maine - 1996 Assessment

WBS #	NAME	TOWN	CLASS	PRIORITY
607R	Black Bk	Windham	B	
	Colley Wright Bk	Windham	B	
	Piscataqua R	Falmouth	B	
	E Br Piscataqua R	Falmouth	B	
	Hobbs Bk	Cumberland	B	
	Inkhorn Bk	Westbrook	B	
	Mosher Bk	Gorham	B	
	Otter Bk	Windham	B	
607R	Thayer Bk	Gray	B	
609R	Presumpscot R	Falmouth	C	X
606R	PresumpscotR	Westbrook	C	X
610R	Capisic Bk	Portland	C	X
	Clark Bk	Westbrook	C	X
	Long Cr	S. Portland	C	X
	Stroudwater R	Gorham	B	
	Barberry Cr	S. Portland	C	X
610M	Fore River	S. Portland	SC	X
611R	Alewife Bk	Cape Elizabeth	A	
	Phillips Bk	Scarborough	C	
612R	Goosefare Bk	Saco	B	X
613R	Wards Bk	Fryeburg	C	
	Deep Bk	Saco	C	
618R	Saco R	Saco	B	X
	Saco R	Dayton	A	
	Saco R	W Buxton	A	X
619R	Saco R	Standish	A/B	X
620M	Saco R	Saco	SC	X
623R	Carpenter Bk	Waterboro	B	
624R	Stevens Bk	Ogunquit	B	
625R	Adams Bk	Berwick	B	
626R	Smelt Bk	York	B	
628R	Mousam R	Sanford	B	X
628M	Mousam R Estuary	Kennebunk	SB	X
629R	Great Works R	N. Berwick	B	
630R	Salmon Falls R	S. Berwick	B	X
630M	Piscataqua R Estuary	S. Berwick	SB	

Table 2. Water Quality-Limited Lakes in Maine - 1996 Assessment.

TMDL lakes are listed below by Waterbody (WBS). The reason for including a lake can be found in the right column (Bloom = more than one season of algal blooms, Trend = increasing trophic trend, Other = refer to text for reason).

Waterbody ID#	Name	Town	Acres	Reason	Priority
123 1682	Long L	T17 R04 WELS	6000	Blooms	
124 1665	Daigle P	New Canada	36	Blooms	
124 1666	Black L	Fort Kent	51	Blooms	
124 1674	Cross L	T17 R05 WELS	2515	Blooms	
125 1672	Square L	T16 R05 WELS	8150	Other	
140 0409	Arnold Brook L	Presque Isle	395	Blooms	
140 1776	Echo L	Presque Isle	90	Blooms	
140 9767	Hanson Brook L	Mapleton	118	Blooms	
143 1808	Fischer L	Fort Fairfield	10	Blooms	
143 1820	Monson P	Fort Fairfield	160	Blooms	
145 1802	Madawaska L	T16 R04 WELS	1526	Blooms,Trend	
146 9779	Trafton L	Limestone	85	Blooms	
209 1728	Pleasant L	T04 R03 WELS	1832	Other	
215 0894	Onawa L	Elliottsville	1344	Blooms	
224 4128	Garland P	Garland	102	Blooms	
225 2274	Etna P	Etna	361	Blooms	
225 2286	Hermon P	Hermon	461	Blooms	
225 2294	Hammond P	Hampden	83	Blooms	
303 0269	Fitzgerald P	Big Squaw TWP	550	Blooms	
303 0404	Spencer P	E. Middlesex Canal Grant	980	Blooms	
304 0328	Notch (Big) P	Little Squaw TWP	12	Blooms	
317 3680	Varnum P	Wilton	331	Other	
317 3682	Wilson P	Wilton	563	Other	
317 5198	Pease P	Wilton	109	Other	
315 2336	Toothaker P	Phillips	30	Blooms	
321 5296	Fairbanks P	Manchester	14	Blooms	
321 5349	East P	Smithfield	1725	Blooms	
321 5352	Salmon L (Ellis P)	Belgrade	666	Blooms	
325 2264	Sebasticook L	Newport	4288	Blooms	
325 5460	Halfmoon P	St. Albans	36	Blooms	
326 5172	Unity P	Unity	2528	Blooms	
326 5174	Sandy (Freedom) P	Freedom	430	Blooms	
327 5176	Lovejoy P	Albion	324	Blooms	
328 5448	China L	China	3845	Blooms,Trend	X
329 5458	Pattee P	Winslow	712	Blooms	
333 5408	Webber P	Vassalboro	1201	Blooms	X
333 5416	Threemile P	Vassalboro	1132	Blooms	X
333 5424	Threecornered P	Augusta	182	Blooms	
334 5236	Cobbosseecontee L.	Winthrop	5543	Blooms	X
334 5254	Pleasant (Mud) P	Gardiner	746	Blooms	
334 8065	Cobbosseecontee (LT)	Winthrop	75	Blooms	
334 9961	Annabessacook L	Monmouth	1420	Blooms	

Table 2 (continued). Water Quality-Limited Lakes in Maine - 1996 Assessment.

