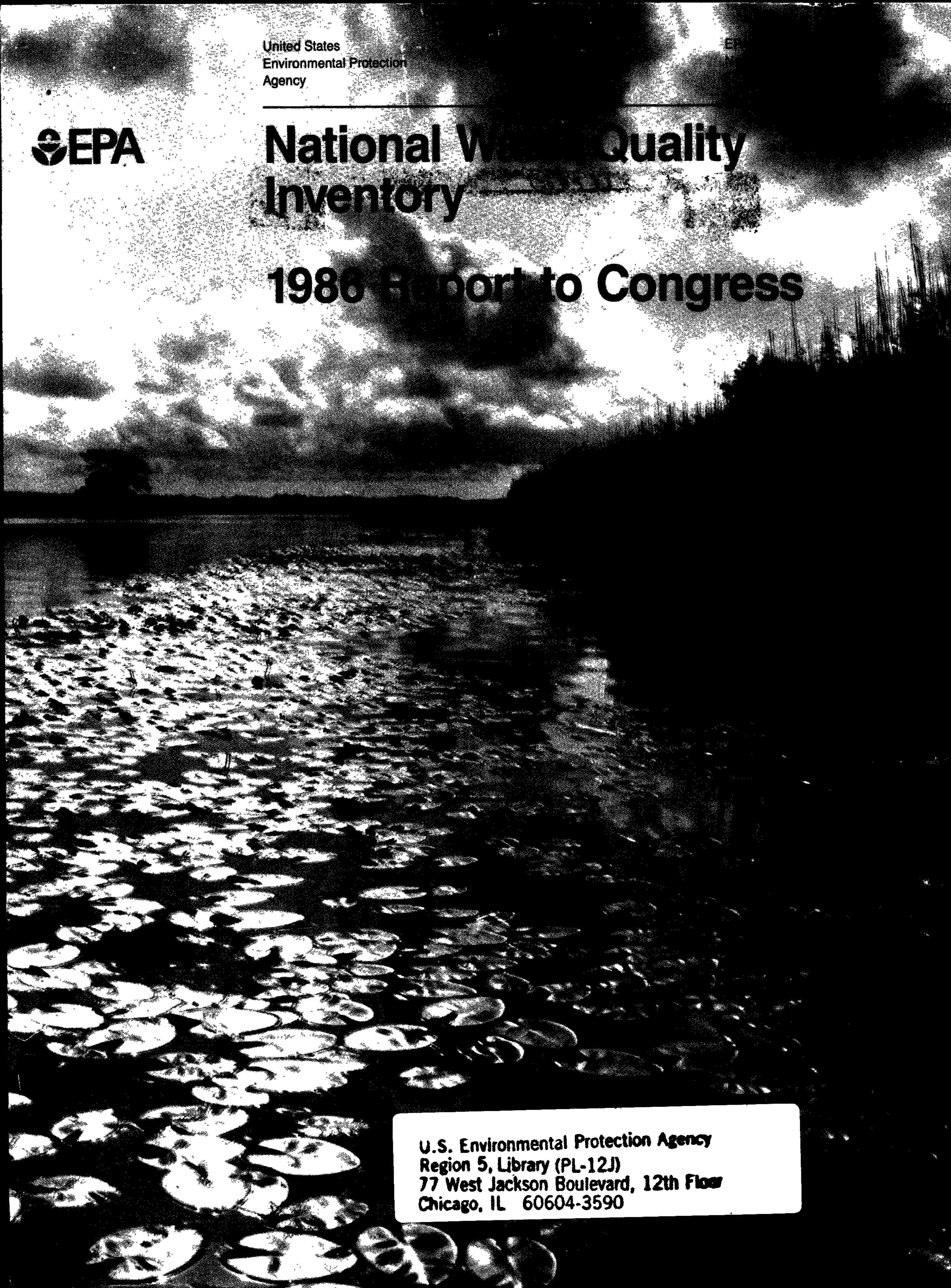
United States
Environmental Protection
Agency

EPA

National Water Quality Inventory

1986 Report to Congress



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This report was prepared pursuant to Section 305(b) of the Clean Water Act, which states:

"(b)(1) Each State shall prepare and submit to the Administrator by April 1, 1975, and shall bring up to date by April 1, 1976, and biennially thereafter, a report which shall include—

"(A) a description of the water quality of all navigable waters in such State during the preceding year, with appropriate supplemental descriptions as shall be required to take into account seasonal, tidal, and other variations, correlated with the quality of water required by the objective of this Act (as identified by the Administrator pursuant to criteria published under section 304(a) of this Act) and the water quality described in subparagraph (B) of this paragraph;

"(B) an analysis of the extent to which all navigable waters of such State provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water;

"(C) an analysis of the extent to which the elimination of the discharge of pollutants and a level of water quality which provides for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allows recreational activities in and on the water, have been or will be achieved by the requirements of this Act, together with recommendations as to additional action necessary to achieve such objectives and for what waters such additional action is necessary;

"(D) an estimate of (i) the environmental impact, (ii) the economic and social costs necessary to achieve the objective of this Act in such State, (iii) the economic and social benefits of such achievement; and (iv) an estimate of the date of such achievement; and

"(E) a description of the nature and extent of nonpoint souces of pollutants, and recommendations as to the programs which must be undertaken to control each category of such sources, including an estimate of the costs of implementing such programs.

"(2) The Administrator shall transmit such State reports, together with an analysis thereof, to Congress on or before October 1, 1975, and October 1, 1976, and biennially thereafter."

Front Cover: A view of the Pearl River at the Mississippi-Louisiana border. Photo by Steve Delaney

United States
Environmental Protection
Agency

Washington DC
20460

EPA

The Administrator

Dear Mr. President:
Dear Mr. Speaker:

As required by Section 305(b) of the Federal Water Pollution Control Act, I am transmitting to the Congress the National Water Quality Inventory Report for 1986. This report is the sixth in the series of national inventory reports published since 1975. It is based primarily on reports submitted by the States in 1986; in some cases, State-reported information has been supplemented by data developed by the Environmental Protection Agency (EPA). Although the EPA has analyzed and summarized the water quality information in the State reports, the views and recommendations presented are those of individual States, not those of the EPA or the Administration. The individual 1986 State reports are being transmitted to the Congress in their entirety.

The message presented by the States in their 1986 Section 305(b) reports is clear—since the enactment of the 1972 Clean Water Act, the Nation has made significant progress in cleaning up water pollution. It is equally clear, however, that persistent pollution problems remain.

Of the rivers, lakes, and estuaries that were assessed by the States, most are supporting the uses for which they have been designated. These uses, such as drinking water supply, swimming, and the propagation of aquatic life, were found to be supported in 74 percent of assessed river miles, 73 percent of assessed lake acres, and 75 percent of assessed estuarine and coastal waters.

However, a variety of pollution problems continue in our rivers, lakes, and estuaries at levels that exceed water quality standards or other levels of concern. In those waters that are not supporting their uses, pollution from nonpoint or diffuse sources such as runoff from agricultural and urban areas is cited by the States as the leading cause of water quality impairment. Issues of concern reported by the States include ground-water protection, toxic substances and toxics control, nonpoint sources, wetland loss, and acid deposition. Concern about diminishing financial resources for pollution control is also reported.

Nevertheless, as this report shows, the Nation's commitment to improve water quality has had significant results. Expenditures by EPA, the States, and local governments to construct and upgrade sewage treatment facilities have substantially increased the population served by higher levels of treatment. Permitting backlogs have been reduced. The States have made significant strides toward developing and implementing a variety of ground-water management activities. Continued progress and activity is occurring in the implementation of nonpoint source controls. In addition, by providing statutory emphasis and Federal resources in many of these areas, the new Water Quality Act of 1987 addresses problems such as nonpoint sources and toxics identification and control, and strengthens many of the programs that have been in place since the passage of the Clean Water Act of 1972.

The Water Quality Act (WQA) of 1987 created several new requirements for water quality assessments. Effective implementation of Federal and State pollution control programs depends on coordinating these assessments and using the information in program planning. We have therefore asked the States to integrate their WQA assessments with their 1988 Section 305(b) reports. We are also asking the States to prepare Clean Water Strategies that provide a blueprint for setting priorities and addressing identified problems. In addition, EPA is working with the States to improve the consistency and comprehensiveness of the Section 305(b) process, and will continue to refine future reports in this series.

Sincerely,

Lee M. Thomas

Honorable George M. Bush
President of the Senate
Washington, D.C. 20510

Honorable James Wright
Speaker of the House of Representatives
Washington, D.C. 20515

Acknowledgments

This report is based primarily on water quality assessments submitted to EPA by the States, Territories, and interstate commissions of the U.S. The Environmental Protection Agency (EPA) wishes to thank the authors of these assessments for the time and effort spent in preparing these reports and reviewing the draft of this national assessment. Additional thanks go to the water quality assessment coordinators from all ten EPA regions who work with the States.

This document was written and edited by Alice Mayio of the Monitoring and Data Support Division, Office of Water Regulations and Standards (OWRS), under the direction of Bruce Newton, Chief, Monitoring Analysis Section. Contributions were also made by the following individuals in other EPA program offices: Ed Bender and Katherine Wilson, Office of Water Enforcement and Permits; Lee Braem, Office of Ground-Water Protection; William Fallon, Office of Research and Development; Katherine Minsch, Office of Marine and Estuarine Protection; David Moon and Elaine Greening, Office of Municipal Pollution Control; Brett Snyder, Office of Policy, Planning, and Evaluation; Stuart Tuller and Joseph Yance, OWRS; and Lorraine Williams, Office of Wetlands Protection.

Special thanks also go to Sandra Gill of the Washington Information Center, and Jendayi Oakley-Gordon of OWRS.

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Contents

Figures

Tables

Preface

This document, the sixth in a series of National Water Quality Inventories published since 1975, summarizes water quality reports submitted by the States and other jurisdictions of the United States in 1986. These State reports are submitted to the U.S. Environmental Protection Agency (EPA) pursuant to Section 305(b) of the Clean Water Act. All States and jurisdictions submitted reports in time for their inclusion in the tables, figures, and text of this document. It should be noted that some of the State reports on which this document is based were submitted in draft form and may contain additional information in their final form. The State reports for the most part reflect field data collected in 1984 and 1985 and were written before the passage of the Water Quality Act of 1987. Where appropriate, this document supplements State-reported information with EPA data, especially in discussing programmatic issues.

Section 305(b) of the Clean Water Act requires each State to submit a biennial report to the EPA describing the quality of its navigable waters. This report is to include the following: an analysis of the extent to which the State's waters support fish, shellfish, and wildlife populations and allow water-based recreation; an analysis of the extent to which pollution control actions have achieved this level of water quality, and recommendations for needed additional actions; an estimate of the environmental impacts, economic and social costs and benefits, and date of achieving this level of water quality; and a description of the nature and extent of nonpoint sources of pollution and recommendations for their control. The EPA is required to transmit the State reports to Congress, along with an analysis of these reports describing the quality of the Nation's water. Although EPA has analyzed and summarized the State water quality information, the views and recommendations presented here are generally those of individual States, not of EPA or the Administration.

Over the past four years, EPA and the States have worked together to improve and standardize their reporting methods for this Section 305(b) process. Through cooperative projects with the Association of State and Interstate Water Pollution Control Administrators, the States and EPA have selected a number of common measures to describe water quality. Many States were able to use these measures in their reports. It should be noted that in some cases the States may be reporting the best professional judgement of water quality analysts, and not necessarily quantifiable monitoring data.

In addition to serving as major sources of water quality information, the State Section 305(b) reports are proving valuable in directing and supporting State and Federal water quality management and planning activities. The States and EPA will use the 305(b) process as a primary vehicle for the reporting of a variety of new water quality and programmatic measures required by the Water Quality Act of 1987. Continuing efforts are therefore being made to improve the quality of these reports, and hence their usefulness both as water quality assessments and as management tools.

Steve Delaney

Executive Summary

The message presented by the States in their 1986 Section 305(b) reports is clear: since the enactment of the 1972 Clean Water Act, the Nation has made significant progress in cleaning up water pollution. It is equally clear, however, that some persistent pollution problems remain.

To What Extent Do the Nation's Surface Waters Support Beneficial Uses?

According to the 1986 State Section 305(b) reports, approximately one-fifth of the Nation's rivers and streams, one-third of its lakes, and one-half of its estuarine waters were assessed for attainment of water quality standards (termed designated use support). There are many reasons why such relatively small percentages of the Nation's waters were assessed: not all States provided information on designated use support; monitoring, assessment, and reporting strategies vary among those States that did provide information; and States tend to focus their monitoring resources on waters most likely to be affected by pollution.

In 1986, the States reported that designated beneficial uses were found to be supported in most of the waters assessed, including 74 percent of assessed river miles, 73 percent of assessed lake acres, and 75 percent of assessed estuarine and coastal waters (see Table ES-1). For rivers and streams, the 1986 results are essentially consistent with those reported in 1984. In the case of lakes and estuaries, States reported slightly lower percentages of waters supporting uses. Comparison of the 1984 and 1986 figures for these waters is confounded by an increase in the number of States providing data and an increase in the number of waters reported as assessed. The difference may also be a result of more targeted monitoring and discovery of problems, as well as actual water quality degradation.

A variety of pollutants continue to be found in the Nation's waters at levels that exceed water quality standards or other levels of concern:

- Contamination by toxic substances is a special concern in many States. Twenty-two States reported on stream miles affected by toxic substances, 16 States reported on lake acres affected by toxics, and 6 States reported on estuarine square miles affected by toxics. In these States, 8,500 stream miles, 362,000 lake acres, and 190 estuarine square miles reportedly show elevated levels of toxics. Industry is cited as the leading source of elevated levels of toxics in the Nation's waters. (p.71)

- Metals and PCBs are the most widely reported toxic pollutants. Of the pesticides, chlordane is most often cited, although DDT still appears to be a significant concern in many States. (p.72)

- Fecal coliform bacteria was cited most frequently as a pollutant of concern. Other commonly reported pollutants are nutrients, turbidity/suspended solids, biochemical oxygen demand/dissolved oxygen, metals, and other toxics. (p.14)

- The most often cited water quality problem in the Nation's lakes is cultural eutrophication, the over-enrichment of waterbodies due to man-induced causes. In the 23 States reporting, 45 percent of assessed lakes were classified as eutrophic. (p.32)

Table ES-1. Degree of Designated Use Support in the Nation's Waters*

	Rivers (miles)	Lakes (acres)	Estuaries (square miles)
Total in U.S.**	1,800,000	39,400,000	32,000
Assessed (% of Total)	370,544 (21%)	12,531,846 (32%)	17,606 (55%)
Fully Supporting (% of Assessed)	274,537 (74%)	9,202,752 (73%)	13,154 (75%)
Partially Supporting Uses (% of Assessed)	70,916 (19%)	2,181,331 (17%)	3,224 (18%)
Not Supporting Uses (% of Assessed)	22,974 (6%)	859,080 (7%)	1,177 (7%)
Unknown (% of Assessed)	2,127 (1%)	288,684 (2%)	51 (0.3%)

*Based on 1986 Section 305(b) data as follows: for rivers, 42 States and territories reported; for lakes, 37 States reported; for estuaries, 20 States reported.

**Total waters based on State-reported information in *America's Clean Water: The States' Nonpoint Source Assessment*, ASIWPCA, 1985. Total U.S. estuarine square miles excludes Alaska.

What Are the Sources of Pollution in Those Waters That Fail to Support Uses?

The States were asked to rank the sources of pollution affecting those waters where uses are not fully supported. Nonpoint sources (such as runoff from agricultural areas) are reported as the leading cause of failure to support uses in the Nation's lakes, streams, and estuaries. Seventy-six percent of impaired lake acres, 65 percent of impaired stream miles, and 45 percent of impaired estuarine square miles are affected by nonpoint sources. Point sources (such as municipal and industrial discharges that enter the aquatic environment from a pipe) contribute more to use impairment in estuaries and streams than in lakes. Of assessed waters with impaired designated uses, point sources are reported to affect 34 percent of estuarine square miles, 27 percent of stream miles, and 9 percent of lake acres.

Nonpoint sources appear to be increasingly important causes of use impairment, as reported by the States. Intensified nonpoint data collection efforts are certainly a factor in explaining the dominance of nonpoint sources. Another explanation may be that nonpoint source impacts are becoming more and more evident as point sources come increasingly under control.

What Is the Condition of the Nation's Ground Water?

Ground water is a vital natural resource used for a variety of purposes, including industrial operations, agricultural activities, and domestic needs. More than half of the Nation's population depends on ground water for its supply of drinking water. The reports indicate that States are becoming increasingly aware that ground-water resources are extremely vulnerable to contamination and can be seriously harmed. Protection of ground water is getting increased attention from the States through the development of ground-water protection strategies as well as new and expanded programs in ground-water classification, wellhead protection, and control of pollutant sources.

The States have expanded and improved ground-water reporting since the 1984 *National Water Quality Inventory.* In 1986, the States were requested to cite their major sources of ground-water contamination and rank the top four sources. Ground-water contaminants associated with these sources were also to be identified. All but four States and territories provided some information on ground-water contamination and pollutants of concern in their 1986 Section 305(b) reports.

- The most frequently cited sources of ground-water contamination are underground storage tanks, septic systems, and agricultural activities. (p.60)

- More than half the States and territories also cite four other major sources of contamination. These are on-site industrial landfills, surface impoundments, municipal landfills, and abandoned waste sites. (p.60)

- The three most commonly cited contaminants affecting the Nation's ground water—sewage, nitrates, and synthetic organic chemicals—can be clearly associated with the three primary sources of pollution. Sewage, nitrates, and synthetic organic compounds are commonly associated with septic systems; nitrates are also a common product of agricultural activities; and synthetic organic compounds can be linked to leaking underground storage tanks. (p.61)

- A significant increase in State ground-water protection activities is reported in the 1986 State submittals. These activities fall into four distinct categories: ground-water mapping and resource assessment; ground-water monitoring; policy and strategy development; and source control programs. (p.62)

EPA and the States work together under the Clean Water Act, the Safe Drinking Water Act, the Resource Conservation and Recovery Act, and other Federal statutes that address ground-water contamination. In 1986, Congress amended the Safe Drinking Water Act to strengthen Federal and State ground-water protection efforts. Recent EPA actions include: developing rules and guidance for the States' use in designing and implementing two new grant programs to protect sole source aquifers and wellhead areas; initiating a grant program to regulate all underground storage of petroleum products and hazardous substances; and developing and conducting a survey of pesticide residues in public water supply and domestic drinking water wells throughout the U.S.

In 1985, 1986, and 1987, Congress made Federal funds available to the States under the Clean Water Act for the development of ground-water protection strategies. With this and other funding available under other Federal statutes, the States have made significant new strides toward developing and implementing a variety of ground-water management activities.

What Issues Are of Special Concern to the States?

The States were asked to identify issues that are of special concern, either because they are current water quality problems or because they are expected to become problems in the near future. Thirty-eight States reported on their special concerns; a number of the more commonly reported issues are national in scope. For example:

Ground-water protection was cited as a special concern in 20 States. (p.69)

Toxic substances and toxics control issues are cited as a concern by 16 States. Problems with toxics contamination of fish tissue and sediments are especially significant. Twenty-seven States reported finding detectable levels of toxics in some samples of fish tissue; 23 reported concentrations exceeding FDA action levels. Two hundred and eighty six fishing advisories were reported by 24 States, and 15 States reported 108 fishing bans in selected waterways. PCBs, mercury, and chlordane were the pollutants most often cited as responsible for bans or advisories. These findings probably underestimate the problem, since accounting may be incomplete in some States and since about half of the States did not report at all on bans and advisories. Increases in the total number of bans and advisories reported since 1984 are more probably the result of increasingly comprehensive reporting than actual water quality changes. (p.70)

Steve Delaney

Debris along a streambank.

Nonpoint sources are reported as a special concern by 16 States. Agricultural runoff is by far the most commonly reported nonpoint source, followed by urban, construction, and mining runoff. Sediment/turbidity and nutrients are the most prevalent pollutants linked directly to nonpoint sources. (p.80)

Wetland loss is reported as a concern by 12 States. Once considered as wastelands, over 50 percent of the wetlands in the lower 48 States have been converted to other uses such as agriculture over the past 200 years. These losses are continuing at a rapid rate. (p.83)

Funding needs are listed as a special concern by 11 States. The program most commonly cited as vulnerable to funding shortfalls is the construction and upgrading of municipal sewage treatment plants. Ten States also cited proper operation and maintenance of existing sewage treatment plants as a concern. (p.90)

Acid deposition is cited as a special concern by 13 States, although in many cases the effects and extent of acid deposition remain uncertain and unquantified. (p.96)

Abandoned mines and acid mine drainage contribute a variety of problems to the Nation's waters, and are reported as a special concern in nine States. (p.100)

Are the Nation's Water Pollution Control Programs Working?

The Clean Water Act provides a baseline for the way EPA and the States regulate point and nonpoint sources of pollution. Some States and local governments have enacted statutes that provide additional pollution control. Point sources are regulated through permits—issued either by EPA or the States—that contain limits on the amount of pollutants that may be discharged to U.S. waters. Nonpoint sources are most often controlled by best management practices (BMPs). These are practices designed to reduce the rate and impacts of pollution-laden water runoff, and include such activities as conservation tillage, replanting eroding surfaces, and building detention basins. BMPs may be imposed through regulatory or voluntary programs, and are generally developed and applied on a site-specific basis.

Paul Conklin, USDA

Runoff from farmland is the most commonly reported nonpoint source.

Progress in reducing the impacts of point sources to the Nation's waters has been well documented. Many rivers once heavily degraded by municipal and industrial discharges have been returned to health by the construction of improved treatment facilities, and loadings of key conventional pollutants have declined as levels of sewage treatment have improved. Similarly, some nonpoint source control programs have had site-specific successes, and the relative effectiveness of various BMPs has been demonstrated.

Despite this progress, however, the States report mixed signs in many areas. Although the construction grant authorization remains at $2.4 billion until FY 1992, some States feel that declining resources could be a problem that will slow sewage treatment plant construction, upgrading, and, most importantly, maintenance. Our knowledge of many problems such as toxics, ground-water contamination, and acid deposition is still limited. Nonpoint sources, by their very nature, are difficult to identify; they are even harder to control because of fragmented State and Federal responsibilities and the reliance on voluntary pollution mitigation in most States.

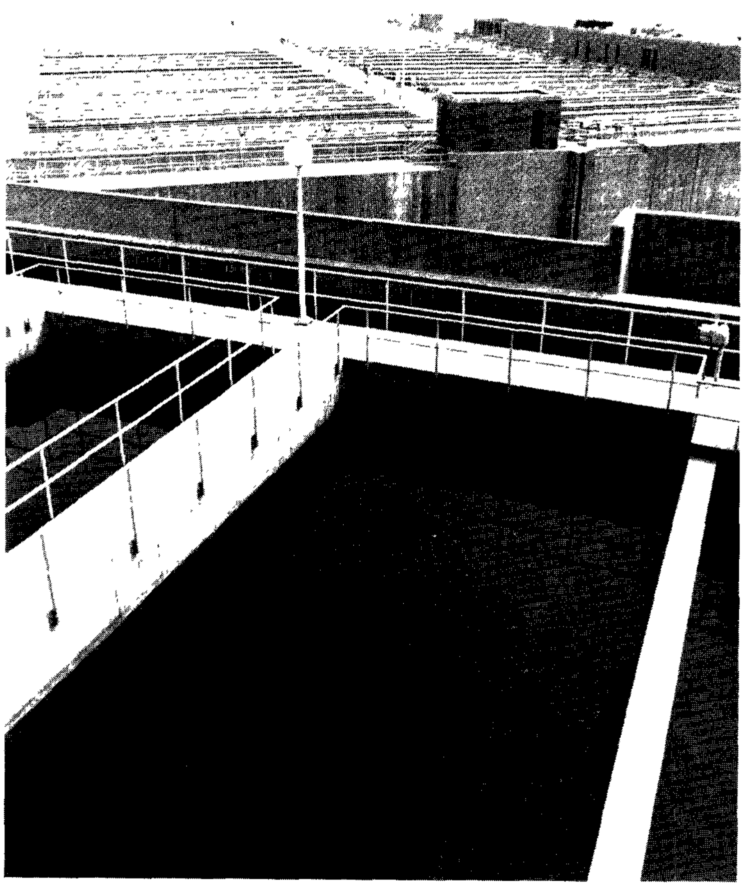
A variety of new control initiatives have been under development to deal with difficult point and nonpoint source problems, as follows:

- Regulations for each of the major use and disposal options for sewage sludge are being developed by EPA to compensate for a current lack of protective control requirements.

- EPA is revising the Ocean Dumping Regulation to take into account the availability and impacts of land-based alternatives to the disposal of sludge and dredge spoil at designated ocean sites.

- Implementation of programs to pretreat industrial discharges to municipal treatment facilities is beginning in approximately 1,500 municipal plants.

- In 1986, EPA issued a nonpoint source strategy that emphasizes: identifying innovative and effective approaches to nonpoint source management for the States and disseminating them through technology transfer; integrating efforts under the strategy and EPA's Near Coastal Waters Strategic Plan; identifying waters not meeting designated uses due to nonpoint source pollution; leveraging the resources and programs of other Federal agencies; and ensuring that necessary controls are installed on Federal lands.



Steve Delaney

Settling basins such as these are used at various stages of the sewage treatment process.

Under the Clean Water Act revisions of 1987, new EPA and State responsibilities are evolving in many areas of point and nonpoint source control. Learning to manage these new responsibilities and effectively measure progress under the more mature programs established in 1972 and 1977 is a basic challenge of coming years.

What Program Actions Do the States Recommend to Further Improve Water Quality?

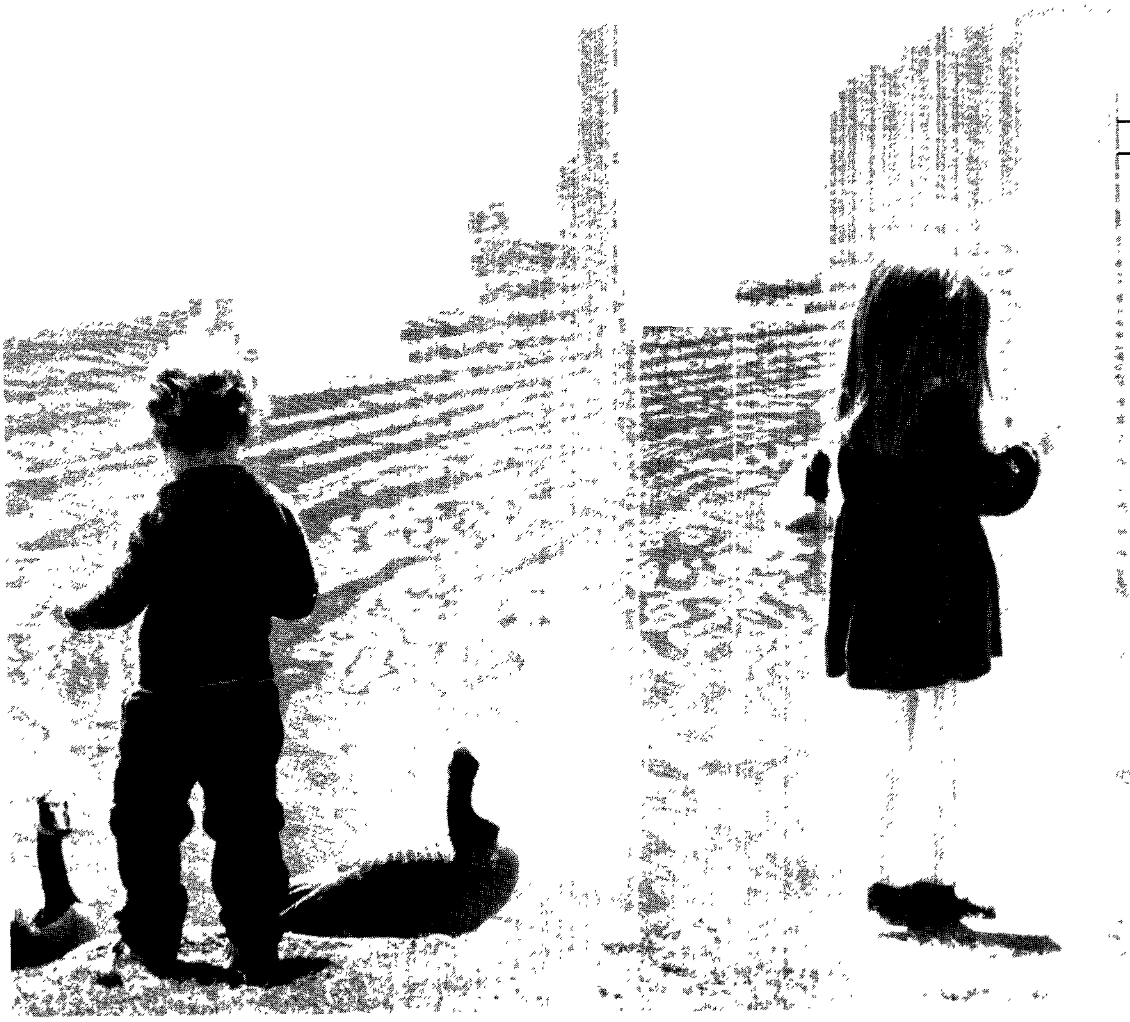
Twenty-nine States and territories provide recommendations for program actions that will allow further progress toward the Clean Water Act's goal of "fishable and swimmable" waters. These recommendations are often expressed by the States in terms of objectives or continuing needs, and cover a range of congressional, EPA, State, and local actions.

Major recommendations include securing sufficient resources at the Federal and State levels to continue the upgrading and construction of sewage treatment facilities; identifying, monitoring, and protecting the Nation's ground-water resources; and developing comprehensive management strategies for the control of nonpoint sources.

Other recommendations commonly cited by the States in 1986 include developing additional criteria for toxic pollutant concentrations in fish, sediment, and water; expanding monitoring and identification of toxics problems; increasing State monitoring capabilities in light of funding constraints; developing methods to fund operation and maintenance programs for existing sewage treatment facilities; managing pretreatment programs; and strengthening permitting and compliance activities. (p.138)

Fishing on a Mississippi bayou. It is the goal of the Clean Water Act that all of the Nation's waters be fishable and swimmable.

Steve Delaney


Steve Delaney

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Introduction

The value of the Nation's water resources is immense. Our surface waters are intensely used for a wide variety of purposes, ranging from public water supply and fisheries habitat to navigation. Our ground waters are the primary source of drinking water for more than half of the Nation's population and a vital source of irrigation water for the agricultural lands of the arid West.

The Federal Water Pollution Control Act (commonly known as the Clean Water Act) has been the primary regulatory force protecting these water resources, although a number of other statutes—for example, the Safe Drinking Water Act, the Marine and Estuarine Protection Act, and the Resource Conservation and Recovery Act—also directly address water quality issues. The objective of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." An interim goal established to achieve this objective is that "wherever attainable...water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983."

In response to the Act, in the early 1970s the Federal government and the States developed new water pollution control programs and strengthened existing efforts to deal with the myriad sources adversely affecting water quality. The problems were daunting: industries and municipalities were discharging poorly treated or raw wastes into rivers, lakes, and estuaries; the disposal of hazardous materials in landfills and dumpsites occurred without regulation or control; the use of pesticides such as DDT was virtually unrestricted despite growing concerns about environmental persistence and harmful effects to organisms other than those targeted; and little or no consideration was given to methods to control surface runoff of pesticides, fertilizers, and sediments.

Significant progress has been achieved in addressing these problems; however, significant obstacles still remain. In the chapters that follow, these successes, problems, and directions for the future will be discussed.

Methodology

Section 305(b) of the Clean Water Act requires States to report to EPA on the extent to which their waters are meeting the goal of the Act, and to recommend how the goal may be achieved. EPA, in turn, is to analyze these reports and transmit them and this national report to Congress.

There are a number of variables involved in defining water quality, collecting monitoring data, and compiling and reporting on that information. EPA seeks to establish consistency among these variables by preparing guidelines for States' use in reporting water quality information. These guidelines promote the use of a consistent measure of water quality based on the degree to which a water is in compliance with the applicable State water quality standards. State water quality standards consist of the water quality objective, expressed as the "beneficial use," and numeric and narrative "criteria" designed to ensure maintenance of the beneficial use. EPA's 305(b) guidelines require that States report on water quality in terms of the degree that beneficial uses are supported. Degree of use support is divided into three categories, as follows: fully supporting, partially supporting, and not supporting. Limited criteria for defining these categories have been developed but there is considerable State discretion in determining exactly how decisions about the degree of use support are made. Thus, the data reported by the States should be considered to represent State judgements about water quality.

The 305(b) Guidelines also request information on the specific problems and sources causing poor water quality. Ideally, the State assessments contain two types of water quality information: waterbody-specific and summary. This dual approach allows the State reports to serve various functions. The identification of specific problem areas and pollutants increases the utility of the reports in determining State management needs and pollution control priorities; summary data permit a "big picture" of State and national water quality to be drawn. In general, it is the State summary data that have been extracted and analyzed for this 1986 *National Water Quality Inventory*. In future 305(b) reporting cycles, considerably more emphasis will be placed on waterbody-specific information that will be managed using a computerized data system.

Some of the major data elements that were used in this report include:

- total number of assessed waters (in river miles, lake acres, estuarine square miles) per State fully, partially, or not supporting their designated uses;
- sources of pollution in those waters not fully supporting their uses, reported as statewide "percent contribution";
- major parameters of statewide concern;
- number of waters adversely affected by toxic pollutants; and
- trophic status of lakes.

James Plafkin

Electrofishing device used in fish sampling.

Guidelines for preparing the 305(b) reports have been issued biennially by EPA since the 1982 reporting cycle. Since 1984, the major aspects of these guidelines were developed jointly by EPA and the Association of State and Interstate Water Pollution Control Administrators to increase consistency and effectiveness of reporting. However, problems still remain: although many States have provided most or all of the summary data requested in the guidance, others have failed to do so. For example, out of the 56 States and jurisdictions that submitted water quality assessments in 1986:

- 42 provided information that could be used to derive the overall degree of designated use support for 370,544 stream miles, 21 percent of the Nation's total;

- 37 provided information on designated use support for 12,531,846 acres of lakes and reservoirs, 32 percent of the Nation's total;

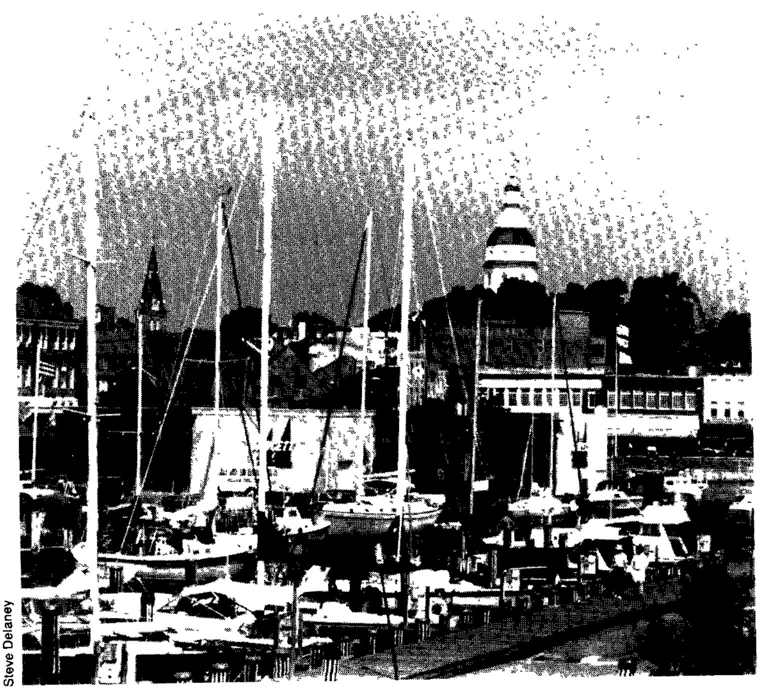
- 20 provided information on designated use support for 17,600 square miles of estuaries, 55 percent of the Nation's total;

- 41 reported on sources of pollution in rivers not fully supporting uses; 31 reported on sources in lakes not fully supporting uses; and 16 reported on sources in estuaries not fully supporting their designated uses;

- 22 provided data on the total number of river miles affected by toxics; 16 reported on the number of lake acres affected by toxics; 6 reported on the number of estuarine square miles affected by toxics; and

- 23 States provided data on the trophic status of lakes.

The failure of some States to provide this information limits EPA's ability to analyze the data over time and creates gaps in our understanding of water quality conditions nationwide. An equal obstacle arises because of inconsistencies between States in how these data were generated. These inconsistencies are themselves the result of different State capabilities, outlooks, and needs, as well as lack of explicit direction from EPA. Inconsistencies result, for example, from the following issues: How far back should a State go to find data on waters that have not been recently assessed? What sorts of assessment activities provide a reasonable baseline for evaluating waters for which no quantitative chemical or biological data exist? If available funding decreases, should States concentrate resources on monitoring previously unassessed waters that are presumed to be of good quality, or focus their attention on known problem areas? What definitions determine if waterways are classified as fully, partially, or not supporting their designated uses? These are a few of the questions EPA and the States are seeking to resolve before the next cycle of 305(b) report preparation.


Steve Delaney

Marina at Annapolis, Maryland.

To an extent, the continuing effort to improve and better manage water quality data is succeeding: despite incomplete reporting, in 1986 the States provided more data on many topics of concern than in previous years. Current State and EPA initiatives to further improve water monitoring and reporting include developing a computerized system to manage information on the condition, trends, pollution sources, and control actions for individual waterbodies and developing more cost-effective monitoring techniques. EPA is also beginning to implement a wide range of projects to develop more effective monitoring and to improve the use of available information.

James Platkin

Measuring a channel transect for a stream flow calculation.

Bruce Zander

2

Surface Water Quality

Introduction

Pollutants in our waterways may impair or destroy aquatic life, threaten human health, or simply foul the water such that recreational and aesthetic potential is lost. What are the most common pollutant categories and what are their effects? Table 2-1 briefly depicts this information.

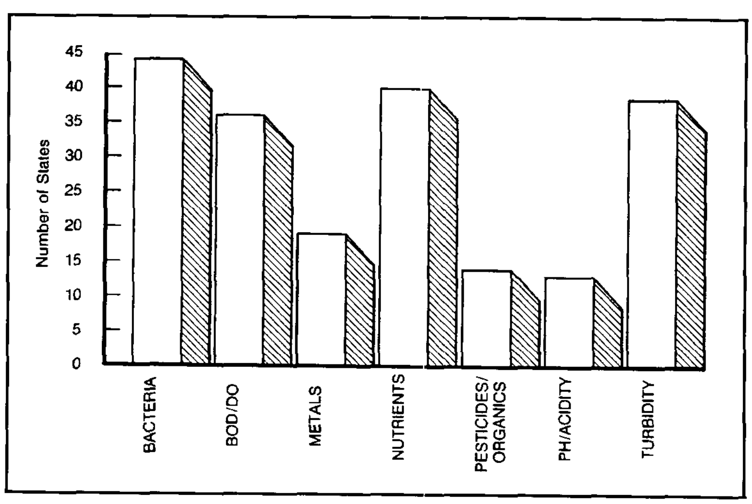
In their 1986 Section 305(b) assessments, the States reported on their most widely found parameters of concern Figure 2-1 depicts these findings for the Nation as a whole. The most widely reported parameter or category of concern is fecal coliform bacteria, followed by nutrients, turbidity/suspended solids, and dissolved oxygen/biochemical oxygen demand. Metals and other toxics also figure highly among the most commonly reported parameters.

All of the most widespread parameters can enter waterways from a variety of sources. Point sources are those that discharge into the water via a discrete "point" such as a pipe or ditch. Nonpoint sources, on the other hand, are diffused over a wide area and cannot be traced to any one point. Table 2-2 illustrates examples of point and nonpoint sources, and shows which pollutants they most commonly contribute.

Table 2-1. Common Categories and Effects of Aquatic Pollutants

Pollutant	Effect
Fecal Coliform Bacteria:	Used as indicators of the presence of disease-causing organisms.
Nutrients:	Stimulate the growth of aquatic plants; can result in altered aquatic communities, fish kills, excess weed growth, unpleasant odors and tastes, and impaired recreational uses.
Siltation/Suspended Solids:	Modify aquatic community through habitat alteration. Impair fish respiration, reduce plant productivity; aesthetic impacts reduce recreational uses.
Biochemical Oxygen Demand:	Reflects materials that reduce the availability of dissolved oxygen, which is crucial to the respiration of fish and aquatic invertebrates.
Salinity/Total Dissolved Solids:	Impair use of water for drinking and crop irrigation and adversely affect aquatic ecosystems.
Toxics:	Can cause death, mutation, or reproductive failure in fish and wildlife and may pose carcinogenic or other health threats to humans.

Which sources of pollution are more significant? Until the last decade or so, pollution control experts might have responded automatically that point sources such as industries and sewage treatment plants were the major contributors of pollution. After all, sewage outfalls, industrial pipes, and plumes of pollution can be easily identified as responsible for poor, often drastically degraded, water quality conditions. But as pollution control efforts were initiated in the 1960s and 1970s to attack these point sources, it became evident that nonpoint sources—more difficult to track and identify—were also major causes of water quality problems.



Source: 1986 State Section 305(b) Reports

Figure 2-1. Statewide Parameters of Concern

Rivers and Streams

As we have already noted, the degree to which waters support their designated uses is the standard measure of water quality. In their 1986 Section 305(b) reports, 42 States provided this information. These States assessed 370,544 river miles—21 percent of the Nation's estimated 1.8 million miles of rivers.* Seventy-four percent of the assessed waters, or 274,537 miles, were found to fully support their designated uses; 19 percent, or 70,916 miles, were reported as partially supporting uses; and 6 percent, or 22,974 miles, were reported as not supporting uses. In less than 1 percent of assessed waters, the degree of designated use support was unknown. Table 2-3 depicts this information on a State-by-State basis.

This table illustrates some of the reporting and assessment inconsistencies that frustrate the current Section 305(b) reporting process. First, 10 States and 4 jurisdictions failed to provide usable current summary data on designated use support. Second, of those States that provided data, wide variations exist in two areas: the percent of total State waters assessed (4 States assessed less than 10 percent of their waters, while 11 States report that they assessed 100 percent of their waters), and methods of assessing use support (9 States reported that 90 percent or more of their waters fully supported uses, while 4 States found that 20 percent or less of their waters fully supported uses).

Vermont Travel Division

Early spring in Vermont: Mt. Mansfield overlooking the Waterbury Dam.

*Estimate from ASIWPCA, *America's Clean Water The States' Nonpoint Source Assessment*, 1985

Why do these monitoring and assessment strategies vary? Clearly, some States have more funds than others for these activities, just as some have more waters to deal with and some have more severe water quality problems. States heavily affected by diffuse and difficult-to-locate nonpoint sources may have to rely on other than traditional fixed station monitoring of chemical pollutants to detect problems.

On the other hand, States with high concentrations of industries and cities may find it more effective to rely on fixed monitoring stations and surveys to assess water quality. Traditionally, then, each State weighs its needs and judges how it can best use its limited monitoring resources.

The drawback of this approach is that it results in only a relatively small percentage of the Nation's waters being assessed. We assume that since States generally focus their monitoring resources on waters most likely to have problems—e.g., urban waters or those that are intensively used for recreational purposes—the remaining unassessed waters may be of better quality. EPA is encouraging increased water quality assessment in order to verify that this is true and to gain a more accurate picture of the Nation's waters as a whole. New monitoring approaches, such as rapid biosurvey techniques, are being developed to increase the number of waters assessed by the States. Chapter 5 discusses the States' current monitoring programs and recent efforts to improve them.

Throughout the remainder of this chapter, certain degraded rivers, lakes, and estuaries will be highlighted for discussion. It should be noted that these waters are not necessarily the worst in their States. They were selected for discussion simply because they illustrate the complex nature of existing pollution problems. In many cases, pollution control programs may be underway to address degraded water quality conditions.

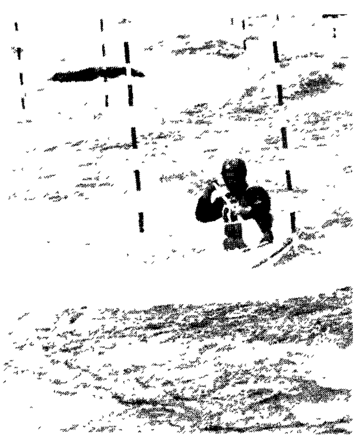
James Pfafkin

Biologist at EPA's Environmental Monitoring System laboratory in Las Vegas running a test to evaluate chronic toxicity.

How do we judge water quality conditions for reporting and assessment purposes? There are many ways to evaluate the quality of a waterbody. However, under Federal statute, States must develop water quality standards that define the "use" that the water is to provide. Pollution control programs must then strive to achieve and maintain a level of water quality that will ensure that the designated use exists. While some waterbodies may be assigned "low quality" uses such as industrial cooling or irrigation, the majority are designated for recreation and for the support of fish populations. Within these designations are subcategories of water use: primary contact, such as swimming and water skiing; secondary contact, such as boating; and cold and warm-water fisheries, which have different levels of quality requirements because of the sensitivities of the fish species they support. Water for drinking, with or without treatment, is yet another designated use. Most waterbodies have more than one designated use and should be clean enough to support all of their uses.

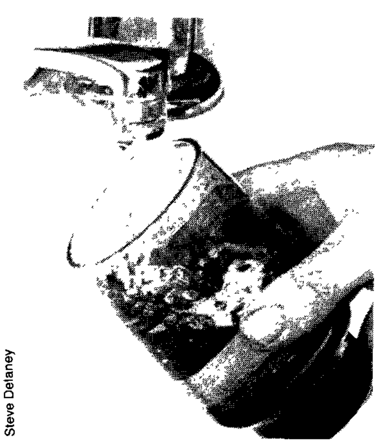
The standard measure for evaluating water quality is the degree to which the designated uses are supported in a given waterbody. Determining the degree of use support involves a considerable amount of judgement, particularly for the aquatic life uses. It also involves going beyond examination of the specific criteria contained in State water quality standards. Such criteria are designed to support the use but are often incomplete compared to the range of potential pollutants and phenomena that adversely affect water quality and, ultimately, the degree of use support.

In the sections that follow, the degree of designated use support and causes of impairments will be discussed for rivers and streams, lakes, and estuaries. These results should be interpreted with caution because of inconsistencies in State reporting and incomplete monitoring. Designated use support numbers reflect different State assessment and reporting methodologies. For instance, some States reported only on monitoring activities conducted within the two-year Section 305(b) reporting period, while others include all waters for which information is available. Some States reported on a very high percentage of their waters, relying on best professional judgement and computer modeling to supplement actual chemical, biological, and physical monitoring data. Other States reported on only a small percentage of their total stream miles because they preferred to rely almost exclusively on actual monitoring data. In addition, there are basic inconsistencies involving how support of designated uses is determined: variability exists between States in defining the characteristics a waterbody must have to be fully, partially, or not supporting its use.