Waterbody ID#	Name	Town	Acres	Reason	Priority
335 9931	Togus P	Augusta	660	Blooms	
404 3526	Quimby P	Rangeley	165	Blooms	
404 3534	Haley P	Dallas Plt.	170	Blooms	
407 3504	Ellis (Roxbury) P	Byron	920	Other	X
412 3624	Bear P	Hartford	432	Other	
412 3626	Crystal P (Beals P)	Turner	47	Other	X
412 3800	Round P	Turner	12	Other	X
412 3822	Pleasant L	Turner	189	Other	X
413 3784	Little Wilson	Turner	111	Other	X
414 3434	Pennessewassee	Norway	922	Other	X
414 3444	Thompson L	Oxford	4426	Other	X
414 3464	Bryant P (L Christopher)	Woodstock	278	Other	
414 3500	North P	Norway	175	Other	
414 3688	Range P (Upper)	Poland	391	Other	X
414 3758	Tripp L	Poland	768	Other	X
414 3760	Range P (Lower)	Poland	290	Other	X
414 3762	Range P (Middle)	Poland	366	Other	X
415 3750	Taylor P	Auburn	625	Other	X
415 3780	Halls P	Paris	51	Blooms	
418 3796	Sabattus P	Greene	1962	Blooms	X
508 1404	Boyden L	Perry	1702	Trend	
514 0447	Long P	Mount Desert	38	Other	
517 4350	Graham L	Mariaville	7865	Blooms	
521 4846	Coleman P	Lincolnville	223	Other	
522 0083	Lilly P	Rockport	29	Blooms	
524 4822	Chickawaukie P	Rockport	352	Blooms	
526 5702	Duckpuddle P	Nobleboro	293	Blooms	
527 5400	Damariscotta L	Jefferson	4381	Other	X
529 5366	Adams P	Boothbay	73	Blooms	
529 5372	Forest Harbor P	Boothbay Harbor	84	Blooms	
530 9943	Sewall P	Arrowsic	46	Blooms	
603 3700	Sabathday L	New Gloucester	340	Other	X
606 3692	Nubble P	Raymond	23	Blooms	
607 3712	Forest L	Windham	210	Other	
607 3734	Highland (Duck) L	Falmouth	634	Trend	
615 3410	Wards P	Limington	44	Blooms	
615 5024	Little Ossipee P	Waterboro	564	Other	X
623 3838	Mousam L	Acton	900	Trend	X
625 0119	Ell (L) P	Wells	32	Blooms	
625 3992	Bauneg Beg L	N. Berwick	200	Other	
626 5596	Scituate P	York	41	Blooms	
628 0007	Estes L	Sanford	387	Blooms	

Table 3. Closed Shellfish Areas Needing TMDLs - 1996 Assessment. (Approved by EPA 10/6/96.)

Closed Area	Location	Priority
1	Spruce Creek, Kittery	
8	Turbats Creek, Kennebunkport	
8	Little River, Kennebunkport	
8	Smith Brook, Kennebunkport	
17	Kelsey Brook, Frost Gully Brook, Harraseeket River	
17-A	Bunganuc Stream, Freeport-Brunswick	
17-B	Wharton Point, Brunswick	
18	Ash Point Cove, Harpswell	
18	Basin Cove, Harpswell	
18	Stover Cove, Harpswell	
19	Sebasco, Phippsburg	
20	Upper Kennebec River	
22	Sheepscot Falls, Wicasset-Newcastle	
25	Great Salt Bay, Newcastle-Damariscotta	
25-B	Pemaquid River, Bristol	
26	Meetinghouse Cove, Medomak River Estuary	
28-D	Long Cove, St. George	
28-H	Mosquito Harbor, St. George	
29-A	Lucia, Crocketts and Crescent Beaches, Owls Head	
30	Saturday and Kelly Coves, Little River, Northport	
33	Stockton Harbor, Stockton Springs	
38B	Burnt Cove, Stonington	
42	Bass Harbor, Tremont	
48-C	Northwest Cove, Bar Harbor	
49-A	Jellison Cove, Hancock	
50-B	Springer Brook, Franklin	
50-D	Flanders Bay, Harrington	
52-G	Tucker Creek, Gouldsboro	
53	Narraguagus River, Milbridge	
53-F	Monhonan Cove, Milbridge	
54	Jonesport	
54-B	Indian River, Addison	
54-H	Chandler River, Jonesboro	
54-K	S.E. Alley Bay, Beals	
55	Machias and East Machias Rivers	X

Chapter 2. Department of Marine Resources Shellfish Harvesting Closure Documentation

Table 4. Shellfish Area Closures - 1996 Assessment. (Updated by Department of Marine Resources staff 2/5/97.)

Closed Area	Location
1	Jaffrey Point, N.H. to Seal Head Point, York
2	York River --York Harbor
3	East Point to Bald Head Cliff. York
4	Ogunquit River -Ogunquit & Moody Beaches
4-A	Bald Head Cliff, York to Israels Head, Ogunquit
5	Webhannet River and Beaches of Wells & Kennebunk
6	Mousam and Kennebunk Rivers
8	Cape Porpoise Harbor and Goosefare Bay, Kennebunkport
8-B	Timber Point to Fortunes Rock, and South Point to East Point, Biddeford
9	Saco River and Saco Bay
11	Northern Saco Bay and Scarborough River
12	Prouts Neck , Scarborough
13	Prouts Neck, Spurwink River, Scarborough / Cape Elizabeth
13-A	Spurwink River, Scarborough to McKenney Point, Cape Elizabeth
13-B	Cape Elizabeth to Portland Head
14	Portland - Falmouth Area
14-C	Cape Elizabeth, Cliff Island, Portland
14-D	Great Chebeague Island, Cumberland
15	Sunset Point to Parker Point, Yarmouth
16	Royal River, Yarmouth, to Flying Point, Freeport
16-C	Cousins and LittleJohn Islands, Yarmouth
17	Harraseeket River, Freeport
17-A	Bunganuc Stream and vicinity, Brunswick
17-B	Northeastern Maquoit Bay, Brunswick
17-C	Southwestern Mere Point Neck, Brunswick
17-D	Bustins Island, Freeport
17-E	Upper and Lower Goose Islands, Harpswell
18	Potts Harbor, Merriconeag Sound, and Harpswell Sound, Harpswell
18-A	Gurnet Straight, Brunswick and Harpswell
18-B	New Meadows River, Brunswick and West Bath
18C	Mere Point Neck, Brunswick
18-D	Eastern Bailey Is., Orrs Is., W. Quahog Bay, Harpswell
18-E	Cundys Harbor Area, Harpswell
18-G	Birch Island, Harpsswell
18-H	High Head to Ewin Narrows, Harpswell
18-I	Harpswell Fuel Depot, Harpswell
18-J	Lumbos Hole. Harpswell Sound
18-L	Southwestern Mill Cove, Harpswell Sound
18-M	Lookout Point & Wilson Cove, Harpswell
18-O	Bethel Point, Harpswell
18-Q	Eastern Dingley Island, Harpswell
18-R	East Harpswell
18-S	Indian Point, Harpswell
18-T	Strawberry Creek, Harpswell
18-U	Middle Bay Cove, Harpswell
18-X	Unnamed cove east of Big Hen Island, Cundys Harbor, Harpswell