Bruce Zander

Steve Delaney



Steve Delaney

The Nation's waters have many uses.

Table 2-2. Sources and Pollutants

Sources	Common Pollutant Categories
Point Sources	
Municipal sewage treatment plants	BOD; bacteria; nutrients; ammonia; toxics
Industrial facilities	Toxics; BOD
Combined sewer overflows	BOD; bacteria; nutrients; turbidity; total dissolved solids; ammonia; toxics; bacteria
Nonpoint Sources	
Agricultural runoff	Nutrients; turbidity; total dissolved solids; toxics; bacteria
Urban runoff	Turbidity; bacteria; nutrients; total dissolved solids; toxics
Construction runoff	Turbidity; nutrients; toxics
Mining runoff	Turbidity; acids; toxics; total dissolved solids
Septic systems	Bacteria; nutrients
Landfills/spills	Toxics; miscellaneous substances
Silvicultural runoff	Nutrients; turbidity; toxics

Although States and Federal agencies monitor for many parameters of both point and nonpoint origin, the traditional monitoring effort has centered on non-toxics. This has occurred for a number of reasons: because the earliest monitoring efforts began before toxics were understood or considered a threat; because toxics are more difficult and expensive to sample for; and because there are not many toxics standards available against which to judge the results of sampling efforts.

This reliance on the monitoring of non-toxic pollutants to judge water quality is changing, but toxics sampling efforts are still limited in many States. Thus, many of the monitoring results discussed in this document may underestimate the prevalence of toxic substances and may reflect the results of control efforts that have traditionally focused on non-toxics. Toxic concerns and programs will be discussed in more detail in Chapters 4 and 5.

Table 2-3. Designated Use Support in Rivers and Streams

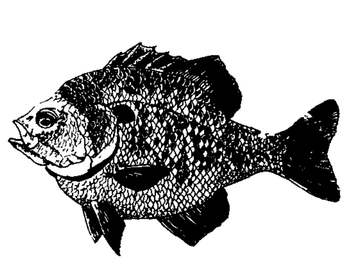
State	Total River Miles	River Miles Assessed	Miles Fully Supporting	Miles Partly Supporting	Miles Not Supporting	Assessed Miles Unknown
Alaska	365,000	5,025	2,662	2,363	0	0
Alabama	40,600	12,101	10,835	804	462	0
Arkansas	11,438	11,438	5,914	5,524	0	0
Arizona	17,537	1,412	615	391	406	0
California	26,959	9,627	6,163	1,518	335	1,611
Connecticut	8,400	880	597	232	51	0
Delaware	579	516	309	184	23	0
District of Columbia	40	40	7	18	10	5
Florida	9,320	6,575	4,448	1,670	457	0
Georgia	20,000	17,000	16,185	458	357	0
Idaho	7,310	7,310	6,046	572	692	0
Illinois	14,080	3,395	1,861	1,457	77	0
Iowa	18,000	4,365	72	3,077	1,216	0
Kansas	20,600	4,495	3,512	359	435	188
Kentucky	40,000	5,683	3,130	1,877	675	1
Louisiana	14,180	2,500	1,240	800	460	0
Maine	31,672	31,672	30,695	513	464	0
Maryland	9,300	7,440	6,852	449	139	0
Massachusetts	10,704	1,676	802	572	302	0
Michigan	36,350	36,350	35,696	0	497	157
Mississippi	10,274	10,274	9,260	1,014	0	0
Missouri	20,536	20,536	10,390	10,075	71	0
Montana	20,532	19,505	12,184	6,934	387	0
Nebraska	24,000	4,794	2,717	1,135	942	0
New Hampshire	14,544	1,320	981	259	80	0
New Jersey	6,450	780	225	465	90	0
New Mexico	3,500	3,500	3,140	360	0	0
New York	70,000	3,400	2,667	246	487	0
North Carolina	37,359	37,359	25,156	10,171	1,867	165
Ohio	43,900	6,628	4,048	1,977	603	0
Oregon	90,000	11,855	9,665	1,915	275	0
Pennsylvania	50,000	6,225	3,332	1,242	1,651	0
Rhode Island	724	724	655	34	35	0
South Carolina	9,679	2,442	2,127	194	121	0
South Dakota	9,937	3,987	1,865	1,130	992	0
Tennessee	19,124	5,748	3,794	1,118	847	0
Texas	80,000	15,942	14,966	0	976	0
Vermont	4,863	1,167	882	269	16	0
Virginia	27,240	4,716	948	1,536	2,232	0
West Virginia	22,819	18,244	10,225	6,631	1,388	0
Wyoming	19,655	19,655	17,386	297	1,972	0
Puerto Rico	3,469	2,243	283	1,076	884	0
Total	1,290,674	370,544	274,537	70,916	22,974	2,127

Note: *Reporting from 14 States and territories* (Colorado, Hawaii, Indiana, Minnesota, Nevada, North Dakota, Oklahoma, Utah, Washington, Wisconsin, Virgin Islands, Guam, Northern Mariana Islands, and American Samoa) did not allow determination of overall use support

Source 1986 State Section 305(b) Reports

The States were asked to assess the relative importance of the various sources of pollution in causing use impairments. Ideally, for those waters not fully supporting (i.e., waters found to be partially or not supporting) their designated uses, the States were to determine the number of miles with impacts due to nonpoint, municipal, industrial, combined sewer overflow, natural, and other sources, then combine these to arrive at estimates of the relative percentage of State waters affected by each source. Weighted national averages were then calculated, with weighting based on the number of river miles per State partially and not supporting uses, as reported in Table 2-3.

Of the 41 States that provided information on sources of pollution, 3 States and 1 territory did not provide statewide data on miles not fully supporting uses and were not included in the calculation. Among the remaining 37 States, nonpoint sources are reported as the predominant sources, affecting 65 percent of assessed river miles where designated uses are impaired. Point sources affect 27 percent of the impaired waters, with the predominant sources breaking out as follows: municipal sources affect 17 percent, industrial sources affect 9 percent, and combined sewer overflows affect 1 percent. Natural sources are cited as the cause of use impairment in 6 percent of impaired river miles, and either "other" or unknown causes are responsible for impairing uses in the remaining 2 percent. Table 2-4 and Figure 2-2 depict these results.



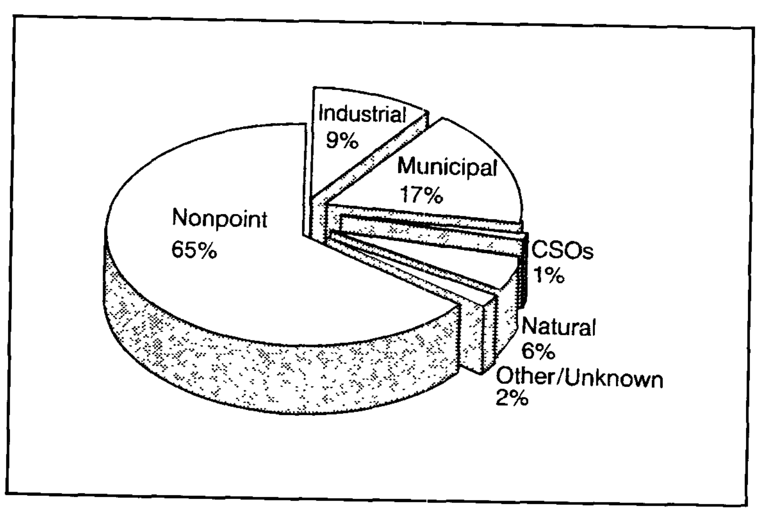
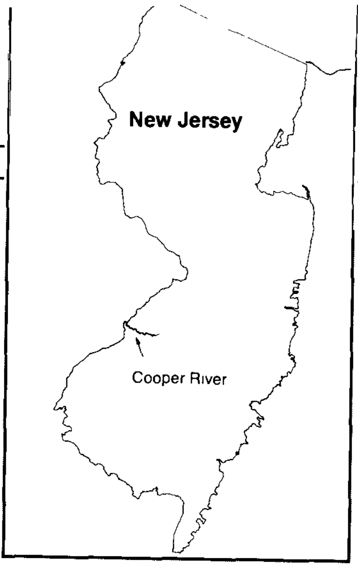


Figure 2-2. Causes of Nonsupport in Rivers and Streams

Table 2-4. Relative Impact of Pollution Sources in Rivers and Streams with Impaired Uses (in percent)

State	Industrial	Municipal	Combined Sewers	Nonpoint Sources	Natural	Other/ Unknown
Alaska	85	1	0	12	0	2
Arizona	26	10	0	20	0	44
California	0	16	0	64	0	20
Connecticut	0	40	20	9	0	31
Delaware	8	6	8	59	19	0
Florida	25	29	0	40	2	4
Georgia	1	95	0	4	0	0
Idaho	2	3	0	78	17	0
Indiana	2	56	30	10	0	2
Iowa	0	3	0	97	0	0
Kansas	7	36	0	25	28	4
Kentucky	26	20	0	54	0	0
Louisiana	7	26	0	46	17	4
Maine	0	100	0	0	0	0
Maryland	5	30	0	50	15	0
Massachusetts	6	26	16	26	14	12
Minnesota	0	42	0	51	0	7
Mississippi	5	23	0	72	0	0
Missouri	0	1	0	99	0	0
Montana	2	3	0	95	0	0
Nebraska	1	7	0	92	0	0
New Hampshire	12	64	6	18	0	0
New Jersey	25	35	0	35	0	5
New Mexico	1	5	0	81	2	11
New York	20	40	13	11	0	16
North Carolina	12	17	0	71	0	0
Ohio	16	36	11	30	0	7
Oregon	3	10	0	57	30	0
Pennsylvania	7	13	1	71	3	5
Rhode Island	42	24	0	19	0	15
South Carolina	12	60	0	26	0	2
South Dakota	4	9	0	34	49	4
Tennessee	5	8	0	76	0	11
Texas	4	71	0	14	11	0
Vermont	11	22	0	50	11	6
Virginia	4	34	1	51	10	0
West Virginia	4	26	0	64	6	0
Wisconsin	1	1	0	98	0	0
Wyoming	10	4	0	43	43	0
Puerto Rico	11	21	0	63	0	5
Guam	5	10	15	50	20	0
Average (weighted)	9	17	1	65	6	2

Source: 1986 State Section 305(b) Reports.



The Cooper River

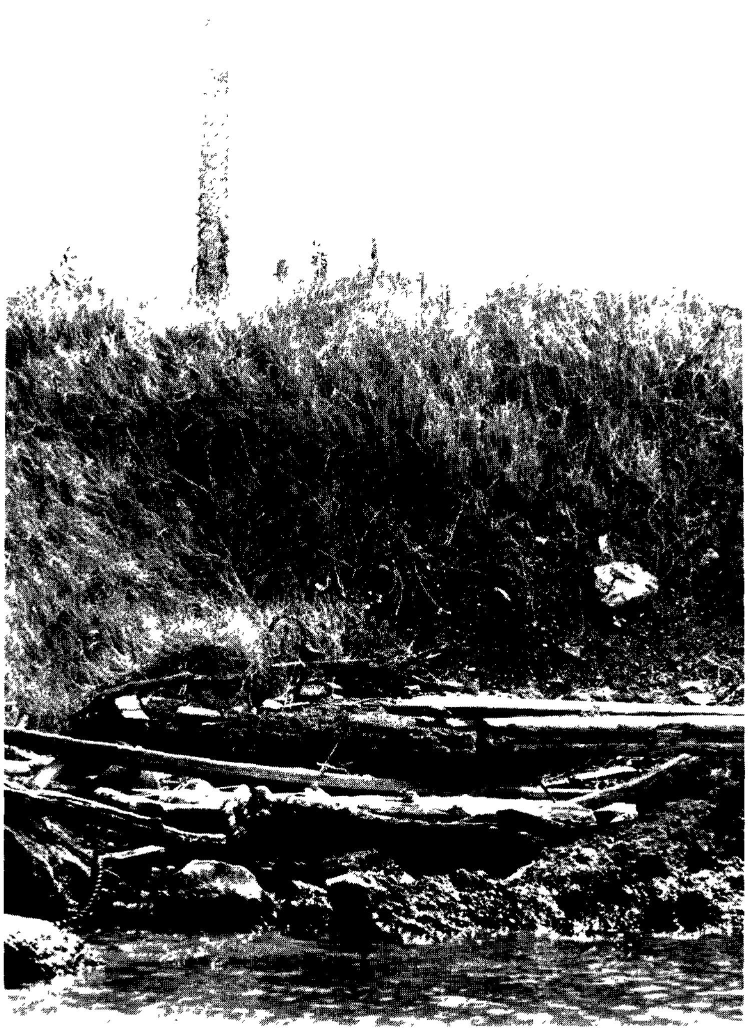
New Jersey's Cooper River is a highly degraded stream receiving significant amounts of sewage treatment effluent. Monitoring reveals that the river is of generally good quality in its upper reaches, but rapidly worsens to some of the poorest quality water in the State as it flows through Camden and adjoining towns. In addition, pesticides contamination in stream sediments and fish have led to a recreational fishing ban for the lower Cooper River.

The water quality problems of the Cooper River are the result of excessive municipal and industrial discharges, combined with the effects of urban stormwater runoff and the stream's limited assimilative capacity. The Camden County regional sewage system will eventually eliminate most of the discharges to the Cooper River, but the river will continue to suffer from runoff and benthic oxygen demands. One national Superfund hazardous waste site, the Cooper Road Dump in Voorhees Township, is located in this watershed.

At its headwaters, the Cooper River is of generally good quality, with moderate amounts of nutrients and low summertime dissolved oxygen concentrations. Fecal coliform counts are low. However, by the time the Cooper River reaches the city of Lawnside it has received wastewaters from a number of municipal treatment facilities. Water quality degradation occurs due to extremely high amounts of nutrients and fecal coliform bacteria in violation of State criteria. Because of high biochemical oxygen demand in the stream, dissolved oxygen is frequently below its criterion level. Un-ionized ammonia concentrations are at times above the criterion for protection of warmwater fisheries.

Downstream at Haddonfield, the Cooper River improves somewhat but is still grossly polluted. Biomonitoring confirms the presence of an unhealthy stream environment dominated by pollution-tolerant organisms. Although long-term trend analysis of water quality data from the Cooper River at Haddonfield finds increased dissolved oxygen concentrations and a reduction in total mercury, these improvements must be considered minor because of gross nutrient and bacterial pollution.

These figures should not be compared to those reported in the 1984 *National Water Quality Inventory* for two major reasons. First, in 1984, national averages of the percent of use impairment caused by individual pollutant sources were calculated using an unweighted averaging technique that ranked each State equally regardless of the amount of waters impaired. This method was replaced in this report by the weighted averaging calculation noted above. Second, in 1986 these numbers appear to reflect increased reporting and a new awareness of the importance and pervasiveness of nonpoint sources. A 1985 nonpoint source assessment sponsored by the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) served to spur this awareness. State water quality personnel were urged to consult agricultural and forestry officials and to search for new sources of nonpoint data. Existing data were reevaluated, and standardized reporting methodologies encouraged the States to make definitive assessments of nonpoint source problems. Doubtless this effort, combined with a growing national interest and concern, has contributed to the change in the States' assessment of their nonpoint problems. The results of the ASIWPCA assessment and their implications will be discussed further in Chapter 4.



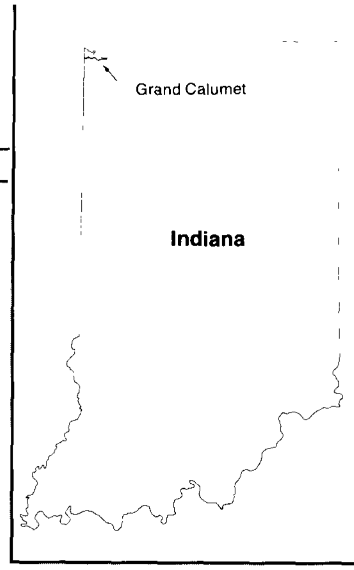
Steve Delaney

Smokestack looms over an urban stream.

Attainment of the Clean Water Act Goal

As stated at the beginning of the Clean Water Act, "It is the national goal that, wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983." Most U.S. waters are classified to reflect this bench mark, which is commonly referred to as the fishable/ swimmable goal of the Clean Water Act.

The Grand Calumet River



Indiana reports on the quality of the Grand Calumet River, which drains some of the most industrialized and populated areas in the State. The east branch of the Grand Calumet originates in Gary, just upstream from outfalls of the U.S. Steel Corporation mill. It joins the west branch and empties into Lake Michigan via the Indiana Harbor Ship Canal.

Because of the intense industrial and municipal uses to which the Grand Calumet-Indiana Harbor Ship Canal system has been put, it has been designated for industrial water supply and limited aquatic life. Its classification was revised downward in 1985 and a partial-body contact designation was dropped due to the presence of high concentrations of toxic substances in sediment.

Designated by the International Joint Committee as a Class A area of concern, the river and canal system is affected by three major sewage treatment plants at Gary, Hammond, and East Chicago; by an extensive network of combined sewer systems; by a variety of industrial dischargers including U.S. Steel, Inland Steel, J & L Steel, and DuPont; and by nonpoint sources such as parking lot runoff and vessel discharges. Standards violations are common for dissolved oxygen, chlorides, ammonia, phosphorus, and fecal coliform bacteria. Fish flesh sampling in 1982 and 1984 has revealed PCBs in excess of the Food and Drug Administration (FDA) action level.

Recent additions to the Gary sewage treatment plant have resulted in water quality improvements to the Grand Calumet River. Data from 1984 and 1985 indicate that ammonia, fecal coliform, phosphorus, and cyanide violations have declined. A gross comparison of biological observations reveals the same improving trend. Resident fish populations are evident, and some salmonids have been found to stray up the river in autumn. Macroinvertebrate communities have increased in diversity, and the bird life along the stream is abundant. These observations could be due to both better wastewater treatment and a reduction in the effluent discharged by the steel mills in recent years.

Programs have been developed by the State and EPA to address problems in the Grand Calumet River. These programs include Best Available Technology permit development, wasteload allocations, pretreatment program development, and municipal and industrial compliance actions. Longer-term evaluations of the effectiveness of existing and new control programs will also be conducted.

In their 1986 305(b) reports, 35 States and territories reported on their progress toward this goal (Table 2-5). These numbers show great disparity between States, in large part because of varying methods of assessing the ability of waters to support fishing and swimming. Some States may determine that inaccessible or physically unsuitable streams (e.g., intermittent or shallow waters) fail to support fishable and swimmable uses. Other States, faced with the same circumstances, reason that the goals are not precluded by pollution and do not count such waters as impaired under the Clean Water Act. Nevertheless, the average percentage of waters meeting the goal—based on the 25 States reporting on fishable and swimmable conditions in 224,279 assessed river miles—is 74 percent, the same as the percent of waters meeting their designated uses.

Seventeen States report that about 14,039 stream miles out of a total of 169,527 they assessed for goal attainment will never be able to attain the fishable/swimmable goal. Virtually all sources of pollution—from inactive mines and stormwater runoff to industrial and municipal dischargers—are reported by the States as causes of failure to attain the goal. An additional 15,349 miles are expected to meet the goal within the next five to ten years, if pollution control programs proceed as planned.

Recreation on the Hudson River near Bear Mountain

Table 2-5. River Miles Meeting the Fishable/Swimmable Goal of the Clean Water Act

State	No. of Miles Assessed	No. of Miles Fishable	No. of Miles Swimmable	No. of Miles Fishable and Swimmable	No. of Miles Expected Fishable/ Swimmable in 5-10 Years	No. of Miles Never Fishable/ Swimmable	No. of Miles Designated More Stringent than F/S	No. of Miles Designated Less Stringent than F/S
Alabama	12,101	6,873	—	2,984	2,144	144	929	629
Arizona	1,412	654	930	—	—	—	81	
Connecticut	880	—	—	596	127	2	289	0
Delaware	516	419	392	—	—	—	—	—
Florida	6,575	—	—	6,118	426	31	265	31
Idaho	7,310	6,422	6,650	6,105	1,032	346	4,075	345
Iowa	4,365	72	—	—	0	4,293	110	3,157*
Kansas	4,495	4,170	—	—	559	7	—	—
Kentucky	5,683	—	—	3,130	—	—	—	—
Louisiana	2,500	2,140	2,040	—	—	—	—	—
Maine	31,672	—	—	30,695	977	0	—	—
Maryland	7,440	—	—	6,852	588	0	—	—
Massachusetts	1,676	1,374	802	802	—	—	—	—
Michigan	36,350	35,960	—	—	—	—	—	—
Minnesota	1,896	1,583	688	—	—	—	—	283
Mississippi	10,274	—	—	9,260	1,009	5	48	5
Missouri	20,536	—	—	10,390	—	—	—	—
Montana	19,505	—	—	19,054	230	221	20,422	64
Nebraska	4,794	3,493	1,067**	2,717	—	—	—	—
New Hampshire	1,320	—	—	934	107	47	65	47
New Jersey	780	690	225	225	—	—	—	—
New Mexico	3,500	3,164	3,490	—	—	—	—	—
New York	3,400	—	—	2,667	733		567	225
North Carolina	37,359	—	—	25,160	5,750	6,476	6,380	0
Ohio	6,628	—	—	4,048	—	—	—	—
Oregon	11,855	—	—	8,773	—	—	—	—
Pennsylvania	6,225	—	—	3,332	—	—	—	—
Rhode Island	724	—	—	588	55	81	276	81
South Carolina	2,442	2,229	1,934	1,748	11	16	—	—
South Dakota	3,987	2,716	1,054	—	—	—	0	6,290
Tennessee	5,748	—	—	3,785	—	—	3,201	0
Texas	15,942	—	—	14,832	—	—	—	—
Vermont	1,167	1,151	855	839	—	217	72	310
Wyoming	19,655	18,549	887***	—	49	1,057	7,459	—
Puerto Rico	2,243	1,311	331	283	1,552	1,096	0	0

*Iowa — 3,157 miles are not designated for swimmable uses
**Nebraska — only 2,347 stream miles have been assigned primary contact as a use; 3,748 miles were assessed
***Wyoming — only 917 stream miles are designated for swimming in the State.

Colorado River Salinity

The Colorado River Basin covers a large area of the American West, including portions of Colorado, Utah, Arizona, New Mexico, Nevada, Wyoming, and California. Much of the basin is arid to semiarid; as a result, the limited waters of the Colorado River dominate the political, economic, and environmental fabric of the region. Major population centers and agricultural areas outside the basin are also dependent upon water diverted from the Colorado River.

The Colorado flows approximately 1,400 miles from its headwaters in the Rocky Mountains to its delta in the Gulf of California and carries an annual salt load of approximately 9 million tons. This salt adversely affects more than 18 million people and over 1 million acres of irrigated farmland in the United States. The Bureau of Reclamation has estimated that a one-mg/l increase in salinity at Imperial Dam equates to approximately $600,000 in annual future damages to water users in the Lower Basin.

Salinity in the Colorado River is the result of both natural processes and human activities. Approximately 75 percent of the land in the basin is managed by the Federal government (primarily the Bureau of Land Management and the Forest Service) and almost half the salinity in the river is attributed to diffuse and point sources on these lands. Salinity concentrations are affected through salt loading (such as irrigation return flows and land use disturbances) and salt concentration (such as diversions of high quality water and reservoir evaporation).

Salinity is recognized as the major basinwide water quality problem in the Colorado River Basin. The salinity issue is of concern to the seven basin States, three EPA Regions, the Departments of Interior and Agriculture, and the Republic of Mexico.

The Colorado River Basin Salinity Control Forum was created in 1973 by the seven basin States (California, Colorado, Arizona, Wyoming, Utah, New Mexico, and Nevada). The Forum was established to encourage interstate cooperation and to provide the States with information necessary to comply with EPA Regulation 40 CFR Part 120, which requires the setting of water quality standards for salinity in the Colorado Basin. Also central to salinity control are agreements with Mexico on Colorado River system waters entering that country.

In 1975, the Forum developed basinwide salinity standards that included numeric criteria and a plan of implementation. These standards call for maintenance of flow-weighted average salinity concentrations of 723 mg/l below Hoover Dam, 747 mg/l below Parker Dam, and 879 mg/l below Imperial Dam.

The implementation plan calls for constructing Federal salinity control measures, placing effluent limitations and monitoring requirements on industrial and municipal discharges, including salinity issues in State Water Quality Management Plans, and other appropriate State actions.

At the Federal level, salinity control requires coordination between the EPA, the U.S. Department of Agriculture, and the U.S. Department of the Interior. The legal bases for controlling salinity are the Clean Water Act and the Colorado River Basin Control Act (P.L. 93-320 as amended by P.L. 98-569). Some of the activities carried out under these authorities include construction of a desalting complex; cost-sharing and technical assistance for on-farm irrigation improvements; canal lining; and water quality management planning.

The Colorado River northeast of Moab, Utah, near the Colorado border.

Since the Forum and the U.S. government have actively worked on the salinity problem, there has not been a violation of salinity criteria at the three key locations below Hoover, Parker, and Imperial Dams on the lower main stem of the Colorado. However, projections indicate salinity levels increasing beyond numeric criteria if planned controls are not implemented. In the last five years, exceptional snowpack and high flows have flushed salt out of the major reservoirs and significantly lowered salinity levels, masking the overall salinity problem.

Despite recent progress in addressing the salinity issue in the Colorado River, complications abound. For example, western water rights—based on the "use-it-or-lose-it" premise—discourage water conservation; State adherence to Forum recommendations is not directly enforceable, although the States themselves have enforcement capabilities; and funding shortages have threatened implementation of salinity control measures and U.S. Geological Survey monitoring efforts. It is therefore clear that cooperation and commitment are a continuing need if the Forum's goal of maintaining the numeric criteria for salinity in the Colorado River is to be achieved.

Jim Crawford

Lakes and Reservoirs

In 1986, 37 States and territories reported on designated use support in their lakes and reservoirs. A total of 12,531,846 lake acres were assessed, 32 percent of the estimated 39,400,000 total lake acres in the U.S. Seventy-three percent of the assessed lake acres, or 9,202,752 acres, were found to be fully supporting their designated uses. Seventeen percent, or 2,181,331 acres, were partially supporting uses, and 7 percent, or 859,080 acres, were reported as not supporting designated uses. Degree of designated use support was unknown in the remaining 2 percent of lake acres.

The States were asked to assess designated use support separately for lakes smaller than 5,000 acres and lakes larger than 5,000 acres. Many States, however, failed to specify the size category of the lakes they assessed. An analysis of the data from the States that did separate their lake assessments by size category reveals that larger lakes may be of somewhat better quality. Sixteen States report that 72 percent of their 1.8 million acres of assessed small lakes fully supported their uses, 19 percent partially supported their uses, and 8 percent did not support designated uses. Eleven States, assessing 3 million acres of large lakes, report that 79 percent of the acres assessed supported uses, 18 percent partially supported uses, and only 3 percent failed to support designated uses (Tables 2-6, 2-7, and 2-8).

Table 2-6. Designated Use Support in Lakes of Unspecified Size Category* (in acres)

State	Total Area	Area Assessed	Supporting Uses	Partially Supporting	Not Supporting	Area Unknown
Alaska	12,787,200	27,513	14,598	12,915	0	0
Alabama	505,336	505,336	505,336	0	0	0
California	1,397,137	1,279,944	617,122	168,585	231,052	263,185
Connecticut	82,900	38,884	36,858	2,026	0	0
Florida	920,320	796,800	497,920	234,880	64,000	0
Georgia	417,730	417,730	361,391	50,961	5,378	0
Idaho	362,718	362,718	362,624	94	0	0
Illinois	242,359	25,303	1,849	11,353	12,101	0
Iowa	81,200	73,771	53,899	19,832	40	0
Louisiana	514,212	467,738	407,215	58,135	2,388	0
Mississippi	500,000	495,191	476,374	18,817	0	0
Montana	756,450	663,363	629,518	20,595	13,250	0
Nebraska	198,100	105,840	103,088	2,222	530	0
New Jersey	18,923	18,923	13,625	3,785	1,514	0
New Mexico	5,725	5,725	5,524	201	0	0
Oregon	500,000	192,000	112,700	75,200	4,100	0
South Carolina	455,000	405,555	399,895	250	5,410	0
Tennessee	538,603	538,603	431,325	89,744	17,534	0
Vermont	224,066	224,066	210,907	13,114	45	0
West Virginia	16,158	16,158	14,360	0	1,798	0
Wisconsin	971,000	969,000	200,000	503,000	266,000	0
Total	21,495,137	7,630,161	5,456,128	1,285,709	625,140	263,185

*Excludes Great Lakes

Source: 1986 State Section 305(b) Reports

Table 2-7. Designated Use Support in Lakes Under 5,000 Acres

State	Total Area	Area Assessed	Supporting Uses	Partially Supporting	Not Supporting	Area Unknown
Arizona	84,458	16,753	11,805	4,213	735	0
District of Columbia	107	107	0	107	0	0
Indiana	71,441	71,441	68,993	2,448	0	0
Kansas	49,742	40,102	23,873	6,289	423	9,517
Kentucky	376,305	22,803	10,569	11,661	573	0
Maine	573,538	573,538	548,916	24,622	0	0
Maryland	32,583	32,583	24,616	7,958	9	0
Minnesota	—	385,997	112,735	211,331	61,931	0
New Hampshire	126,912	86,207	62,103	19,574	4,530	0
New York	331,000	321,000	279,000	25,900	16,100	0
North Carolina	67,938	67,938	58,728	5,510	3,700	0
Rhode Island	16,520	16,520	15,900	530	0	90
South Dakota	1,003,987	60,929	10,581	5,089	45,259	0
Virginia	47,664	47,664	35,510	8,864	0	3,290
Wyoming	141,316	18,316	13,636	3,811	869	0
Puerto Rico	7,250	7,250	1,280	3,305	2,665	0
Total	2,930,761	1,769,148	1,278,245	341,212	136,794	12,897

Source 1986 State Section 305(b) Reports

Table 2-8. Designated Use Support in Lakes Over 5,000 Acres*

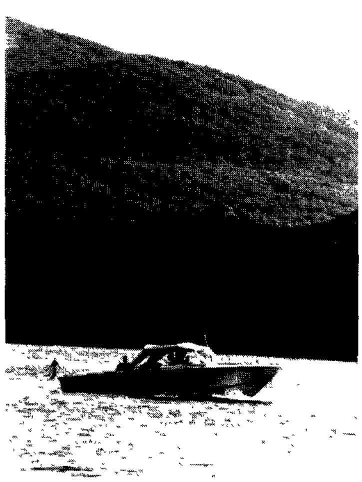
State	Total Area	Area Assessed	Supporting Uses	Partially Supporting	Not Supporting	Area Unknown
Arizona	26,312	18,058	18,058	0	0	0
Indiana	16,000	16,000	16,000	0	0	0
Kansas	118,422	118,422	81,400	24,420	0	12,602
Kentucky	—	339,600	315,914	23,686	0	0
Maine	421,022	421,022	409,479	11,543	0	0
Minnesota	—	553,932	149,771	379,161	25,000	0
New Hampshire	—	58,711	58,711	0	0	0
New York	408,000	408,000	300,600	107,400	0	0
North Carolina	252,568	252,568	252,568	0	0	0
South Dakota	594,298	594,298	562,540	0	31,758	0
Virginia	81,958	81,958	81,958	0	0	0
Wyoming	269,968	269,968	221,380	8,200	40,388	0
Total	2,188,548	3,132,537	2,468,379	554,410	97,146	12,602

*Excludes Great Lakes

Source 1986 State Section 305(b) Reports

For those lake acres not fully supporting their designated uses, the acreages affected by the various pollution sources were combined and statewide percentages derived. Weighted averages were calculated, based on the number of lake acres per State with impaired uses, to arrive at national estimates of the relative contribution of individual pollution sources to use impairment in the Nation's lakes. An evaluation of the causes of use impairment was provided by 31 States. The predominant cause was found to be nonpoint sources, affecting 76 percent of impaired lake acres. Municipal sources were reported to affect 8 percent, with natural sources affecting 12 percent, and other or unknown sources affecting 3 percent. Industrial sources of pollution were reported to have a relatively slight effect, impairing uses in 1 percent of assessed lake acres. This information is depicted in Table 2-9 and Figure 2-3.

Two years ago, the 1984 *National Water Quality Inventory* also reported that nonpoint sources were the major cause of use impairments in lakes, although to a lesser extent. In large part the difference between 1984 and 1986 findings can be attributed to the use of weighted averages in this report to more accurately reflect the total lake acreage with use impairments. The 1986 findings should therefore not be compared to those reported in 1984. Nevertheless, it is clear that nonpoint sources have been and continue to be by far the leading cause of use impairment in the Nation's lakes.



Nonpoint sources are the leading cause of use impairment in the Nation's lakes.

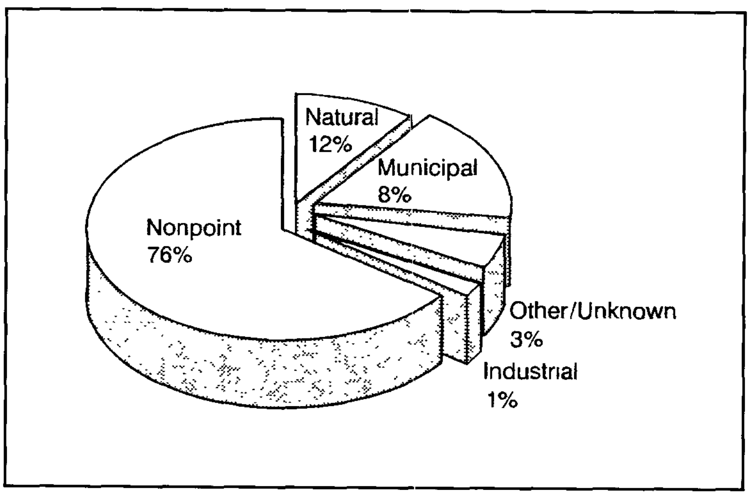


Figure 2-3. Causes of Nonsupport in Lakes

Table 2-9. Relative Impact of Pollution Sources in Lakes with Impaired Uses (in percent)

State	Industrial	Municipal	Combined Sewers	Nonpoint Sources	Natural	Other/ Unknown
Alaska	19	0	0	51	0	30
Arizona	0	1	0	9	2	88
California	0	0	0	52	48	0
Connecticut	0	0	0	32	68	0
Florida	8	47	0	43	1	1
Georgia	2	96	0	2	0	0
Idaho	1	1	0	90	8	0
Illinois	10	15	0	75	0	0
Iowa	0	0	0	100	0	0
Kansas	0	0	0	100	0	0
Kentucky	0	2	0	17	77	4
Louisiana	0	0	0	50	0	50
Maine	0	1	0	88	0	11
Maryland	2	15	0	65	18	0
Minnesota	0	1	0	99	0	0
Mississippi	0	0	0	100	0	0
New Hampshire	11	5	0	34	13	37
New Jersey	0	0	0	100	0	0
New Mexico	0	0	0	100	0	0
New York	2	12	0	75	0	11
North Carolina	24	26	0	50	0	0
Oregon	0	1	0	50	49	0
Rhode Island	7	39	0	54	0	0
South Carolina	45	40	0	15	0	0
South Dakota	0	0	0	98	2	0
Tennessee	0	7	0	89	0	4
Vermont	0	6	6	74	4	10
Virginia	1	1	0	98	0	0
West Virginia	0	0	0	100	0	0
Wisconsin	0	1	0	90	9	0
Puerto Rico	11	17	0	46	0	26
Average (weighted)	1	8	0.03	76	12	3

Source. 1986 State Section 305(b) Reports

The water quality problem most often cited in the Nation's lakes is cultural eutrophication, the over-enrichment of waterbodies due to man-induced causes. Cultural eutrophication occurs when organics and nutrients such as phosphorus and nitrogen enter lakes as fertilizer runoff from cultivated fields, animal waste from pastures, or as components of municipal sewage or septic tank leachate. These nutrients can overstimulate algae, plant, and weed growth, creating choked conditions that can adversely affect swimming, boating, and the health of indigenous fish populations.

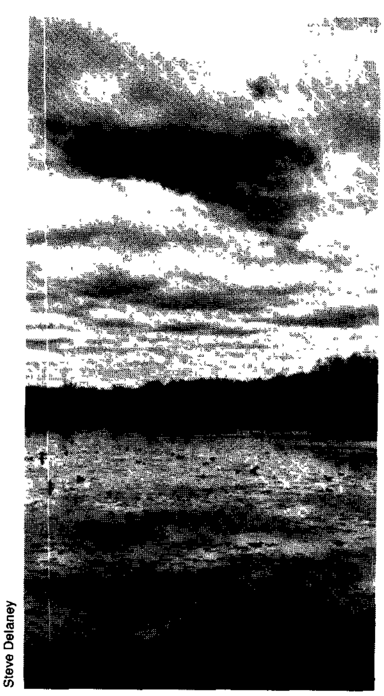
When lakes are classified according to their degree of eutrophication, they are generally placed into one of three categories. *Oligotrophic* lakes are those that have the lowest nutrient levels and the least amount of plant and algae productivity. *Eutrophic* lakes, on the other hand, are those with the highest levels of organic enrichment. *Mesotrophic* lakes are those in an intermediate stage of productivity.

In their 1986 reports, 23 States provided eutrophication data for 23,236 lakes and reservoirs. Forty-five percent, or 10,383 lakes, were assessed as eutrophic; 26 percent of lakes, or 6,077, were assessed as mesotrophic; and 12 percent, or 2,892, were reported as oligotrophic. Trophic status was unknown in 17 percent of assessed lakes. Table 2-10 depicts these numbers for the 23 States reporting. These statistics may not reflect the condition of the Nation's lakes and reservoirs as a whole, and may, in fact, be biased toward eutrophy, since some States concentrate their assessment efforts on those lakes believed to have eutrophication problems. Nevertheless, eutrophication is obviously a significant problem in many areas, particularly where smaller lakes are subjected to persistent urban, recreational, and agricultural pressures.

Table 2-10. Trophic Status of Lakes

State	Number of Lakes Assessed	Number Eutrophic	Number Mesotrophic	Number Oligotrophic	Number of Other/ Unknown
Connecticut	70	18	44	8	0
Florida	135	39	22	36	38
Illinois	36	32	4	0	0
Indiana	554	499	55	0	0
Iowa	107	107	0	0	0
Kansas	154	125	29	0	0
Kentucky	92	50	28	14	0
Massachusetts	462	62	276	124	0
Michigan	160	28	113	19	0
Minnesota	12,034	7,822	3,009	1,203	0
Mississippi	34	29	5	0	0
Montana	1,880	371	428	452	629*
Nebraska	24	22	2	0	0
New Hampshire	418	76	158	141	43
New York	3,340	84	132	85	3,039
North Carolina	25	10	13	2	0
Pennsylvania	26	23	3	0	0
Rhode Island	113	17	52	7	37
Tennessee**	64	36	18	10	0
Vermont	223	25	80	118	0
Virginia	220	61	64	10	85***
Washington	140	45	24	58	13
Wisconsin	2,925	802	1,518	605	0
Total	23,236	10,383	6,077	2,892	3,884

*Includes 127 dystrophic lakes
**Non-federally managed lakes only
***Includes one dystrophic lake
Source: 1986 State Section 305(b) Reports


Steve Delaney

Attainment of the Clean Water Act Goal

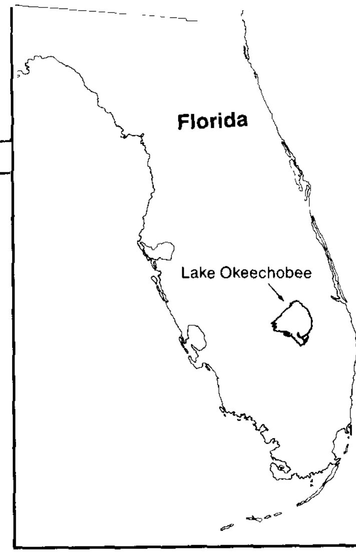
The Nation's lakes and reservoirs, like its flowing waters, are also traditionally measured in terms of their ability to support fishing and swimming, a basic goal of the Clean Water Act. In 1986, 26 States reported this information or a subset (e.g., waters that are fishable).

Twenty States discussed attainment of the fishable and swimmable goal in 6,589,679 acres of assessed lakes. (See Table 2-11.) Of these, an average of 84 percent of assessed lake acres meet the fishable and swimmable goal. As with rivers and streams, the States report a wide range in the percent of lake acres attaining the fishable and swimmable goal; in general, however, the degree of goal attainment in the Nation's lakes appears to be high.

Thirteen States report that 54,518 acres of lakes, of their 5,378,764 acres assessed, will most likely fail to achieve fishable and swimmable uses. Nonpoint sources, natural factors, and nearness to urban centers are all cited as reasons. Over 355,000 acres of lakes are expected to become fishable and swimmable in the next five to ten years, assuming that pollution control efforts proceed as planned or are maintained at their current levels.

Excess nutrients can overstimulate the growth of algae and weeds in lakes.

Lake Okeechobee

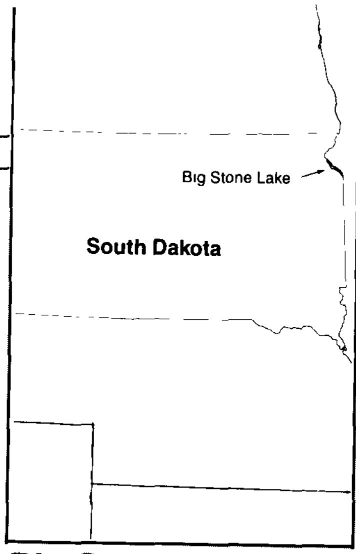


Florida's Lake Okeechobee encompasses 727 square miles. It receives drainage from a number of sources in the Kissimmee River basin, including the Kissimmee River, Indian Prairie Canal, Fisheating Creek, and the Taylor Creek/Nubbin Slough area. The primary land use along the northeast edge of the lake is dairy farming. Land use south of the lake is intensive row crop farming of sugar cane and vegetables. There are also some citrus groves and wetlands in this area. On the south end of Lake Okeechobee, a levee some 85 miles long allows for nearly total control of lake elevation through a system of gates and pumps connecting the six major flood control canals.

Major sources of pollution to the lake include agricultural runoff from ranch and dairy operations and from back-pumping of runoff from row crops and sugar cane. The Kissimmee River also delivers nutrients to the lake from sewage effluents that are discharged in the upper portion of the Kissimmee River basin.

Water quality problems in the north end of the lake include elevated phosphorus and coliform concentrations. In the south end of the lake, increased nutrients and pesticide problems are caused by back-pumping. Consequently, at different locations and at different seasons of rainfall or drought, the lake receives varying amounts of nutrients, biochemical oxygen demanding substances, bacteria, and toxic materials. In the southern portion of the lake, a trend toward increasing levels of nutrients has been found.

In the last ten years there has been a campaign to increase awareness of pollution problems in Lake Okeechobee and protect lake water quality. At a recent workshop, the South Florida Water Management District emphasized the need to intensify enforcement of best management practices designed to decrease the amount of nutrient loadings from cattle waste. Policies were also adopted to decrease the need for back-pumping during dry seasons by decreasing water usage upstream.



Big Stone Lake

South Dakota's Big Stone Lake is hypereutrophic and receives high loads of nutrients from its tributaries. Lengthy algae blooms and excessive weed growth have been observed in the lake. As a result, recreational usage and property values have declined. Erosion from cropland and runoff from livestock operations have been identified as major sources of pollution. Other sources include municipal discharges, food processing wastes, streambank and lakeshore erosion, and erosion from construction activities.

In 1983, a Clean Lakes report submitted to EPA proposed a watershed management approach to restore Big Stone Lake. The goal of the project was to upgrade the trophic status of the lake from hypereutrophic to eutrophic by reducing nutrient and sediment inputs from the watershed. This approach involved the accelerated application of agricultural best management practices (BMPs); construction of animal waste management (AWM) systems; streambank, lakeshore, and roadside erosion control; recovery of a key wetland; a no-till demonstration program; improved management of the Whetstone River diversion and lake level control structure; and participation in related projects to control municipal, industrial, and private wastewater disposal.

Under Section 314 of the Clean Water Act, EPA provided nearly $850,000 to South Dakota and Minnesota in restoration funds in 1984 and 1985; a like amount was required from State and local sources to provide matching funds.

The initiative to clean up Big Stone Lake has involved local authorities, two States, and Federal agencies. Bordering counties applied for grants to build AWM systems. The conservation districts in each county accepted administration of the program and set up program guidelines. South Dakota provided a list of nearly 200 feedlots for priority attention based on a computer model developed by Minnesota's Agricultural Research Service. The priority list will allow cost-share funds to be targeted to feedlots with the most severe pollution problems. The U.S. Department of Agriculture's Soil Conservation Service agreed to provide technical assistance, engineering, and contruction management for the program. Operators of those feedlots contributing the largest pollution loadings were invited to join the program. However, although initial response was good, only three AWM systems had been completed by 1986.

Table 2-11. Lake Acres Meeting the Fishable/Swimmable Goal of

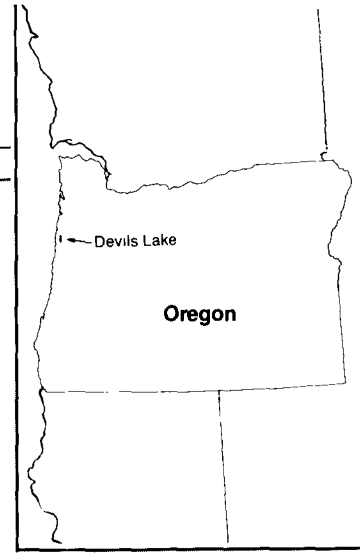
State	No. Acres Assessed	No. Acres Fishable	No. Acres Swimmable	No. Acres Fishable and Swimmable
Alabama	505,336	448,746	—	56,590
Arizona	34,811	32,431	31,508	—
Connecticut	38,884	—	—	36,858
Florida	796,800	—	—	732,800
Idaho	362,718	362,718	362,718	362,718
Iowa	73,771	53.899	—	51,827
Kansas	152,810	139,214	137,430	137,430
Kentucky	362,403	—	—	326,483
Louisiana	467,738	—	—	407,215
Maine	994,560	—	—	958,395
Maryland	32,583	—	—	32,574
Michigan	840,960	820,480	—	—
Mississippi	495,191	—	—	476,374
Montana	663,363	650,113	663,363	—
Nebraska	105,840	103,100	105,840	—
New Hampshire	144,918	—	—	137,672
New Jersey	18,923	—	—	13,625
New Mexico	5,725	5,524	5,725	5,524
New York	729,000	—	—	579,600
North Carolina	320,506	—	—	311,296
Oregon	192,000	—	—	112,700
Rhode Island	16,520	—	—	15,950
South Carolina	405,555	405,555	404,465	—
South Dakota	655,227	—	—	573,121
Vermont	224,066	224,024	224,063	224,021
Wyoming	411,284	409,223	230,335	—

*Excludes Great Lakes

Source: 1986 State Section 305(b) Reports

the Clean Water Act*

No. Acres Expected Fishable/ Swimmable in 5-10 years	No. Acres Never Fishable/ Swimmable	No. Acres Designated More Stringent than F/S	No. Acres Designated Less Stringent than F/S
—	—	56,590	0
—	—	0	—
951	0	20,000	0
64,000	0	339,840	0
—	—	279,250	0
3,321	17,476	24,658	7,380
—	21,452	0	15,139
—	—	—	—
60,523	0	—	—
36,165	0	—	—
9	—	—	—
—	—	—	—
18,817	0	38,000	—
—	13,250	134,000	—
—	—	—	—
—	—	23,000	9
—	—	—	—
—	—	—	—
149,400	0	545,000	—
7,450	1,760	177,515	—
—	—	—	—
35	535	7,203	436
—	0	—	—
—	—	0	0
—	45	—	—
14,398	—	184,821	0



Devils Lake, Oregon

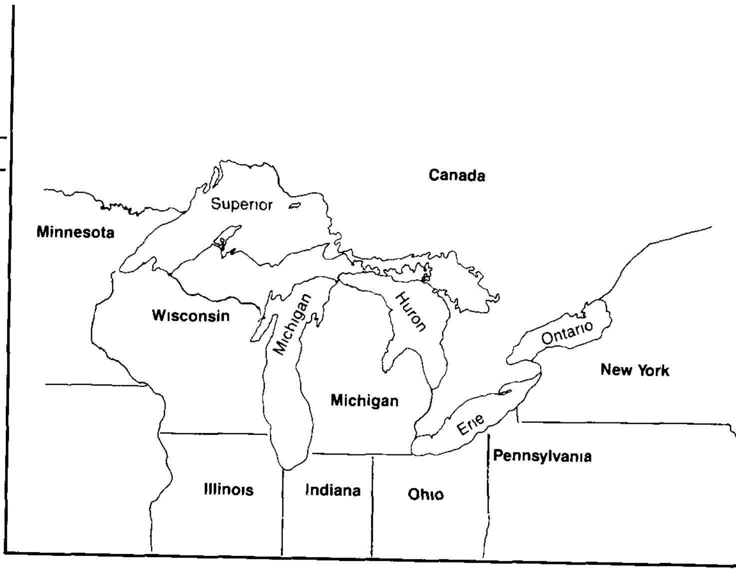
Devils Lake is a long, shallow coastal lake located in Oregon's Lincoln County. It is 678 acres in size, with a length of 3 miles, an average width of 0.4 miles, and an average depth of 12 feet.

Two tributary streams, Rock and Thompson Creeks, flow into the lake. Rock Creek drains about 60 percent of the watershed area—primarily steep, undeveloped, forested land. The upper portion of the watershed is managed for timber and the lower portion for agricultural uses such as dairy farming. Thompson Creek drains the moderately sloped northern area of the watershed, where land use is predominantly residential with some agriculture. The shore around Devils Lake is zoned residential and is ringed with permanent single family homes, summer and weekend cottages, and motels.

The condition of Devils Lake has impaired its use by local residents and the thousands of visitors that come to enjoy the tourist facilities in Lincoln City every year. Boat ramps, parks, and campgrounds were used extensively at one time. However, algae blooms and dense macrophyte growth, along with high fecal coliforms in bathing areas, have impaired recreational enjoyment of the lake in recent years.

An EPA Clean Lakes Phase 1 Diagnostic and Feasibility Study was initiated in 1980 to investigate these problems. The study determined that the algae blooms and the dense macrophyte growth resulted from both natural eutrophication processes and nutrient loadings to the lake from nonpoint sources. Animal wastes on dairy farms in the Rock Creek watershed, lawn fertilizing, and leachate from septic tanks located near the shore were found to contribute nitrates, phosphates, and fecal coliform bacteria. Nutrients are also stored in high concentrations in lake bottom sediments, and may have been contributed by the former Oceanlake sewage treatment plant that discharged inadequately treated sewage directly into the lake until 1970. Strong wind mixing dispersed the effluent plume and contaminated the entire south end of the lake. Nutrients were also contributed to lake sediments via the decay cycle of macrophytes and ground-water influx.

A Phase 2 grant was awarded in 1985 to employ lake restoration techniques to improve water quality, increase accessibility and recreational use, and implement watershed management strategies. In 1986, a workplan was developed that outlined components of the lake restoration program. Plans were designed for watershed management, introduction of a sterile, weed-eating grass carp, and a public participation process. Dredging and harvesting are still being considered.



The Great Lakes

Introduction

The Great Lakes, containing 20 percent of the world's fresh water, are commercially and recreationally valuable natural resources. They provide drinking water, varied recreational opportunities, and routes for travel and commerce. Over the years, they have also served as vast sinks for the industrial and municipal dischargers clustered along their perimeter.

The Great Lakes are cooperatively protected by the U.S. and Canada under the Great Lakes Water Quality Agreement of 1978. The International Joint Commission (IJC), which was established under the 1909 Boundary Water Treaty with Canada, is responsible for identifying actions needed to maintain the integrity of the Great Lakes ecosystems. The Commission's two boards, the Great Lakes Water Quality Board and the Science Advisory Board, include members from a variety of State and Federal agencies and universities who work together to identify problem areas, plan programs to reduce pollution, and publish reports on issues and findings.


Michigan Travel Commission

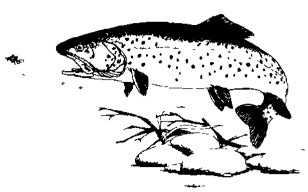
The IJC has identified 42 areas of concern in the Great Lakes region. These are defined as waterways where environmental quality is degraded and beneficial uses are adversely affected. The IJC has developed a system to classify the areas of concern in terms of the information available on each and the stage of development and implementation of remedial actions. The IJC's main focus, in its listing of these problem areas, has shifted away from eutrophication toward toxic contamination of fish tissue and sediments.

Among these areas of concern are the following discussed in the 1986 305(b) reports:

- The Niagara River, New York;
- Ohio's Maumee, Black, Cuyahoga, and Ashtabula harbors in Lake Erie;
- Lake St. Clair, the Detroit River, and the St. Mary's River, connecting channels between the Great Lakes;
- The Grand Calumet River-Indiana Harbor Ship Canal, Indiana;
- Saginaw River and Saginaw Bay, within Michigan's jurisdiction in Lake Huron; and
- Wisconsin's Milwaukee estuary and the Lower Fox River/Southern Green Bay.

In their 1986 Section 305(b) reports, seven States—Illinois Indiana, Michigan, Minnesota, New York, Ohio, and Wisconsin—provided some information on the quality of the Great Lakes within their jurisdictions. Some overall conclusions can be drawn about Great Lakes water quality based on these assessments:

- Contamination of fish tissue and sediments by toxic substances such as mercury, PCBs, DDT, and other pesticides continues to be widespread. Fish advisories and bans remain in place in many areas of the Great Lakes. However, declines are noted in toxics in fish tissue—particularly in levels of DDT and mercury—in all the Great Lakes.
- No improvement is noted for toxic contamination of sediments, a common problem in Great Lakes harbors and bays which, in turn, can affect aquatic life and serve as a continuing source of toxics to the larger lake system.
- Phosphorus control programs such as bans on phosphorus-containing detergents have been successful in reducing the levels of this nutrient in the Great Lakes and in improving the eutrophic condition of nearshore waters. Nitrogen levels, however, appear to be increasing.
- Nearshore waters—particularly harbors and river outlets—seem to have the greatest problems with industrial and municipal pollution, combined sewer overflows, and upstream sources.



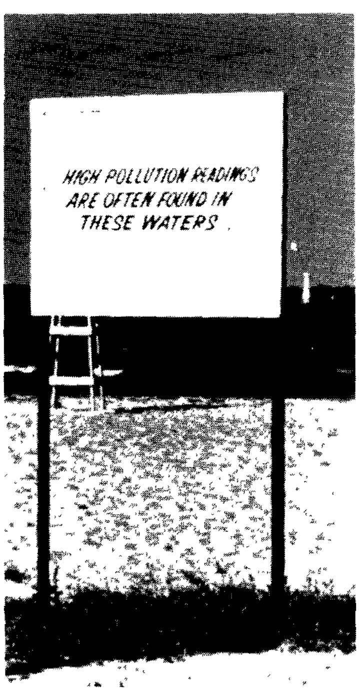
Information from the State 305(b) reports is summarized below for each of the lakes in the Great Lakes system.

Lake Superior

According to the 1986 Michigan 305(b) report, Lake Superior is classified as oligotrophic and has only a few localized problem areas along its shoreline. An intensive study of Lake Superior was conducted by the U.S. and Canada in 1983 to update information on trophic status and toxics.

Preliminary results indicate that metals concentrations are low relative to other Great Lakes; that phosphorus levels are lower than in 1973; but that concentrations of ions such as sodium, sulfate, and nitrate have increased. Organochlorine pesticides and PCBs were found to be widespread but at low levels. DDT and mercury levels in lake trout appeared to have declined between 1977 and 1982 and are below U.S. Food and Drug Administration (FDA) action levels. PCB levels, though fluctuating, were found to be lower in 1982 than at any time since 1977. Dieldrin levels in trout remained consistently low.

Minnesota reports that Lake Superior's sport fishery has improved dramatically in recent years. Total angler hours and total catch have increased in the 1980s, and a lake trout stocking program has been successfully implemented.



Lake Michigan

Lake Michigan's open waters are classified as oligotrophic. Nearshore areas in Green Bay and the southern portion of the lake are more mesotrophic due to nutrients from industrial and urban areas.

A 1983 survey of Lake Michigan by EPA found that phosphorus levels have declined since 1976. However, a variety of other contaminants such as nitrate, sulfate, chloride, and sodium have increased. Mercury levels in fish have been declining since 1972; 1984 data for several species under 20 inches in length showed that levels in 90 percent or more of the fish tested did not exceed FDA action levels. On the other hand, in larger fish and in carp and brown trout, mercury levels remained high. Levels of DDT, dieldrin, and PCBs are consistently higher in fish taken from the southern end of the lake, where the higher levels are also found to contaminate sediments. U.S. Fish and Wildlife Service data show substantial declines in total DDT and PCBs in fish since the mid-1970s.

Illinois monitors Lake Michigan from stations on the north and south shores and in open water. Among its findings are that the lake's trophic status appears improved since 1977 and that levels of total coliform, ammonia nitrogen, and total phosphate have improved since 1968. Illinois notes that this change is primarily due to the diversion of treated municipal and industrial discharges from Lake Michigan to the Des Plaines river basin. Relatively high sulfate and chloride levels along the south shore are attributed to heavy concentrations of industry, particularly petroleum refining and steel manufacturing.

1983 fish flesh data collected from the Illinois portion of Lake Michigan found chlordane, PCBs, dieldrin, DDT, and heptachlor epoxide in over 75 percent of samples analyzed, although only PCBs and chlordane exceeded the FDA tolerance level in 9 percent and 4 percent of the samples, respectively. A sport fish health advisory has been issued for Lake Michigan by Illinois, Indiana, Michigan, and Wisconsin.

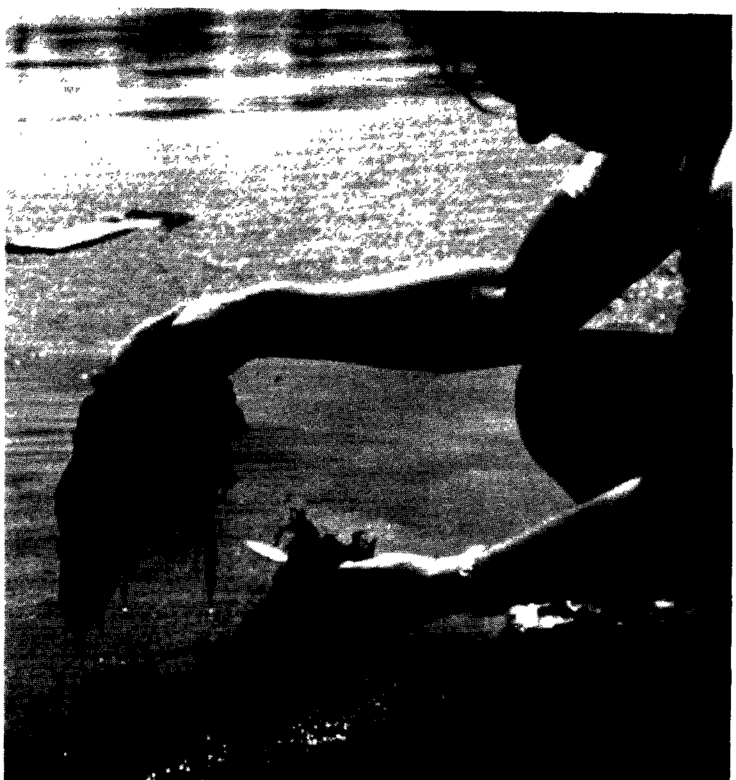
Indiana reports that the Indiana Harbor Ship Canal is the site of the highest levels of mercury and phenols in Lake Michigan waters under its jurisdiction. Violations of dissolved oxygen, chlorides, ammonia, phosphorus, and fecal coliforms are also common. The Ship Canal empties into Lake Michigan and is formed by the two branches of the Grand Calumet River. The Grand Calumet, in turn, drains the most populated and industrialized area in the State, including the cities of Gary, Hammond, and East Chicago. All three cities are involved in wastewater enforcement actions with the EPA at this time.

Indiana reports that water quality in the Grand Calumet River-Indiana Harbor Ship Canal system is improving somewhat due to better wastewater treatment and a reduction in discharges from steel mills in recent years.

Lake Huron

Michigan reports that Lake Huron is classified as oligotrophic, although it contains two eutrophic areas: Saginaw Bay and Thunder Bay. A 1983 water quality study revealed that many contaminants such as chloride, sulfate, sodium, and potassium remain at low levels, but that nitrate and silica values have increased since 1971.

In general, lake trout taken from northern Lake Huron have lower levels of toxic contaminants than fish collected in the southern part of the lake. Mean values of PCBs increased between 1979 and 1982 but declined in 1983; DDT values decreased in 1982 and 1983. Mercury levels have remained consistently below the FDA action level in all Lake Huron fish species studied.



Lake Erie

Lake Erie is classified as eutrophic; its warm temperatures and comparative shallowness make it susceptible to nutrient enrichment. Michigan reports that eutrophic conditions appear to be improving due to phosphorus control programs. An increase in the walleye population in Lake Erie is another indication of improved water quality. PCBs and other organochlorine compounds monitored in walleye since 1977 show no obvious trends, but mercury levels have decreased and are below FDA action levels.

Ohio reports that Lake Erie nearshore areas are generally in good to fair condition and are partially attaining their uses. The major problems in harbor areas are metals from industrial and municipal effluent and urban runoff; high nutrient concentrations; high fecal coliform concentrations from combined sewer overflows, septic systems, and municipal sewage treatment plants; and the deposition of contaminated sediments.

Many bathing beaches along the Ohio shores of Lake Erie are monitored for fecal coliform bacteria levels. However, water quality testing is generally carried out by local authorities and may not be uniform or extensive. Ohio reports that factors such as heavy rainfall, proximity to sewage treatment plants and combined sewer overflows, and frequency of monitoring increase the potential for violations of water quality standards.

Lake Ontario

According to the New York Section 305(b) report, Lake Ontario's nearshore waters are those that are most affected by pollution problems. Inflow from the Niagara, Genessee, and Oswego Rivers contributes much of the pollution to the lake. The Niagara and Oswego Rivers, for example, have been identified as major sources of the pesticide Mirex in Lake Ontario sediments and fish.

The bioaccumulation of toxics is one of the lake's biggest water quality problems. Fishing advisories are in effect for several species of fish because of contamination by PCBs, Mirex, and dioxin. However, the advisory was rescinded for smallmouth bass in 1985 when Mirex levels were found to be less than the FDA action level. Analysis of herring gull eggs collected from 1974 to 1983 indicates declines in the six organochlorine substances that were studied.

Eutrophication of Lake Ontario was identified as a major concern in the 1960s; since then, phosphorus control measures have resulted in reductions of this nutrient, although nitrogen levels are on the rise. Improving conditions are evident in the shift of the open lake phytoplankton community toward more species associated with oligotrophic, rather than mesotrophic, water quality. However, New York reports that eutrophication is a significant problem in two major embayments, Irondequoit Bay and Sodus Bay.

Algae scooped from Lake Michigan, 1985.

New Initiatives in the Great Lakes

A variety of programmatic and monitoring activities are underway in the Great Lakes to address many of the problems discussed above. With one exception, they focus on the problem of greatest concern in the Great Lakes today: toxics contamination.

Great Lakes Phosphorus Control—Progress has been reported under this plan to reduce phosphorus inputs to the Great Lakes. The U.S. and Canada, working in cooperation with the IJC, have determined how much phosphorus is entering the lakes from all sources and the reduced levels, or "targets," that must be reached to protect the lakes from eutrophication.

Required point source controls for major municipal dischargers, together with industrial controls and detergent phosphate bans, have been found to adequately protect the upper lakes except for Saginaw Bay in Lake Huron. For the lower lakes of Erie and Ontario, further controls will be necessary. Load reductions still needed to meet the targets have been calculated for these areas.

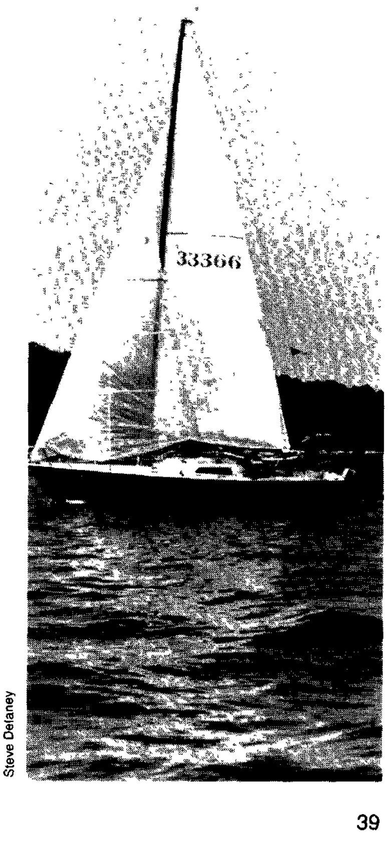
Phosphorus plans have been prepared by a task force of State, interstate, and Federal officials focusing on the potential for control of nonpoint sources. The plans place major reliance on voluntary adoption of agricultural nonpoint source management practices that will be tracked to determine their adequacy.

Niagara River Toxics Activities—The Niagara River is a connecting channel of the Great Lakes and an IJC-designated area of concern. In 1980, work began to coordinate monitoring activities by the EPA, the New York Department of Environmental Conservation, the Ontario Ministry of the Environment, and Environment Canada. The Report of the Niagara River Toxics Committee was published in October 1984; its recommendations are currently being addressed in the recent Niagara River Toxics Management Plan.

Upper Great Lakes Connecting Channels Study—Begun in 1983, this study of the sources and effects of toxics in the connecting channels of the upper Great Lakes—the St. Mary's, St. Clair, and Detroit Rivers, and Lake St. Clair—is a joint U.S./Canada effort similar to the Niagara River initiative.

The Study is a joint research and monitoring effort being carried out by 12 agencies undertaking 150 separate projects. The results of the Connecting Channels study will assist both the State of Michigan and the Province of Ontario in finalizing Remedial Action Plans for the four study areas. The study has also served to focus international attention and resources on defining and controlling pollution originating from the huge petrochemical complex at Sarnia, Ontario and the problems of the Rouge River sub-basin.

Green Bay Mass Balance Study—The Green Bay Mass Balance Study will pilot the use of the mass balance approach for management of toxic substances in a lake system. The primary goal of the effort, which will run from October 1986 to September 1990, is to model selected organic and metal contaminants from incoming loads to the tissue of important fish species. While the specific goal of the study is quite narrow, researchers are being encouraged to participate and contribute complementary studies on the transport, fate, and effects of toxics in Green Bay. Major participants will be the Wisconsin Department of Natural Resources, the National Oceanic and Atmospheric Administration, the Michigan Department of Natural Resources, and Wisconsin Sea Grant.



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Fish Advisories—The Great Lakes National Program Office (GLNPO) has been working with the States since 1984 to develop consistent, scientifically sound advice for consumers of chemically contaminated fish in the Great Lakes. Since then, comparable monitoring protocols have been adopted and the States are actively engaged in sharing and evaluating their combined data bases.

Fish Tissue Residue Monitoring—The Great Lakes Fish Monitoring Program is a coordinated effort by more than 18 Federal and State agencies to monitor and evaluate fish contaminants in the Great Lakes. The program consists of four broad elements: trend monitoring in the open lakes; detection of emerging problems in harbors and tributary mouths; human exposure through consumption of fish; and tumors and other indicators of environmental health.

Atmospheric Deposition in the Great Lakes Basin—Since 1981, the Great Lakes National Program Office has been operating a network of precipitation samplers around the Great Lakes to measure the concentrations of selected nutrients and metals being deposited into the lakes. From these measurements, annual precipitation loadings to each of the Great Lakes have been estimated for parameters such as acidity, total phosphorus, sulfates, nitrates, ammonia, lead, cadmium, calcium, and sodium.

As a result of a recent acid deposition workshop, and in response to increasing concerns about the atmospheric deposition of toxic substances, the GLNPO's atmospheric deposition monitoring network is being redesigned. Planned changes call for a reduction in the number of monitored sites from 36 to 17, with additional sampling at each of the remaining sites for toxic organics in both the atmosphere and in precipitation.

Estuaries and Coastal Waters

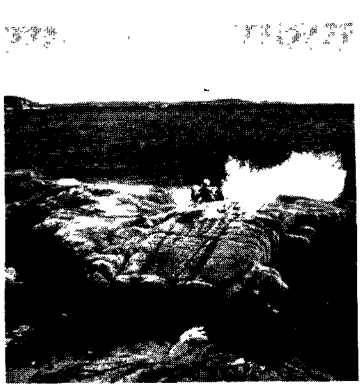
The Nation's estuaries and coastal waters serve as crucial habitat to many species of fish and wildlife, including inland species that migrate to salt water for a portion of their life cycles; are of enormous recreational value to vast numbers of people who live near—or travel to—coastal areas to enjoy boating, swimming, and fishing; and are of economic importance to the coastal cities that depend on their harbors and offshore waters for commercial fishing, shipping, industry, and tourism.

However, the U.S. estuarine and coastal environment is becoming increasingly stressed, particularly as growth in coastal regions continues to accelerate. Population in coastal counties increased by 69 percent between 1950 and 1980 and is still growing rapidly. In fact, the U.S. Census Bureau predicts that by 1990, 75 percent of the U.S. population will live within 50 miles of a coastline. The average population density in coastal counties is 343 persons per square mile, compared to 71 persons per square mile in non-coastal counties.

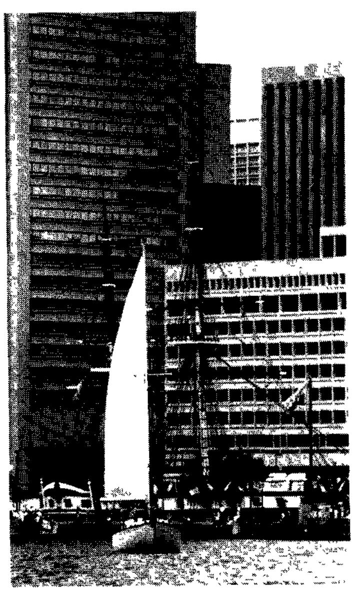
Pollution sources abound. In addition to their own municipal sewage treatment plants, industrial outfalls, combined sewers, and varied nonpoint sources, coastal areas are affected by the contaminants accumulated by rivers as they flow to the sea. Commercial shipping brings with it vessel discharges and spills of oil and hazardous substances. Marinas and vacation-area development stress fragile coastlines. Offshore activities such as oil and gas drilling and ocean dumping of sludge and dredged material can impair or destroy aquatic habitats and introduce a variety of toxicants to the near-shore environment. Hazardous waste disposal sites located within coastal drainage basins are potential sources of toxic chemicals.

The information provided by the States in their 1986 Section 305(b) reports is highly consistent with data reported for the Nation's rivers and lakes. Twenty States and jurisdictions reported on the degree of designated use support for 17,606 square miles of estuaries, 55 percent of the estimated 32,000 square miles of estuaries* in the U.S. (Table 2-12). Of these, 13,154 square miles, or 75 percent, are reported to fully support their designated uses; 3,224 square miles, or 18 percent, partially support their uses; and 1,177 square miles, about 7 percent, do not support their uses.

The designated use numbers reported in 1986 differ significantly from those reported in 1984. These numbers show an increase of eight percentage points in the number of waters with some degree of use impairment. Explanations for the apparent decline in estuarine water quality include more comprehensive reporting, an increase in State monitoring and hence in the discovery of problems, and actual water quality degradation. It is not yet possible to determine which of these factors is most responsible for the change in use support. In any case, it appears that the more comprehensive 1986 designated use support numbers more accurately reflect current estuarine conditions.



National Park Service



Steve Delaney

Coastal areas have enormous commercial and recreational value.

*Source: ASIWPCA, *America's Clean Water The States' Nonpoint Source Assessment*, 1985 Estimate excludes Alaska

The States were asked to assess the relative importance of the various sources of pollution in their estuarine waters. For those estuarine square miles not fully supporting uses, the areas affected by individual pollution sources were combined and statewide percentages derived. Weighted averages were then calculated based on the number of waters with impaired uses per State (see Table 2-12) to arrive at national estimates of the contribution of the various pollution sources to use impairment in the Nation's estuarine waters (Table 2-13 and Figure 2-4).

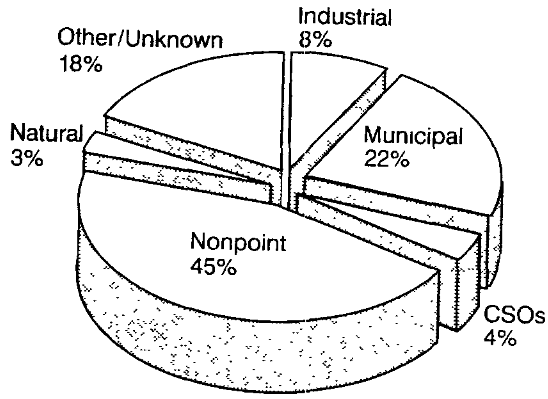


Figure 2-4. Causes of Nonsupport in Estuaries

Table 2-12. Designated Use Support in Estuaries (in square miles)

State	Total Area	Area Assessed	Supporting Uses	Partially Supporting	Not Supporting	Area Unknown
Alaska	—	127	100	27	0	0
Alabama	625	625	593	0	32	0
California	—	483	409	47	20	7
Connecticut	600	600	483	73	1	43
District of Columbia	7	7	0	5	1	1
Florida	2,728	2,287	1,349	762	176	0
Georgia	594	475	468	0	7	0
Louisiana	7,656	2,233	914	699	620	0
Maine	1,850	1,850	1,814	28	8	0
Maryland	2,382	1,822	1,159	663	0	0
Massachusetts	164	156	39	105	12	0
Mississippi	133	133	118	14	1	0
New Hampshire	27	27	14	13	0	0
New York	1,564	1,564	1,115	190	259	0
North Carolina	3,200	3,176	2,677	498	1	0
Oregon	71	66	3	63	0	0
Rhode Island	257	257	228	17	12	0
South Carolina	790	384	340	19	25	0
Virginia	2,382	1,300	1,300	0	0	0
Virgin Islands	—	34	31	1	2	0
Total	25,030	17,606	13,154	3,224	1,177	51

Source: 1986 State Section 305(b) Reports

Sixteen States reported on the sources of pollution in estuarine waters that do not fully support uses. According to these results, nonpoint sources are the major contributors to use impairment in estuaries, as was also reported for rivers and lakes. Nonpoint sources are the cause of use impairment in 45 percent of impaired estuarine waters. Municipal sources are the next leading cause, affecting 22 percent of impaired waters. Other sources include industrial dischargers, affecting 8 percent, and CSOs, affecting 4 percent. Other or unknown sources of pollution affect 18 percent of impaired estuarine waters, and natural sources are cited in the remaining 3 percent of estuarine waters.

As for rivers and lakes, the contribution of the various pollution sources to use impairment in estuaries should not be compared between 1984 and 1986, primarily because of differences in averaging techniques used to arrive at national figures. An additional six States reported on sources of estuarine pollution in 1986 than reported in 1984, further reducing the comparability of results between the two years. It is expected that, as reporting becomes even more comprehensive, these numbers will stabilize to form a consistent picture of estuarine water quality.

Table 2-13. Relative Impact of Pollution Sources in Estuaries with Impaired Uses (in percent)

State	Industrial	Municipal	Combined Sewers	Nonpoint Sources	Natural	Other/ Unknown
Alaska	34	16	0	50	0	0
California	9	8	0	83	0	0
Connecticut	4	19	55	14	0	8
Florida	23	34	0	43	0	0
Georgia	15	5	0	0	80	0
Louisiana	0	0	0	50	0	50
Maine	0	78	22	0	0	0
Maryland	0	30	0	50	20	0
Mississippi	13	31	0	56	0	0
New Hampshire	0	79	6	15	0	0
New York	6	38	31	0	0	25
North Carolina	10	25	0	65	0	0
Oregon	6	20	0	66	8	0
Rhode Island	15	64	0	21	0	0
South Carolina	1	14	0	84	0	1
Virgin Islands	0	55	0	45	0	0
Average (weighted)	8	22	4	45	3	18

Source 1986 State Section 305(b) Reports

The States provide significant details about these pollution sources and their impacts. In most cases, a combination of sources impair estuarine water uses; however, many States can cite the particular industries or runoff problems that are responsible for use impairments. For example:

- Boston Harbor is degraded by a number of urban sources. Sewage discharges from two million people enter the harbor and total roughly 500 million gallons per day. Degraded conditions also result from industrial waste discharges, approximately a hundred CSOs, vessel wastes, and pollution brought by tributaries to the harbor. Major water quality problems include elevated levels of trace metals, coliform bacteria, oil and grease, and depleted levels of dissolved oxygen. Flounder sampled from Boston Harbor reportedly display a high incidence of liver lesions and tumors.

- New Jersey reports that clean water goals are not attained in the New Jersey-New York interstate waters and in the tidal Delaware River near Philadelphia. This is due to the large amount of untreated and primary treated wastewaters still being discharged to these waters. In New York City alone, over two billion gallons per day are discharged, with ten percent being raw sewage. Twice this amount may be discharged during storm events by combined sewer overflows. A number of New Jersey-New York interstate waters contain extremely high levels of fecal coliform bacteria and experience severely depressed summertime dissolved oxygen (DO) concentrations.

High levels of PCBs and certain pesticides (primarily chlordane) have been found in finfish from New York-New Jersey interstate waters. As a result, commercial fishing bans and recreational fishing advisories have been issued by the States for these waters.

UN Photo 150,094, Milton Grant

Runoff and poorly treated wastes from urban areas may degrade estuarine and coastal waters.

■ Although North Carolina reports that its coastal waters are generally of good quality, coastal estuaries such as the Chowan/Albemarle, Tar-Pamlico, and Neuse Rivers have experienced symptoms of accelerated eutrophication over the past decade. Major factors affecting coastal waters are the conversion of forests to agricultural land; waterfront development along barrier islands; and septic systems contributing coliform bacteria.

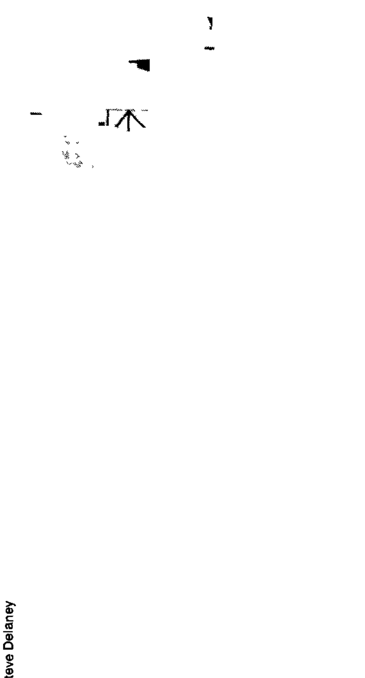
■ In Louisiana's Barataria Bay, sewage treatment plant bypasses and drainage from non-sewered communities are the main sources of bacterial contamination.

■ Seafood processing and oil and gas production are the two primary causes of non-support of uses in Alaska's estuarine waterways, affecting about 8 and 7 square miles, respectively. Discharges from seafood processors can smother benthic life, decrease availability of dissolved oxygen, and cause noxious gases to arise. The major pollution problems from oil and gas production include high levels of heavy metals and petroleum hydrocarbons from oil spills, the disposal of muds and drilling fluids, and discharges from refineries and ballast treatment facilities.

Development along the North Carolina coast.

USDA Soil Conservation Service

Shrimp processing facility in the Gulf of Mexico.



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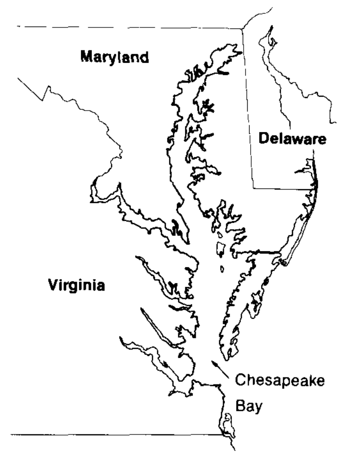


Chesapeake Bay

Maryland and Virginia reported extensively on the water quality of the Chesapeake Bay in their 1986 Section 305(b) reports. Problems cited by the States in the bay and its tributaries include high nutrient levels from agricultural and urban runoff and municipal discharges; high bacterial levels from municipal sources, failing septic systems, and agricultural and urban runoff; seasonally low levels of dissolved oxygen in the deeper portions of the bay, caused by natural decomposition processes believed to be aggravated by man-related activities; high concentrations of toxic organic compounds in the bottom sediments of the bay near known sources such as industrial facilities, river mouths, and areas of maximum turbidity; and high metal concentrations in the water column and sediments in certain areas, particularly in tributaries such as the Patapsco and Elizabeth Rivers, where industries are concentrated.

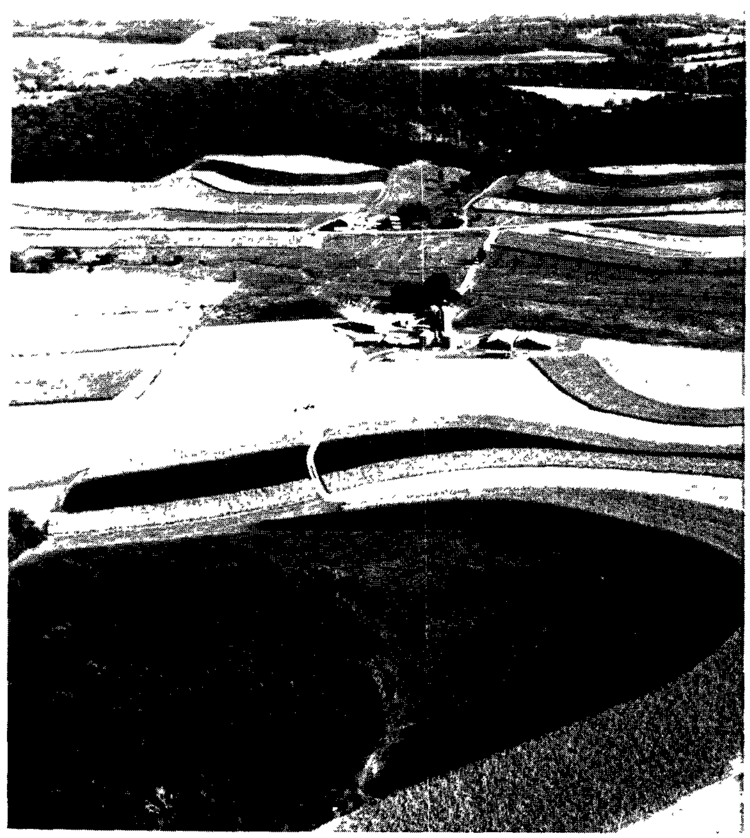
The following impacts caused by these water quality problems have been documented:

- Seasonal algal blooms occur throughout the bay due to high nutrient levels.
- Submerged aquatic vegetation has declined in abundance and diversity since the late 1960s.
- Landings of freshwater spawning fish such as shad and alewife have decreased.
- Oyster harvests have decreased baywide. Increases have been noticed in the harvest of blue crabs, but are attributed to increased fishing effort.

The Chesapeake Bay Agreement of 1983

In response to these problems, in December 1983 the Governors of Maryland, Pennsylvania, and Virginia and the Mayor of the District of Columbia pledged to restore and protect Chesapeake Bay. This commitment, known as the Chesapeake Bay Agreement of 1983, established the Chesapeake Executive Council to coordinate bay cleanup efforts undertaken by the signatories to the Agreement. EPA provides funding to support this effort, as well as technical and administrative assistance. In 1984, several Federal agencies joined the bay States, the District, and EPA to expand the partnership to clean up the bay.

Since the signing of the Agreement, substantial progress has been made. Effective interagency networks have been developed. States have built many new programs that deliver educational, technical, and financial assistance. After less than one year of best management practices (BMP) implementation, funds leveraged with Chesapeake Bay Program grants enabled the three bay States to install agricultural BMPs on approximately 61,620 acres; reduced erosion on those acres by about 363,860 tons per year; and reduced losses from cropland by nearly 400,250 pounds annually within the bay basin. During the same time, 830,290 tons of animal waste were controlled.



USDA Soil Conservation Service

Agricultural runoff is a leading source of nutrients and bacteria to the Bay. Contour strip cropping, shown here on a Maryland farm, may help reduce the problem.

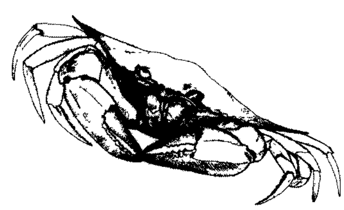
The Water Quality Act of 1987 reinforces the Federal commitment to the bay by new statutory recognition of the Chesapeake Bay Program. A new section of the Act (Section 117) directs EPA to continue the Chesapeake Bay Program, to maintain an office to coordinate Federal and State cleanup efforts, and to continue to assess and report on the problems of the bay. Section 117 authorizes $3 million for FY 1987 through 1990 for these support activities and $10 million per year in grants to the States.

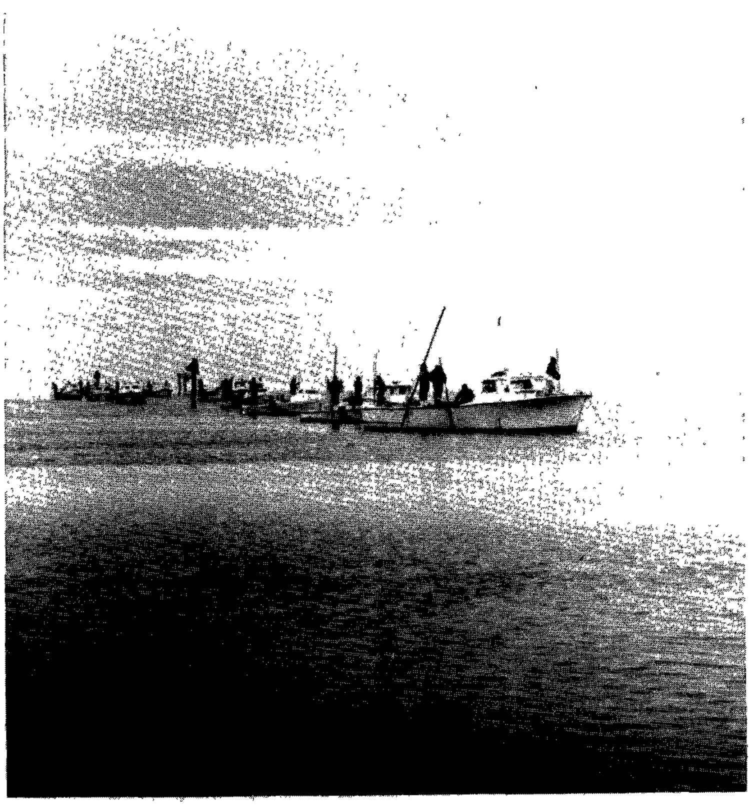
A number of special initiatives have been undertaken by the States to address the problems in the bay:

Maryland has developed 34 legislative initiatives authorizing $36 million in operating and capital expenses. In addition to nine point source pollution control initiatives and eight nonpoint source pollution control initiatives, a number of other efforts are underway including initiatives to restore biologically and commercially important resources such as submerged aquatic vegetation and oyster populations; land protection initiatives to protect the State's shorelines and wetlands; resource enhancement initiatives to improve habitats and encourage fisheries development; programs for public environmental education; and monitoring and research initiatives.

Virginia supports 31 Chesapeake Bay initiatives, funded for FY 1984-1986 with over $17 million. Among these are a chlorine discharge control effort; a sewerline infiltration/inflow renovation initiative; a program to provide State funds for the construction and renovation of local sanitary systems; various targeted monitoring efforts; a program to reestablish submerged aquatic vegetation; and a number of shoreline residential sanitation projects. Five shoreline residential sanitation projects have been completed to date, opening over 800 acres of shellfish waters; additional projects are in progress and are expected to open several thousand acres to shellfishing.

Pennsylvania reports on new initiatives to improve bay quality by reducing excess nutrient loadings from the Susquehanna River. Pennsylvania provides assistance to farmers in the Susquehanna basin to manage nutrients and control soil loss. Recently approved point source control regulations will further reduce phosphorus loads.





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Oystermen on the Chesapeake Bay. Oyster harvests appear to have declined in recent years.

Shellfish Growing Waters

Possibly the most obvious result of pollution in estuarine and coastal areas is the closure, restriction, or decline of shellfish growing waters. Individual States are responsible for the sanitary control, harvest, shipment, and marketing of shellfish. The National Shellfish Sanitation Program, developed by the U.S. Food and Drug Administration, provides criteria and standards that are then incorporated into State law.

According to the *1985 National Shellfish Register of Classified Estuarine Waters* (NOAA/FDA, 1985), shellfish populations are affected by many factors. Dams, canals, dredge and fill operations, and other land use activities can alter circulation patterns, salinity regimes, or sedimentation rates that can directly affect shellfish abundance. Toxic waste discharges, oil spills, and numerous other types of contamination can be lethal. Even subtle changes in the nutrient input from domestic waste treatment, urban development, and agricultural runoff can alter plankton composition and, in turn, affect the feeding ability and survival of shellfish resources. Shellfish are at the mercy of their immediate surroundings and can be affected by activities occurring throughout the river drainage systems that feed estuaries.

In order to ensure that these factors do not impair public health, the States classify their shellfish growing waters into five categories. *Approved waters* are those determined by sanitary surveys to be free of hazardous concentrations of pathogenic organisms and/or pollution. *Prohibited waters* are those closed due to hazardous levels of contamination. *Conditionally approved waters* are those that may or may not be suitable for shellfish harvesting, depending on predictable levels of pollution such as increased wastewater effluent due to seasonal population growth in coastal towns. *Restricted waters* produce shellfish that are unsafe for direct marketing but can be made safe following purification. *Nonshellfish/ nonproductive waters* are those that are inaccessible or do not naturally support shellfish in commercial quantities. It should be noted that in most cases, shellfish area classifications are based primarily on concentrations of fecal coliform bacteria. Other pollutants such as toxics are often not monitored in sanitary surveys.

The classification of shellfish growing waters is affected by many factors other than changes in water quality. These include, for example, the ability of States to conduct sanitary surveys, the economic importance of the available shellfish resources, and the ability of States to manage the classification. Table 2-14 summarizes the classification status of shellfishing waters as reported in the *1985 National Shellfish Register*. The *Register* reports that during the past five years, States have expanded their shellfish control activities and increased the extent of waters classified.

In FY87 and FY88, the interagency task force that oversees production of the *Register* will attempt to better quantify and account for some of the inconsistencies that inevitably arise in combining data sets from many States. One cause for such inconsistencies is that water quality specifications associated with each regulatory category are not identical from State to State. However, even given the inconsistencies that exist in the data bases of past *Registers*, the information they present is extremely valuable; they provide comprehensive descriptions of measured water quality for all the estuarine waters of the contiguous United States over a two-decade time period.

Table 2-14. Classification of Shellfish Growing Waters, 1985 (in thousands of acres)

Region and State	Approved for Harvest	Harvest Limited Areas: Prohibited	Harvest Limited Areas: Conditionally Approved	Harvest Limited Areas: Restricted	% of Total Productive Waters Approved	Nonshellfish/ Nonproductive	Total
Northeast							
Maine	936	87	13	10	89	0	1,046
New Hampshire	4	6	0	0	40	0	10
Massachusetts	255	41	1	5	84	500	802
Rhode Island	96	20	12	0	75	0	128
Connecticut	309	78	6	0	79	0	393
New York	828	192	1	0	81	0	1,021
New Jersey	236	118	20	21	60	0	395
Pennsylvania	0	0	0	0	—	6	6
Delaware	209	19	3	0	90	44	275
Maryland	1,369	64	0	0	96	97	1,530
Virginia	1,295	174	33	0	86	2	1,504
Subtotal	5,537	799	89	36	86	649	7,110
Southeast							
North Carolina	1,755	370	0	0	83	0	2,125
South Carolina	200	72	9	0	71	0	281
Georgia	61	144	0	0	30	0	205
Florida	40	36	37	0	35	748	861
Subtotal	2,056	622	46	0	75	748	3,472
Gulf of Mexico							
Florida	266	260	306	0	32	578	1,410
Alabama	74	103	195	0	20	2	374
Mississippi	123	96	171	0	32	0	390
Louisiana	0	31	3,462	0	—	0	3,493
Texas	1,310	358	0	0	79	2	1,670
Subtotal	1,773	848	4,134	0	26	582	7,337
West Coast							
California	2	263	12	1	1	248	526
Oregon	14	14	0	12	35	44	84
Washington	147	49	45	0	61	1,795	2,036
Subtotal	163	326	57	13	29	2,087	2,646
U.S. Total	9,529	2,595	4,326	49	58	4,066	20,565

Source: NOAA/U.S FDA, *1985 National Shellfish Register of Classified Estuarine Waters*, 1985

In their 1986 Section 305(b) reports, some States discussed the problems affecting their shellfish growing waters. The most commonly cited pollutant is fecal coliform bacteria, originating primarily from inadequate municipal sewage treatment plants, storm drainage, and malfunctioning septic systems. Viruses and outbreaks of shellfish-associated gastroenteritis are also reported, although to a far lesser degree. No national trends are readily apparent from this State-reported data: some States cite declining acreages of approved waters, while others find improvements occurring due to upgraded sewage treatment facilities and nonpoint source controls. Some examples of both declining and improving quality in shellfish growing waters are provided below.