Table 4. **Shellfish Area Closures - 1996 Assessment (continued).**

Closed Area	Location
18-Z	Cliff Island to Bailey Island, Casco Bay
18-AA	Little Yarmouth Island, Harpswell
19	Wood Island to Harbor Island, Phippsburg
19-A	Birch Point, West Bath to Bear Island, Phippsburg
19-B	West Point, Phippsburg
19-C	Foster Point to Birch Point, West Bath
19-D	Long Cove, West Bath
20	Upper Kennebec River and Tributaries
20-B	Montsweag Bay To Back River, Wiscasset, Woolwich, Westport
20-E	N. Robinhood Cove, S. Robinhood Cove & Nubble Bay, Georgetown, Westport
20-G	Cape Small, Phippsburg to Kennebec Point, Georgetown
20-H	Lower Kennebec River, Atkins Bay, Wyman Bay, Parker Flats, Phippsburg and Todd Bay, Georgetown
20-J	Sagadahoc Bay, Georgetown
21	Indian Point Georgetown to Fowle Point, Westport
22	Sheepscot River and Tributaries
22-A	Westport Island (Now included in CA 22)
22-B	Sawyer Is., Hodgdon Is, Merrow Is., etc., Boothbay
22-E	Western Barters Island, Boothbay
22-F	Ovens Mouth and Sherman Creek, Cross River, Boothbay - Edgecomb
23	Boothbay Harbor-Damarascove Island area
23-A	Ebenecook Harbor & Vicinity, Southport/Boothbay Hbr
23-B	Southwestern Southport Island
24	Reeds Island to Meadow Cove, Boothbay
24-A	Dodge Lower Cove, Edgecomb
25	Damariscotta River, Damariscotta-Newcastle-Edgecomb-South Bristol
25-A	South Bristol
25-B	Pemaquid River, Bristol
25-C	New Harbor, Bristol
25-D	Long Cove Point to Muscongus Harbor, Bristol
25-E	Inner Heron Island, South Bristol
25-F	Pemaquid Neck, Bristol
25-G	Soldiers Cove, Bristol
25-H	Keene Narrows, Medomak, (River), Bremen
25-I	Moscongus Harbor, Bristol-Bremen
25-J	Eastern Farmers Island, South Bristol
25-L	North end of Hog Island, Bremen
25-M	Greenland Cove, Bremen
25-N	High Island to McFarlands Cove, South Bristol
25-O	Louds Island, Bristol & Bremen Long Island Area
25-Q	Western Branch of Broad Cove in Bremen and Waldoboro
26	Medomak River, Waldoboro - Friendship
26-A	Monhegan Island
26-B	Friendship Harbor
26-D	Hawthorne Point- Bailey Point, Cushing
26-H	Broad Cove, Cushing
26-K	Back River, Friendship and Crotch Island, Cushing
26-M	Pleasant Point Gut to Davis Cove, Cushing
26-N	South & North ends of Maple Juice Cove, Cushing
26-O	Friendship Long Island - Harbor & Vicinity, Friendship

Table 4. Shellfish Area Closures - 1996 Assessment (continued).

Closed Area	Location
27	St. George River
27-A	Clark Point to Racliff Island causeway, St. George
27-B	Deep Cove to Watts Pt, St George
28	Tenants Harbor to Mosquito Head, St George
28-A	Port Clyde and St. George Islands
28-B	Spruce Head Is, S. Thomaston to Thorndike Point, South Thomaston
28-C	Rackliff Island, St, George
28-D	North end of Long Cove, St. George
28-E	Ash Point to Birch Point, Owls Head
28-G	Seavey Cove, St. George
28-H	Marshall Point, Mosquito Head, St. George
28-I	Weskeag River, South Thomaston and Owls Head
29	Rockland (Rockland Harbor, Broad Cove and Deep Cove)
29-A	Owls Head
29-B	Matinicus Island
29-C	Owls Head Bay
30	Rockport Area
30-A	Southwestern Vinalhaven
30-B	Arey Cove, Vinalhaven
30-C	Pulpit Harbor, North Haven
30-D	Northwestern Vinalhaven and Vicinity
30-E	Old Harbor, Vinalhaven
30-F	Isle Au Haut and Nearby Islands
30-G	Northeastern Vinalhaven and Vicinity
30-H	Kent Cove, North Haven
30-I	North Haven Island
30-J	Vinal Cove - Starboard Rock, Vinalhaven
30-K	Northeastern end of Southern Harbor, North Haven
30-L	Ames Creek Area, North Haven
30-M	Roberts Harbor, Vinalhaven
30-N	Indian Point to Burnt Iskand, North Haven
31	Camden
31-A	Rockport Harbor to Ducktrap Harbor, Lincolnville
31-B	Spruce Head to Kellys Cove, Northport
32	Belfast Bay
32-A	Saturday Cove Area (Rockport)
33	Searsport-Stockton Springs
35	Penobscot River
36	Penobscot & Bagaduce Rivers , Towns of Castine-Penobscot.
36-F	Islesboro
37	Condon Point to"The Herricks" Village, Brooksville
37-A	Deer Isle
37-B	Blasto Cove, Deer Isle
37-C	Sylvester Cove-Dunham Point, Deer Isle
37-E	Eggemoggin, Little Deer Isle
37-G	Tinken Ledges to Thompson Cove, North Deer Isle
37-I	Western Cove, Stinson Neck, Deer Isle
38	Webb Cove to Burnt Cove, Stonington and upper Crockett Cove, Deer Isle
38-A	Inner Harbor, Stonington-Deer Isle
38-C	Whig Is. & Huckleberrry Is. Coves in Long Cove, Deer Isle

Table 4. Shellfish Area Closures - 1996 Assessment (continued).