- Delaware reports that the landings of hard clams by commercial shellfishing interests has dropped drastically since 1958. One possible reason is the increase in sediment reaching the inland bays. This sediment, originating from agricultural runoff, residential construction, and wetland modification, alters the optimum clam habitat by covering the sand or shell bottom on which clams grow. Insufficiently treated waste discharges, overland runoff, and septic systems also considerably degrade bay water quality.

- Massachusetts reports that shellfish contamination is increasing rapidly due to high levels of coliform bacteria from sewage discharges. More waters are being closed to shellfishing, in part because of more monitoring and reclassification.

- Florida reports that between 1980 and 1985, about 40 percent of its approved shellfish harvesting areas were downgraded to conditional status. Waste treatment plants and nonpoint source runoff were cited as the reason for the degradation.

- In New Hampshire, the oyster population is cited as improving due to sediment and erosion controls, the reestablishment of eelgrass beds, and the construction of wastewater treatment facilities.

- New York reports that there has been a net increase of approximately 7,300 acres of certified shellfish waters in that State since 1976.

New Initiatives in Estuarine and Coastal Water Protection

The EPA is responsible for establishing and supervising many regulatory and management programs affecting the quality of the coastal environment. The two statutes most responsible for guiding EPA's coastal activities are the Clean Water Act and the Marine Protection Research and Sanctuaries Act. Other agencies, including the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service, the Food and Drug Administration, and the Coast Guard, also have jurisdiction over aspects of estuarine and coastal water protection.

These agencies and EPA are responsible for the administration of at least 21 programs affecting the near coastal water environment. Additionally, the coastal States are directly concerned with water, agriculture, health, fishery, land use, and resource protection programs affecting their estuarine and coastal waters.

Steve Delaney

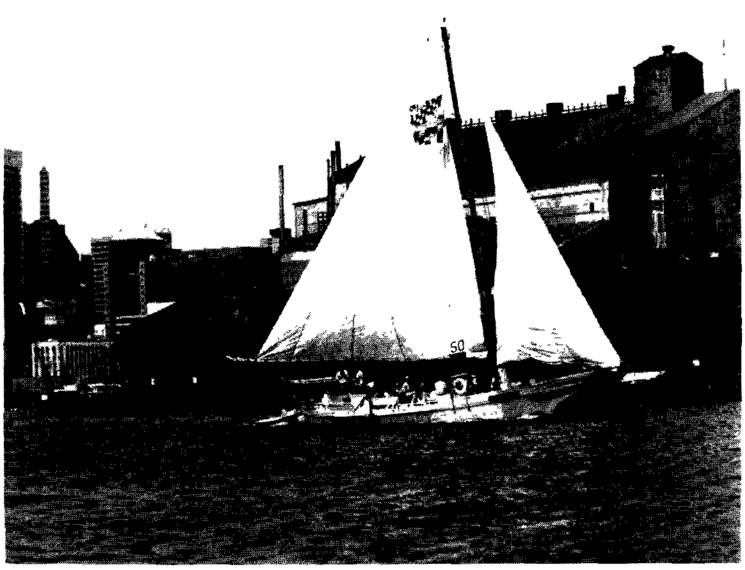
States are responsible for the sanitary control, harvest, shipment, and marketing of shellfish.

However, no national policy exists for protecting and improving estuarine and coastal waters, and progress has been impeded due to conflicts caused by overlapping programs and jurisdictions, a multiplicity of laws and authorities, and a clear lack of interagency coordination. Further, in order to implement more effective controls, it is necessary to better understand the interaction of pollutants with the physical, chemical, geological, and biological processes in near coastal waters. This requires short- and long-term research, as well as the application of existing data through inter-agency coordination.

In response to these needs, EPA has begun developing a long-term strategic plan for improving the management of the near coastal water environment. The plan will address five major national near coastal water environmental problems identified through the initiative: toxics contamination, eutrophication, pathogens, habitat loss and alteration, and changes in living resources. EPA is currently identifying tools that could be used to achieve the initiative's strategic goal of maintaining—and, where possible, enhancing—the environmental quality of near coastal waters. Potential tools include regulatory activities (criteria, permitting, and enforcement); research and data collection; innovative management techniques; institutional changes; interagency coordination; technology transfer; and public participation. Two major activities are planned to begin in FY88: a national assessment of near coastal waters (relying on existing information such as that gathered through the 305(b) process and from other State and Federal agencies) and three or four pilot projects to demonstrate innovative management techniques. The purpose of the assessment is to identify those near coastal waters needing management attention, whether it be regulatory, nonpoint source control, protection, or designation under the National Estuary Program.

The National Estuary Program (NEP), which was created in 1985 to protect and restore water quality and living resources in the Nation's estuaries, is now officially recognized in Section 320 of the Water Quality Act of 1987. It is envisioned as one of the future tools of EPA's Near Coastal Waters Initiative. The NEP consists, to date, of six individual programs, each of which has a geographical focus on a single estuary and its associated drainage basin. Each estuary program seeks to:

- increase public understanding of the nature of the estuary and rank its problems;
- provide State and local managers with the best scientific and technical information available on well-defined problems;
- focus efforts on the need for and benefits of system-wide and basin planning; and
- gain acceptance for the public and private costs of increased pollution controls and restoration of living natural resources.



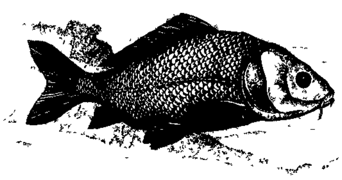
EPA is developing a long-term plan to maintain and enhance the quality of near coastal waters.

Each estuary program establishes a working partnership with other Federal agencies, State and local governments, academic and scientific communities, industries and businesses, public action groups, and private citizens. The program participants establish goals that seek to maintain existing conditions, restore historical water quality or resources, or maintain pristine areas.

The following problem statements for each of the areas in the National Estuary Program were developed by EPA and illustrate the nature of the water quality impairments that will be addressed by the Program.

San Francisco Bay/Delta—The San Francisco Bay and Delta have been extensively modified by human activities, with direct and often unanticipated adverse impacts on the ecology of the estuary. Major activities causing impacts are diking and filling of wetlands, introduction of exotic aquatic species, and diversion of freshwater inflow. These activities have changed the dynamics of the estuarine ecosystem and contributed to the decline of desirable species such as striped bass. In addition, disposal of toxic waste has contaminated organisms and sediments, and sewage effluent has caused eutrophication.

Albemarle and Pamlico Sounds, North Carolina—The Albemarle/Pamlico Estuary suffers from environmental problems related to eutrophication, overfishing of important commercial fish stocks, deforestation, and physical alterations. The area is experiencing a rapid increase in development. Industrial and municipal point sources and agricultural runoff have caused eutrophication. The ecology of the estuary is also threatened by physical alterations such as dams which block fish migration, drainage of wetlands for cultivation, and urban nonpoint sources.



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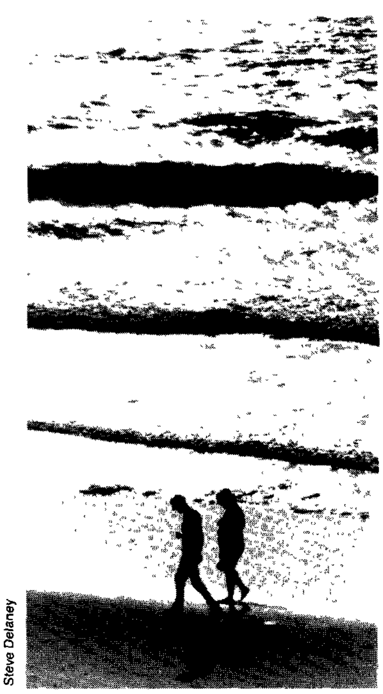
Netting crabs in Baltimore Harbor.

Puget Sound, Washington— Puget Sound is one of the most biologically productive and recreationally important estuarine systems in the U.S. It supports a rich and diverse commercial and sport fishery for finfish and shellfish. Economically, the Puget Sound basin is a focus for industrial and commercial activity, shipping, and international commerce. The Puget Sound Estuary Program evolved from earlier efforts of EPA and the Washington State Department of Ecology to examine Puget Sound pollution issues through joint studies. The program has focused primarily on toxics in urban bays, particularly on the development and implementation of urban bay action plans, including implementation of toxicity-based permitting. Once ongoing sources of contamination are controlled, remedial actions to clean up contaminated sediments can occur. In addition, the State has identified variable flushing rates, wetland loss, pathogen contamination, inadequate funding and implementation of water quality programs, and land use patterns as priority problems for Puget Sound. Future work coordinated through the State and EPA will continue to assess and seek to understand the nature, extent, and significance of pollution in the Puget Sound system.

Buzzards Bay, Massachusetts—Buzzards Bay is subject to increasingly rapid nearshore water quality degradation, in part because of major population shifts to shoreline areas, especially on the side of the Bay bordered by Cape Cod. Increased closures of swimming beaches and shellfishing areas have occurred because of the high levels of bacteria and elevated levels of PCBs and heavy metals. Primary causes of the high coliform bacteria levels are believed to be septic tanks and other nonpoint sources, but inputs from wastewater treatment plants, marinas, and other sources are also being evaluated. An additional major cause for concern in Buzzards Bay is the extremely large quantity of toxic wastes—PCBs in particular—in the sediments of the western shore's New Bedford Harbor, a National Superfund site. The Superfund program and the Buzzards Bay study are assessing the ecological effects of these wastes, possible approaches to cleanup, and the extent to which local fisheries and shellfisheries will have to remain closed in the future to safeguard human health.

Steve Delaney

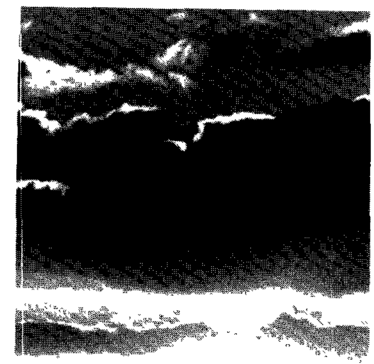


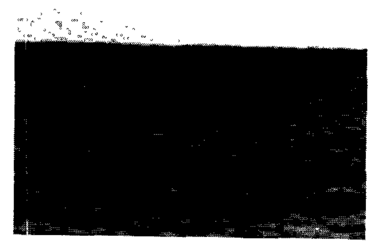
Steve Delaney

One of the goals of the National Estuary Program is to increase public understanding of the nature of the estuarine environment.

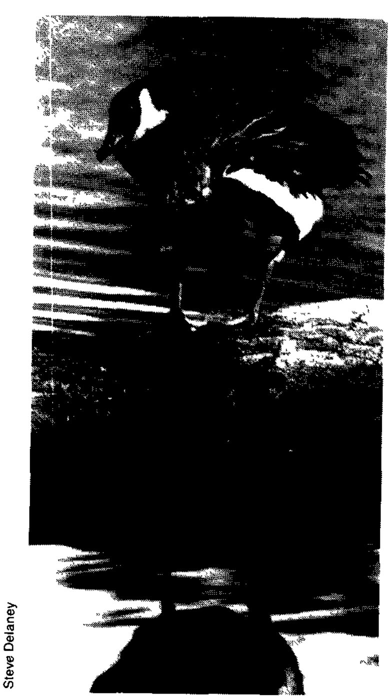
Narragansett Bay, Rhode Island—Narragansett Bay supports several important commercial shellfisheries and is one of the Northeast's major marine recreational areas. The shores and tributaries of Narragansett Bay also support heavily industrialized, older urban areas. The Bay therefore receives an exceptionally large input of untreated or poorly treated sewage and urban runoff from overburdened combined sewer overflows and storm drains, as well as large loads of heavy metals associated with the industries of the region. Urban runoff and sewer overflows result in a large portion of the upper Bay being frequently closed to shellfishing. The ecological and public health significance of the heavy metal and other toxic chemical inputs is not well quantified, and is a primary subject for investigation by EPA's Narragansett Bay Program.

Long Island Sound, New York and Connecticut—Long Island Sound is a long, narrow waterbody bordered by two States. Water quality characteristics range from oxygen depletion and significant in-place toxicant contamination in the heavily urbanized western sound, to areas with very good water quality in the east, where the surrounding land is primarily suburban and rural Dissolved oxygen levels in the western sound have historically been depressed by conventional (i.e., non-toxic) pollutant loads. Preliminary results of a dissolved oxygen assessment indicate that seasonal oxygen concentrations in the extreme western sound may have improved in recent years, possibly due to the upgrading of many wastewater treatment plants to secondary treatment. However, during the same time period, trends toward declining dissolved oxygen levels have taken place further east in the sound, indicating that secondary treatment upgrades may not be sufficient to solve the low oxygen problem entirely. These declines appear to result when nutrients in the effluent stimulate algal growth. The algal growth, occurring in the form of more frequent phytoplankton blooms, creates new areas of oxygen depletion. Further studies are being conducted to verify the cause and increased frequency of these phytoplankton blooms.





Steve Delaney



Steve Delaney

The Islands

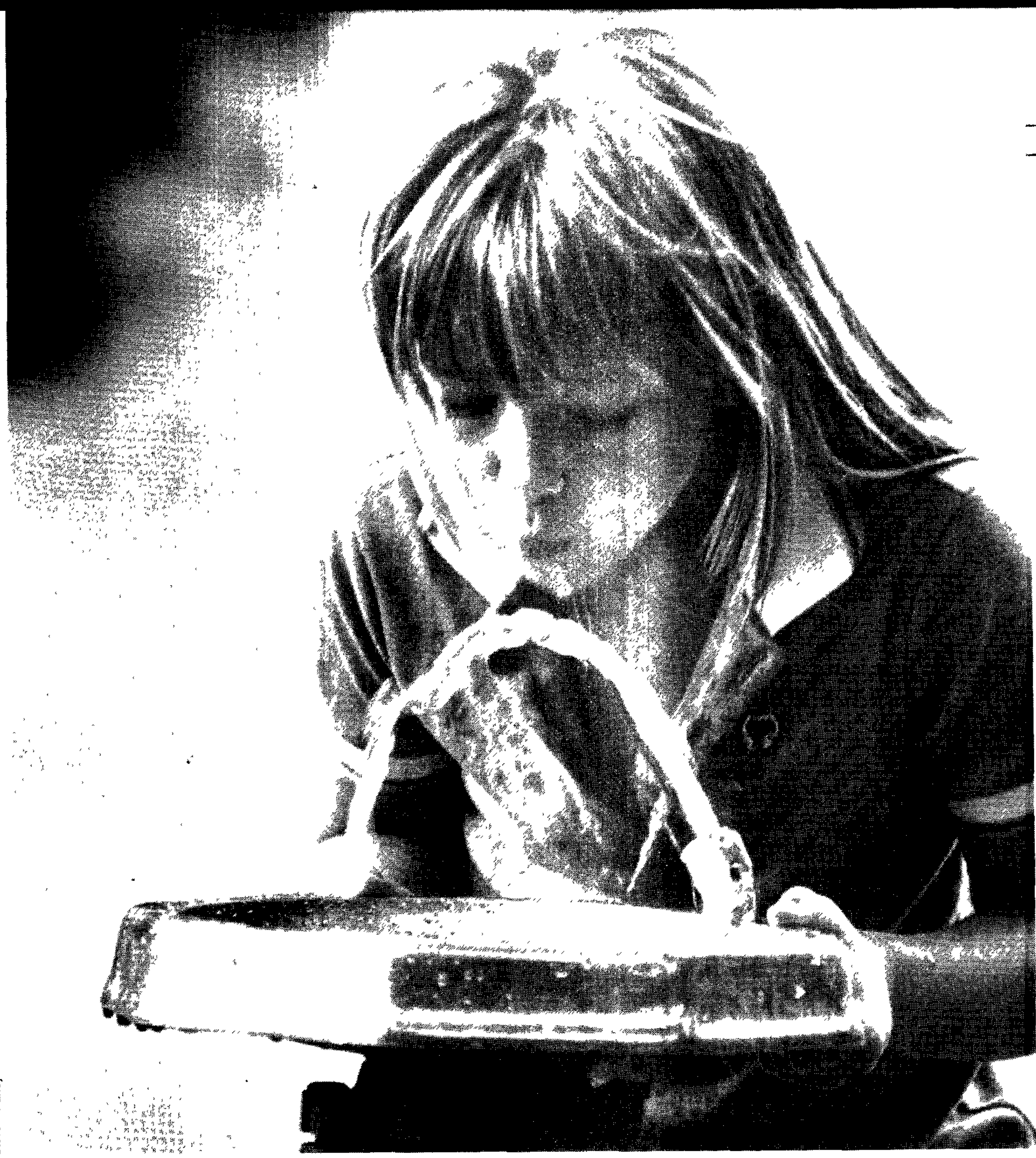
Hawaii and five island territories of the U.S.—Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Northern Mariana Islands—submitted Section 305(b) reports in 1986. These islands are unique ecosystems. They have few if any lakes, and most streams are generally small and dominated by rainfall. Pollution problems tend to concentrate where population is highest, near the coastal waters, harbors, and bays that are also the primary focus of industrial and recreational activity. Ground water is a critically important source of drinking water on most islands, and is increasingly being stressed.

The most prevalent pollutant affecting water quality on the island territories is fecal coliform bacteria, originating primarily from inadequate sewage treatment, septic systems, and other nonpoint sources. Elevated levels of fecal coliform bacteria—indicators of the possible presence of disease-causing organisms—are responsible for the closure of some bathing beaches in Puerto Rico, the Virgin Islands, and Guam. Incidences of water-borne gastroenteritis are also reported. Hawaii and the island territories also report some evidence of toxics contamination, primarily nonpoint in origin. In fact, nonpoint sources appear to be the leading cause of pollution problems in the islands. Problems from septic systems, urban runoff, agriculture, petroleum storage tanks, and landfills are reported.

Monitoring efforts and pollution control programs are in their early stages in many of the U.S. islands, and in general appear to focus on ensuring safe drinking water supplies and preventing degradation of high quality coastal waters. While island water quality is generally good to excellent, it is clear that many of the problems affecting the continental U.S. can also be found in the islands, particularly nonpoint source pollution, ground-water contamination, and inadequate sewage treatment.

Susan Svirsky

Sunset on Haena Beach, Kauai.



Steve Delaney

3

Ground-Water Quality

Introduction

Ground water is a vital natural resource used for a variety of purposes in the U.S., including industrial operations, agricultural activities, and domestic needs. The States are becoming increasingly aware that ground-water resources are vulnerable to contamination. Protection of ground water is receiving increased attention from the States through the development of ground-water protection strategies as well as new and expanded programs in ground-water classification, wellhead protection, and control of pollutant sources such as underground storage tanks and hazardous waste treatment and disposal facilities. Programs to prevent contamination are particularly desirable, because cleaning up contaminated ground water, providing alternative drinking water supplies, or adding treatment to public water systems can be costly to a community in both monetary and personnel terms. This chapter on ground-water resources reflects the States' increased awareness and concern for protecting the Nation's ground water.

Section 106(e)(1) of the Clean Water Act ties State receipt of Federal grant funds under the Section to the submittal of ground-water data to EPA. The data are to include information on State ground-water monitoring programs and ground-water quality. This information is provided to EPA through the Section 305(b) reporting process.

Starting with the 1984 report, the States have been requested by EPA to expand and improve ground-water reporting. The instructions EPA sent to the States for preparing the 1986 report specified minimum ground-water reporting criteria.

These instructions directed States to cite their major sources of contamination and rank the top four sources, with the top-ranked source identified as the primary source of concern. The States were required to identify the ground-water contaminants associated with these sources. EPA also asked the States to voluntarily provide a discussion of special concerns and issues that affect their ground-water quality programs. All but four of the fifty States and six territories included some information on sources of ground-water contamination and types of pollutants in their Section 305(b) reports. Three of these four States did not include any information on ground water.

This chapter is based on information from three separate sources: State-reported data from the 1986 Section 305(b) reports; ground-water use data from the U.S. Geological Survey; and an EPA study of State ground-water programs prepared jointly by the Office of Ground-Water Protection (OGWP) and the ten EPA regions in March 1985

This chapter consists of four main sections summarizing the following State information: ground-water use in the United States; major contaminants and sources of contamination; ongoing State programs for ground-water protection; and current Federal initiatives designed to assist the States in developing their ground-water protection programs. Three State programs are presented that illustrate current ground-water protection strategies being developed and implemented by the States. A summary of ground-water conditions in each State is included in the Appendix to this report.

Ron Hoffer

Water pours freely from an artesian well.

Current Ground-Water Use

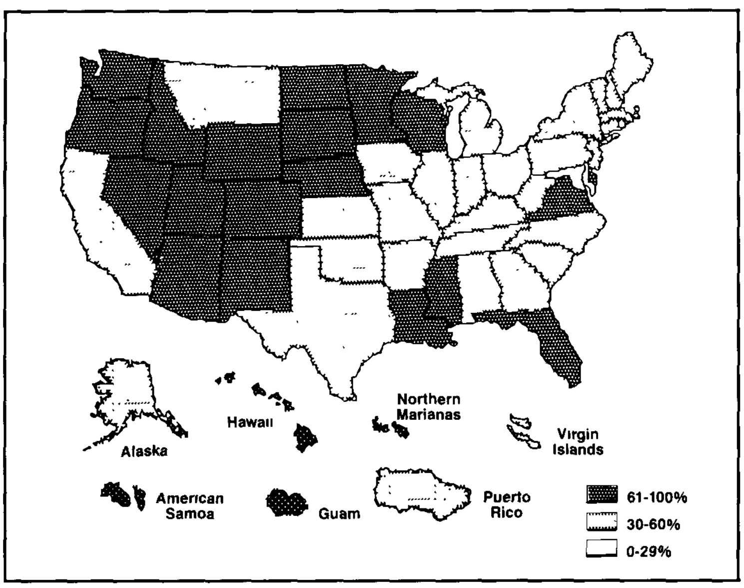
At present, more than half of the Nation's population depends on ground water for its supply of drinking water. Table 3-1 shows the percentages of population, by State, using ground water for drinking water purposes. In nearly 68 percent of the States and territories (38 of 56), ground water serves as the principal source of drinking water: 50 percent or more of the population rely on ground water. Of these States and territories, five depend on ground-water sources for 90 percent or more of their drinking water needs. For these States and territories, and for many of the Nation's rural areas, ground-water protection is essential since alternative sources of water may not be physically, legally, or economically available. It should also be noted that in every region of the country there are some States with more than 50 percent dependence on ground water.

Figure 3-1 shows the demand for ground water throughout the U.S. It shows a large number of States in which more than 60 percent of the population uses ground water as a potable water source. Of these States, 14 (excluding Alaska and Hawaii) are rural States located west of the Mississippi River and are dependent on agricultural activities as a revenue source. Five of these States (Arizona, Colorado, Nebraska, New Mexico, and Wyoming) depend on ground water for 80 percent of their irrigation requirements as well. Two of the remaining States heavily dependent on ground water have large coastal areas (i.e., Florida and Virginia). Typically, communities along the coastline must use ground water for their potable water needs.

Table 3-1. Population Reliance on Ground Water for Drinking Water, by State

State	Percent
Northern Marianas	99
Nevada	95
Hawaii	95
Mississippi	93
Florida	90
Idaho	88
New Mexico	87
Nebraska	82
Iowa	82
American Samoa	80
Virginia	80
South Dakota	77
Colorado	75
Washington	71
Guam	70
Louisiana	69
Wisconsin	67
Delaware	67
Utah	66
Wyoming	65
Arizona	65
North Dakota	62
Minnesota	62
Oregon	60
New Hampshire	60
Indiana	59
Maine	57
Vermont	55
Montana	55
Alabama	54
West Virginia	53
Tennessee	51
Michigan	50
Alaska	50
New Jersey	50
Arkansas	50
North Carolina	50
California	50
Illinois	49
Kansas	49
Georgia	48
Texas	47
Pennsylvania	44
Ohio	42
Virgin Islands	42
South Carolina	42
Oklahoma	41
New York	35
Missouri	34
Massachusetts	33
Puerto Rico	33
Connecticut	33
Kentucky	31
Rhode Island	24
Maryland	15
District of Columbia	0

Source. 1986 State 305(b) Reports supplemented by U.S. Geological Survey's *National Water Summary 1984*



Source: 1986 305(b) State Submittals or USGS National Water Summary of 1984

Figure 3-1. Population Reliance on Ground Water for Drinking Water

Ground-Water Quality Throughout the U.S.

The States identified 16 major sources of ground-water contamination, as shown in Table 3-2, and three-quarters of these sources were the primary source of contamination in at least one State. Underground storage tanks and septic tanks were the two most prevalent primary sources, and these two sources, together with agricultural activities, were the most frequently cited major sources of contamination. Table 3-3, listing the principal contaminants, shows a clear-cut relationship between the most cited contaminants and the three most prevalent sources. Sewage, nitrates, and synthetic organic compounds, for example, are associated with septic tanks; nitrates from agricultural activities are also common contaminants, and synthetic organic compounds are linked to leaking underground storage tanks. Below is a detailed discussion of the major sources and contaminants.

Of the 52 States and territories reporting ground-water quality information, 46 (i.e., 89 percent) identified failing septic systems as a major source of ground-water contamination. Failing septic systems were cited as the primary source of concern in nine of these States (Arkansas, Delaware, Illinois, Kentucky, Maine, Maryland, Nevada, Ohio, and Tennessee). Contamination from septic systems is not a new problem; however, shifts in housing patterns and land use, specifically population growth in suburban areas, have made septic system discharges a more prevalent problem. As a result, many States have recently initiated new programs or modified their existing programs for managing septic systems. These programs are designed to control contaminants such as pathogenic bacteria (sewage) and nitrates, two contaminants cited most often by the States as major ground-water contaminants (see Table 3-3). To assist the States, the U.S. EPA recently developed a guide for State and local officials that provides technical and institutional information on programs to control septic systems.*

Table 3-2. Major Sources of Ground-Water Contamination Reported by States

Source	No. of States Reporting Source†	% of States Reporting Source	No. of States Reporting as Primary Source**
Septic Tanks	46	89%	9
Underground Storage Tanks	43	83%	13
Agricultural Activities	41	79%	6
On-site Landfills	34	65%	5
Surface Impoundments	33	64%	2
Municipal Landfills	32	62%	1
Abandoned Waste Sites	29	56%	3
Oil and Gas Brine Pits	22	42%	2
Saltwater Intrusion	19	37%	4
Other Landfills	18	35%	0
Road Salting	16	31%	1
Land Application of Sludge	12	23%	0
Regulated Waste Sites	12	23%	1
Mining Activities	11	21%	1
Underground Injection Wells	9	17%	0
Construction Activities	2	4%	0

†Based on a total of 52 States and territories which reported ground-water contamination sources in their 305(b) submittals.
**Some States did not indicate a primary source

*U.S Environmental Protection Agency, Office of Ground-Water Protection, *Septic Systems and Ground-Water Protection A Program Manager's Guide and Reference Book* (July 1986), Washington, DC

Incidents of petroleum products and solvents (listed in Table 3-3 as volatile organic chemicals) leaking from underground storage tanks are a major source of ground-water contamination throughout most of the U.S. They are the second most cited source, reported by 43 (i.e., 83 percent) of the States. Underground tanks are listed as the primary source of ground-water contamination in 11 of these States (Alabama, Alaska, Florida, Michigan, Montana, New Jersey, New York, North Carolina, Pennsylvania, South Dakota, and Virginia). Several of these States provided specific information in their 305(b) reports on this particular problem. For example:

- New Jersey reports that 8,985 gasoline stations in the State have the potential to have leaking underground storage tanks.

- In upstate New York, 65 percent of the reported private well contamination incidents are petroleum-related.

- Over 75 percent of the spills reported on Long Island, NY were due either to inland (i.e., non-marine related) spills from filling underground tanks or leaks from such tanks.

- Florida has discovered and is repairing several hundred leaking underground storage tanks and estimates that 6,000 more are presently leaking.

- In 1985, approximately half of the confirmed ground-water pollution incidents in North Carolina were due to leaking underground storage tanks.

Another widespread pollution source is contamination from agricultural activities (cited by 41, or 79 percent, of the States and territories). Six States (Arizona, Arkansas, California, Connecticut, Hawaii, and Iowa) listed this as their primary contamination source. Agricultural activities that lead to ground-water contamination include use of fertilizers, application of pesticides, and runoff from animal feedlots. Nitrate, a major contaminant listed in Table 3-3, originates from animal waste and application of chemical fertilizers at agricultural sites.

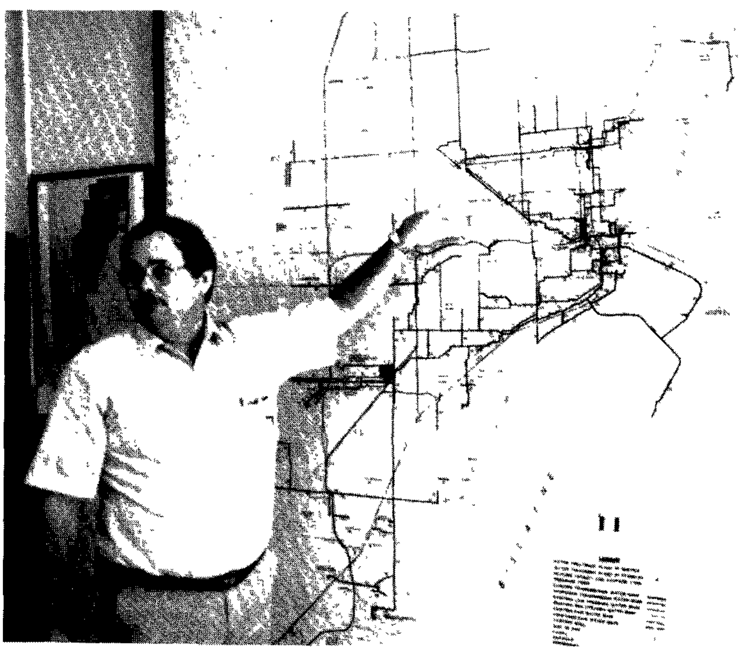
Underground storage tanks being lowered into place.

Table 3-3. Major Ground-Water Contaminants Reported by States

Contaminant	Reported as a Major Contaminant: No. of States	% of States
Sewage	46	89%
Inorganic Chemicals:		
Nitrates	42	75%
Brine/Salinity	36	69%
Arsenic	19	37%
Fluorides	18	35%
Sulfur Compounds	7	14%
Organic Chemicals:		
Synthetic	37	71%
Volatile	36	69%
Metals	34	65%
Pesticides	31	60%
Petroleum	21	40%
Radioactive Materials	12	23%

*Based on a total of 52 States and territories which cited ground-water contaminants in their 305(b) submittals

More than half the States and territories also cited four other major sources of contamination. These are on-site industrial landfills, surface impoundments, municipal landfills, and abandoned waste sites.



Ron Hoffer

Map depicts the relationship between Wellhead Protection areas, sources of ground-water contamination, and the water distribution network in Dade County, Florida.

Saltwater intrusion, although only cited by four States as their primary contamination source, was nonetheless reported as a major source by 19 States. Problems with saltwater intrusion were reported by coastal States and territories or those that have high concentrations of oil and gas drilling operations. Coastal States reported high salinity levels in aquifers due to excessive withdrawals for potable water or irrigation demands.

Overview of State Programs for Ground-Water Protection

The States are currently adopting a number of ground-water protection activities. Table 3-4 lists ten activities typically found in State programs to protect ground-water resources. The table indicates that a majority of States are performing at least one of four distinct activities for ground-water protection. These include ground-water mapping and resource assessment (91 percent), ground-water monitoring (82 percent), policy and strategy development (68 percent), and some form of source control program. In addition, a significant number of States are developing and implementing ground-water discharge permitting, ground-water classification systems, public outreach programs, and new or revised ground-water standards.

Table 3-4. Overview of Activities Included in State Ground-Water Protection Programs

Activities	Number of States Initiating	Percent of States Initiating
GW Mapping/Resource Assessment	51	91%
GW Monitoring Program	46	82%
Policy/Strategy Development	38	68%
GW Discharge Permit Program	26	46%
GW Classification System	23	41%
Public Information/Education Program	23	41%
GW Standards Development	22	39%
Data Management System	14	25%
Local Management Plan Development	2	4%
Specific Source Control		
Underground Injection Control Program	47	84%
Septic Management	38	68%
Underground Storage Tank Program	30	54%
Hazardous Waste Sites	34	61%
Agricultural Contamination	23	41%
Landfill Sites	20	36%
Surface Impoundments	14	25%

For most of the activities listed in the table, the number of States involved in the activity has risen sharply in the past two years. For example, 38 States and territories (68 percent) report that they have developed or are developing a ground-water protection policy or strategy.* Additionally, 22 States (39 percent) have developed standards for ground-water resources. This is a significant increase from 1985. An OGWP summary of State ground-water protection programs at that time found that only 12 States and/or territories had developed a strategy or policy and few States had specific ground-water standards. To better understand the activities covered by State ground-water programs, several examples of State strategies are presented later in this chapter.

A recent accomplishment in ground-water management has been State efforts to map and assess their ground-water resources (Table 3-4). Most of these studies have been completed in conjunction with the U.S. Geological Survey. As many as 23 States have accomplished or initiated efforts to classify ground-water resources, and many other States have such studies in preliminary stages of development.

It is crucial that States know what the major problem contaminants are and the magnitude of the contamination before embarking on controls and corrective actions. Forty-six States (about 80 percent) have started or have already developed ground-water monitoring programs. These monitoring programs have focused on establishing drinking water quality, measuring discharges from non-hazardous and hazardous waste sites, and identifying the presence of saltwater and pesticides in ground water.

Pollution controls must often be applied at the source. Although source controls are typically described as pollution control technologies, other source controls for ground-water contamination include siting laws, registration, monitoring, and inspection. Source control programs implemented by over half the States include: septic system or on-site waste management programs (68 percent), ground-water control at hazardous waste sites (61 percent), and underground storage tank programs (54 percent). The percent of States implementing these programs could reflect the concern noted earlier that septic or on-site systems and underground storage tanks represent the two sources cited most often as causes of ground-water contamination in the U.S. In addition, about half of the States have developed discharge permit programs. Twenty-three States (41 percent) have initiated programs that address agricultural activities. However, more work remains to be done since agricultural pollutants were cited as the third highest contaminants of concern. The cleanup of ground-water contamination by agricultural chemicals can be more difficult than the cleanup of contamination by storage tanks because the sources are disparate and points of infiltration are distributed over large land areas.

State ground-water protection programs have many sources to control and different ways to address them The above discussion highlights the major sources, associated contaminants, and general activities States are currently performing to address risks to ground-water resources. To better understand how these pieces fit together, the following discussion briefly describes the strategies and management plans of three States.

States are implementing ground-water programs at hazardous waste sites.

Steve Delaney

*A recent survey by U S EPA's Office of Ground Water Protection indicates that all States and territories are at some stage in developing a ground-water protection strategy.

Examples of Ground-Water Protection Strategies

Most States are developing or have completed comprehensive State ground-water protection strategies. Many of these strategies were based on approaches developed over the past several years. The range of approaches is exemplified by the following State strategies.

Florida completed its ground-water protection strategy in 1983. This strategy combines several approaches including a ground-water classification system, permitting systems for waste discharges and other surface activities, ground-water quality standards, a statewide monitoring program, protection of the zones of influence around public supply wells, and various public awareness and involvement programs. Specifically, the Florida program applies ground-water protection management activities and controls in specified areas around public water wells. Florida explored various techniques for establishing the size and shape of these "special well protection areas." Through a State technical advisory committee, Florida chose to establish the protection zones on the basis of how long contaminants took to travel, both vertically and horizontally. through ground water to the wells.

Massachusetts has a coordinated ground-water protection program involving State, county, and municipal governments. The State's numerous statutes and regulations governing sources of contamination are supplemented by local ordinances and regulations. Regulatory measures implemented by the State include drinking water standards, water well registration requirements, sewage disposal requirements, ground-water protection regulations for solid and hazardous waste sites, and an underground storage tank program requiring specific leak detection and prevention measures.

In 1982, Massachusetts established the Aquifer Land Acquisition (ALA) Program that has provided almost $15 million in financial assistance to cities and towns to purchase lands, waters, and easements to protect and conserve ground-water aquifers for future water resource needs. Applications are ranked in order of priority according to value and use of the resource, degree of resource protection, and cost-effectiveness of the project. In order to be eligible for a grant, the applicant must have developed a plan that includes a three-zone approach to ground-water protection: a 400-foot radius around the wellhead, the primary recharge zone, and the streamflow source zone. Each zone is controlled in a different manner.

Connecticut's comprehensive ground-water management program was initiated with the enactment of the Clean Water Act of 1967 (Connecticut Public Act 57). In addition to conventional regulatory approaches for ensuring the quality of public water (such as a ground-water classification system), Connecticut has enacted legislation requiring parties responsible for pollution of ground waters to provide potable drinking water to affected people. A responsible party may include the manufacturer, distributor, applicator, or user of the polluting substance and the person causing or allowing the discharge of the substance.

Another provision of the law allows the Commissioner of the Connecticut Department of Environmental Protection (DEP) to direct a municipality to provide potable water if a responsible party determination cannot be made or the responsible party does not have sufficient assets. The municipality can obtain a State grant to pay for developing and connecting the alternate water supply. If action cannot be taken quickly, the DEP Commissioner is responsible for providing bottled water to residences and schools until a responsible party, municipality, or water company provides the water. The responsible parties can be required to reimburse the State, municipality, or water company for the expense of developing an alternate water supply.

Federal Programs for Ground-Water Protection

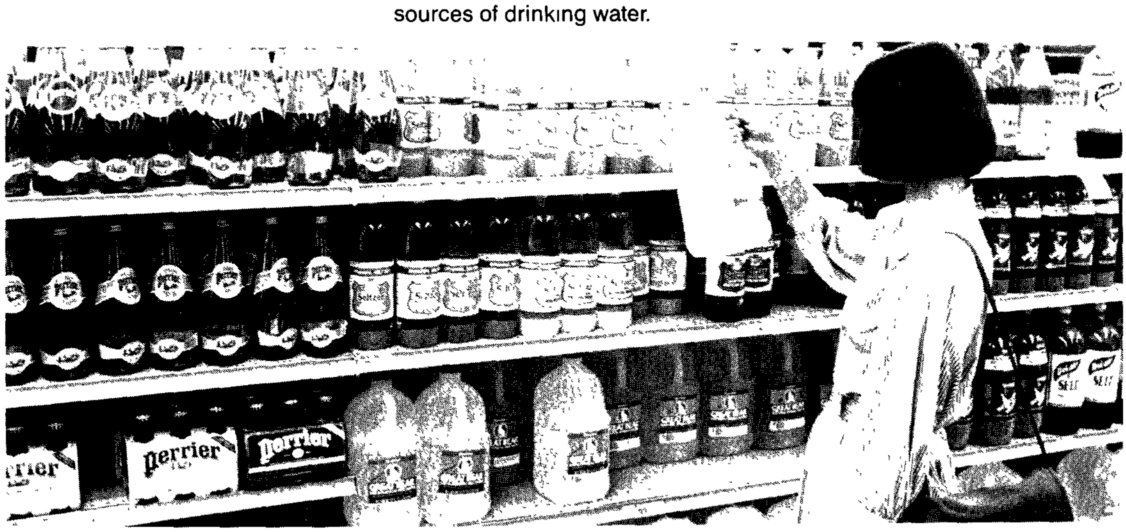
States have a long history of establishing programs to protect and manage their ground-water resources. In recent years, EPA has joined in a partnership with the States to deal more effectively with increased concerns about ground-water contamination. In fact, this is one element of the Agency's Ground-Water Protection Strategy. Several current Federal programs deal specifically with control of sources and pollutants that could contaminate ground water. These programs grow out of Federal statutes such as the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response and Liability Act (CERCLA), and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Several of these programs, together with a special EPA study of pesticides in ground water, are described in the following subsections.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA), enacted in 1974, established several programs to protect both surface and underground sources of drinking water. One such program, the Underground Injection Control Program, establishes technical criteria and standards for the construction, operation, monitoring, and testing of wells to control underground injection practices. Establishment of drinking water standards to control contaminants is part of the Public Water Supply Supervision program. A third program, the Sole Source Aquifer Designation program, requires EPA to undertake a special review of possible ground-water impacts from federally funded projects in designated areas where 50 percent or more of the population depends on ground water for drinking water. In 1986, Congress amended the SDWA to strengthen these and other Federal and State ground-water protection efforts. Specifically, the Act established two new grant programs for the States: the Sole Source Aquifer Demonstration (SSAD) and Wellhead Protection (WHP) programs.

Responsibility for administering these two new ground-water protection programs rests with the Office of Ground-Water Protection (OGWP), which EPA established in 1984. OGWP is currently developing rules, procedures, and guidance for the States to use in designing and implementing both the SSAD and/or WHP programs. The guidance for the WHP program and regulation for the SSAD program were issued by June 1987.

The Safe Drinking Water Act of 1974 established programs to protect sources of drinking water.



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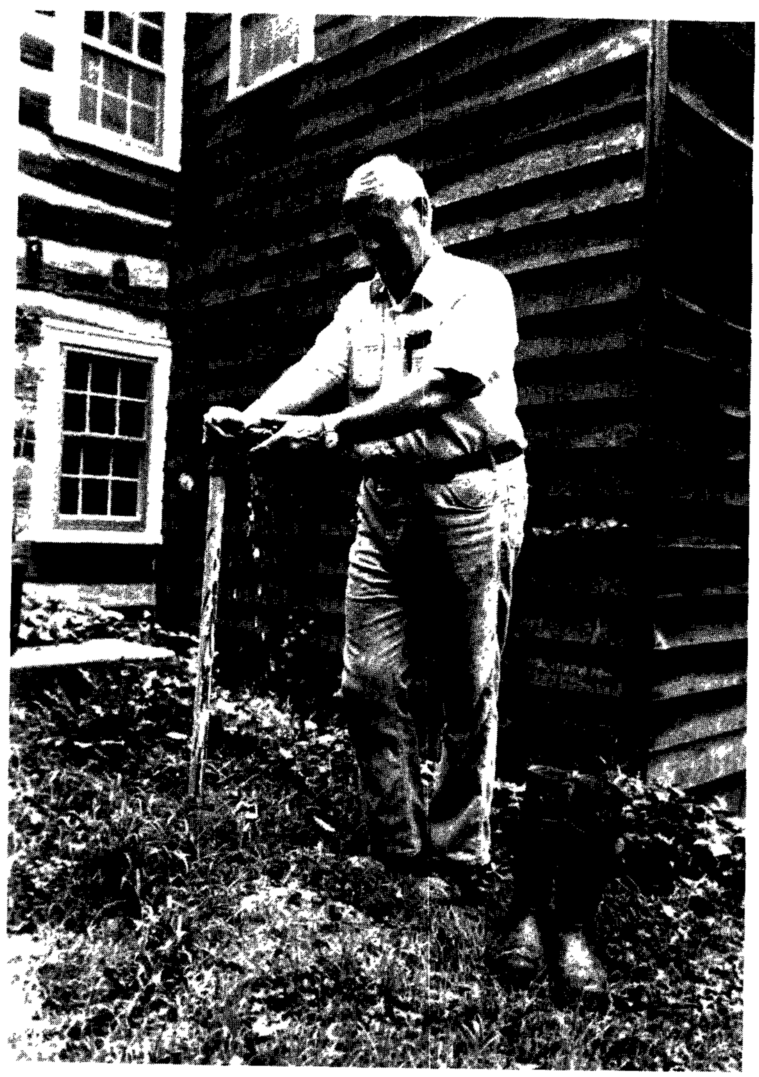
Wellhead Protection Program

The 1986 SDWA Amendments authorize assistance to States to develop a program to protect the wellhead area of all public water systems from ground-water contaminants that may adversely affect human health. Each State Wellhead Protection program must, at a minimum:

- specify the duties of participating State and local agencies;
- determine the extent of the WHP area;
- inventory all potential manmade sources of contaminants;
- describe a program to protect the water supply from such contaminants in the wellhead area;
- include contingency plans for alternate drinking supplies for each public water system; and
- consider all potential contamination sources before construction of new wells.

EPA is required to provide States with guidance which they may use for determining the extent of the wellhead protection area. Public participation is required in the development of the Wellhead Protection program. Once a program is approved, the EPA is authorized to make 50 to 90 percent matching grants to the State. The States are required to submit biennial reports on the progress and accomplishments of the WHP program.

In many rural areas, ground water may be the only available source of drinking water.



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Sole Source Aquifer Demonstration Program

The purpose of the second program under the SDWA is to designate Critical Aquifer Protection Areas (CAPA) within sole source aquifers and to establish demonstration programs for the CAPA. The sole source aquifer designation must be made no later than two years after enactment of the SDWA to be eligible for the program. EPA also is required to establish, by rule, criteria to define a CAPA within one year after the date of enactment.

Any State or local agency with jurisdiction over the CAPA may apply for funds. Through the development of a comprehensive management plan, the applicant should propose a plan that involves a new or unique technique for source identification and assessment, management and control of sources, or institutional arrangements. EPA approval of the plan is a prerequisite for eligibility for a grant. Eligibility, however, will not guarantee demonstration funding.

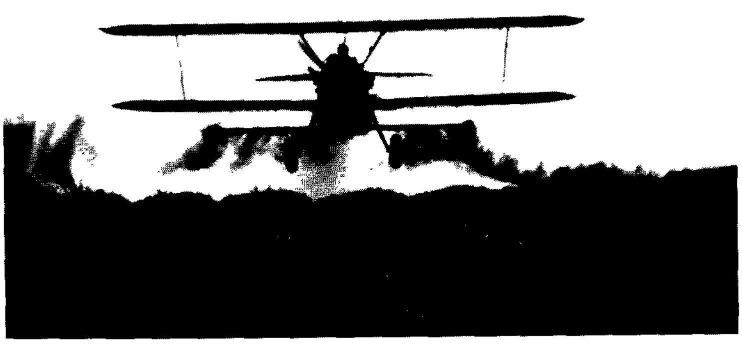
Underground Storage Tank (UST) Control

Subtitle I of RCRA, passed in the 1984 Hazardous and Solid Waste Amendments, directed EPA to initiate a major Federal program to regulate all underground storage of petroleum products and hazardous substances. It is the intention of Congress to have the States implement the UST program because of the enormous number of tanks involved (over 1.5 million) and their distribution throughout the U.S. A State grant program was established to assist the States. In response, States are beginning to set up their own underground storage tank control agencies and initiate programs to protect ground water from leaking tanks.

Pesticides in Drinking Water Study

In 1985, EPA initiated the National Survey of Pesticides in Drinking Water, which is a joint effort of the Office of Pesticide Programs and the Office of Drinking Water. The goals of the survey are to estimate pesticide residues in public water supply and domestic drinking water wells throughout the U.S. and to assess the relationships among hydrogeologic conditions, ground-water vulnerability, agricultural activities, and pesticide residues. An essential feature of the study is close and extensive cooperation among EPA, State and local officials, and well owners. States will perform the sampling of public wells, gather crop and pesticide usage data at the county level, and support the overall survey effort. States will be promptly notified about wells that are found to contain pesticides. When the results of the full study have been analyzed, States will receive information on parameters that affect the extent to which ground-water resources are vulnerable to pesticides.

Some potential sources of ground-water contamination.



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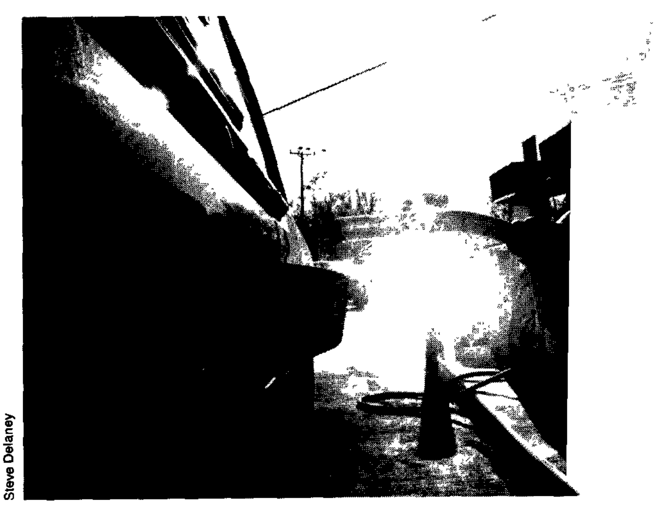


Clean Water Act Section 106 Grant

To support State programs to protect ground water, Congress appropriated $7 million in FY 1985 and $6.7 million in FY 1986 and 1987 under Section 106 of the Clean Water Act. Subsequently, EPA developed State ground-water grant guidance that focused on improving State institutional capabilities through the development of ground-water protection strategies. With the Section 106 funds, States have made strides towards completing and implementing ground-water management strategies and plans as shown earlier in the chapter. These funds also allow States to expand or accelerate their own ground-water pollution control activities.

EPA's grant guidance also mentioned other Federal program funds that States could use to support ground-water protection programs: Sections 205(g) and 205(j) of the Clean Water Act; Section 1443(b) of the Safe Drinking Water Act; and Section 3011 of the Resource Conservation and Recovery Act.

Georgia Minnich

Enjoying spring water in Virginia.

4

Special Issues and Emerging Concerns

In their 1986 305(b) reports, the States were asked to provide individual discussions of any issues they had found to be of either current or emerging special concern. The results of those findings are presented in this chapter.

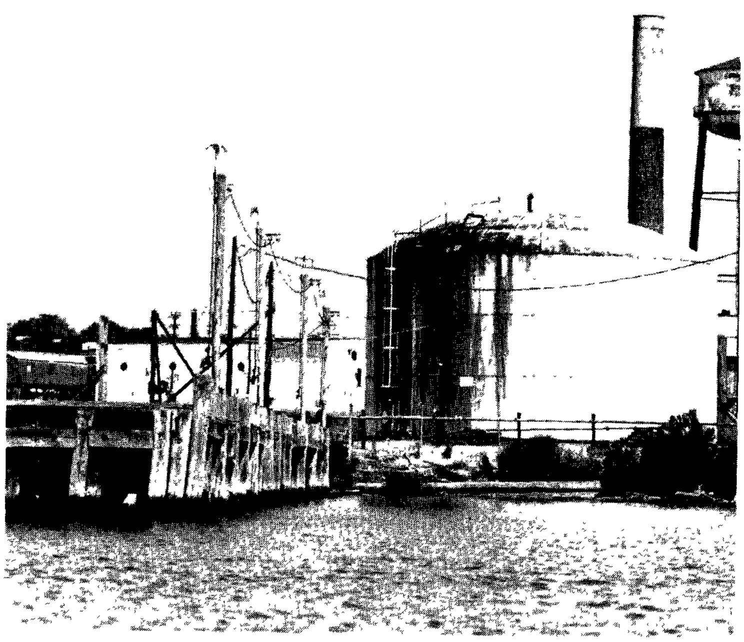
Those surface water concerns most often discussed by the States were toxics and public health; nonpoint sources; wetland loss; funding needs; acid deposition; and acid mine drainage. Twenty States reported that ground-water protection was a special concern (see Chapter 3 for further discussion of ground-water issues).

Toxics and Public Health

In 1986, 16 States reported that toxic substances or some aspect of toxics control—e.g., the need to develop statewide toxics management strategies or address the water quality problems associated with toxic waste sites—is an issue of special concern (see Figure 4-1). What are toxics and why are they such a problem?

The dictionary defines the term "toxic" as "harmful, destructive, or poisonous." Although any pollutant may have toxic effects if it is found in sufficient amounts, a number of pollutants appear to have adverse and long-term effects at extremely low concentrations. These are the substances that are commonly referred to as "toxics." They may be either synthetic or naturally occurring, may persist in the environment for long periods of time or dissipate quickly, and may have a variety of different effects on public health and aquatic life.

Although our knowledge of the health effects of many toxics in water and fish tissue is still limited, we know that some toxics are linked to human health problems such as cancer, kidney ailments, and birth defects. Some chronic health effects may result only after long-term exposure; others may develop years after a single exposure. In addition to public health problems, toxic pollutants can damage aquatic ecosystems by eliminating sensitive species or causing disease in the species that remain. Some toxics may persist in the environment for decades, posing a continuing threat to humans, aquatic organisms, birds, and other wildlife.



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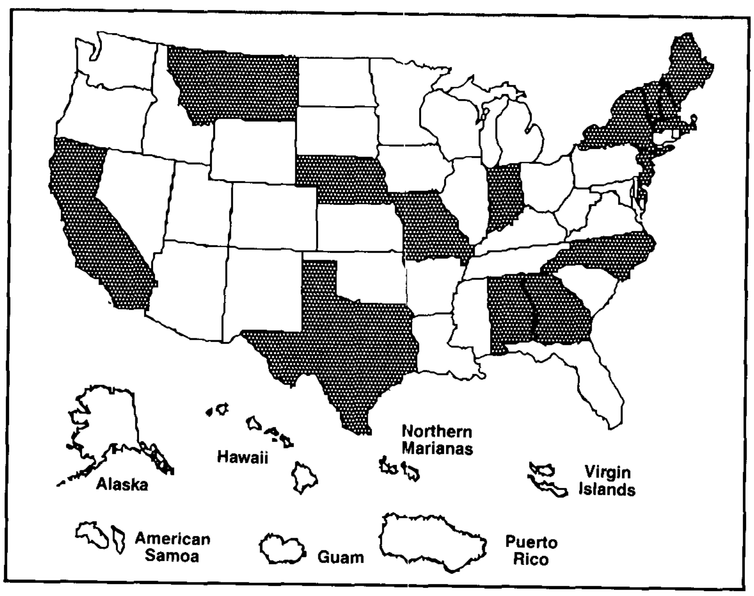
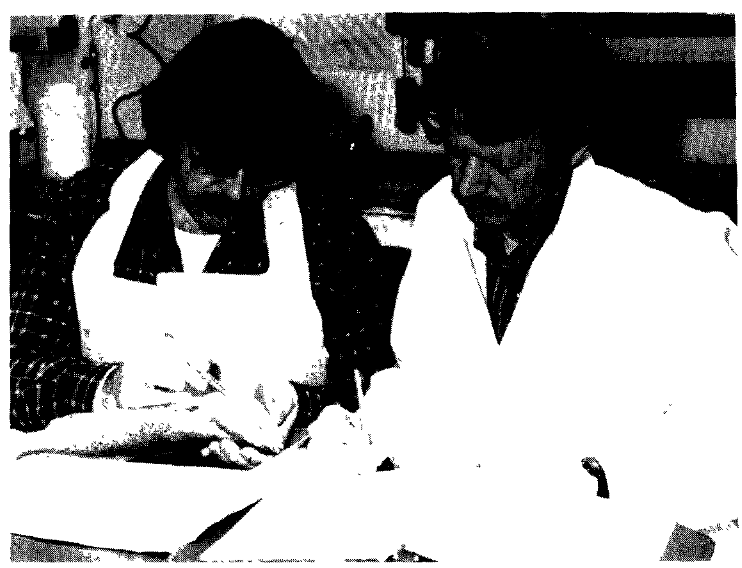


Figure 4-1. States Reporting Toxics Control as a Special Concern

The problem of toxics control is particularly troublesome because of the Nation's dependence on products that may contain hazardous substances or lead to the creation of hazardous by-products. Over 60,000 commercial chemical substances are currently in use in the U.S. About 3.5 billion pounds of formulated pesticide products are applied each year, with over 50,000 pesticide products registered since 1947. The value of these products in everyday life is substantial, and the Nation is unlikely to retreat from their use. Therefore, it is important to prevent the misuse of these products, avoid releases resulting in environmental degradation and risks to human health, and clean up those sites and waters that have already been contaminated.

To a large extent, our understanding of toxic risks, exposure routes, and levels of concern is limited by the difficulty and expense of monitoring and conducting long-term studies. The Federal government has developed 62 numeric human health criteria and 25 aquatic life criteria for toxics against which sampled concentrations can be measured; many more toxic substances affect the aquatic environment, and State adoption of existing criteria is not universal. Therefore, in 1986 as in 1984, the following discussion of toxic contamination is only in terms of "elevated" levels reported by the States. These elevated levels are defined as either exceedances of State water quality standards, of criteria developed by EPA under Section 304(a) of the Clean Water Act, of action levels or tolerances established by the Food and Drug Administration under the Federal Food and Cosmetics Act, or of "levels of State concern" where numeric criteria do not exist.

Reporting on the extent of toxic contamination of waters was more comprehensive in the 1986 State Section 305(b) reports than in past years. In 1986, 22 States reported that 8,500 of their stream miles showed elevated levels of toxics and 16 States reported toxics in 362,000 lake acres. Six States reported that 190 square miles of estuarine waters were affected by toxics. These numbers reflect substantial increases compared to 1984 data on waters affected by toxics; the increase most likely occurred because a greater number of States provided information in 1986. Increased monitoring activity may also explain the increase.



Scientists at EPA's research lab in Gulf Breeze, Florida, examine a marine fish for tumors, which may indicate toxic contamination.

Tables 4-1 and 4-2 display the toxic pollutants most commonly reported by the States. This information reveals that metals and PCBs are the most widely reported toxic pollutants. Of the pesticides, chlordane is the most prevalent; DDT appears still to be a significant concern despite bans on its use imposed in the mid-1970s.

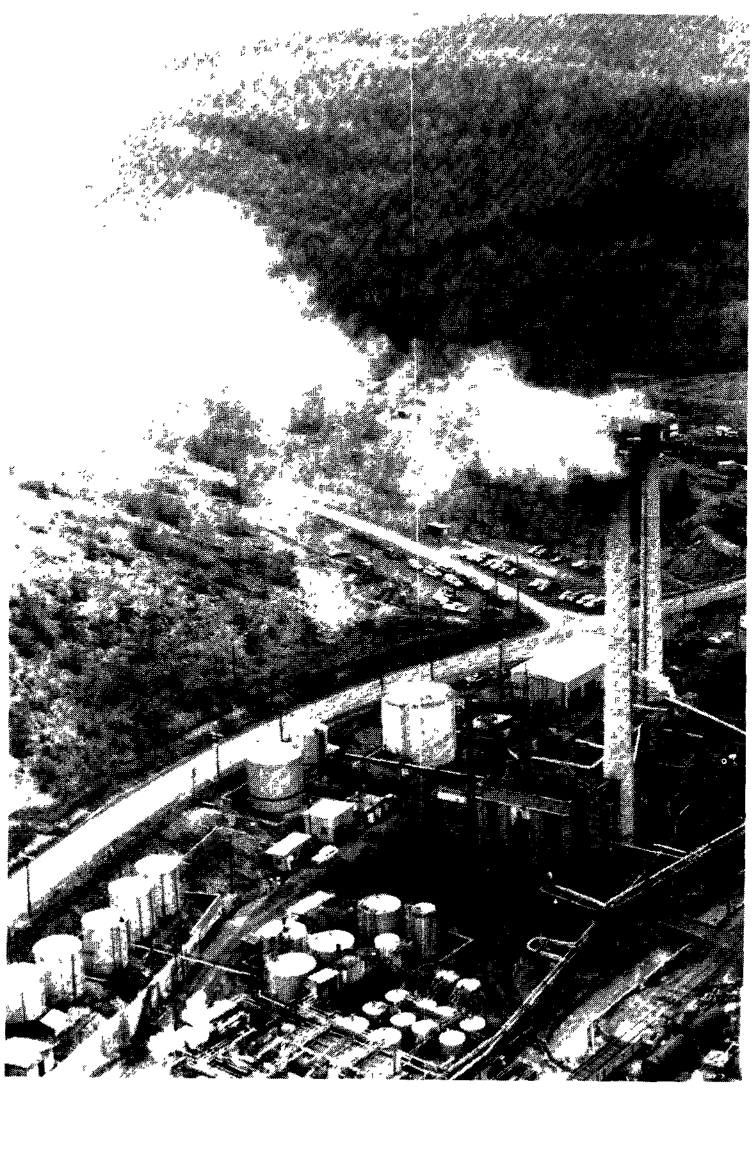
Many States reported on the sources of toxics found in their waters, sediments, and fish tissue. Table 4-3 summarizes these findings.

Table 4-2. Number of States Reporting Elevated Levels of Pesticides and Other Organics

Pesticides and Other Organics	Number of States
PCBs	22
Organics (unspecified)	20
Chlordane	15
DDT	11
Dieldrin	10
Dioxin	6
Phenols	5
Toxaphene	4

Table 4-1. Number of States Reporting Elevated Levels of Metals and Inorganics

Metal and Inorganics	No. of States
Metals (unspecified)	23
Mercury	24
Copper	12
Cadmium	12
Lead	10
Zinc	10
Chromium	8
Cyanide	8
Selenium	7



Steve Delaney

Industry is the most commonly cited source of toxics in the aquatic environment.

Table 4-3 shows that industrial facilities are cited by the States as the most common source of toxic substances in the aquatic environment. Toxics discharged by industries include heavy metals such as mercury and cadmium, and organics such as PCBs and phenols.

Table 4-3. Number of States Reporting Sources of Toxics

Source	Number of States
Industry	28
Agriculture	16
Municipal facilities	14
Mining	13
Sediments	10
Urban runoff	8
Landfill leachate	6
Spills	4
Natural conditions	4

Agriculture is also a significant source of toxics, primarily pesticides such as chlordane, DDT, and dieldrin that are washed off cultivated fields by rainfall and irrigation. Municipal facilities, especially those that receive industrial waste that has not been pretreated, may discharge a wide variety of toxic chemicals. Ongoing mining activities and abandoned mines where no pollution controls are in place may contribute metals such as lead, copper, and silver that leach from the geologic formations that were mined. Sediments are also significant contributors of toxics, as they can retain substances discharged in the past and release them to the water and aquatic organisms long after the discharge has ceased.

Agricultural activities such as pesticide application can be a source of toxics.

USDA

In fact, in their discussions of toxic conditions, seven States identified contamination of sediments as a special problem, and a number of other States cited examples of localized problems with sediment contamination. The severity and complexity of the sediment contamination issue can be illustrated by a few such examples.

- In Connecticut, the most significant incidence of sediment contamination is in the Housatonic River. From the 1930s until 1977, General Electric discharged PCBs used in the manufacture of transformers at its plant in Pittsfield, Massachusetts. PCBs are now found in fish in various parts of the river and in river sediments. In 1977, an advisory was issued against the consumption of fish taken from the river between the Massachusetts State line and Stevenson Dam at Lake Zoar. Extensive studies of this sediment contamination problem have been performed and presently a 5-year study (1984-1988) of sediment management options and fish tissue concentrations is underway.

- Montana reports that toxic, metals-bearing sediments are a concern at most abandoned mine sites and, particularly, in the Clark Fork River, where they have accumulated behind hydroelectric dams. For example, at the Milltown dam near Missoula, sediments laden with arsenic contaminated the Milltown water supply; the town's source of drinking water had to be changed and a Superfund cleanup action initiated.

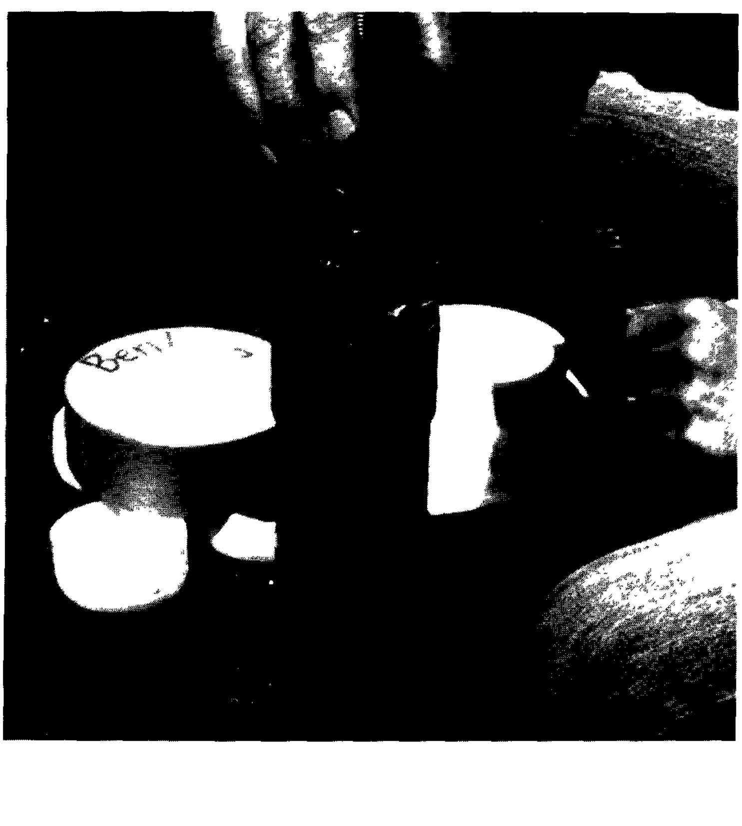
- In New York, PCB-contaminated sediments are a problem in the Hudson River, and sediments containing Mirex are known to affect Lake Ontario. Heavy metals in sediments are a problem in the Mohawk River between Rome and Utica, the Buffalo River, and at the mouths of the Oswego and Genesee Rivers.

- Wisconsin reports that sediment contamination has been identified in the State through statewide monitoring of toxics in fish tissue, follow-up sediment studies, and review of dredging projects. Pollutants in Wisconsin sediments are widely distributed and chemically diverse. The most common problem parameters are PCBs, mercury, dioxin, and pesticides. Wisconsin began a Toxic Materials Management Program in 1983 to address the problem.

In addition to potential impacts on the water column and biota, sediment contamination can pose obstacles to the maintenance dredging of harbors and navigation channels. Disposal of dredge spoil can become a difficult issue if that spoil contains PCBs, mercury, dioxin, and similar chemicals. Methods of disposal such as open water dumping, confinement in diked containment areas, and spreading in coastal areas, wetlands, and "reclaimed lands" could clearly create new—and possibly more severe—environmental problems. Other impacts that may occur when dredging takes place include resuspension of toxics into the water column, habitat alteration, and the smothering of bottom-dwelling aquatic organisms.

On the other hand, dredging of contaminated waters is sometimes practiced specifically to clean up problem areas, although it is an expensive and difficult solution. New York, for example, reports that a proposed project to dredge PCB "hotspots" in the Upper Hudson River has been delayed due to cost and administrative considerations; New York also notes that dredging is not a practical cleanup solution for large areas of contamination such as Lake Ontario.

Since it may be necessary to dredge harbors simply to keep them open for navigation purposes, the States face difficult decisions where sediment contamination is a concern. Rhode Island reports that toxicity issues and lack of disposal sites have brought the maintenance dredging of most harbors and channels to a standstill in the State. Connecticut estimates that approximately 60 million cubic yards of dredged sediment will have to be disposed of in the next 50 years because of routine maintenance dredging and harbor improvement projects. Several areas in Long Island Sound will require special consideration because of high levels of sediment contamination.



Sediment core taken from an ocean disposal site.

Fish Consumption Advisories and Bans

Toxic chemicals discharged to rivers, lakes, and estuaries may be absorbed or ingested by aquatic organisms that are, in turn, consumed by larger predators. Toxics can collect (bioaccumulate) in the tissues and organs of these fish, posing a potential health hazard to people who eat fish taken from contaminated waters. The Food and Drug Administration (FDA) has established "action levels" against which to measure these tissue samples. Fish that contain toxic contaminants above these levels can be harmful to human health if consumed.

In 1986, 27 States reported finding detectable levels of toxic contaminants in some fish tissue samples; 23 reported concentrations exceeding FDA action levels in localized areas. Many States respond to the finding of FDA action level exceedances by imposing fishing bans or fish consumption advisories. Advisories typically recommend limiting consumption of certain species of fish from given waterways to a few meals per week or month. Fishing bans, of course, are completely restrictive.

National statistics on fishing advisories and bans are incomplete. Many States rely on local authorities to impose these restrictions, and therefore do not keep statewide tallies of their numbers, locations, and the species of fish affected. Nevertheless, these statistics are valuable indicators of the extent of toxic pollution, and their reporting will be stressed in the future. In their 1986 reports, 25 States provided some discussion of fishing advisories and bans: in most of these States, both kinds of fishing restrictions were cited, although some cited only one type. Two hundred and eighty-six fishing advisories were reported by 24 States, and 15 States reported 108 bans on fishing in selected waterways. Several States discussed the imposition of advisories, but did not report on how many were in effect.

These results should be interpreted with caution and should not be compared to the findings of previous 305(b) reports until standardized and complete reporting is in effect. Bans and advisories, once imposed, tend to remain in place for a number of years because of the biological persistence of many of the chemicals involved. Thus, large apparent changes in the total number of bans and advisories reported by the States over a two-year period are more probably the result of increasingly comprehensive reporting and monitoring than actual water quality changes. The reader should also note that for any given waterway, a combination of advisories and bans may be imposed for different fish species or in different segments.

Steve Delaney

Those toxic pollutants or pollutant categories that were most commonly cited by the States as responsible for fishing restrictions are listed in Table 4-4.

It is clear from these statistics that pollution due to toxic substances is not a problem that is "going away." On the contrary, the more we study and monitor for toxics, the more likely we are to find them and realize their pervasiveness. Since much of our water quality information to date deals with conventional (i.e., non-toxic) pollutants, any statement on the condition of the Nation's waters must be qualified with this caution.

The following examples of fishing advisories and bans were drawn from the 1986 State 305(b) reports:

■ New York reports that PCBs once discharged in the Upper Hudson River have remained in sediments and contaminated aquatic life in both the Upper and Lower Hudson River. Fishing advisories and bans are in effect for several fish species, including striped bass.

■ Kentucky reports that fish consumption advisories were issued in 1985 and remain in effect for 47 miles of the West Fork of Drakes Creek and 65 miles of the Mud River due to PCB contamination. Discharges from an adhesives plant and a metal dye-cast plant are believed to be the sources of the contamination.

■ In Iowa, a fish consumption advisory was issued for Cedar Lake near Cedar Rapids due to elevated chlordane levels believed to originate from termite control applications.

■ In Missouri, an advisory has been issued against consumption of any fish caught in the lower 22 miles of the Meramec River because of chlordane contamination. Fish contamination by dioxin has also been discovered, although at average concentrations below the FDA action level.

■ Montana reports that mercury contamination in trout has led to a fish consumption advisory in Silver Creek near Helena. Mining operations are believed to be the source of the contamination.

■ California provides examples of advisories in estuarine and coastal waters. These include the Monterey Harbor/Cannery Row area, posted against consumption of mussels due to lead contamination; the Elkhorn Slough/Moss Landing Harbor area, posted against shellfish consumption due to pesticides; and the San Diego Bay/Harbor Island East Basin area, posted against shellfish consumption due to PCBs.

The States and EPA are committed to increasing our knowledge about toxic substances, locating problem areas, and implementing controls to reduce toxic hazards to human health and aquatic life. Chapter 5, "Water Pollution Control Programs," discusses these State and Federal efforts.

Table 4-4. Primary Pollutants Associated with Fishing Advisories and Bans

Pollutant	No. of States
PCBs	15
Mercury	11
Chlordane	10
Pesticides (unspecified)	7
Dioxin	7
DDT	5
Metals (unspecified)	5
Organics (unspecified)	3
Dieldrin	3

EPA's National Dioxin Study

"Dioxin" is the generic term for a group of 75 related compounds known as polychlorinated dibenzo-p-dioxins; however, in common use the name refers to the most toxic and thoroughly studied of these compounds: 2,3,7,8-tetrachlorodibenzo-p-dioxin, or 2,3,7,8-TCDD. This compound, which has caused toxic effects at concentrations lower than any other manmade chemical, is not produced intentionally but rather is a byproduct in the manufacture of several pesticides, chiefly 2,4,5-trichlorophenol (2,4,5-TCP).

While the use of many products that may cause dioxin contamination has been suspended, the compound is persistent once it enters the environment. In addition, dioxin bioaccumulates so that even if present in extremely low concentrations, it can concentrate in organisms to much higher levels, increasing the likelihood of hazard.

During the past three years, EPA has conducted a national monitoring program using new and sensitive analytical techniques to estimate the extent of 2,3,7,8-TCDD contamination in the environment.

In 1983, EPA issued its National Dioxin Strategy. This strategy was designed to provide a framework for the study of dioxin-related problems, including the nature and extent of dioxin contamination throughout the country and risks to people and the environment. The strategy also addressed the cleanup of contaminated sites and the destruction or disposal of existing dioxin. To implement the information-gathering portion of the strategy, EPA defined seven categories (or tiers) of sites for investigation. The tiers were believed to exhibit a decreasing potential for 2,3,7,8-TCDD contamination.

Findings of the National Dioxin Study

- Of the 84 sites selected for sampling where 2,4,5-TCP and its derivatives were formulated, 64 were sampled. Contamination was detected at 12 sites, and only 2 were extensively contaminated. As a result of these findings, EPA concluded that the immediate investigation of the remaining sites is not warranted, although the Agency will conduct further evaluations of specific large pesticide manufacturers where 2,4,5-TCP and its derivatives are formulated.
- Twenty-six sites were sampled in areas where pesticides suspected of containing dioxin had been used. At the 15 sites where 2,3,7,8-TCDD was detected, soil and sediment contamination was extensive, with over 40 percent of the samples analyzed at each site containing levels above the parts per trillion (ppt) detection limit. Two sites had detectable levels in fish, and, at one of these, all fish samples were contaminated. While contamination in soil and sediment was widespread, concentrations were generally quite low (less than 5 ppt). Levels detected in fish fillets were between 8 and 23 ppt, and dioxin was not detected in other animal tissue or in vegetation samples. Due to low levels found at these sites, EPA concluded that further national investigation of spray areas was not warranted.

Westec Services

Technician extracts a sample from a trench at a feed packaging outlet as part of the National Dioxin Study.

■ EPA identified 67 facilities thought to manufacture one or more of the 60 compounds whose production can create dioxin. Twenty-eight sites were selected for sampling and dioxin was detected at only three. None of the three sites was extensively contaminated. As a result, it was concluded that additional investigation of this tier was not warranted.

■ Sampling was carried out at 359 soil sites and 395 fish sites that had no previously known sources of dioxin. In the soil samples, 2,3,7,8-TCDD was detected infrequently (17 sites) and at very low levels (0.2-11.2 ppt). Background fish contamination was somewhat higher (112 sites, 0.3-85 ppt). Of the fish samples, the highest proportion of contaminated samples was found in Great Lakes sites.

■ The two fish sampling sites with the highest levels of dioxin contamination were the Androscoggin River in Maine and the Rainy River in Minnesota. In both cases, the rivers were subject to upstream pulp and paper mill discharges. Further investigations at these and similar sites are being conducted by EPA, the States, and the paper industry to determine the sources of 2,3,7,8-TCDD within the mills. As a result of the study, fish consumption advisories were issued by the two States.

Major accomplishments of the National Dioxin Study include a major increase in EPA's knowledge of 2,3,7,8-TCDD levels in the environment, and a refinement of the tools needed for further understanding of dioxins.

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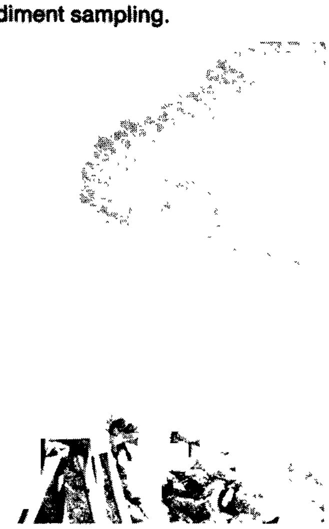
Sediment sampling in the Potomac River at the former site of a pesticide formulator.



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Transit used to locate sites for sediment sampling.

Nonpoint Source Pollution

As discussed in Chapter 2, nonpoint or diffuse sources of pollution are major causes of water quality problems in the U.S. Their extent and intensity are becoming more and more evident as the States increase their ability to assess the causes of use impairments, and as new sources of data are tapped.

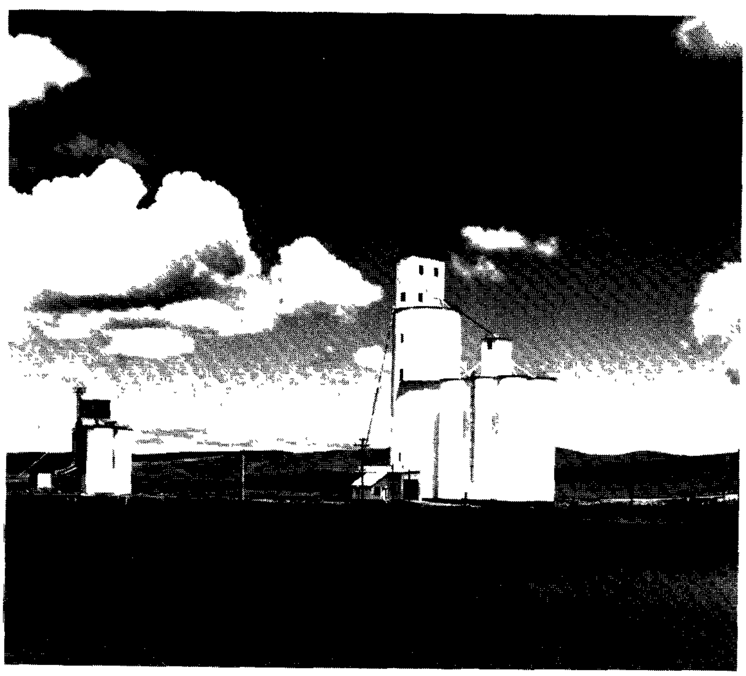
In their 1986 Section 305(b) reports, 16 States identified control of nonpoint sources as an issue of special concern (Figure 4-2).

Additional State-reported information provided insight into the widespread nature of the nonpoint source problem. Of the 52 States and territories that ranked the relative impacts of nonpoint sources, 33 found nonpoint sources to be a major problem, 14 found them to be a moderate problem, one reported only minor impacts, and four stated that nonpoint sources were a problem of unknown magnitude. These findings, compared to 1984 when 24 States found nonpoint sources to be a major problem, indicate that the States are becoming more aware of the extent and impacts of nonpoint sources.

By far the most common nonpoint source reported by the States in 1986 is agricultural runoff. Runoff from urban areas, construction sites, and mining areas are also major nonpoint sources, followed by landfill leachate, septic systems, hydrologic modification, and silviculture.

Forty-nine States listed problem pollutants that can be linked directly to nonpoint sources. Of these, sediments/turbidity are most widely cited, followed by nutrients, fecal coliform bacteria, toxics, and biochemical oxygen demand/dissolved oxygen. These results are pictured in Figures 4-3 and 4-4.

A grain elevator on a midwestern farm.



USDA Soil Conservation Service

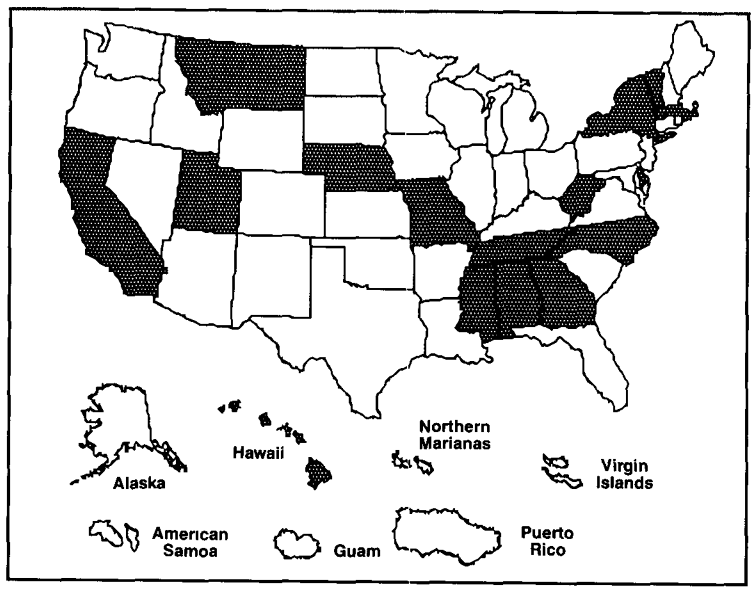


Figure 4-2. States Reporting Nonpoint Sources as a Special Concern

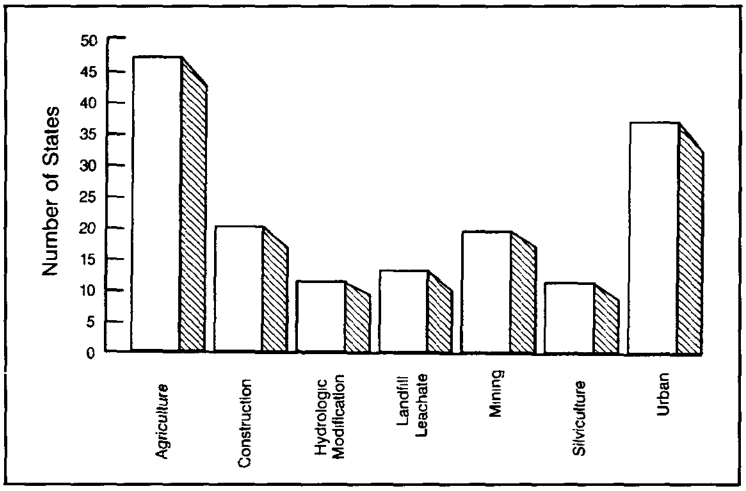


Figure 4-3. Nonpoint Sources Reported as Major Causes of Use Impairments

A number of 1986 State submissions did not comprehensively discuss nonpoint sources. A more comprehensive picture of the nature and scope of nonpoint source pollution may be gained from a recent study of nonpoint source pollution and related Federal, State, and local nonpoint source programs. This study was conducted by the States under the sponsorship of the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA).

Documented in a report entitled *America's Clean Water: The States' Nonpoint Source Assessment, 1985*, the assessment was based on surveys prepared by 49 States, 3 territories, 3 interstate agencies, and the District of Columbia. In making their evaluations, the States used long-term monitoring data, short-term water quality surveys, other more general information such as fish surveys and citizen observations, and best professional judgement. States were queried regarding the quantity and types of water resources in their States; the extent and severity of use impairments from nonpoint sources associated with rivers, lakes, wetlands, estuaries, and ground water; the primary pollutants and sources causing use impairments; and current nonpoint source programs. Overall, approximately ten times as many stream/river miles, lake acres, and estuary square miles were assessed for nonpoint source pollution effects as had ever been formally assessed before. However, varying amounts of the Nation's rivers, lakes, and estuaries have yet to be assessed for nonpoint source pollution. Significant data gaps remain (e.g., information on the Great Lakes, the Great Salt Lake, Chesapeake Bay, and Puget Sound was not included). Nevertheless, ASIWPCA's study provides the most up-to-date and extensive national summary of nonpoint source pollution problems and programs currently available.

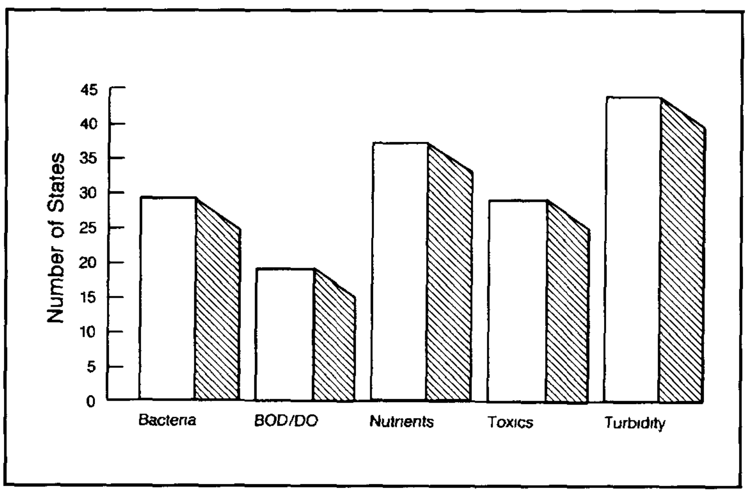


Figure 4-4. Nonpoint Source Parameters Most Widely Reported

The percentage of total waters in the Nation assessed by the States for this study varied by category of waters. For rivers and streams, the miles assessed represent from 13 to 23 percent of the total river/stream miles in the United States, depending upon the total river/stream mile estimate used.* Lake acres assessed represent 39 percent of the total lake acres in the Nation (the Great Lakes and the Great Salt Lake were excluded). Estuary square miles assessed represent 59 percent of the total estuary square miles in the United States (the Chesapeake Bay and Puget Sound were excluded). From these percentages, it is apparent that varying amounts of the Nation's rivers, lakes, and estuaries have yet to be assessed for nonpoint source pollution.

Of the 406,000 miles of rivers and streams assessed by the States, 30,000 miles (7 percent) were found to be severely impaired, 87,000 miles (21 percent) were moderately impaired, and 48,000 miles (12 percent) were threatened by nonpoint source pollution.**

Agricultural activities were found to be the predominant contributor of nonpoint source pollution in both lakes and rivers. Agriculture was reported as the primary pollutant source for 64 percent of affected river miles, 57 percent of affected lake acres, and 19 percent of affected estuarine areas. Urban runoff, resource extraction, and hydrologic modification were noted as the next most widespread nonpoint sources of pollution. The predominant pollutant of nonpoint origin in rivers and streams was found to be sediment; in lakes and estuaries, nutrients were the predominant pollutant of nonpoint origin.

Nonpoint Source Programs

The States also reported on nonpoint source programs at the Federal, State, and local levels as of 1984. They identified 354 programs at the State and local level, and 32 programs in 17 Federal agencies, that manage nonpoint source-related activities and affect water quality.

The most frequently listed Federal programs were those of the Soil Conservation Service, the Forest Service, the Office of Surface Mining, the Bureau of Land Management, and the U.S. Army Corps of Engineers State programs ranged from dredge-and-fill permitting and fish and wildlife management to pesticide applicator licensing and coastal zone/floodplain management. Local programs listed most frequently included those of soil and water conservation districts and planning/zoning commissions and those having to do with permitting of well construction/septic systems and erosion/sediment control.

States reported that 69 percent of State- and locally-initiated nonpoint source programs include some degree of regulatory authority. Grants, loans, tax abatement, and other incentives are included in 14 percent of the State and local programs, with most of these programs directed toward agricultural activities. The States concluded that effective nonpoint source programs require close cooperation among State, Federal, and local governments, along with private interests and the public at large.

Controlling pollution from nonpoint sources is a difficult task, in large part because of the very nature of diffuse runoff. Chapter 5 will explore the programs and responsibilities of those agencies with jurisdiction over nonpoint sources, the obstacles they face, and the successes they have achieved to date.

Runoff from construction sites is a significant nonpoint source problem.

*The States report a total of 1 8 million miles, but detailed National estimates indicate the total is 3 2 million miles when first-order streams are included First-order streams are more likely to be degraded by nonpoint than by point source pollution

**Numbers may differ slightly from those in ASIWPCA's summary report because they were computed directly from the report's Appendix of State submissions (ASIWPCA, *The States' Nonpoint Source Assessment 1985, Appendix*)

Wetlands

Wetlands are areas that are flooded or saturated by surface or ground water frequently enough—and for long enough time—to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands frequently include swamps, marshes, bogs, and similar areas. They may be coastal or inland, salt or freshwater, and as diverse as the Florida Everglades, sphagnum-heath bogs in Maine, coastal Alaskan salt marshes, and the shallow, seasonally flooded potholes of the northern Great Plains. Although of critical value to the natural environment, wetlands have historically been treated as unhealthy and useless, fit only for draining, filling, and conversion to other uses.

It is now known that wetlands serve a wide variety of important natural functions. For example, wetlands provide habitat for a huge number of plants and animals, including many endangered species. Approximately two-thirds of the major U.S. commercial fish species depend on estuaries and salt marshes for nursery or spawning grounds. Coastal wetlands are essential for important shellfish such as shrimp, blue crabs, clams, and oysters. In addition to providing year-round habitat for resident birds, wetlands are extremely important as breeding grounds, overwintering areas, and feeding grounds for migratory waterfowl and other birds.

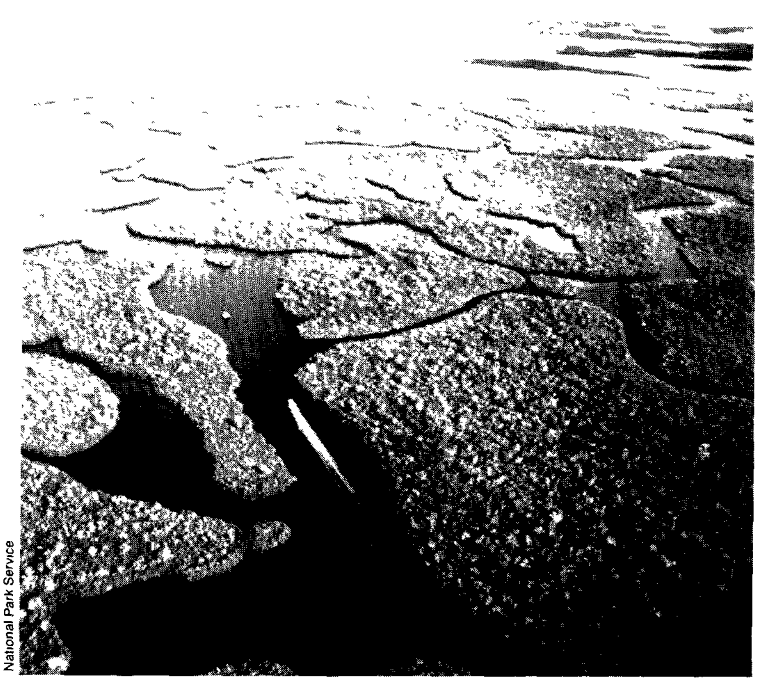
Wetlands can also temporarily store flood waters, thereby protecting downstream property. This flood storage ability also helps slow the water's speed and lower the height of waves, thus reducing the water's erosive potential. Wetland vegetation can reduce shoreline erosion by stabilizing substrates, dissipating wave and current energy, and trapping sediments. This reduces turbidity, thereby improving water quality.

The role that wetlands play in ground-water recharge is not clear. It appears that some wetlands recharge the ground-water system. The recharge potential varies according to type of wetland, location, soil type, water table location, and precipitation.

Most wetlands provide recreational opportunities that can be enjoyed by the general population, including hunting, sport fishing, and bird watching. Wetlands can also be used for open space, scientific study, and educational purposes.

Lastly, wetlands often play a role in improving water quality. They can function as filters that remove sediments and pollutants from moving waters. Dissolved nutrients may be directly taken up by plants and by chemical absorption and precipitation at the wetland soil surface. Organic and inorganic suspended material tends to settle out and is trapped in the wetland.

An aerial view of the Florida Everglades.



National Park Service

Regional Trends

Throughout history, wetlands have been considered "wastelands" to be drained or filled for conversion to "productive" use. Within the last 200 years, over 50 percent of the wetlands in the lower 48 States have been converted to other uses such as agriculture, mining, forestry, oil and gas production, and urbanization. These losses are continuing today at an alarming rate; an estimated 350,000 to 500,000 acres are lost annually.

The most extensive inland wetlands losses have occurred in Louisiana, Mississippi, Arkansas, North Carolina, North Dakota, South Dakota, Nebraska, Florida, and Texas. Estuarine wetlands losses have been greatest in California, Florida, Louisiana, New Jersey, and Texas.

In many coastal areas where estuarine wetland loss is high, urbanization and increased ground-water withdrawal have resulted in saltwater contamination of public water supplies. In Chesapeake Bay—the largest estuary in the United States—sea grass beds and tidal wetlands have been declining since the 1960s; in some areas of the bay, they have almost disappeared. This is due to a combination of natural and manmade factors. The manmade factors include industrial and sewage treatment plant discharges, failing septic systems, and agricultural and urban runoff. These result in increased turbidity and sedimentation, nutrient overload, and chemical pollution in the bay.

In North Carolina, forestry and agriculture have played an important role in the loss of much of the evergreen forested and scrub-shrub wetlands known as pocosins. Much of this area has been transferred to large-scale agriculture. In addition to extensive land clearing and ditching, large quantities of fertilizers and lime must be added to these former wetlands to keep them fertile and productive. Runoff from these areas degrades the water quality of adjacent estuaries.

In their 1986 State 305(b) assessments, 12 States reported that wetlands were of special concern (Figure 4-5). Problems with both wetland loss and diminished wetland quality are noted.

Despite their importance to the natural environment, wetlands are still being destroyed at a rapid rate.

USDA Soil Conservation Service

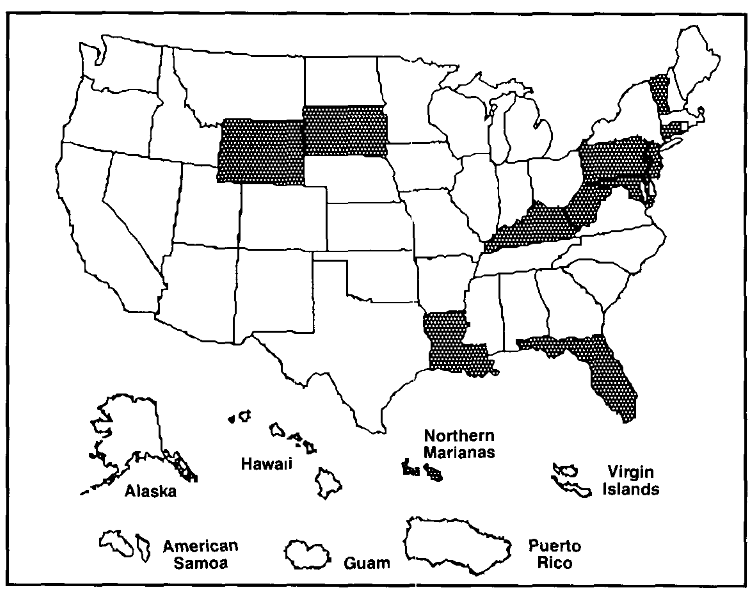


Figure 4-5. States Reporting Wetlands as a Special Concern

A number of States provided information that illustrates the variety and extent of problems affecting wetlands in the U.S.