Closed Area	Location
39	Blue Hill Harbor to Blue Hill Falls
39-A	Center Harbor - Brooklin
39-B	Sedgewick
39-C	McHerd Cove, East Blue Hill
39-D	Western Blue Hill Bay and Watson Brook, Brooklin
39-F	Benjamin River, Sedgwick
40	Union River Bay, Patten Bay & Union River, Ellsworth, etc.
42	Bass Harbor & Eastern Duck Cove, Tremont
42-A	Lunt Harbor, Frenchboro
42-B	Burnt Coat Harbor, Swans Island
42-C	Swans Island and Round Island
42-D	Red Point, Swans Island
42-E	Mackerel Cove, Swans Island
43	Southwest Harbor
44	Somes Harbor, Southern Mt. Desert Is. & Cranberry Isles
45	Northeast Harbor
46	Seal Harbor
46-A	Otter Cove, Mt Desert - Bar Harbor
47	Bar Harbor
48	Thomas Bay, Bar Harbor
48-A	Goose Cove and Mt Desert Narrows, Trenton
48-C	Mill Cove, Mount Desert
49	Salisbury Cove, Bar Harbor
49-A	Jellison Cove, Hancock
49-B	Hancock Point, Hancock
49-C	Kilkenny Cove, Hancock
50	Sorrento
50-A	West Sullivan to Falls Point and Long Cove, Sullivan
50-B	Springer Creek to Mill Brook, West Franklin
50-D	Northwest end of Flanders Bay, Sullivan-Sorrento
50-E	Egypt Bay, Hancock and Franklin
51	Winter Harbor
51-A	Arey cove, Winter Harbor
51-B	Grindstone Neck, Winter Harbor
52	Prospect Harbor, Gouldsboro
52-A	Corea Harbor
52-C	Bunkers Harbor, Gouldsboro
52-D	Southwestern Petit Manan Point, Steuben
52-E	Dyer Harbor, Dyer Bay, Steuben
52-F	Birch Harbor, Gouldsboro
52-G	Tucker Creek, Gouldsboro and Steuben Harbor
52-H	Wonsqueak Harbor, Gouldsboro and Roger's Point to Marsh Cove Point, Steuben
52-J	Over Cove, Dyer Bay, Steuben
53	Narraguagus River, Milbridge
53-A	Pleasant River and Dyer Cove, Addison
53-D	Curtis Creek , Harrington
53-E	Upper Harrington River
53-G	Smith Cove, Narraguagus Bay, Milbridge
53-H	Mash Harbor, Cape Split, Eastern Harbor, Addison
54	Jonesport And West Jonesport

Table 4. Shellfish Area Closures - 1996 Assessment (continued).

Closed Area	Location
54-A	North End of Beals Island
54-B	Indian River, Addison-Jonesport
54-D	East and West Branches, Little Kennebec Bay, Machias, etc.
54-E	Hall Cove, Steele Harbor Island, Jonesport
54-F	Sandy River and Popplestone Beach, Jonesport
54-G	White Creek, Masons Bay, Jonesport-Jonesboro
54-H	Chandler River, Jonesboro
54-K	Eastern Alley Bay and Pig Island Gut, Beals
54-L	Sanford Cove, Roque Bluff
54-M	Lamsen Brook in West River, Addison
54-P	Cow Point to Calf Point, Roque Bluffs
55	Machias- East Machias Rivers and Northwestern Machias Bay
55-A	Little River - Cutler Harbor
55-B	Howard Cove - Starboard Cove, Bucks Harbor
55-C	Northeastern Holmes Bay, Whiting - Cutler
55-G	Money Cove, Cutler
55-H	Bucks Harbor, Machiasport
55-I	Indian Head, Machiasport
56	Dennys River & NW Dennys Bay, Edmunds-Pembroke
56-A	Pennamaquan Bay, Pembroke
56-B	Hobart Stream (Edmunds)
56-C	Haycock Harbor, Trescott
56-F	Talbot Cove, Straight Bay, Trescott
56-I	Canal Cove, Seward Neck, Lubec
56-J	Sipp Bay, Perry and Robinston
57	Eastport
57-A	Pleasant Point, Perry
57-B	Deep Cove, Eastport
58	Lubec and South Lubec
58-C	North Lubec
58-E	Federal Harbor. West Lubec
58-F	The Haulup, South Bay, West Lubec
60	Little River, Perry
62	St. Croix River - Passamaquoddy Bay
83	Eastern Harbor, So. Addison