■ In Alaska, the major cause of wetland impacts is oil and gas extraction activity on the North Slope and Kenai Peninsula. A total of 19,200 acres—less than 1/100 of a percent of Alaska's inland and tidal wetlands—have been assessed; of those, 16,640 do not fully support designated uses.

■ California reports that 56 percent of its assessed wetland area is classified as poor in quality, including the 57,000-acre Suisun Marsh. Nonpoint sources are identified as the primary causes of use impairment in California wetlands.

■ In Kentucky, half of the original wetland acreage is gone. Nearly all of the areas that remain have been degraded by either pesticides, acid mine drainage, siltation, brine water, or domestic and industrial sewage. In addition, Kentucky reports that it does not have a wetlands monitoring program and that there continues to be a poor understanding of wetland conditions, remaining areas, and rates of loss.

■ Louisiana reports that the loss of wetlands in the deltaic plain of coastal Louisiana is occurring at an accelerated rate, with an estimated annual loss of 25,000 acres. Approximately 800,000 acres of wetlands have been lost from the deltaic plain over the last 80 years.

The factors causing wetland loss in coastal Louisiana are complex and involve wave erosion following channelization, subsidence, and saltwater intrusion. Louisiana's coastal wetlands originally developed as the Mississippi River deposited freshwater, nutrients, and sediments over a broad coastal area. Extensive leveeing of the river for flood control has reduced the area of natural "delta building" by cutting off the flow of water and sediment to the marshes. The construction of navigation and pipeline canals has interrupted flow patterns and accelerated rates of erosion and saltwater intrusion.

The net result has been a rapid loss of land and the intrusion of saline water into coastal marshes and waterbodies. Some local trappers and fishermen have reported a decline in harvests of freshwater species due to the higher salinity levels. Some freshwater swamp and marsh vegetation has died and been replaced by more salt-tolerant plant species.

■ It has been estimated that Michigan once had 11.2 million acres of wetlands; by 1955, only about 3.2 million acres remained. Wetlands along Michigan's Great Lakes coast are estimated to have once covered 369,000 acres, but a 1972 inventory identified only 105,855 acres of coastal wetlands remaining. Most wetlands were lost through the development of land for agricultural production, highways, parking lots, residential and commercial building sites, industrial plants, marinas, and harbors.

■ By 1980, nearly half of the original wetland acres in North Dakota had been drained. Since 1980, the rate of wetland loss in North Dakota is estimated at 20,000 acres per year. The annual loss of wetlands appears to be lessening; however, this may be attributable to the diminishing wetland base as well to the cost and difficulty of draining.

■ In Vermont, it is estimated that approximately half of the yearly impacts on wetlands are due to construction of bridges and highways. The remaining impacts are caused by dredging, drainage, clearing for utility rights-of-way, structures, filling, boat moorings and wharves, railroad beds, logging, auto junkyards, impoundments, sanitary landfills, and sewage treatment facilities.

■ In Wyoming, the principal developmental pressure on wetland areas is the encroachment of urban and industrial development on flood plains. The primary areas of impact are in relatively isolated patches along the Platte, Big Horn, and Bear Rivers, although lesser drainage areas are also affected. Intensive cropland management and livestock grazing pressure are also cited as causes of wetland loss.

■ West Virginia has two major wetland complexes: Canaan Valley and Meadow River. Both are constantly being threatened: Canaan Valley by a proposed hydropower project, resource extraction, second-home development, and off-road recreation vehicles, and Meadow River by interstate highway construction. Threats to smaller wetlands come primarily from resource extraction activities, land development, and transportation projects.

Wetland Regulations

Section 404 of the Clean Water Act gives the Army Corps of Engineers authority to issue permits for "the discharge of dredged or fill material into the navigable waters [of the United States] at specified disposal sites." Section 404 also gives EPA a number of responsibilities to assure that the environment is sufficiently protected from the adverse impacts of these discharges. Since 1972, the "404 program" has developed into the most important Federal regulatory program for the protection of wetlands.

Inland freshwater wetlands comprise 95 percent of the remaining wetland resource in the United States and 97 percent of the estimated 300,000 acres of wetlands lost each year to development. Many of the losses involve drainage without a discharge, which is not regulated under the 404 program. The 1985 Farm Bill should help mitigate this problem by discontinuing subsidies to farmers who drain and plant wetlands.

Steve Delaney

Marshlands in the Chesapeake Bay.

Approximately 11,000 project applications under Section 404 are processed each year by the Corps of Engineers. EPA reviews and evaluates them using its 404(b)(1) guidelines, which contain the environmental criteria for 404 permit decisions. The Fish and Wildlife Service and the National Marine Fisheries Service also influence the 404 permitting process through their review of applications. After receiving comments from these agencies, the States, and other interested parties, the Corps of Engineers makes its permit decisions.

Before permits are issued, EPA has an opportunity to exercise its authority to prohibit, condition, or restrict the use of any site if such use is found to "have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas." However, this action occurs on only a small fraction of projects.

As a result of this process, the Corps of Engineers annually denies slightly more than three percent of project applications. About one-third of the permits are significantly modified from their original application, and about 14 percent of the 11,000 annual permit applications are withdrawn by applicants. The Congressional Office of Technology Assessment has estimated that these denials, modifications, and application withdrawals save 50,000 acres of wetlands every year.

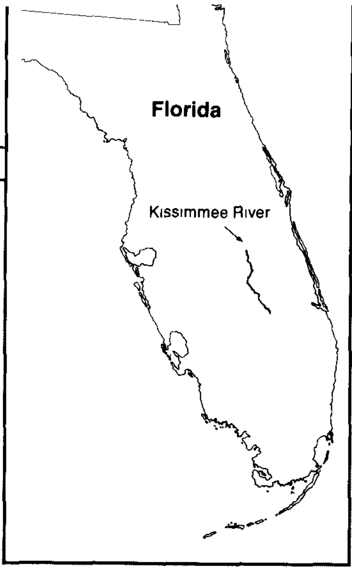
In their 1986 305(b) reports, the States discussed their wetland protection programs and in many cases cited examples of successes as well as continuing problems. In general, passage of State-level wetland protection legislation appears to be an important first step in protecting valuable wetlands.

■ In Florida, the Warren S. Henderson Wetlands Protection Act of 1984 authorizes the Department of Environmental Regulation to adopt rules and regulatory programs to protect wetlands. One of its primary requirements is an inventory to track gains and losses of wetland area.

■ Michigan, the first State to assume Section 404 permitting responsibility, has enacted a Wetland Protection Act that provides for the preservation, management, and use of wetlands; requires permits to alter wetlands; and provides penalties for illegal wetland alteration. A number of other State laws also regulate the use of Michigan's wetlands. Successful programs also exist to purchase wetland areas using revenues from oil, gas, and mineral production on State-owned land, from hunting activities, and through a "Save-the-Marsh" drive for St. John's Marsh along Lake St. Clair.


Joel Arrington, NC Wildlife Resources Commission

A hardwood swamp in North Carolina.



The Kissimmee River

The Kissimmee River once meandered for 98 miles from Lake Kissimmee to Lake Okeechobee in central Florida. After several serious floods, the U.S. Army Corps of Engineers, at the request of the State of Florida, channelized the river. Today, the "Kissimmee Ditch" is a 30-foot deep, 48-mile long canal. The project resulted in many environmental problems, including:

- conversion of approximately 40 miles of meandering river to stagnant pools;

- loss of 70-80 percent of the basin's original 40,000 acres of wetlands, and degradation of remaining wetlands;

- loss of valuable fish and wildlife habitat;

- conversion of basin hydrology from upland/floodplain retention and slow runoff to one of upland/floodplain drainage and rapid runoff; and

- induced upland drainage resulting in increased land use, degraded water quality entering Lake Okeechobee, and saltwater intrusion into the Biscayne Aquifer.

Source: *National Wetlands Newsletter*, February 1986.

Even before the project was completed, restoration of the Kissimmee was being considered. Various State agencies recommended developing measures for restoring the water quality in the Kissimmee River Valley and to consider restoration of the river. Following Congressional authorization, the Corps began evaluating options for enhancing the river's environmental resources. The Corps concluded that
(1) a nonchannelization alternative (pool stage manipulation) offered the greatest potential for wetlands restoration, and
(2) implementation of best management practices would be the most cost-effective means of maintaining and improving the basin's water quality. The Corps also concluded that none of the alternatives qualifies for Federal implementation.

The State of Florida is committed to restoring natural fish, wildlife, and water quality benefits to the Kissimmee River system. The State will proceed with a dechannelization alternative that it believes is the best method for achieving its environmental goals.

- Delaware's Wetlands Act gives the State authority to regulate activities in all tidal wetlands and contiguous non-tidal wetlands that are of 400 acres or greater. This State authority has meant a dramatic reduction in the loss of these wetlands. Delaware lost about 450 acres per year from 1954 until regulations were implemented in 1973. Between 1973 and 1979, the average annual rate of wetlands loss resulting directly from human actions was 20 acres per year. Generally small-scale and nondestructive projects are still allowed with a State permit. In larger projects, the destruction of wetlands in one area must be offset by the creation of an equal area of wetlands nearby.

However, non-tidal or freshwater wetlands less than 400 acres currently have no State protection and only limited protection under Section 404 of the Clean Water Act. Roughly 20 percent of the State's freshwater wetlands have been lost since 1954. Most of this loss resulted from drainage projects and agricultural conversion. Freshwater wetlands currently account for 132,695 acres, or about 60 percent of the State's wetlands.

Jim Hunt, USDA Soil Conservation Service

Protection of America's important wetlands resources is one of EPA's top priorities. EPA created a new Office of Wetlands Protection in 1986 to enhance wetlands protection nationwide. One of the key objectives for the new office is to improve coordination with, and provide increased assistance to, State wetland protection efforts. Another focus will be increased coordination of the long-range research efforts underway at EPA and other Federal agencies. One focus of EPA's current research plan is the water quality functions of wetlands. The plan also provides for research on cumulative impacts of wetlands losses and evaluation of mitigation alternatives.

In addition to these efforts, EPA will strive to build consensus on the value of wetlands; expand on the progress already made in cooperating with other Federal agencies to establish consistent policies and procedures for wetlands protection; increase efforts to identify, protect, and restore wetlands, strongly stressing the early identification of particularly valuable and vulnerable wetlands; and emphasize communication with the public, including individual property owners and developers, to give them a better understanding of the values of wetland resources.

The Rainwater Basin

Nebraska reports that wetland acreage in the Rainwater Basin has declined from its original area of about 95,000 acres to 21,000 acres in 1984. The primary cause of this wetland loss is draining and filling activity designed to expand agricultural production.

The severe decline of wetland acreage and associated problems such as waterfowl overcrowding, flooding, and erosion in the Rainwater Basin has captured the attention of a number of resource agencies. EPA and the U.S. Army Corps of Engineers have taken the lead in initiating the Rainwater Basin Project with several State agencies—the Nebraska Department of Environmental Control, the Game and Parks Commission, and the Natural Resources Commission—along with the U.S. Fish and Wildlife Service, the U.S. Department of Agriculture's Soil Conservation Service, and three local natural resources districts cooperating in the project.

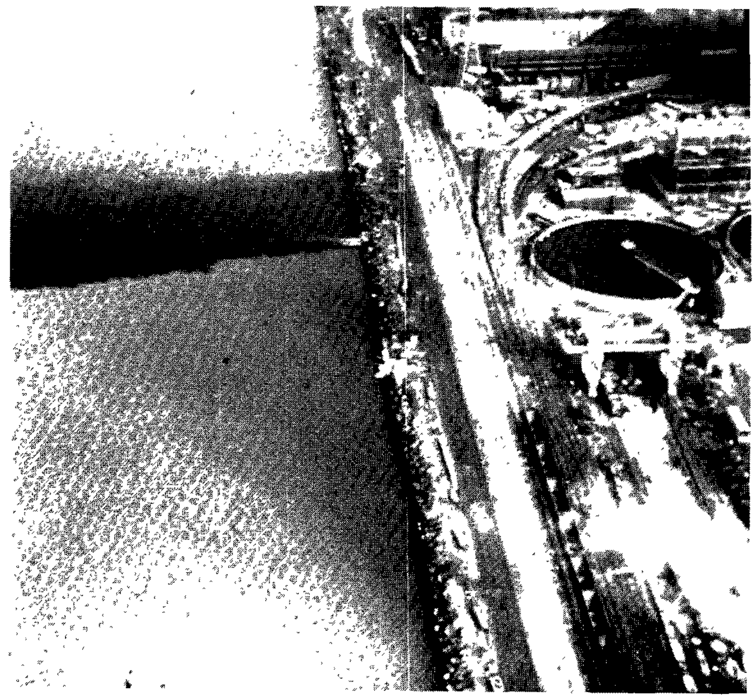
Although 404 permit requirements are not being changed and no sites are being prohibited from fill, the advance identification of these wetland sites is needed in order to provide critical information for appropriate 404 permit decisions. Field components of the project are designed to provide information on jurisdictional limits (i.e., where a 404 permit would be needed), wildlife and waterfowl use, detailed vegetative characteristics, and functional values of the wetlands. This information will be combined with an analysis of the historic variability of Rainwater Basin wetlands and information from the National Wetlands Inventory to form a list of wetland sites generally unsuitable for fill.

In addition to the advance identification of wetland sites, the project will conduct an analysis of the economics of filling wetlands. Landowners will be involved: this information will be made available to them, and educational programs will improve awareness of Section 404 requirements and the value of wetlands. It is hoped that the information generated during the project will provide the basis for additional wetland protection programs.

In Nebraska's Rainwater Basin, conversion to agricultural uses is the primary cause of wetland loss.

Funding Needs

In 1986, 11 States reported that diminishing Federal and State funds for water pollution control are an issue of special concern, especially in light of their expectation of additional funding cutbacks. The program most commonly cited by the States as vulnerable to funding shortfalls is the construction and upgrading of municipal sewage treatment plants. However, passage of the Water Quality Act of 1987 authorizes an additional $7.2 billion for construction grants and $8.4 billion for a new program for the establishment of State revolving loan funds. In addition, ten States noted the importance of proper operation and maintenance of existing sewage treatment plants—a problem closely tied to funding needs in many States. Figures 4-6 and 4-7 depict these findings.



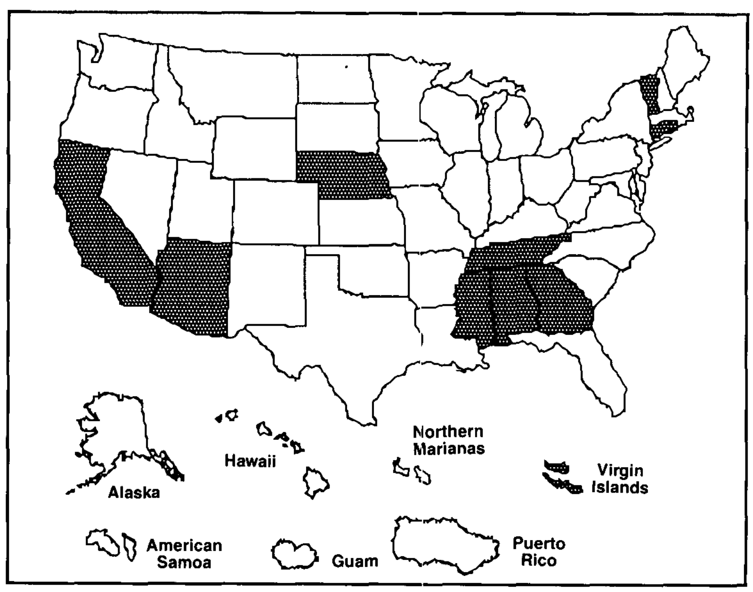


Figure 4-6. States Reporting Funding Needs as a Special Concern

Steve Delaney

The Clean Water Act requires that EPA assess and report on State needs in municipal upgrading and construction. EPA does so through its biennial Needs Survey. In 1986, the Survey determined that extensive construction is needed in order to solve existing water quality and public health problems. These needs are restricted to those based on documented water quality or public health problems. As shown in Table 4-5, needs for the current population in all categories total $60.3 billion, while documented needs for population growth between 1986-2005 total $15.9 billion.

The total of $76.2 billion in wastewater construction needs is distributed among 10,100 facilities. One hundred of these facilities—one percent of the total—have needs greater than $100 million each, accounting for almost half of all needs. The average need per facility is $7.5 million.

Meeting all needs will result in improved treatment facilities as well as expanded treatment capacity. As shown in Table 4-6, meeting all needs will result in a net addition of 1,800 advanced treatment facilities, 1,300 secondary treatment facilities, and 10,700 million gallons per day of treatment capacity at secondary or better. Meeting all needs will also increase the total population served by secondary treatment or better from 127 million to 193 million.

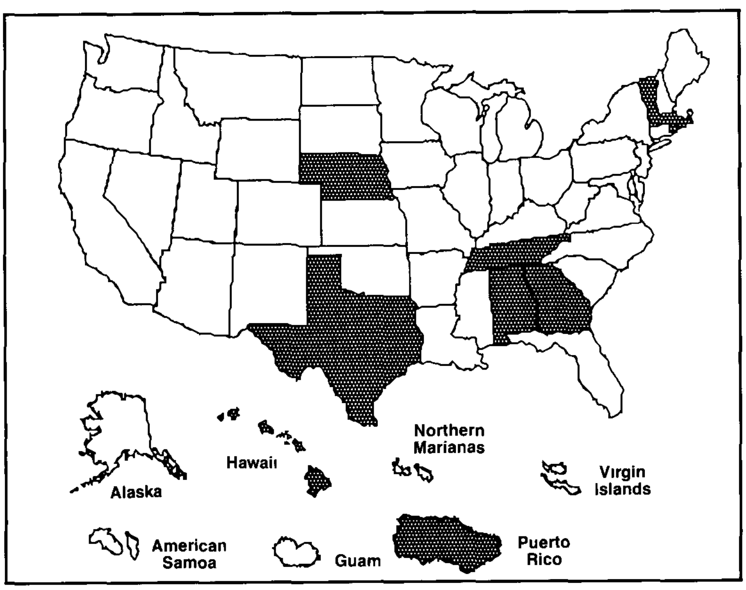
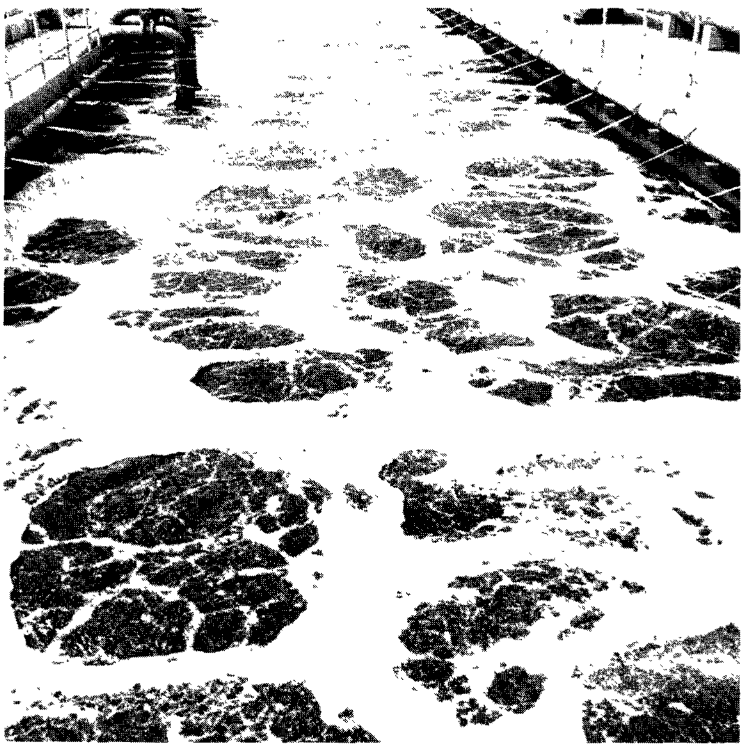


Figure 4-7. States Reporting Operation and Maintenance as a Special Concern



Steve Delaney

During sewage treatment, wastewater is aerated to promote microbial growth and breakdown of pollutants.

An analysis of Needs Survey data has indicated that roughly 15 percent of all treatment needs ($28 billion) are associated with upgrading levels of treatment, while the remaining 85 percent are linked to providing expanded capacity. Treatment upgrades, defined as construction that improves wastewater treatment for population currently being served, typically result in decreased discharge of municipal pollutants and improved surface water quality. Treatment expansions, defined as construction that adds treatment capacity for current population not being served or for future population, often result in either the elimination of ineffective small treatment plants (in favor of regional plants) or the elimination of failing septic systems. An estimated 3,100 communities are currently served by deficient septic tank systems, many of which threaten ground-water drinking supplies and public health.

Table 4-5. Needs for Publicly Owned Treatment Works (in billions of 1986 dollars)

Category of Need	Needs for 1986 Population	Needs for Population Growth	Design Year (2005) Needs
I. Secondary Treatment	$17.8	$6.1	$23.9
II. Advanced Treatment	3.3	1.0	4.3
IIIA. Infiltration/Inflow Correction	2.6	0.0	2.6
IIIB. Major Sewer Rehabilitation	3.0	0.0	3.0
IVA. New Collector Sewers	9.0	3.8	12.8
IVB. New Interceptor Sewers	9.4	5.0	14.4
V. Combined Sewer Overflows	15.2	0.0	15.2
Total	60.3	15.9	76.2

Note: All needs are based on a documented water quality or public health problem.

Source: U.S. EPA, *1986 Needs Survey Report to Congress*

A second major class of wastewater treatment problems involves facilities that have completed needed construction but still do not satisfy the requirements of the CWA due to improper operation and maintenance (O&M). One reason many municipal facilities are experiencing O&M problems is that many of the treatment facilities that were constructed over the last 14 years are more mechanically complex than in the past and thus require highly skilled operators and sophisticated O&M practices. Another reason is that user charges often do not fully cover the cost of O&M as required by Section 204(b) of the Clean Water Act.

While State and EPA monitoring and enforcement of O&M and local user charge programs are currently very limited, there is increasing interest in establishing improved information on the status of O&M problems at municipal facilities. A number of States are working on developing better compliance programs that include O&M and operator training for both major and minor facilities. Increased EPA emphasis on enforcement activities to meet the 1988 compliance deadline has contributed to expanded efforts by State and local governments to promote effective O&M and operator training programs.

The States and EPA have increased efforts specifically focused on resolving O&M problems at minor facilities (those with flows less than one million gallons per day). Efforts have included onsite technical assistance, identifying and resolving local user charge system and O&M budget problems affecting O&M compliance, identifying opportunities for more cost-effective O&M, disseminating information, and increasing private sector contracting for O&M management by local governments.

Table 4-6. Facility Data by Level of Treatment, 1986/All Needs Met

	No. of Facilities		Population Served (millions)		Design Capacity (MGD)	
Level of Treatment	**1986**	**Needs Met**	**1986**	**Needs Met**	**1986**	**Needs Met**
Raw Discharge	149	0	1.6	0	N/A	N/A
Less than Secondary*	2,112	45**	28.8	2.9	5,529	387
Secondary	8,403	9,675	72.3	107.4	15,714	18,844
Greater than Secondary	3,115	4,906	54.9	85.8	14,373	21,996
No Discharge	1,762	2,273	5.7	10.9	973	1,686
Other	46	81	10.5	36.7	88	110
Total	15,587	16,980	173.8	243.7	36,677	43,023

*The Needs Survey definition of less than secondary includes trickling filter and lagoon systems

**These treatment plants have applied for a waiver from the secondary treatment requirements in accordance with section 301(h) of the Clean Water Act. All have received at least tentative approval

Source. U S. EPA, *1986 Needs Survey Report to Congress*

Some examples from the State 305(b) reports illustrate the problem of funding and O&M needs:

■ Rhode Island reports that the massive rehabilitation and upgrade of the Field's Point wastewater treatment facility in Providence is the highest priority project in the State and alone is capable of using all of Rhode Island's dwindling grant allotment. Several communities are faced with tight schedules for secondary upgrades in order to meet June 1988 secondary treatment requirements. Uncertainties, changes, and delays in funding have caused disruption in project schedules. Communities are experiencing significant shortfalls in local funding necessary to complete projects. These same communities are then forced to increase their bonded indebtedness, if possible, to cover the incremental costs.

Rhode Island also notes that failure to properly operate and maintain sewage treatment plants threatens the water quality progress that has been made to date under the Clean Water Act. The costs for operation and maintenance of Rhode Island's older treatment facilities are becoming an increasingly greater portion of total annual costs.

■ Vermont provides specific findings illustrating the water quality problems that can result from poorly operated and maintained sewage treatment plants. Analysis of compliance monitoring data in that State shows that 60 percent of the time, treatment plant effluents contain more coliforms than permit limits allow. Furthermore, ten percent of the time, effluents were found to contain coliforms at over 60 times the concentration allowed in operating permits. Specific facilities were found to have better or worse operation records depending on their design and the care taken in their operation and maintenance.

The 1986 Needs Survey found that extensive construction is needed to solve existing water quality and public health problems.

■ Nebraska cites concern about the recent trend toward an early phaseout of Federal assistance for construction of needed facilities. Continued maintenance of an adequate wastewater infrastructure is also of great concern. Mechanisms are needed to ensure that local authorities maintain their treatment and collection facilities in order to prevent operational deterioration. Without continued maintenance of these facilities and completion of new treatment plants to meet the needs of a growing population, domestic point sources will become a significant factor causing water quality impairment.

■ Puerto Rico reports serious problems with the operation and maintenance of its sewage treatment plants. Eighty-five of a total of 114 facilities were cited in a Federal court order because of failure to comply with NPDES permits. As a result of these operational problems, the quality of drinking water from affected streams has been degraded. Fifty-one of the plants were identified as overloaded and operating above their maximum designated capacity.

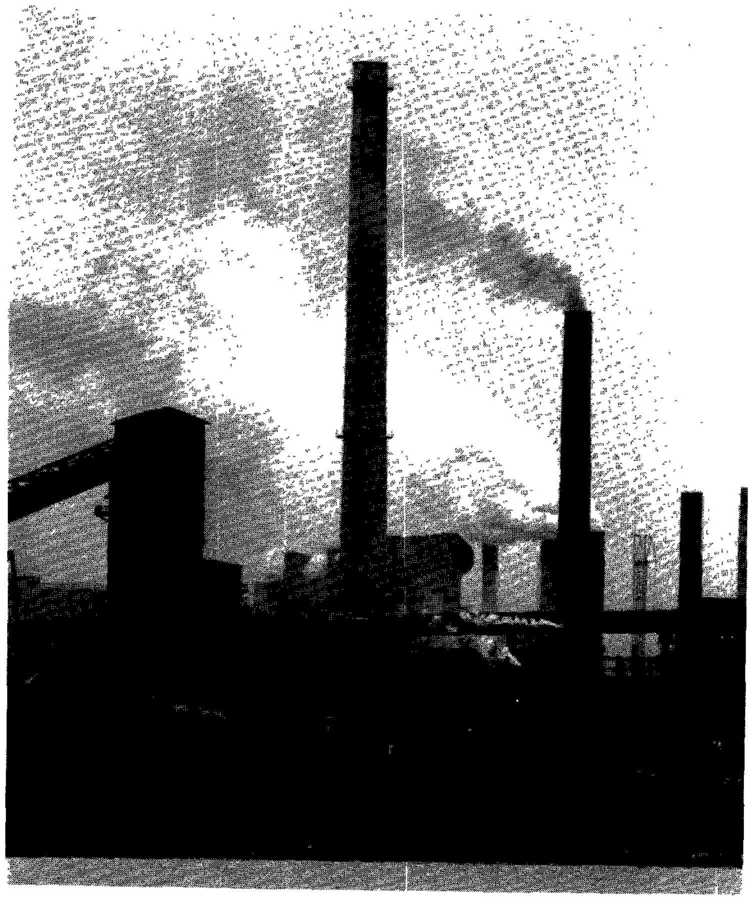
Funding needs affect a variety of program efforts other than sewage treatment plant construction and upgrading. Permitting and enforcement efforts have slowed in some areas, with resultant backlogs in permit issuance by some States. Water quality monitoring may also be affected and several States report reductions in their number of fixed monitoring stations. Tests to identify toxics in the water column, fish tissue, and sediment are sophisticated and expensive; their cost restricts the ability of some States to conduct extensive toxics sampling. Correction of difficult water quality problems such as combined sewer overflows and nonpoint sources may be given lower priority in funding decisions. Many States are clearly concerned that funding shortfalls will negate the gains in water quality that have been made since the passage of the Clean Water Act. To prevent this, resources will have to be carefully managed and alternate funding methods may need to be explored. Meeting these challenges will likely become a pressing task for all levels of government—local, State, and Federal—in the years ahead.

USDA Soil Conservation Service

Many States are concerned that funding shortfalls may negate recent gains in water quality.

Acid Deposition

Thirteen States cite acid deposition as an issue of special concern (Figure 4-8), although in some areas the effects of acid deposition remain uncertain and unquantified. In general, most States cite lowered pH of rainfall as evidence of potential problems. Lowered-pH rain is most commonly reported in the New England and mid-Atlantic States. For example, Connecticut and New Jersey note that rain in those States has an average pH of about 4.3 (compared to the 5.6 pH of unpolluted rain); Maine reports finding a consistent pattern of deposition ranging in pH from 3.8 to 4.5; and in New Hampshire, rain sampled between 1972 and 1983 had an average pH of 3.9. However, acidic precipitation is not limited to the east coast of the U.S. Montana, for example, reports that snow in the southwestern portion of the State commonly has a pH of between 4 and 5.



Acid deposition occurs when emissions of sulfur and nitrogen oxide gases interact with sunlight, other chemical substances, and water vapor in the upper atmosphere to form acidic compounds.

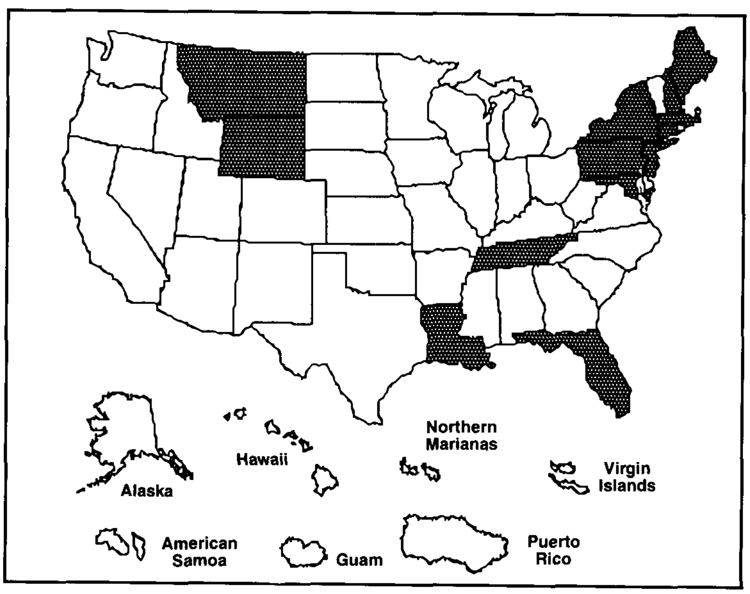


Figure 4-8. States Reporting Acid Deposition as a Special Concern

Nonetheless, factors other than the pH of rainfall must be considered when evaluating the impacts of acid rain. Perhaps the most significant factor is an area's geologic formations. Some soil and rock formations have few natural carbonates to buffer or neutralize the acidity in rain. Montana notes that studies of the buffering capacity of its lakes show that many lakes in the State—particularly alpine lakes overlying granitic basins—are extremely sensitive to acid rain. In New York, detrimental acid rain effects are documented for lakes in the Adirondack region, and other geographic areas such as the central Catskills and the Hudson highlands have recently been determined to be sensitive. Two areas in New Jersey—the Pine Barrens region in the south, and portions of the Highlands, Ridge, and Valley provinces in the north—are believed to be particularly sensitive to acid deposition. Lakes and streams in northwestern New Jersey appear to have sufficient buffering capacity to prevent increases in acidity, although pollution may be increasing pH and therefore masking the effects of acid deposition in some waters. Connecticut reports that its soils are generally well buffered and measurements of the alkalinity of 35 lakes show little evidence of acidification.

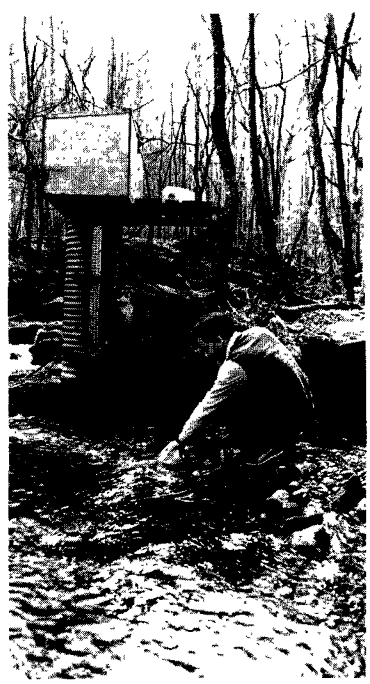
In response to the growing concern about possible impacts of acid rain, many States are instituting research and monitoring programs and have passed legislation to address the problem. Examples from the State 305(b) reports illustrate the nature of these programs.

- In 1985, the Maine legislature appropriated money for a study of acid rain. Included in the study are assessments of nitrogen oxides emissions, the response of geologically sensitive lakes, the impact of acid deposition on forests, and modeling efforts to determine sources of pollution.

- Connecticut reports that it has initiated several studies to assess the effects of acid rain, including research on impacts to trout and salmon in headwater spawning streams.

- Maryland established an interdepartmental work group in 1983 to document acid rain effects. In response to recommendations from this group, a variety of research and monitoring efforts are being designed to address problems in sensitive areas such as Maryland's coastal streams.

- New York passed a State Acid Deposition Control Act in 1984. This Act contains a procedure and schedule to reduce sulfur dioxide emissions within the State, although a regional program involving other States is necessary in order to significantly reduce the impact of wet sulfate deposition in sensitive areas.



Gathering samples for analysis of acidity in Tennessee.

New Initiatives: EPA's National Surface Water Survey

EPA is carrying out a National Surface Water Survey to characterize the status of lakes and streams in regions potentially sensitive to acidic deposition, and to select characteristic waters for long-term monitoring. The first phase of the lake survey has been completed, and the results were published in 1986 (U.S. EPA, *Characteristics of Lakes in the Eastern United States*, June 1986). Samples were collected from 2,332 lakes selected from within four regions (the Northeast, upper Midwest, Southeast, and West). A suite of chemical variables was measured for each lake.

The sampling design allows estimation of the chemical status of lakes within a specific region or subregion. Estimates of the numbers of lakes in sampled portions of individual States at or below specific values of acid neutralizing capacity and pH were also made (see Tables 4-7 and 4-8).

Acid neutralizing capacity is one of several factors that can influence the response of a lake to inputs of acid. The acid neutralizing capacity in lake waters is influenced by numerous factors such as the surrounding geology. pH is a measure of the acidity of a lake. Most lakes exhibit a pH of 6.5-8.0, although some lakes, particularly lakes associated with swampy areas, are naturally more acidic and exhibit a lower pH.

Some of the findings of the study are as follows:

- Western lakes tended to be low in acid neutralizing capacity and did not appear to have experienced acidification on a regional scale.
- The eastern subregions that contain the largest proportion of low pH lakes are the Adirondacks, the Upper Peninsula of Michigan, and Florida.

Table 4-7. Eastern Lake Survey Results*

State	Estimated Number of Lakes	Number of Lakes Sampled	Acid Neutralizing Capacity (μ eqL^{-1})**			pH	
			≤0	≤50	≤200	≤5.0	≤6.0
Connecticut	346	24	47	47	145	19	47
Florida	2,088	138	453	732	1,146	249	677
Georgia	155	54	10	10	49	10	10
Massachusetts	926	97	52	239	578	54	180
Maine	1,966	225	8	200	1,337	8	90
Michigan	2,073	160	107	368	704	103	330
Minnesota	3,026	174	0	143	1,124	0	103
North Carolina	55	30	0	4	35	0	1
New Hampshire	639	69	17	171	537	17	126
New York	2,041	191	168	577	1,200	128	384
Pennsylvania	616	106	20	79	284	13	58
Rhode Island	113	15	13	33	86	0	20
South Carolina	40	12	0	0	10	0	0
Vermont	258	29	0	19	90	0	11
Wisconsin	3,402	253	41	801	1,690	27	386

*Includes only States in which more than 10 lakes were sampled
**μeqL^{-1} = microequivalents per liter

Source: U S. EPA, Office of Research and Development, *Characteristics of Lakes in the Eastern U S.*, June 1986.

- Sulfate concentrations were greatest in Florida and the southern portions of the Northeast. No linear relationships between sulfate and pH or acid neutralizing capacity were evident. High concentrations of sulfate were found at low and high pH values.

- Extractable aluminum, which can be toxic to aquatic life, was found in higher concentrations in lakes with low pH, and found to be higher in the Northeast than in other regions.


USDI Bureau of Reclamation

An impoundment in California.

Table 4-8. Western Lake Survey Results

State	Estimated Number of Lakes	Number of Lakes Sampled	Acid Neutralizing Capacity (μ eqL^{-1})* ≤50	≤200	pH ≤6.0
California	2,390	147	880	2,078	32
Colorado	1,476	132	70	591	0
Idaho	972	72	189	599	0
Montana	1,597	80	160	824	0
Oregon	551	55	113	461	10
Utah	548	30	20	484	0
Washington	1,338	117	219	822	31
Wyoming	1,480	83	94	1,068	30

*μeqL^{-1} = microequivalents per liter

Source: U.S EPA, Office of Research and Development

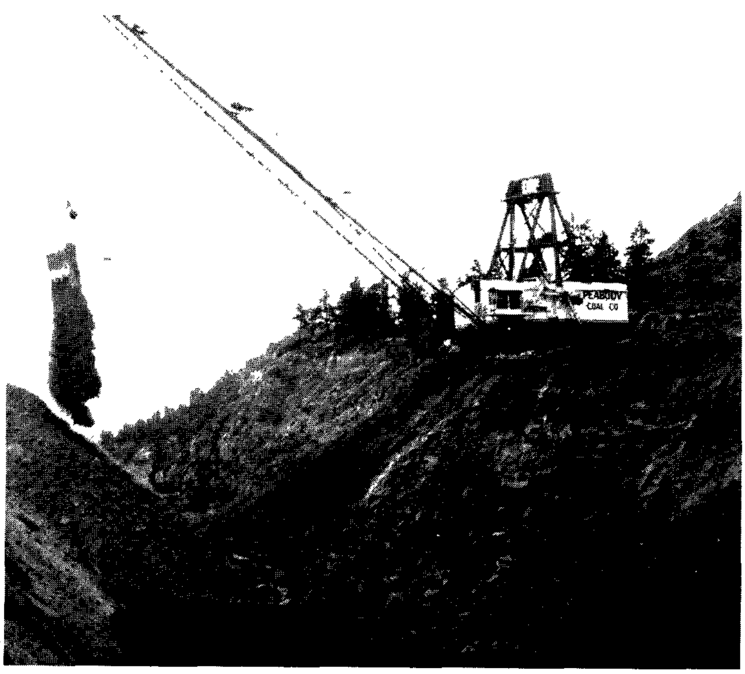
Mine Drainage

Nine States cited drainage from mines as a special concern (Figure 4-9). In addition, mining activities are widely reported as a cause of use impairment across the Nation.

Impacts to rivers and lakes come from a variety of mine-related sources. Acid mine drainage occurs when sulfur-bearing minerals are exposed during the mining process and form sulfuric acid in the presence of water and air. Contaminated water draining or seeping from mines can create acid conditions in receiving streams; may dissolve metals from geologic formations and carry these into waterways; and, when entering a pH-neutral stream, may form iron compounds that "settle out" and smother bottom-dwelling aquatic organisms. These factors can devastate streams for miles downstream of mining activity; cleanup and control, always a complex issue, is complicated further because many of the worst problems come from mines that were operated and abandoned long before water quality impacts were a consideration.

In addition, metal mines such as silver, lead, and copper mines most widely found in the western U.S. can directly contribute metal-laden runoff through tailings piles and mine seepage. Sedimentation, erosion, and habitat destruction, which can result from earthmoving activities, are also significant problems associated with mining.

Earthmoving activities associated with mining can lead to sedimentation, erosion, and habitat destruction.



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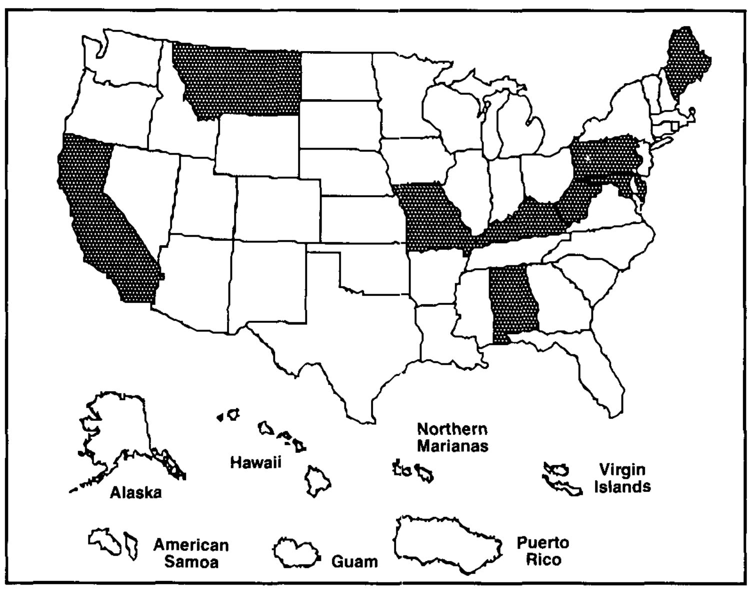


Figure 4-9. States Reporting Mine-Related Problems as a Special Concern

Point source discharges from active mines are regulated by EPA and State National Pollutant Discharge Elimination System (NPDES) permits, and many States employ best management practices to lessen nonpoint runoff. Pollution from abandoned mines is addressed in the Federal Surface Mining Control and Reclamation Act of 1977 (P.L. 95-87). Programs to control runoff from abandoned mines include treating wastes; reclaiming land through refilling, regrading, and replanting; and sealing mine openings. These programs are expensive and the problems they address are difficult to solve. The following examples from the State 305(b) reports illustrate the variety of mine-related problems cited by the States in 1986, as well as progress being made in their control.

■ In 1979, sediment from abandoned mines was identified as a major cause of stream degradation in North Carolina's Appalachian Mountain region. An extensive area of eroding abandoned mines was inventoried along the Nolichucky River in the French Broad River Basin. One hundred and three mines covering 590 acres were found to be responsible for extensive sedimentation affecting the macrobenthos and fisheries and causing severe loss of storage capacity in downstream dams.

To control these impacts, the Tennessee Valley Authority, the Soil Conservation Service, and State and local governments began a cooperative reclamation effort in 1979. From 1980 to 1985, all 590 acres were reclaimed at an average cost of $825 per acre. This reclamation effort is expected to reduce levels of sedimentation and improve the biota in the Nolichucky River.

■ Within the past 15 years, extensive mining in the upper 15 miles of West Virginia's Buckhannon watershed has created many acid mine drainage sources. Because of the low buffering capacity of the Buckhannon River, relatively small amounts of acid are capable of acidifying significant portions of the river. Acid mine drainage from these sources is normally treated and neutralized at the mine site before being allowed to enter the river. However, over the past eight years, intermittent and temporary releases of relatively small amounts of unneutralized acid mine drainage from mines in the upper watershed have entered the river and eliminated or significantly reduced the aquatic resources of a ten-mile stretch of the Buckhannon River.

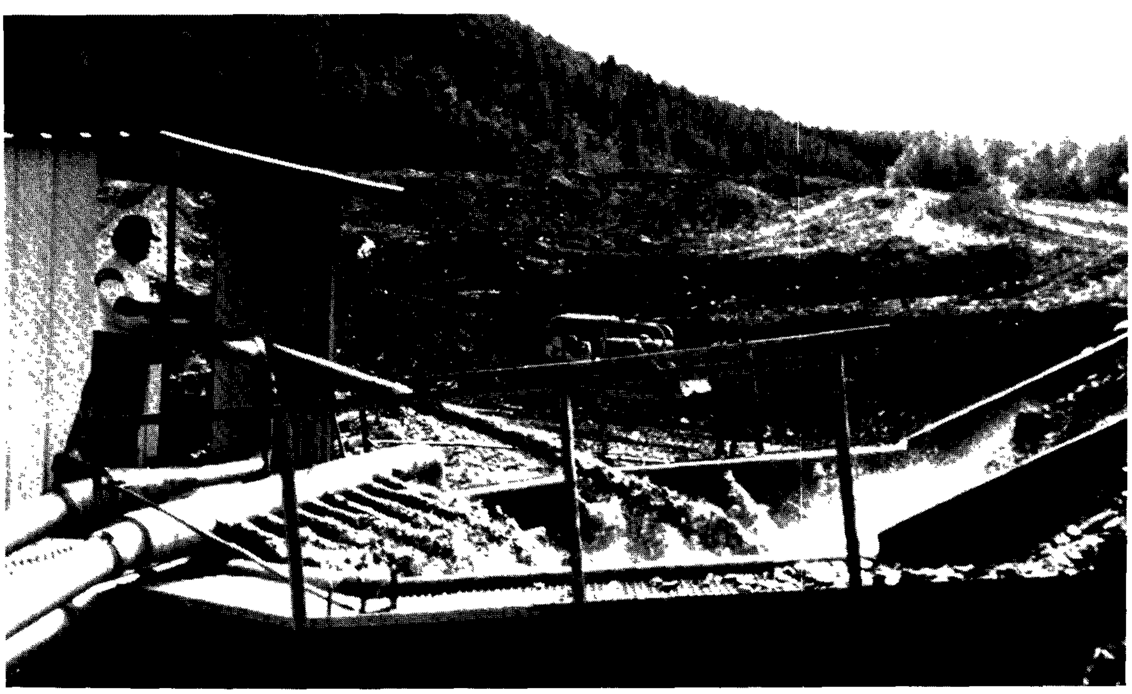
West Virginia also reports that several active coal operations are currently using anhydrous ammonia in treatment processes to increase pH and reduce metal (iron and manganese) concentrations. Anhydrous ammonia is desirable because it is relatively inexpensive and much easier to apply than the traditional lime slurry process. However, potential problems associated with the use of ammonia include nutrient enrichment, instream ammonia toxicity, oxygen demand, generation of acidity in the nitrification process, and reduction of stream buffering capacity.

■ Maryland reports that before implementation of State and Federal mining and reclamation regulatory programs, approximately 9,500 acres of land and 450 miles of streams in the State were adversely affected by surface and underground coal mining.

Significant progress has been made in the reclamation of abandoned coal mine lands and waters. Between 1984 and 1985, the Abandoned Mine Lands Program reclaimed approximately 152 acres of disturbed mine lands, and directly improved the water quality in 17 miles of streams.

■ Pennsylvania reports on its program, carried out under authority of P.L. 95-87, the Surface Mining Control and Reclamation Act of 1977, to designate certain areas as unsuitable for surface mining. Many areas have unique or extremely sensitive environmental characteristics which even after land reclamation would be irreparably damaged by surface mining. Precluding any surface mining activity is seen as the most effective way to protect these sensitive areas. As of December 1985, Pennsylvania had designated, proposed, or studied 10 separate streams and watersheds under this program.

At a placer mine in Alaska, an operator mixes muddy recycled water with soil that is being mined for gold. The water forces the dirt through a sluice into a settling pond.



■ In Missouri, erosion of tailings has affected 40 miles of classified streams, including seven miles in which aquatic habitat uses are precluded. High levels of soluble heavy metals affect an additional 18 miles of classified streams. Ownership of almost all of these tailings has been transferred to persons without the financial resources to rehabilitate these sites. Thus, although violations of State and Federal water law have continued for many years, no enforcement actions have been taken to resolve this problem. No State or Federal funds exist for rehabilitation of these sites.

The Department of Natural Resources is now developing a process that would ensure maintenance and inspection of active tailings ponds once they are abandoned, and prevent transferring ownership to persons unable to afford maintenance and any needed repairs.

As can be seen by these examples, mine-related problems are varied and require a substantial commitment by State and Federal authorities if they are to be solved. Some States appear to be dedicating necessary resources and directing effective abatement programs, although other States have only just started to develop strategies to address mine drainage concerns.

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A coal strip mine in Montana.


James Plafkin

5

Water Pollution Control Programs

Introduction

The Clean Water Act of 1972 determines the way the Federal government and the States regulate point and nonpoint sources of pollution. Although revised by amendments in 1977, 1981, and 1987, the basic directives embodied in the original Act continue to guide the Nation's water pollution control programs.

The Clean Water Act (CWA) established two basic types of approaches for controlling pollution from point sources: the technology-based approach and the water quality-based approach. Technology-based controls consist of uniform, EPA-established standards of treatment that apply to industries and municipal sewage treatment facilities. These effluent standards are limits on the amounts of pollutants that may be discharged to waterways. The limits are derived from the technologies that are available for treating the effluent and removing the pollutants. They are applied uniformly to every facility in an industrial category, regardless of the condition of the water to which the effluent is discharged.

Water quality-based controls, on the other hand, are based on the quality of the receiving water. This approach relies on the use of water quality standards set by the States on the basis of the uses to be made of the streams (e.g., fishing and swimming) and the criteria (or limits on pollutants) necessary to protect those uses. Individual discharge requirements are based on the effluent quality that is needed to ensure compliance with the water quality standards.

Regulatory attention in the National Pollutant Discharge Elimination System (NPDES) program has begun to shift focus to water quality-based pollutant control. To this end, EPA has issued a policy on the control of toxic pollutants (49 FR 9016) as well as guidance documents to assist States and Regions in developing controls.

EPA expects that the current plans for implementing the Water Quality Act (WQA) of 1987 will go far toward increasing the number of water quality-based limits in NPDES permits. The principal means of achieving this goal is Section 304(l) of the CWA, as amended, which requires a progressive program of toxicity control. Under Section 304(l), States must identify waters where technology-based controls and existing water quality-based controls are not adequate to meet water quality standards, either for the Section 307(a) priority pollutants or to protect users, wildlife, or the fish and shellfish in a waterbody.

Section 304(l) of the CWA further requires the development of individual control strategies for point sources causing impairment. Under this provision, States must identify (within two years of the enactment of the WQA) individual point sources that may be causing violation of standards in the waters not presently achieving water quality standards, and develop individual control strategies for each point source that will attain applicable water quality standards within three years after the strategy is established.

As in the case of pollution caused by point sources, nonpoint pollution may also be said to be subject to two abatement approaches: in this case, regulatory and non-regulatory. Regulatory controls tend to apply where cause-and-effect relationships can be most easily established, although many exceptions exist. Examples include controls on runoff from mining, construction, and silvicultural activities in many States where these are significant industries. Other nonpoint categories such as agricultural runoff are more likely to be subject to non-regulatory—i.e., voluntary—controls, with incentives and technical support provided by a number of State and Federal agencies. Nonpoint pollution controls are often applied on a case-by-case basis, and are in many situations administered at the local or State level.

Programs to control point and nonpoint source pollution will be discussed in more detail below, along with obstacles to their implementation, successes achieved, and new initiatives for the future.

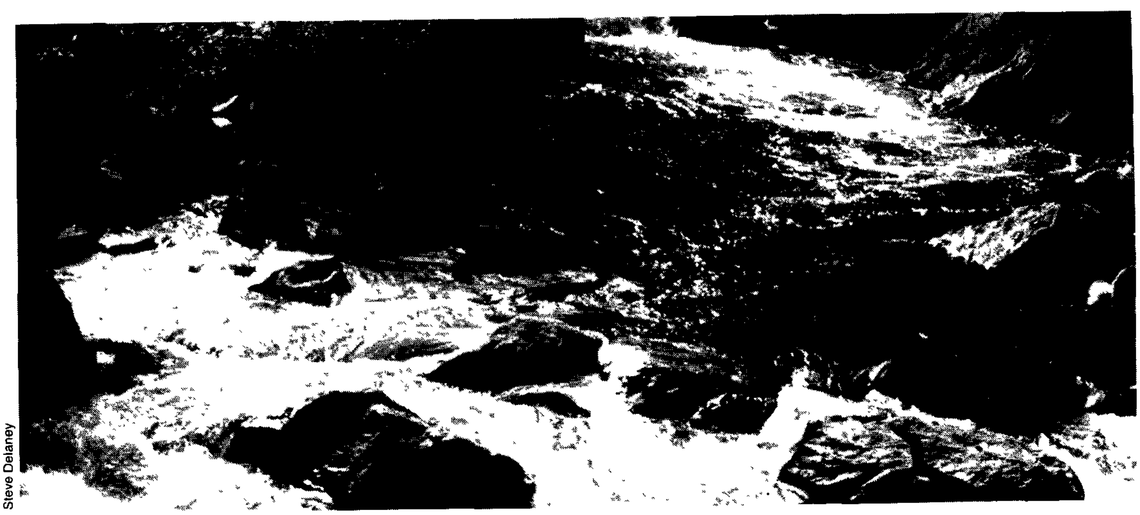
Point Sources

Technology-based limits are incorporated into the permits issued to industries and municipalities under the National Pollutant Discharge Elimination System. The Clean Water Act requires these discharges to reach progressively more protective technology-based controls over time. Where technology-based controls will not be stringent enough to ensure that waters can support their uses, the water quality-based approach is used to develop stricter effluent limits. Permits based on water quality standards therefore provide a greater degree of protection than permits based on technological considerations alone.

One of the basic tools of the water quality-based approach is the wasteload allocation (WLA) process: mathematical modeling that determines the maximum amount of waste each source located along a waterbody can discharge, while still allowing water quality standards to be met. Kansas and Wisconsin were two States that provided examples illustrating the application of the WLA process to problem waters affected by both industrial and municipal discharges.

■ In Kansas, a recent study was performed in Johnson County to evaluate the water quality conditions and future requirements for effluent limits for Mill and Indian Creeks. Water quality models were calibrated and then used to perform wasteload allocations on the two streams. The modeling showed that advanced treatment is needed at all plants, with low effluent concentrations required for both BOD and ammonia.

■ Wisconsin reports on the use of the WLA process on the Wisconsin River. Described as "one of the hardest working rivers in the world," the Wisconsin River has 29 major industrial and municipal dischargers located along its 170 miles between Rhinelander and the Petenwell Flowage. This stretch of the river was grossly polluted in the early 1970s: extensive fish kills were common, and game fish were unpalatable due to taste and odor problems. WLAs were performed between 1973 and 1983, and, as a result of the water quality-based effluent limits set under the WLA process, an over 90 percent reduction occurred in the amount of BOD being discharged by pulp and paper mills and municipalities. Marked increases in dissolved oxygen levels resulted, and the river now meets fish and aquatic life standards.



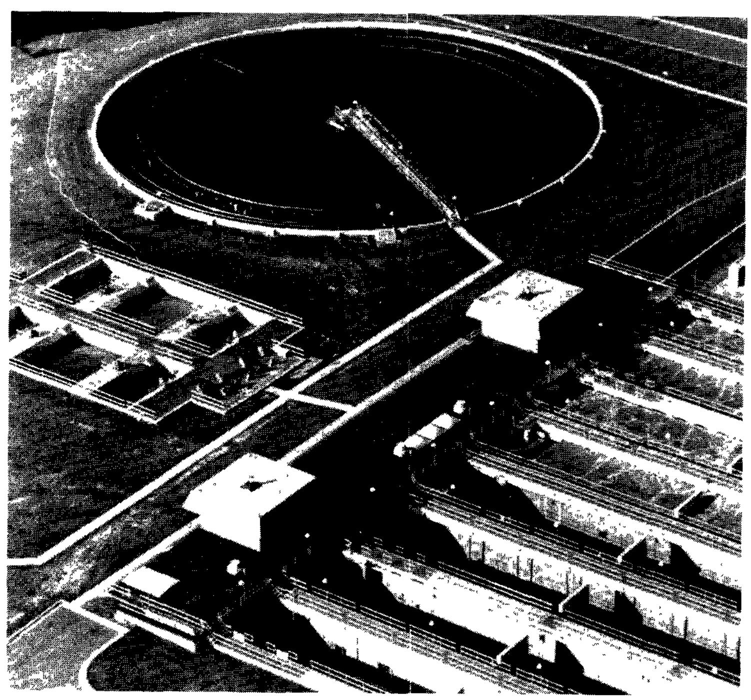
Steve Delaney

Treating Municipal Wastewater

Water entering wastewater treatment plants is typically contaminated by organics, solids, nutrients, bacteria, viruses, and household toxics such as paint and drain cleaners. It may also contain industrial waste, infiltration from ground water, and inflow from stormwater runoff. Adequate treatment of municipal wastewater is important for the protection of the Nation's water resources and public health. Without adequate treatment, this pollution poses a potentially serious threat to fish and shellfish communities, recreational opportunities, surface water drinking supplies, ground-water drinking supplies, and the general health and stability of many of the Nation's streams, rivers, lakes, and estuarine ecosystems.

The Clean Water Act requires municipalities to achieve treatment levels based on technology performance. A July 1977 deadline, extended by the 1981 CWA amendments to July 1, 1988, for eligible plants, was established for the achievement of "secondary treatment," a level of treatment that removes at least 85 percent of several key conventional pollutants. If secondary treatment is not enough to protect water quality and public health, the Clean Water Act mandates advanced or 'tertiary" levels of treatment.

Under the Clean Water Act, EPA is authorized to help municipalities solve their wastewater treatment problems by providing grants (and now loans) for construction. Projects eligible for grant assistance include wastewater treatment facilities that provide secondary or advanced treatment, interceptor sewers, and correction of infiltration/inflow problems in sewer systems. The grants process includes the ranking of each project via a State priority system that is based on water quality and public health objectives, the development of a detailed facilities plan and project design, the distribution of construction grant funds to States (based on an allotment formula specified by the CWA), and, finally, the issuance of grants to fundable high priority projects.



Aerial view of a sewage treatment plant showing aeration basins in foreground and settling basin in background.

Steve Delaney

Since 1972, EPA, State, and local governments have invested heavily in the construction and upgrading of sewage treatment facilities. As a result of these expenditures, the Nation's ability to adequately treat its wastewater has improved substantially. The total population served by secondary treatment or better has increased from 85 million in 1972 to 127 million in 1986, while the total population discharging untreated wastewater has dropped from 5 million to less than 2 million. Many of the upgraded and/or expanded treatment plants were financed in part by the construction grants program. Through fiscal year 1986, a total of 11,100 construction grants have been awarded, totaling more than $40 billion, while projects totaling $25 billion have been completed. Thus far, roughly 4,600 operational treatment plants have been built or improved with construction grant funds.

During the reporting period of 1984 through 1986 alone, a total of 2,200 construction grants projects were physically completed, totaling $10 billion. Projects completed during FY 1984-86 have resulted in improved treatment facilities as well as expanded treatment capacity. As shown in Table 5-1, roughly 500 more treatment plants provided secondary treatment or better in 1986 than in 1984, and an additional 1,600 million gallons per day of increased capacity at secondary or better were provided. These upgraded and expanded wastewater treatment facilities are protecting public drinking water supplies and are helping to make the Nation's waters fishable and swimmable.

What has been the actual water quality effect of these State, local, and Federal investments? As we have said, the construction grants program is widely acknowledged to have led to a reduction in the loadings of pollutants from municipal sources; to have significantly reduced the number of untreated or undertreated sewage discharges; and to have improved water quality and biological conditions downstream of many new and upgraded facilities. However, efforts to quantify these improvements have lagged because of the extensive stream sampling and modeling efforts that are required—before and after sewage treatment plant construction—to definitively assess effects.

Table 5-1. Facility Data by Level of Treatment, 1984/1986

	Number of Facilities			Design Capacity (MGD)		
Level of Treatment	**1984**	**1986**	**Net Change**	**1984**	**1986**	**Net Change**
Raw Discharge	202	149	−53	N/A	N/A	N/A
Less than Secondary	2,617	2,112	−505	6,510	5,529	−981
Secondary	8,070	8,403	+333	14,603	15,714	+1,111
Greater than Secondary	2,965	3,115	+150	13,874	14,373	+499
No Discharge	1,726	1,762	+36	938	973	+35
Other	0	46	+46	0	88	+88
Total	15,580	15,587	+7	35,925	36,677	+752

Source: U.S. EPA, *1984 and 1986 Needs Survey Report to Congress.*

The results of one such analysis were reported in the Missouri 1986 305(b) report. Before-and-after studies of 10 municipal facility construction or upgrading projects in Missouri estimated 1.25 miles of stream improvement per project, representing about an 86 percent reduction in the length of affected segments. The study concludes that:

- Upgrading or replacing a single facility typically results in an average improvement of just over half a mile. Percent of affected stream improved by the grant project would range from 40-80 percent, depending upon which treatment types are involved.

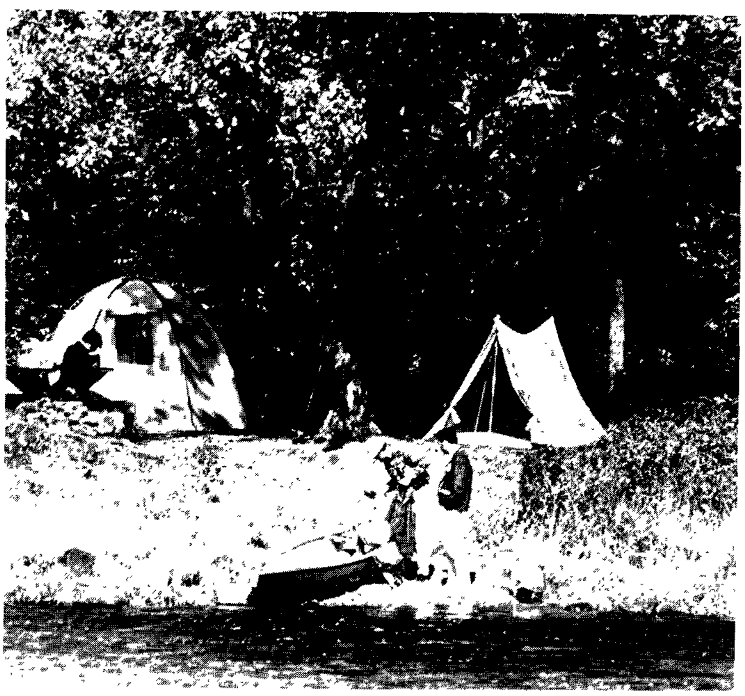
- Regionalization of wastewater treatment usually results in several miles of stream improvement per project.

Although such quantified results are rare, site-specific narrative information is available from the 1986 State 305(b) reports on water quality improvements due to the construction grants program. For example:

- Georgia reports that during 1984-85, significant improvement was noted in the Conasauga River below Dalton, in the South River below metropolitan Atlanta, and in the Ochlocknee River below Moultrie. The improvements in each case were the result of municipal water pollution control plant upgrading. In addition, municipal facility upgrading in Covington (Dried Indian Creek), Hinesville (Peacock Canal), Jesup (Little McMullen Creek), LaFayette (Chattooga Creek), and Fitzgerald (Turkey Branch) also provided for improved quality in the receiving streams.

- Idaho reports that since 1982, nearly 50,000 people have been added to the total population served by secondary treatment facilities. This is a result of the recent completion of more than two dozen grant-supported projects to improve wastewater treatment. All of these facilities discharge an effluent which meets or exceeds State and Federal standards.

- In New Mexico, comparison of data from 1977 and 1985 indicates that the amount of biochemical oxygen demand discharged to the State's surface waters decreased by 34 percent despite a 30 percent increase in the amount of waste being treated by municipal wastewater treatment facilities. Furthermore, municipal waste discharged to surface waters was treated to a higher level in 1985 than in 1977. In 1977, the discharged BOD was 42 percent of the generated waste, whereas in 1985 the discharged BOD was only 11 percent. These percentages are equivalent to 58 and 89 percent removals, respectively.



A number of states reported that improved water quality has occurred as a result of the construction grants program.

■ Nevada's Truckee River continues to show improvement in aquatic life below the Reno/Sparks wastewater treatment plant because of control of toxics (e.g., chlorine) and the reduction of phosphates in the river. At the end of 1981, Reno/Sparks initiated phosphate removal and had reduced the phosphate loading to the river from the treatment plant at least 70 percent. More recently, Reno/Sparks has reduced levels of phosphorus further, resulting in over 95 percent removal of total phosphorus.

■ New York reports that water quality in the Little Ausable River below the Peru sewage treatment plant improved immediately when a new facility was placed in operation in April 1985. Sludge deposits and odors disappeared after the inadequate primary plant was upgraded. Similar observations were noted in the Saranac River and tributary when the Village of Dannemora upgraded its primary facility to secondary treatment and the Village of Bloomingdale built a new facility with secondary treatment to eliminate raw discharges there.

■ South Dakota reports that 22 stream miles improved in 1984 and 19 improved in 1985 due to projects carried out under the construction grants program.

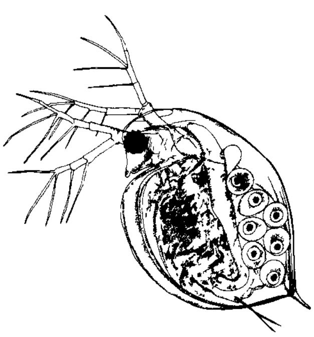
■ In Vermont, municipal treatment plant upgrading and construction has restored a number of important rivers and streams. These include the Dog River, now known locally for its fine trout fishery; the aesthetically much-improved Winooski River between Montpelier and Essex Junction; and the greatly improved Connecticut River, now being seriously considered as a recreational site by Brattleboro and other communities along its banks. Vermont's rivers and streams have been improved so much that more than half of the State's population presently uses them for swimming and other water contact sports. The recently upgraded Newport City wastewater treatment plant has improved Lake Memphremagog's water quality such that the municipal swimming beach is no longer closed each summer due to high bacteria counts.

Steve Delaney

Treating Industrial Wastewater

The Clean Water Act required industries to achieve Best Practicable Control Technology Currently Available (BPT) by July 1, 1977. These BPT limitations are based, in general, on the average of the best existing performance by plants of various sizes, ages, and processes within the industry or subcategory of industry.

EPA was also required to establish more stringent technology-based limits for individual categories of industrial dischargers. These new requirements, referred to as Best Available Technology Economically Achievable (BAT), are specifically designed to control the discharge of toxic pollutants from industrial sources. EPA has promulgated 27 final BAT regulations since 1979.



The aquatic invertebrate *Ceriodaphnia*, used in toxicity testing.

In addition to these technology-based requirements, in 1984 EPA issued a policy on the water quality-based control of toxic pollutants discharged by point sources. In 1985, a technical guidance document was issued to support the national policy. Both the policy and guidance recommend using overall toxicity as a measure of adverse impact and as a regulatory parameter. The use of toxicity testing as a regulatory tool is a new concept, but its use, coupled with chemical testing for pollutants that are hazards through bioaccumulation, provides a powerful means of detecting and controlling toxicity.

States are making progress in developing the capability to assess and regulate toxic discharges using biological techniques. As of summer 1986, 42 States required effluent toxicity monitoring by dischargers. Fifteen States either required toxicity testing in over half of their major permits or had more than 50 permits with testing requirements. 1,033 permits included permit limitations on effluent toxicity; 1,802 permits required effluent toxicity monitoring; and 73 permits required ambient field biological assessment.

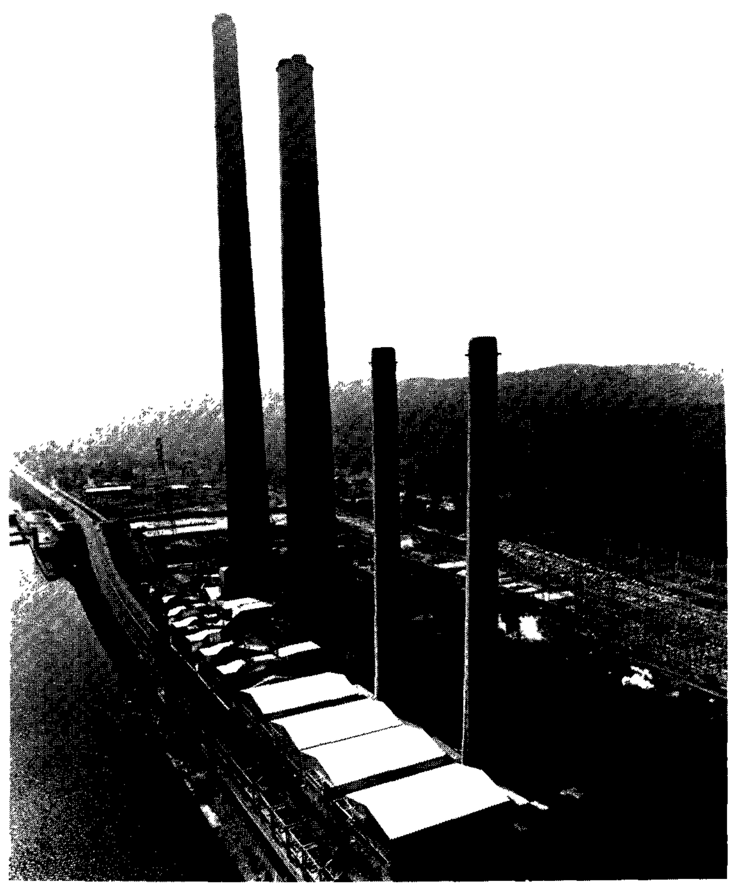
There is no doubt that improvements in the treatment of industrial wastes have benefited some of the Nation's waterways. Examples of water quality improvements due to the implementation of industrial controls are provided by several States:

- Connecticut reports that approximately 400 miles of major streams in that State have improved to varying degrees due to the regulation of industrial facilities. Further treatment beyond normally required BAT is still needed on some river systems in order to reduce remaining toxic impacts on aquatic life.

One example of water quality enhancement is the Naugatuck River, once considered one of the most polluted rivers in the country. Between 1973 and 1976, the State issued abatement orders to 35 major and 42 minor industrial dischargers along the river. Metal finishing plants were required to neutralize acids, destroy cyanide wastes, and remove heavy metals. In 1970, the river was virtually devoid of aquatic life; today, water quality has improved so much that the upper 22 miles from Torrington to Thomaston Dam have been stocked with trout on an experimental basis. Monitoring has shown a marked reduction in heavy metals such as copper and zinc and improved pH levels. The river has been identified as a potentially valuable resource for cold water and anadromous fisheries. However, the large number of dischargers remaining in the river in 1986 still creates water quality problems in the lower portion of the river. More stringent effluent limitations will still be required in order to fully achieve water quality goals.

■ New York reports on a number of streams and rivers improved due to industrial controls. Among them is Cattaraugus Creek, which once received inadequately treated industrial wastes from facilities in Gowanda. This stream was severely polluted and supported only a few desirable fish species until one of the industries ceased operation and the other installed appropriate waste treatment. Cattaraugus Creek is now reportedly the best salmonid fishing stream in New York's portion of the Lake Erie basin, and is stocked annually with chinook and coho salmon and steelhead trout. The stream is popular with anglers along the 42-mile segment from Lake Erie to the Springville Dam.

■ North Dakota reports that pollution loadings from industrial dischargers had significant impacts on the quality of the Red River of the North. A dramatic reduction in BOD loading has occurred since industrial controls were implemented starting in 1972. The industrial loading of the Red River in 1972 was in excess of 3.8 million pounds; in 1985, the industrial loading had dropped to approximately 0.25 million pounds.



A power plant on the Ohio River.

Pretreatment

The goal of the National Pretreatment Program is to protect municipal wastewater treatment plants and the environment from damage that may occur when toxic or hazardous wastes are discharged by industries into a sewer system. This protection is achieved by regulating the wastewater discharged to municipal facilities by industrial or non-domestic users. There are two types of standards: prohibited discharge standards and categorical pretreatment standards. The responsibility for administering the program is shared with municipalities that must develop and receive approval to operate a pretreatment program.

Over the past two years, most of the major municipalities have had their programs approved and have begun to implement them. EPA and the States have begun evaluating the municipal programs and have continued to enforce requirements for pretreatment among more than 20,000 categorical industrial users. Full implementation will significantly reduce loading of metals and organic toxic pollutants to municipal facilities, thus providing protection to the facility and the receiving stream. EPA hopes that States and municipal sewage treatment plants will continue to make progress toward assuming their full responsibility so the program goals may be realized.

As of September 30, 1986, 1,429 local programs had been approved. Of those remaining, 60 programs were recently identified and are on compliance schedules. More than half of the other unapproved programs have been sued to obtain an approvable program and implementation. Progress has been slow and uneven, but implementation is now beginning.

In their 1986 305(b) reports, a number of States reported on their progress in implementing the pretreatment program. Because of the program's relative youth, few actual water quality improvements were reported, although benefits can be measured in other ways. For example:

- In New Jersey, active implementation of the Federal pretreatment standards, with an emphasis on electroplating standards, has resulted in the reduction of toxics, especially heavy metals, cyanides, and organics discharged to municipal sewage treatment plants. Approximately 270 indirect dischargers are affected by the electroplating standards, with 40 percent already in full compliance.

- Mississippi reports that essentially all categorical industries are now under State-issued pretreatment permits. The State's permitting efforts have resulted in the construction of many pretreatment facilities, most of which were completed in 1985 or are nearing completion. The State has a compliance rate for the metal finishing industry in excess of 90 percent, with compliance being defined as attainment of permit limits or the facility being on schedule with enforceable orders. The State is now primarily shifting emphasis for pretreatment categorical facilities to compliance and enforcement rather than simply permit issuance. Significant reductions are expected in the number of municipal noncompliance and treatment "upsets" caused by toxics. Additionally, significant levels of heavy metals, pentachlorophenols, total phenols, and other toxic parameters are being removed prior to discharge to receiving streams.

■ Indiana has identified 51 municipalities that need direct control of their industrial users (IUs). Only three of these have yet to receive EPA/State approval of their program plan. There are also approximately 70 IUs that discharge into smaller municipal sewage plants that will be controlled directly by the State. The State has already issued about 30 industrial waste pretreatment permits, and another 30 permits have been drafted and are waiting to be issued.

Table 5-2. Status of Permit Issuance

	Major Permits	Minor Permits
Total Facilities	7,406	57,187
EPA-Issued:		
Total	2,193	9,193
Expired	189	4,150
Percent	9	45
State-Issued:		
Total	5,213	47,994
Expired	494	15,541
Percent	9	32

Source Permit Compliance System, November 10, 1986.

Permitting

During the early 1980s, the rate of permit issuance fell behind the rate of permit expiration, and large backlogs of unissued permits developed. This resulted from delays in promulgating BAT treatment standards and confusion about limiting toxics based on water quality. Efforts to remedy these backlogs have been largely successful. As Table 5-2 illustrates, the backlog of major unissued permits has been brought down to less than 10 percent and the backlog of minors to less than 35 percent.

Compliance and Enforcement

Despite examples of water quality improvements associated with the construction and upgrading of municipal sewage treatment plants, 35 percent of major municipal facilities do not meet the requirements of their National Pollutant Discharge Elimination System permits. Industrial permittees have achieved a much higher rate of compliance and only 6 percent are now unable to meet their final permit limits.

EPA and the States are responsible for ensuring that municipal and industrial facilities comply with the terms of their discharge permits. Currently, 37 States have approval to administer their own NPDES programs. EPA has the lead implementation responsibility in the remaining States. Along with the States, EPA monitors discharger compliance with permit limits. Facilities in noncompliance are subject to Federal as well as State enforcement action.

Table 5-3 illustrates rates of significant noncompliance, based on statistics maintained by EPA for the reporting period of June 1984 through June 1986. It is important to note that at the beginning of FY 1986, the NPDES program modified its definition of significant noncompliance to promote greater consistency and clarify what quantifiable and qualitative violations needed to be reported by the States. This redefinition included a strict interpretation of the resolution of significant noncompliance and a stronger emphasis on violations of reporting requirements and enforcement orders. As a result, rates of significant noncompliance increased during FY 1986.

Table 5-3. National Composite Rates of Facilities in Significant Noncompliance (in percents)

Quarter Ending	Non-Municipals	Municipals
12/31/83	8	19
3/31/84	10	20
6/30/84	6	14
9/30/84	6	13
12/31/84	5	12
3/31/85	5	13
6/30/85	5	10
9/30/85	5	9
12/31/85*	8	14
3/31/86*	8	16
6/30/86*	8	15

*Reflects NPDES rule change

Because of the generally poor municipal compliance record, and because of Congressional concern over the performance of treatment plants built substantially with Federal funds, EPA and the States developed the National Municipal Policy (the Policy) to address the entire spectrum of municipal noncompliance. On January 23, 1984, the EPA Administrator signed the Policy into effect. The Policy clarifies and emphasizes EPA's resolve to assure that municipalities comply with the Clean Water Act as quickly as possible, regardless of whether Federal grant assistance is available for treatment construction.

The Policy requires EPA and the States to identify affected municipal facilities and their construction needs and to prepare individual facility action plans to bring these facilities into full statutory compliance by July 1, 1988. September 30, 1985, was set as an interim Agency goal for all noncomplying major facilities to be on enforceable compliance schedules. A major municipal sewage treatment facility is one that discharges one million gallons per day or greater, or serves an equivalent population of 10,000. After the Policy took effect, EPA and the States identified about 1,500 major and over 2,000 minor facilities that needed some construction to meet requirements.

During 1985 and 1986, EPA and the States brought 278 majors into compliance and placed an additional 1,095 on enforceable schedules requiring compliance with the July 1988 deadline. Many of these communities are constructing facilities without substantial Federal assistance. As of November 1986, an additional 72 were under referral for judicial enforcement action to obtain the necessary schedules; 55 major municipal facilities were still not on final compliance schedules, nor had formal enforcement been initiated. Over 1,000 minor facilities were also placed on enforceable schedules.

In addition to the Municipal Policy, EPA has adopted several improvements in the area of enforcement procedures. During FY 1986, all States and EPA Regions were required to prepare and/or update written enforcement management system procedures. These procedures describe the process for reviewing violations and determining appropriate enforcement responses.

In February 1986, EPA issued a revised Clean Water Act Penalty Policy for determining penalties that are appropriate for settlements. The principles of the policy have been adopted by States and accepted in several court decisions as equitable and logical approaches to assess penalties for violations of NPDES permit conditions.

New Initiatives in Point Source Control

Toxicity Testing and Toxicity Reduction Evaluations:

States and EPA regional offices are beginning to incorporate toxicity limits and toxicity testing requirements into permits. When toxicity testing shows that a permittee's discharge contains toxicity at unacceptable levels, either the EPA region or the State agency with responsibility for that permit are urged to require the permittee to reduce toxicity so that no harmful effects occur instream.

Toxicity reduction evaluations (TREs) are a way to identify and implement whatever actions are needed to reduce effluent toxicity to the levels specified in the permit. TREs combine toxicity testing, chemical tests, and treatment analysis to determine either the actual causative toxicants or the treatment methods that will reduce effluent toxicity. EPA is currently documenting successful TREs conducted by permittees, States, and EPA researchers.

In addition, EPA's *Permit Writer's Guide to Water Quality-Based Permitting for Toxic Pollutants* is urging the use of an integrated toxics control strategy with both whole effluent toxicity-based assessment procedures and pollutant-specific assessment procedures to uphold State water quality standards.

Sludge Management

The need for effective sludge management is continuous and growing. In the United States, the quantity of municipal sludge produced annually has almost doubled since 1972. Municipalities currently generate approximately 7.6 million dry metric tons of wastewater sludge per year, or approximately 32 kilograms per person per year. Improper sludge management could lead to significant environmental degradation of land and air. Failure to properly dispose of sludge could have impacts on ground water and wetlands, as well as human health.

Prior to the 1987 amendments to the Clean Water Act, the authorities and regulations related to the use and disposal of sewage sludge were fragmented and did not provide States and municipalities with adequate guidelines on which to base sludge management decisions. There was no single legislative approach or framework for integrating the various Federal laws to ensure that sludge would be used or disposed of in a consistent or environmentally acceptable manner. While the Clean Water Act, the Clean Air Act, the Resource Conservation and Recovery Act, the Marine Protection, Research and Sanctuaries Act (MPRSA), and the Toxic Substances Control Act all regulate some aspect of sludge management, coverage is uneven, and the requirements are based on different methodologies and approaches.

Section 406 of the Water Quality Act of 1987, which amends Section 405 of the Clean Water Act, for the first time sets forth a comprehensive program for reducing the environmental risks and maximizing the beneficial uses of sludge. The program is based on the development of technical requirements for sludge use and disposal, and the implementation of such requirements through permits.

Pursuant to these requirements, EPA is developing regulations for each of the major use and disposal options for sewage sludge. These options include land application, incineration, landfilling, distribution and marketing, and ocean disposal. EPA will ensure that these regulations also comply with other relevant statutes such as the Clean Air Act, the Solid Waste Disposal Act, and the MPRSA. The first set of regulations, addressing 41 pollutants in sewage sludge, is scheduled to be proposed in early 1988. Development of a comprehensive set of disposal option regulations will give the States and municipalities a basis for making environmentally appropriate and cost-effective sludge management decisions.

EPA is also developing regulations to include sludge limits in NPDES permits, and to establish requirements for State sludge management programs to implement the new statutory requirements. These are scheduled to be proposed in December 1987.

Ocean Dumping

EPA is in the process of revising the Ocean Dumping Regulation in response to a lawsuit brought by the city of New York. This legal decision found that EPA could not categorically prohibit the ocean dumping of materials such as sludge and dredge spoil which fail the marine impact criteria. Instead, the EPA must take into account the need for ocean dumping and the availability and impacts of land-based alternatives to ocean dumping. The revision is also in response to the results of a National Wildlife Federation lawsuit on dredged material disposal, and to statutory amendments since the last promulgation of regulations in 1977. The revised regulations are scheduled for proposal in early 1988.

Nonpoint Sources

EPA's current nonpoint source responsibilities are embodied in several provisions of the Clean Water Act. Sections 208 and 303 of the Act established a framework, within the general water quality planning process, for planning and implementing nonpoint source controls. From 1975 through 1981, Section 208 funds were provided to the States and areawide planning agencies. These funds were to be used to analyze the extent of nonpoint source-related water quality problems and to develop strategies to control them as part of each State's overall water quality management program. During this period, significant funding was also devoted to evaluating best management practices, developing assessment methodologies and models, and providing other nonpoint source technical support to State and local water quality managers.

Toward the end of this period, major emphasis was placed on addressing water quality problems caused by urban stormwater runoff. From 1978 through 1983, the Office of Water committed $30 million to the Nationwide Urban Runoff Program (NURP). The NURP program included 28 projects scattered across the Nation, conducted separately at the local level but centrally reviewed, coordinated, and guided. All included one or more of the following elements: characterizing pollutant types, loads, and effects on water quality; determining the need for control; and evaluating various alternatives for the control of urban stormwater pollution.

NURP was not intended to be a research program per se, but to provide information, methodologies, and site-specific technical support to water quality management efforts. Therefore, wherever possible, the projects were selected with two basic criteria in mind: work undertaken would complete the urban runoff elements of formal water quality management plans, and the results would likely be incorporated in future plan updates and lead to implementation of management recommendations. Several forums for the communication of experience and the sharing of data were provided through semi-annual meetings involving participants from all projects.

Steve Delaney

The Nationwide Urban Runoff Program was conducted to characterize the types and effects of pollutants in urban runoff and to evaluate controls.

In addition to assisting communities in resolving their particular urban runoff problems, NURP produced important insights into the performance of selected best management practices and generated the most extensive database on urban stormwater runoff yet available. But what may prove to be of greatest value was the development of a statistically based analytic methodology that is capable of reliably predicting, with a high degree of accuracy, the high variability of pollutant concentrations found in urban runoff. This methodology has particular value as a screening tool to enable water quality managers to determine more quickly and cost-effectively where their worst urban runoff problems are and which control practices are most promising for particular applications. With modifications, the methodology will be applicable to all forms of nonpoint source pollution.

EPA has also worked extensively with other Federal agencies to provide technical support to State and local agencies in their efforts to manage and control nonpoint source pollution. The prime example of such interagency cooperation is the Experimental Rural Clean Water Program (RCWP), begun in 1979 as a result of national legislation enacted by Congress. The Agricultural Stabilization and Conservation Service of the U.S. Department of Agriculture (USDA) is the lead agency and has primary responsibility for directing the program. EPA's role is to ensure that water quality objectives are fully addressed. RCWP is designed to provide incentives for the implementation of agricultural best management practices (BMPs) to solve nonpoint source water quality problems. This program provides long-term technical and financial assistance to farmers in 21 watersheds across the country.

Since 1980, EPA and USDA have sponsored a special project of the North Carolina Extension Service called the National Water Quality Evaluation Project (NWQEP). NWQEP conducts technical analyses and evaluations of agricultural nonpoint source projects around the country, especially RCWP projects, and issues an annual report identifying current findings and observations of interest and use to those responsible for agricultural nonpoint source pollution control. Some recent findings are summarized on the following pages.

Erwin W Cole, USDA Soil Conservation Service

The Rural Clean Water Program provides financial incentives for the implementation of best management practices.

Control Strategies and Best Management Practices: Recent Findings

Urban Runoff

The Nationwide Urban Runoff Program (NURP), comprised of 28 projects conducted by State and local water quality management agencies from 1978 to 1983 under EPA's direction, reached the following conclusions about best management practices to control urban runoff:

Detention basins are capable of providing very effective removal of pollutants from urban runoff. Wet basins (designs which maintain a permanent water pool) have the greatest performance capabilities. When basins are adequately sized, particulate removals in excess of 90 percent (for total suspended solids and lead) can be obtained. Pollutants with significant soluble fractions show lower reductions, on the order of 65 percent for total phosphorus and approximately 50 percent for biochemical oxygen demand, chemical oxygen demand, total Kjeldahl nitrogen, copper, and zinc. Dry basins (conventional stormwater management basins) can be effective in attenuating peak runoff rates but according to NURP data are essentially ineffective in reducing pollutant loads. Dual-purpose basins (conventional dry basins with modified outlet structures which significantly extend detention time) appear from limited NURP data to provide effective reductions in urban runoff loads.

Adequately sized recharge devices are capable of providing very effective control of urban runoff pollutant discharges to surface waters, but continued attention to the potential for ground-water contamination is warranted. Soil type, depth to ground water, land slopes, and proximity to water supply wells must all be given careful consideration.

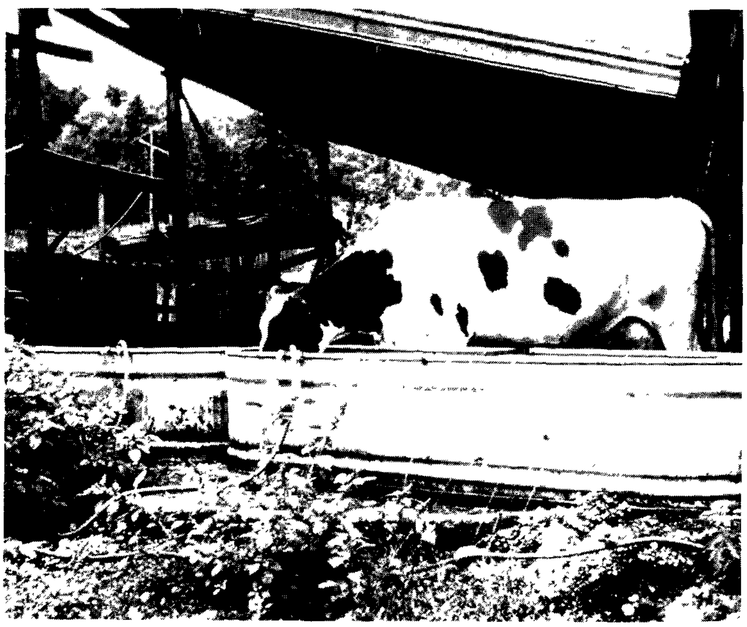
Street sweeping is generally ineffective as a technique for improving the quality of urban runoff. However, there may be special cases in which street cleaning, applied at selected times of the year (e.g., immediately following snow melt or leaf fall) or at restricted locations (e.g., urban neighborhoods consistently prone to amass debris) could provide reductions in pollution levels.

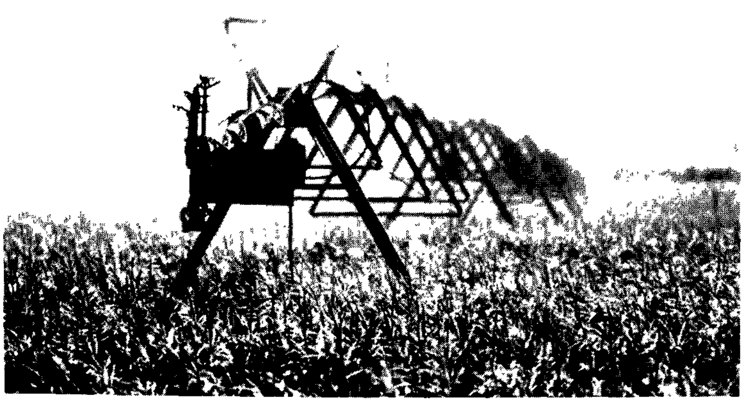
Grass swales can provide moderate improvements in urban runoff quality. Design conditions are important. Additional study could significantly enhance the performance capabilities of swales.

Wetlands, both natural and artificial, are considered to be of potential value in the control of urban runoff quality. Only one NURP project actually monitored performance of a wetland. This was a natural wetland; flows passing through it were uncontrolled. Initial results suggest potential to improve quality, but the investigation was not adequate to associate necessary design factors with performance capability.

The relative effectiveness of various best management practices has been demonstrated under the Nationwide Urban Runoff Program and the National Water Quality Evaluation Project.

Steve Delaney





Agriculture

The National Water Quality Evaluation Project has evaluated the effectiveness of more than 30 agricultural nonpoint source pollution control projects. Among its findings:

- Arid land irrigation canals respond most quickly to BMP implementation.

- The time it takes to observe water quality results from agricultural nonpoint source control measures depends on monitoring design, meteorologic variability, watershed size, water resource type, and pollutant type. At least five years are needed to document water quality improvements in humid regions.

- Eliminating the practice of manure spreading may slightly reduce loss of total phosphorus and substantially reduce loss of ortho-phosphate.

- While structural BMPs can be effective in reducing sediment and nutrient losses, they often are not the most cost-effective methods. Preliminary evaluation shows that conservation tillage and vegetative cover practices are substantially more cost-effective than sediment basins, diversions, terraces, and sediment control structures.

- Improved fertilizer management appears to be the most cost-effective BMP for reducing nutrient losses in most projects.

- Nitrogen management can reduce applied nitrogen substantially, with no adverse effect on corn yields. Irrigation management is thought to be effective in minimizing the leaching of nitrate into the ground water with no effect on corn yields.

- Irrigation scheduling has a significant effect on seasonal sediment loss. In many cases, reducing the number of irrigations can lower sediment losses without affecting productivity.

- Aggressive marketing, use of local agricultural agencies, and water quality plans integrating on-farm and water quality concerns can be effective even in areas that are economically depressed.

- Factors that may contribute to high rates of farmer participation include visible water quality objectives, large amounts of money for cost-sharing, identifying preferred BMPs, technical assistance, and active publicity.

By 1983, it became clear that stricter control of nonpoint source pollution was needed in order to fully realize the water quality benefits of the Nation's large point source control expenditures, and to meet the goals of the Clean Water Act. Congress commissioned EPA to compile a comprehensive report on nonpoint source pollution control efforts. In January of 1984, EPA issued *Nonpoint Source Pollution in the United States*, a summary of what was then known about the nature and extent of nonpoint source water quality problems and current efforts by Federal, State, and local agencies to address them.

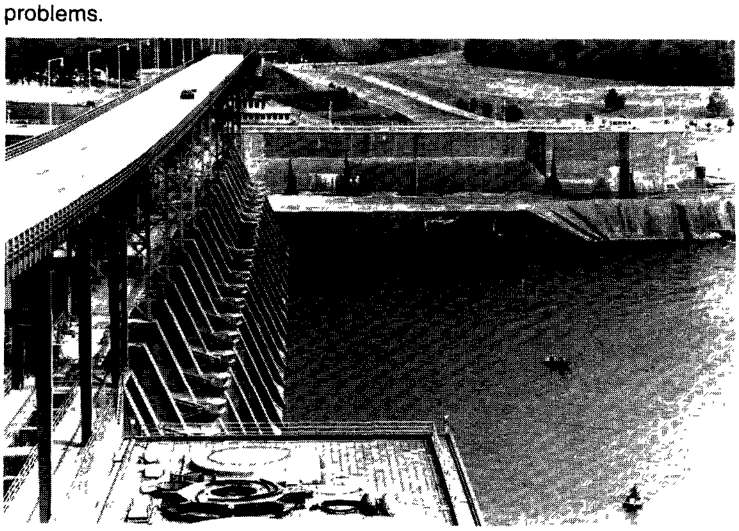
Recognizing the need to accelerate efforts to control nonpoint source pollution and the importance of closer coordination among the diverse agencies with nonpoint source management responsibilities at all levels, EPA convened a Federal/State/local Nonpoint Source Task Force in March of 1984. This Task Force included representatives of all parties with an interest or involvement in nonpoint source management, including Federal, State, and local agencies; public and private interest groups; and individual landowners and land managers. The Task Force developed a recommended national nonpoint source policy, and all participating Federal, State, and local agencies developed individual strategies to implement the recommended policy. Both the national policy and individual strategies were founded on the principle that States have primary responsibility for preventing and controlling nonpoint source pollution. There are several reasons for this:

- Nonpoint source water quality problems are typically diverse and site-specific, and States best combine proximity to the problems with sufficient span of control to address hydrologic units effectively.

- States legally possess primary authority for land use regulation and control.

- States, in cooperation with local jurisdictions, are in the best position to weigh local needs and conditions and to make necessary adjustments to implementation strategies.

Dams alter the natural courses of rivers and may create water quality problems.



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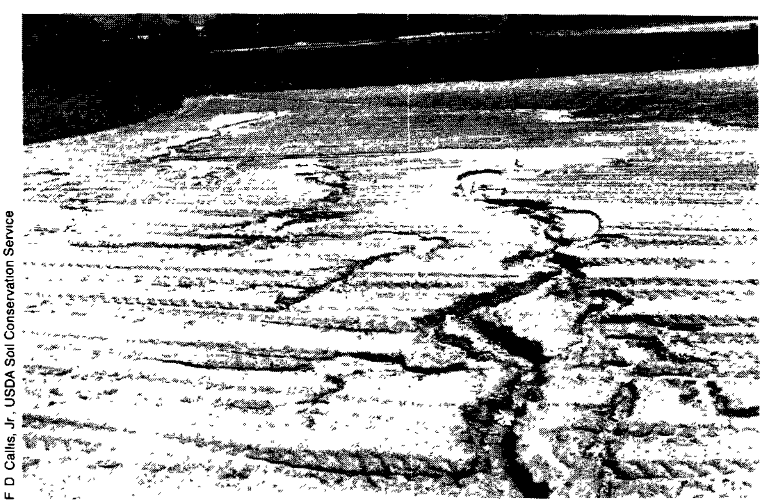


F D Callis, Jr, USDA Soil Conservation Service

To provide additional incentive to accelerate nonpoint source control efforts by the States, Congress enacted major new nonpoint source requirements for the States as part of the Water Quality Act (WQA) Amendments of 1987. The provisions require that each State prepare and submit to EPA within 18 months of enactment a nonpoint source Assessment Report and Management Program. The Assessment Report must identify State waters that will not attain or maintain water quality standards without additional nonpoint source controls; the particular nonpoint sources responsible; the process to identify BMPs for each nonpoint source category; and the State and local programs that would implement controls. The Management Program, covering a four-year period, will identify the following: actual BMPs to address the problems documented in the assessment and programs to implement the BMPs; sources and proposed uses of all nonpoint source control funding; and Federal programs and projects that States need to review for consistency with their own nonpoint source programs.

Under the WQA, EPA may award implementation grants to States that apply and whose Assessment Reports and Management Programs are approved. The WQA authorizes appropriations of $70 million in FY88, $100 million each in FY89 and FY90, and $130 million in FY91. In addition, the WQA reserves an additional one percent of each State's annual construction grant allotment to be used to prepare and carry out the Assessment Report and Management Program. The WQA also makes implementation of approved State Nonpoint Source Management Programs eligible for funding under the Governor's twenty percent discretionary set-aside of the State's annual construction grant allotment and under the State Water Pollution Control Revolving Fund.

In addition, the Water Quality Act of 1987 established new deadlines for the development of a permit program for stormwater discharges associated with industrial activities and municipal separate storm sewers. The substantive requirements of these programs are still being evaluated.

Finally, EPA is required to provide annual reports to Congress on the States' progress in controlling nonpoint source pollution. At the end of the four-year period provided by Congress for the States' initial Management Programs, EPA is further required to recommend programs (including enforcement) that are needed to control nonpoint sources sufficiently to attain and maintain water quality standards and the goals of the Act.

In addition, the nonpoint source provisions of the WQA amendments require that ground water as well as surface water protection be addressed by States in developing and implementing their nonpoint source programs. States must specifically identify the

Harvesting potatoes in Idaho.

potential ground-water impacts of BMPs they propose to use in their nonpoint source Management Programs. Up to $7.5 million annually of the grant funds authorized for State implementation of such Management Programs may be used for ground-water protection activities that will advance implementation of the Programs.

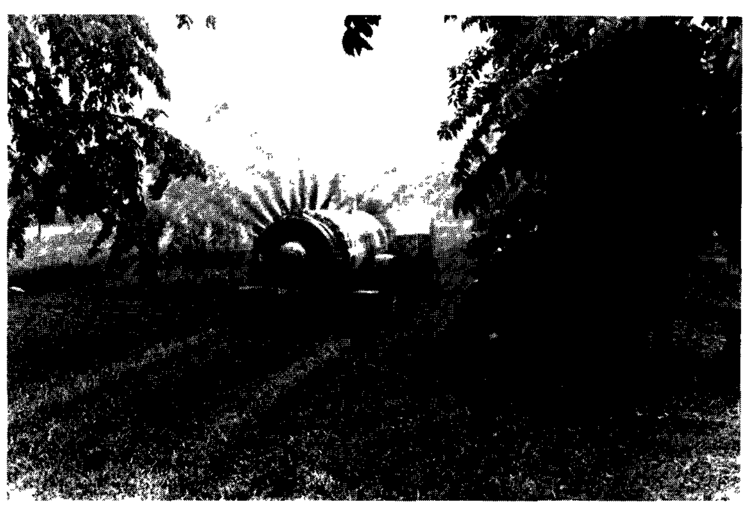
Clearly, much remains to be done to achieve adequate control of nonpoint source pollution. More precise and reliable analytic techniques are needed in order to estimate the water quality impacts of pollutants generated by nonpoint source activities and transported by storm events of variable frequency, intensity, and duration. More effective institutional arrangements must be forged between the many jurisdictions, organizations, and individuals involved in nonpoint source management. In order to more efficiently use the resources available at Federal, State, and local levels, more workable approaches must be devised to target and set priorities for nonpoint source cleanup activities. The WQA amendments of 1987 provide needed support, incentives, and opportunity for the States to move forward more aggressively on all these fronts.

Some examples of water quality successes due to the implementation of nonpoint source controls are reported by the States in 1986:

- In Idaho, a project to monitor the effectiveness of BMPs for irrigated agriculture is underway in the Rock Creek drainage area. Intensive trend monitoring funded through the Rural Clean Water Program is showing a substantial reduction in loadings of suspended sediments and other pollutants in areas where the most BMPs were implemented. A significant reduction in DDT has been shown in upper Rock Creek, indicating that past residues are breaking down and new sources are not being introduced.

Two examples of nonpoint source problems: runoff from fields causes soil erosion, and chemicals sprayed on crops may be washed into waterways.

Tim McCabe, USDA Soil Conservation Service



USDA

■ Indiana reports that large-scale implementation of agricultural conservation tillage practices have significantly reduced phosphorus loadings to Lake Erie. Target phosphorus loadings, which were agreed upon by the U.S. and Canada, called for Indiana to reduce its phosphorus loadings to Lake Erie by 90 metric tons per year for four years, beginning in 1985. Since earlier State legislation had curbed point source phosphorus discharges, it was determined that any additional significant decreases would have to come from nonpoint controls. The U.S. Department of Agriculture, local Soil and Water Conservation Districts, and the Cooperative Extension Service, in cooperation with EPA, assisted farmers in the use of BMPs including conservation tillage. The calculated result of the effort was a 106 metric ton reduction for 1985, 16 tons more than the year's target.

■ Kentucky's Reformatory Lake, once classified as hyper-eutrophic due to nutrients from livestock operations, was impaired as a recreational fishing resource because of low dissolved oxygen levels. Better livestock management practices were instituted to treat the problem. Preliminary data from 1985 indicate that the measures taken by farm managers, with assistance from the State and the University of Kentucky's Agricultural Extension Service, have dramatically improved lake quality. Decreases were found in chlorophyll, phosphorus, and nitrogen levels, with a concomitant increase in dissolved oxygen and water clarity. The lake is no longer considered hypereutrophic.

■ New Hampshire reports on efforts undertaken to relieve construction runoff at a large residential development site on Lake Winnipesaukee. Problems with sediment runoff were traced to inadequate retention structures, large areas of raw earth, and resultant channelization. Immediate controls were imposed, including seeding and mulching; the use of rip-rap, check dams, and diversion ditches; the redesign of a sedimentation pond; and the development of a "timing and sequencing" plan to ensure immediate stabilization of soil and temporary controls to prevent erosion. Since imposition of control measures, no further sedimentation problems have occurred at this project.

■ In North Dakota, information provided by the Soil Conservation Service indicates that soil conservation BMPs instituted in 1984 and 1985 have resulted in reductions in soil loss. In 1984, soil conservation measures applied to 1.6 million acres of cropland, pastures, rangeland, woodland, wildlife areas, and recreation land resulted in savings of 3.4 million tons of soil, averaging 2.1 tons per acre; in 1985, 4.4 million tons of soil were saved, averaging 2.4 tons per acre. Nonpoint source impacts are expected to decline as sediments and nutrients are kept on the land and out of rivers and lakes.


Gene Alexander, USDA Soil Conservation Service


Steve Delaney

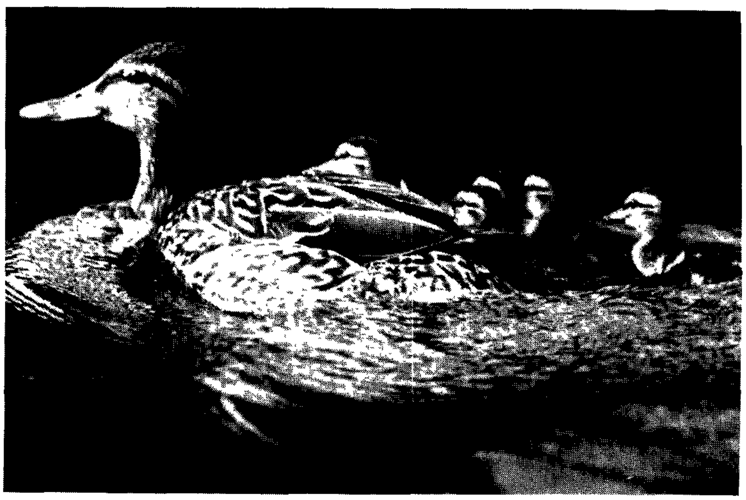
State discussions of nonpoint source control programs reveal that continued progress and activity is occurring in BMP implementation, especially in the control of agricultural pollution. For example, in Iowa, projects to control agricultural nonpoint source pollution have begun in the watersheds of a number of high priority lakes including Prairie Rose Lake, Green Valley Lake, Arrowhead Lake, and twelve others. A statewide water quality management plan has been implemented, State legislation has provided funding for no- and low-interest loan programs for soil conservation, and cost-share funding has been increased.

Idaho reports that 43,524 acres of farmland are under contract for cost-share projects. With cost-share funds, local soil conservation districts conduct voluntary pollution control projects along stream segments affected by agricultural runoff. In Maryland, the recent finding that agricultural nonpoint sources contribute much of the nutrient enrichment to Chesapeake Bay has resulted in revisions to the State agricultural control program. BMPs for reducing nutrient losses from cropland and animal wastes are being promoted, and a new set of priority watersheds has been identified in which to focus conservation measures.

California reports on the adoption of a basin water quality control plan for Lake Tahoe that includes the expenditure of $12.5 million in State, local, and Federal funds for remedial erosion control, and the expenditure of Federal funds to purchase environmentally sensitive land in the Tahoe Basin. Significant strides are also noted in the areas of mining, agriculture, abandoned gas wells, and the application of chemicals in silviculture.

A number of States report on the passage of strengthened erosion control legislation. In Connecticut, for example, major erosion and sedimentation control legislation was passed in 1983. Georgia reports that amendments to the Erosion and Sedimentation Control Act were passed in 1985. Illinois adopted a soil erosion and sediment control program in January 1983 that requires each soil and water conservation district to prepare district-wide erosion and sedimentation guidelines. In addition, a $2.3 billion "Build Illinois" program was adopted in 1985 for agricultural soil erosion control practices.

Despite progress and the passage of new legislation, barriers to nonpoint source pollution control persist. Primary barriers reported by the States include funding and resource limitations, and the need to document the effectiveness of BMPs.



Steve Delaney

Water Quality Monitoring

Under the Clean Water Act, the States and interstate agencies, in cooperation with EPA, perform water quality monitoring. This monitoring is needed in order to establish and revise water quality standards; calculate total maximum daily loads; assess compliance with permits; evaluate the effectiveness of control measures; and report on conditions and trends in ambient waters.

To determine the severity of pollution, States must make evaluations based on the most accurate information available. This information is of various types:

- Chemical screening data cover specific pollutants and constituents sampled from the water column, sediments, and fish/shellfish tissue. They are collected through "fixed" or stationary monitoring station networks; intensive, short-term surveys; or special studies designed to answer questions about a particular stream segment or pollution discharger.

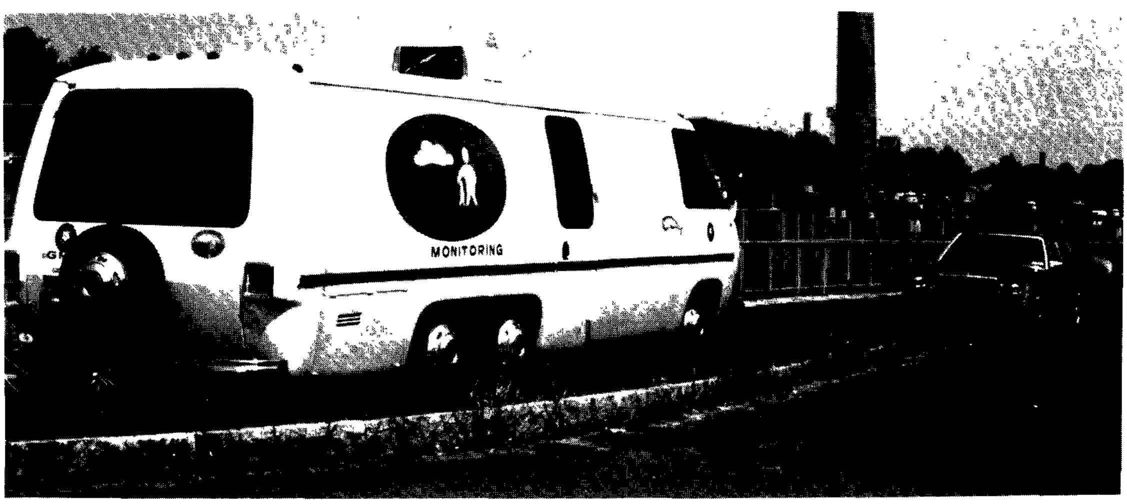
- Biomonitoring data can be obtained from two types of monitoring activities: biosurveys and bioassays. Biosurveys may consist of surveys of fish, macroinvertebrates, and other biological communities; tissue analyses; studies of species diversity and abundance; habitat evaluations; and other quantitative measures. Bioassays, on the other hand, are tests for assessing the toxicity of discharges and ambient water samples to aquatic life, and for screening discharges for human health hazards.

- Professional judgement and direct observation include data on stream loadings and dilution, stream models, discharge data, fish kill reports, citizen complaints, and data from other streams of similar size and watershed characteristics within the same aquatic ecological conditions.

An additional type of data results from compliance monitoring activities. Compliance monitoring includes all monitoring activities by State or Federal regulatory agencies to determine whether NPDES permittees are adhering to the conditions of their permits. Generally, this type of monitoring data is used in compliance evaluations and in support of enforcement actions where permit violations are occurring.

EPA directs the States to establish balanced monitoring programs capable of collecting all types of information. In combination, these activities help each State set management priorities for cleanup and direct limited resources where they will be of most value.

Mobile laboratory belonging to Connecticut's Department of Environmental Protection.



James Plafkin

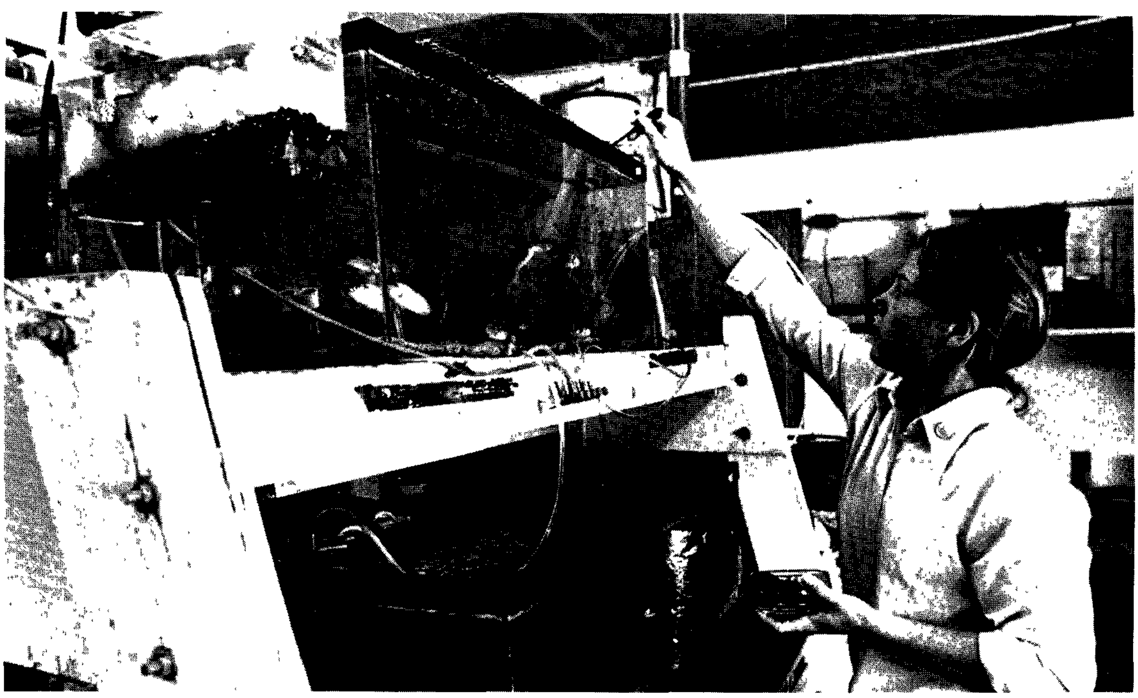
Responsibility for the EPA-sponsored water quality monitoring effort rests with both EPA and the States. In general, EPA provides overall policy, guidance, technical assistance, training, and overview of program implementation. EPA is also responsible for national assessments of water quality and program effectiveness. The States collect data from fixed stations and dischargers; conduct biosurveys/bioassays, intensive surveys, and special studies; perform wasteload allocations and water quality analyses; and ensure that needed environmental data are provided to EPA.

New Initiatives in Water Monitoring

In an effort to increase the percentage of the Nation's waters that are assessed and to make judgements on the reliability of those assessments, EPA is proposing that States report in more specific detail on individual waterbodies, especially those that fail to support designated uses. The Section 305(b) process will be the vehicle for this reporting. A computerized waterbody information system is being designed by EPA and the States to contain this information and keep it readily available for updating and revision. Key monitoring data reported by the States and incorporated into this system will include segment-specific data on impaired uses, sources of pollution, problem parameters, and monitoring and control activities.

New tools are being developed by EPA to expand the States' capability to assess previously unassessed waters. Such tools include techniques for rapid bioassessment. EPA is preparing guidance on these methods, which involve brief site visits to evaluate water quality using cost-effective biological sampling and evaluation methods. New toxicity tests are also available for sensitive and economical screening of ambient waters and effluents. The test procedures are described in EPA's *Technical Support Document for Water Quality-Based Toxics Control* (Office of Water, September 1985.)

Conducting bioassays at EPA's laboratory in Narragansett, Rhode Island.



Costs and Benefits of Pollution Control

Section 305(b) of the Clean Water Act calls for States to provide an estimate of the economic and social costs necessary to achieve the objective of the Act in their States and the economic and social benefits of such achievement. The EPA must then provide an analysis of the State submittals. This is a new area of analysis for many States, and, as a result, State-reported information is not extensive. This section will therefore include data from a variety of sources in addition to the 1986 State 305(b) reports.

Costs

Many States do not provide data on costs in their 305(b) reports; where they do, these data are mostly capital costs for municipal wastewater treatment systems. Therefore, in order to provide an overall, historical view on resources devoted to water pollution control, aggregrate expenditures—based primarily on surveys and analyses by the Bureau of Economic Analysis, U.S. Department of Commerce—are shown in Table 5-4. The data compare expenditures from 1972 to 1984.

Expenditures for municipal sewage treatment facilities are shown in Figure 5-1 in constant 1982 dollars. Capital spending rose from $6.9 billion per year in 1972 to a peak of $10.1 billion in 1978. Since then, the rate of investment has dropped to a level of about $6.0 billion per year in 1982-1984.

Table 5-4. Spending for Water Pollution Abatement and Control (billions of constant 1982 dollars)

	Pollution Abatement											Control		
	Point Sources									Nonpoint Sources				Total Pollution Abatement and Control
	Operation of Facilities				Capital Spending									
Year	Municipal Systems	Industrial	Other	Sub-Total	Municipal Systems	Industrial	Other*	Sub-Total	Total Point Sources		Total Pollution Abatement	Research and Development	Regulation and Monitoring	
1972	2.9	2.5	0.2	5.6	6.9	3.3	2.0	12.1	17.8	1.9	19.7	0.3	0.3	20.3
1973	3.2	2.8	0.3	6.3	7.2	3.6	2.1	12.8	19.2	2.1	21.3	0.4	0.4	22.0
1974	3.3	2.8	0.4	6.5	8.1	3.4	1.7	13.2	19.7	1.7	21.5	0.3	0.5	22.2
1975	3.4	3.0	0.5	6.9	9.0	4.2	1.3	14.5	21.4	1.4	22.8	0.3	0.5	23.6
1976	3.7	3.4	0.4	7.5	9.4	4.6	1.4	15.4	22.9	1.5	24.4	0.3	0.5	25.3
1977	4.1	3.7	0.4	8.2	9.4	4.4	1.6	15.5	23.7	1.0	24.7	0.3	0.6	25.5
1978	4.4	3.9	0.5	8.8	10.1	4.3	1.9	16.2	25.0	1.6	26.6	0.3	0.6	27.5
1979	4.6	4.2	0.5	9.3	9.8	4.0	1.8	15.6	24.9	1.6	26.5	0.3	0.6	27.4
1980	4.7	4.1	0.3	9.1	8.9	3.7	1.5	14.1	23.2	1.4	24.6	0.3	0.6	25.5
1981	4.9	4.2	0.2	9.3	6.9	3.3	1.3	11.4	20.7	1.2	22.0	0.3	0.6	22.8
1982	5.2	4.0	0.3	9.4	6.1	3.1	1.3	10.6	20.0	1.2	21.2	0.3	0.5	22.0
1983	5.5	4.4	0.5	10.3	5.6	2.8	1.6	10.0	20.3	1.1	21.5	0.3	0.4	22.2
1984**	5.8	4.7	0.4	10.8	6.4	2.9	1.9	11.2	22.0	1.2	23.2	0.2	0.4	23.9

Note Pollution abatement and control expenditures cover: direct *pollution abatement* expenditures by industry, household, and governmental units for reduction of point and non-point source discharges; *regulation and monitoring* expenditures by government for activities that "stimulate and guide action to reduce pollutant emissions", and *research and development* expenditures to support abatement and to help increase the efficiency of regulation and monitoring.

*Consists largely of spending for private connectors to public sewer systems

**Preliminary.

Source. Kit D. Farber and Gary L. Rutledge, "Pollution Abatement and Control Expenditures," *Survey of Current Business,* July 1986, p. 86

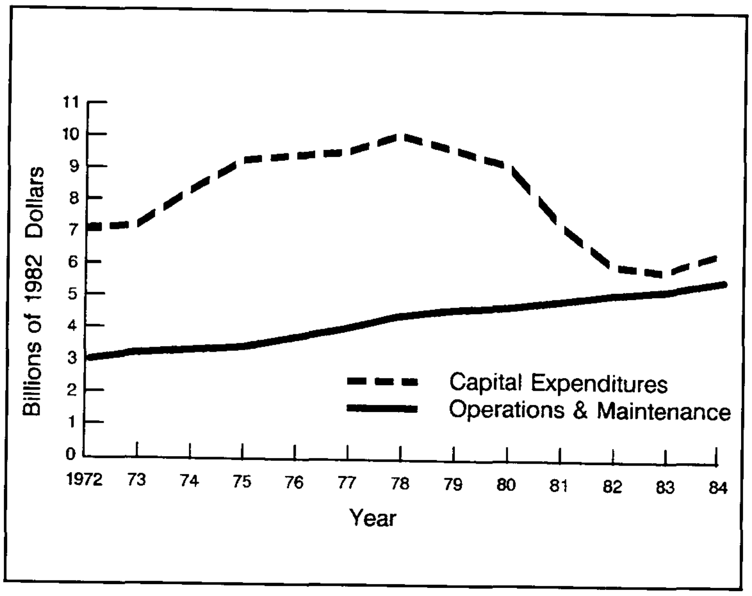


Figure 5-1. Spending on Municipal Systems

Although the rate of capital expenditures has dropped, the total value of municipal plant and equipment continues to grow. This is indicated indirectly by the continuing growth in operation and maintenance (O&M) expenditures for municipal sewage treatment facilities. This statistic, which excludes depreciation of capital equipment, has grown from $2.9 billion in 1972 to double that amount, $5.8 billion, in 1984.

Analogous data for industrial waste treatment are shown in Figure 5-2. Capital expenditures rose from $3.3 billion per year in 1972 to $4.6 billion in 1976 and then drifted downward to a recent level of about $3 billion per year (in constant 1982 dollars). Figure 5-3 shows that the total value of industrial treatment plant and equipment in place increased steadily from $18.5 billion in 1972 to $43.7 billion in 1984.

As in the case of municipal facilities, industrial O&M expenditures show an upward, though less stable, trend. The irregularity of the trend is apparently the result of fluctuations in industrial activity. To examine the possible effect of industrial activity on wastewater treatment O&M, the Federal Reserve Board Industrial Production Index is shown in Figure 5-2. The pauses in the upward movement of the O&M trend appear to be correlated with the drops in industrial production in 1974-75 and 1980-82.

One question on which these time series cast light is this: how much greater is the cost of water pollution control since the Clean Water Act was passed than it was before the Act, after taking into account the growth in industrial production? The annual cost of interest and depreciation for industrial water pollution control (estimated to be 12 percent of the value of water pollution plant and equipment) plus O&M expenditures yields the total annual cost of industrial pollution control. These costs have risen from $4.74 billion in 1972 to $9.89 billion in 1984. This 109 percent increase is estimated to be the product of a 40 percent increase in industrial production and a 49 percent increase in water pollution control requirements per unit of production. Thus, for a given production level, it is estimated that industrial pollution control costs have increased by a half as a result of the Clean Water Act requirements. For example, if pollution control costs were one percent of production costs before the Clean Water Act, today they would be, on average, 1.5 percent.

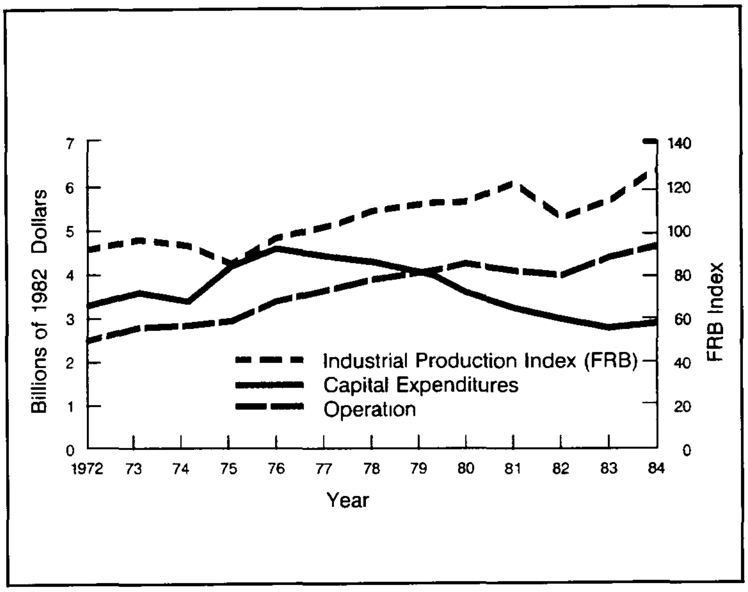


Figure 5-2. Spending on Industrial Pollution Abatement

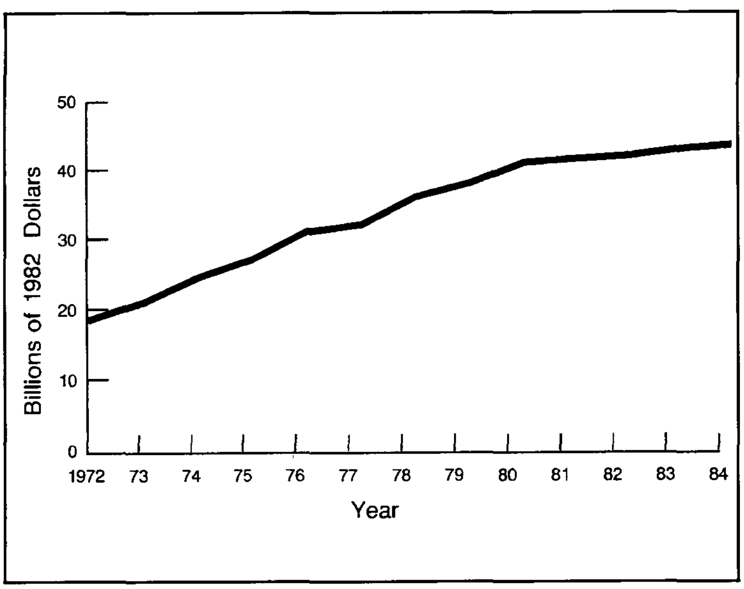


Figure 5-3. Net Capital Stock of Industrial Wastewater Treatment Plant and Equipment

Two other household expenditure categories in Table 5-4 are quite sizable. The "Point Sources/Capital Spending" category largely represents the cost of connecting private homes to public sewer systems. This category has fluctuated in the range of $1.3 to $2.1 billion per year over the period. The "Nonpoint Sources" cost estimate is much less inclusive than one might expect: the largest portion represents capital and operating expenditures for septic systems, and a much smaller component is for highway erosion abatement. These nonpoint source expenditures have also fluctuated in the range of $1.1 to $2.1 billion.

These data are of interest, first, in illustrating the time pattern of water pollution control expenditures since 1972—a surge in plant and equipment expenditures following passage of the Clean Water Act, peaking in 1976-1978. Since then, plant and equipment expenditures have dropped off, but growth continues in the value of water pollution plant and equipment and in the resources devoted to their operation. The data also support an observation made in the 1977 edition of this report that industrial point sources had moved faster toward compliance than municipal treatment plants: the peak rate of municipal investment spending occurred in 1978, that of industrial spending on plant and equipment in 1976. Finally, the time series provide the data for a back-of-the-envelope calculation that, per unit of output, the costs of industrial water pollution control are about 50 percent higher now than before the Clean Water Act was passed.

Benefits

Federal, State, and local expenditures for pollution abatement are easier to measure than the benefits derived from these programs. However, as funding for water quality control programs becomes scarcer, there is a greater need to compare the tradeoffs between environmental programs and evaluate their abilities to achieve desirable water quality goals. Several States have begun to place a greater emphasis on considering the beneficial outcomes that result from specific water quality projects. Nevertheless, in general, the States do not assess the overall benefits of water quality improvement.

A first step in this process is to define benefits and the various categories of benefits attributable to pollution abatement (see Figure 5-4). The "benefits" of water quality improvement are defined by economists in terms of people's willingness to pay for such improvements. The major distinction in the classification of benefits is between user and non-user benefits. User benefits are those related to the instream use of the water—such as recreational benefits from improved fishing, swimming, and boating—or those benefits that occur because the water withdrawn for industrial, agricultural, or public water supply use is of better quality. A review of monetary estimates of these benefit categories indicates that recreational benefits make up a major portion of user benefits, and that all user benefits make up about 60 percent of total benefits.*

However, there is evidence that a significant portion of the benefits from water quality improvement result from benefits *perceived* by non-users—either because they might wish to take advantage of using the resource in the future, or because they value the preservation of environmental quality for other reasons. These non-user benefits are estimated to range from 30-50 percent of total benefits.**

In the past few years, strides have been made to improve methods of evaluating the benefits of water quality improvement. EPA has funded a number of studies with this goal. For some categories of benefits, these methods focus on inferring the amount people would be willing to pay for improved water quality, based on the travel costs they are willing to incur for recreation at sites with better water quality. Another approach has been to devise surveys to determine the public's willingness to pay for improved water quality. A great deal of attention has been devoted to examining the validity of the latter techniques, and there appears to be promise in these methods.

Michigan Travel Commission

A view from the shore of Lake Michigan.

*A Myrick Freeman, *Air and Water Pollution Control A Benefit-Cost Assessment*, Wiley, New York, 1982

**Ann Fisher and Robert Raucher, "Intrinsic Benefits of Improved Water Quality Conceptual and Empirical Perspectives," in V Kerry Smith and Ann D. Witte, eds , *Advances in Applied Microeconomics*, Vol III, JAI Press, 1984

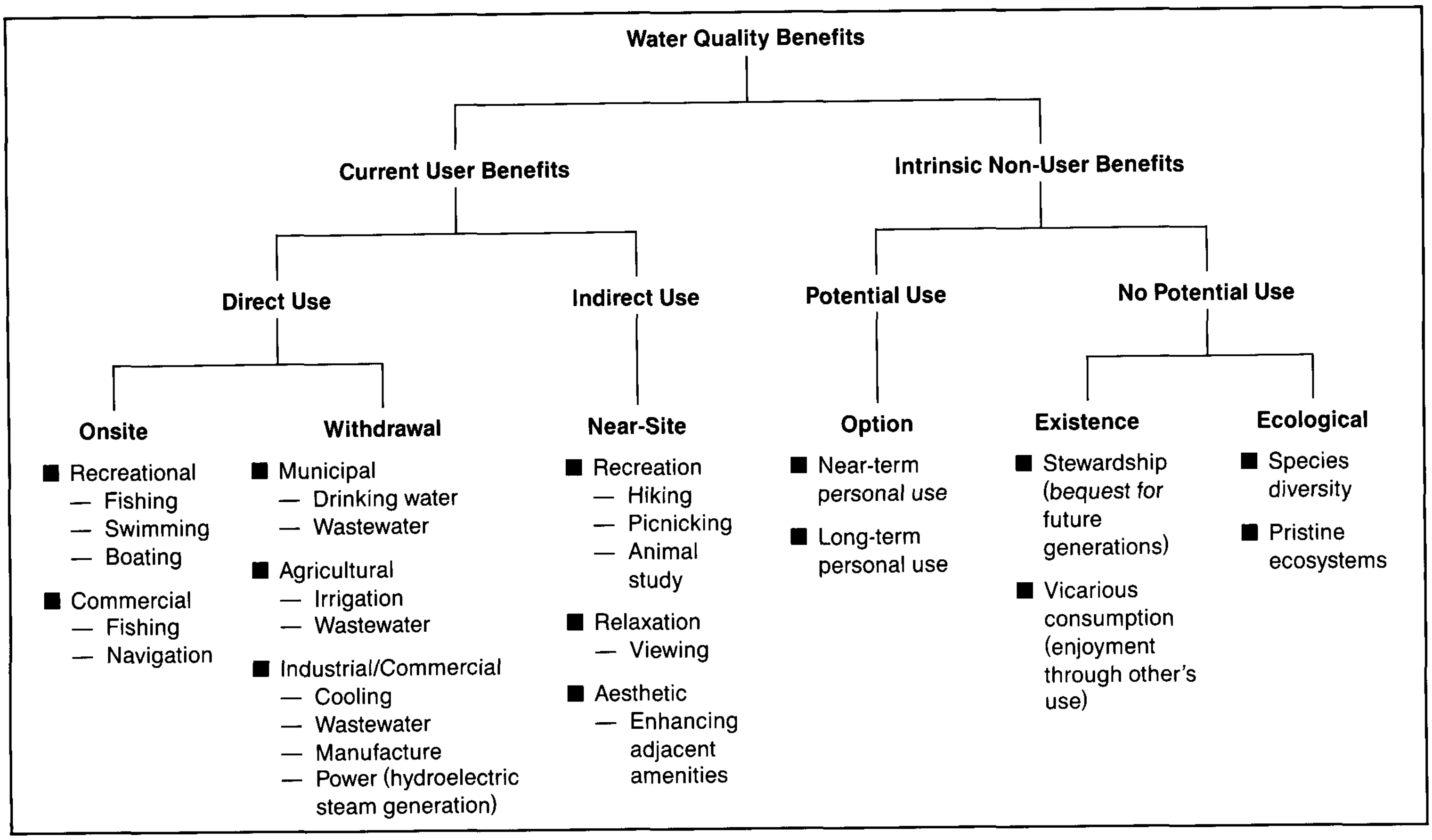
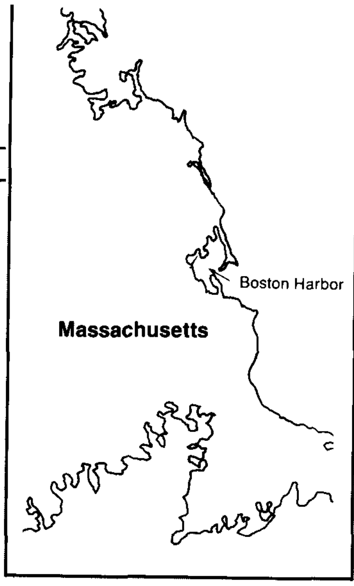


Figure 5-4. Benefit Categories for Analysis of Water Quality Programs

Ron Hoffer

Strides are being made in evaluating the benefits of improved water quality.



In 1985, EPA completed a study examining the feasibility of using economic tools to assess the beneficial outcomes of upgrading municipal sewage treatment plants (STPs) and combined sewer overflows (CSOs). The report used the Boston Harbor in Boston, Massachusetts, as a case study to demonstrate the application of benefit estimation techniques. Where feasible, the study provided dollar estimates of the economic benefits of treatment alternatives for recreation and commercial fishing, as well as other relevant categories.

The report considered the impacts of fecal coliform, biochemical oxygen demand, suspended solids, heavy metals, and toxics on potential uses of the harbor. The categories for which benefit estimates were computed were determined by those uses of Boston Harbor that are affected by pollutants discharged from STPs and CSOs. A term often used to describe uses which are adversely affected by pollution sources and which benefit from abatement processes is "receptor." The receptors or benefit categories in this study included recreational activities such as fishing, swimming, boating and fishing; commercial finfishing and shellfishing; support of a healthy ecological habitat; and intrinsic benefits to non-users who would be willing to pay for pollution control.

The benefits of improved water quality accrue to users and non-users alike, and are presented with a summary discussion of specific benefit estimates (see Table 5-5). Some conclusions reached by the study include:

- Recreational categories appear to be especially important for urbanized areas where local population density and demand for yearly recreational opportunities are high.

- Geographic location of the pollution source in relation to the receptor or benefit category is an important factor in determining the type and level of benefits that will be generated by different treatment options.

The benefit estimate numbers presented in Table 5-5 are approximations and represent means computed from ranges—sometimes wide ranges—that have been developed for each benefit category. For the most part, they are conservative assumptions and generally underestimate the benefits.

Despite some limitations in our ability to place a value on each category of benefits, this study shows that economic analysis of the beneficial outcomes of water quality improvements is feasible and is a useful tool, especially where there is a choice to be made among several alternatives and where funds are limited.

Table 5-5. Annual Benefits and Costs of Control Options for Sewage Treatment Plants and Combined Sewer Overflows (millions of 1982 dollars)

	Pollution Control Option		
Benefit Estimates by Category	**Combined Sewer Overflows for Boston Harbor**	**Combined Sewer Overflows and Ocean Outfalls for Boston Harbor**	**Combined Sewer Overflows and Secondary Treatment for Boston Harbor**
Swimming	12.1-18.0* (15.1)**	15.2-23.6 (19.0)	14.2-22.4 (18.3)
Recreational:			
Boating	None available. Available only for CSO and STP control scenario.	5.4-12.1 (8.8)	6.5-14.6 (10.5)
Fishing		0.3-7.9 (4.1)	0.8-9.5 (5.1)
Health	0.1-1.7 (0.9)	0.2-2.7 (1.4)	0.2-2.8 (1.5)
Commercial Shellfishing	0.001-0.02 (0.01)	0.02-0.12 (0.06)	0.02-0.12 (0.06)
Intrinsic	Based on total recreation benefits. None available.	10.1-21.8 (15.9)	10.7-23.2 (17.0)
Ecological	Unquantified. Value of productive salt marshes in harbor: supporting animals, shore birds, and waterfowl.	Unquantified. Potentially large benefit to shoreline saltmarshes. Negative impacts on Massachusetts Bay: finfish, shellfish, and migratory whales.	Unquantified. Potentially large benefit to shoreline saltmarshes.
Total Benefits	12.2-19.7 (16.0)	31.2-68.2 (49.3)	32.4-72.6 (52.5)
Total Costs	6.4-12.2	103.3-109.1	137.4-143.2

Source: U.S. EPA, Office of Policy Analysis. *A Methodological Approach to an Economic Analysis of the Beneficial Outcomes of Water Quality Improvements from Sewage Treatment Plant Upgrading and Combined Sewer Overflow Controls*, EPA-230-11-85-017, March 1986.

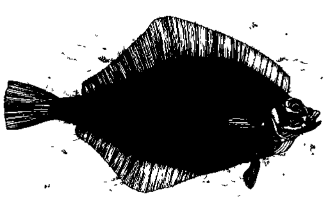
*Range of potential benefits.
**Point estimate.

Techniques of benefit estimation are gradually moving from the research phase to application. Many of the benefit categories are understood and accepted by environmental managers. However, there are obstacles to progress because of the different way that economic analysts and environmental managers consider benefits. For example, there is lack of consensus on how to interpret additional economic activity—such as increased sales of fishing tackle, bait, accommodations, and increased employment in the service sector—resulting from improved water quality. Some studies by State agencies have interpreted these measures of economic activity as the primary measures of benefits. On the other hand, economic theorists often omit these "secondary benefits" altogether, claiming that they represent the expenditure of funds that, in the absence of the water quality improvement, would be spent elsewhere. It is also claimed that including these secondary benefits may result in double counting benefits that have been estimated using other methods.

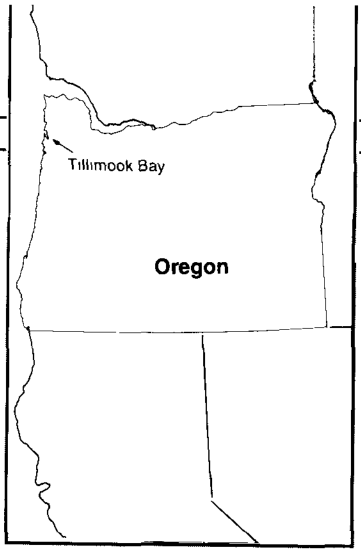
Clearly some conceptual matters in the field of cost-benefit assessment are still at issue. The preparation of statewide assessments of water quality benefits is a goal that will be only gradually achieved as concepts and techniques improve. In addition, improved data are essential. Systematic attempts to inventory surface waters and their quality will form an important part of benefit assessments in the future.

State-Reported Information

Although there are little quantitative data provided in State 305(b) reports on water-based recreational and commercial improvements, most States provide some information on the benefits that have resulted from actions taken to reduce water pollution. For example, coastal States have funded wastewater treatment projects that enabled the opening of shellfish beds and improved bathing water quality at beaches. Several States report the return of pollution-sensitive fish species and increasing recreational demand placed on waters located in or near major urban areas. Increases in demand for rafting, canoeing, and other boating activities have been observed on previously degraded streams.




Steve Delaney



Tillamook Bay, Oregon

Tillamook Bay was selected in 1980 as a nonpoint source (NPS) pollution control project under the Rural Clean Water Program (RCWP). This isolated community, situated along the northern coast of Oregon, depends economically on the dairy, shellfish, and recreation industries.

The Tillamook Bay RCWP project area was selected as a case study for economic analysis of nonpoint source controls for several reasons:

- The water resource has a clearly documented use impairment that is largely attributable to nonpoint source pollution.
- Reliable and relatively complete data are available on the economic value of the water resource, the costs associated with pollution, and the cost of pollution control.
- Agricultural nonpoint source pollution control has improved the quality of the bay.

The watershed surrounding Tillamook Bay includes about 120 dairy farms located near bay tributaries. The climate is mild with extremely high rainfall, and the density of fecal coliform bacteria in the bay frequently causes closure of the shellfish beds. Prior to the RCWP project, in 1980, the situation had become so severe that the U.S. Food and Drug Administration (FDA) threatened to withdraw certification of the bay's commercial shellfishing for interstate shipment unless a vigorous pollution control effort was initiated and water quality improvements were demonstrated. FDA action would have initiated a chain of actions that would culminate in complete closure of the bay to both commercial and recreational shellfishing.

Project Costs

Records from the RCWP project indicate that during the period 1981 through 1990, a total of $5.7 million will be spent to administer and implement the NPS control project. This cost includes information and education programs to generate public support and farmer participation, cost sharing to help cooperating farmers install pollution control practices, and technical assistance to design appropriate pollution control plans for each farm. The farmers' share of pollution control costs (generally 25 percent) is not considered because this cost is generally offset by on-farm benefits from manure nutrient savings, direct labor savings, and improved water management that allows more efficient operation in wet weather.

Project Benefits

Benefits from three categories have been identified: commercial shellfishing, recreational shellfishing, and other recreational activities such as viewing and picnicking. Because FDA action would result in complete closure of the bay to shellfishing activities, radical consequences are expected in both commercial and recreational shellfishing, and mild consequences were expected in other recreational activities. Economic consequences are amplified because of the isolation of the Tillamook Bay community and the lack of comparable shellfishing opportunities in that region of the Pacific coast.

As shown below, commercial shellfishing benefits over a ten-year timeframe are equal to 80 to 95 percent of the amount spent on pollution control in the RCWP project. Recreational benefits that would be lost from closure of the bay, however, exceed the cost of the RCWP project from three- to sevenfold. Even the benefits associated with a five percent decline in picnicking and viewing could be equal to 25 percent of the cost of the RCWP project.

Analysis of the Tillamook Bay RCWP shows that:

- NPS control can be highly cost-effective when the impairment is clearly attributable to nonpoint sources.
- Recreational benefits represent substantial value, the loss of which could justify expenditure of public funds for control of NPS pollution.
- Unique, productive ecological habitats such as Tillamook Bay provide very high economic benefits that are seldom recognized.

This information was provided by North Carolina State University's National Water Quality Evaluation Project and the Tillamook Bay Rural Clean Water Program.

Table 5-6. Cost and Benefits Associated with NPS Control in Tillamook Bay Rural Clean Water Program

Project Costs (1981-1991):	$5,736,074
Benefits to Shellfish Industry:	$4,700,000-$5,500,000
Benefits to Recreational Shellfishing:	$21,734,000-$43,800,000
Benefits to Other Recreation (5% decline):	$1,300,000

Some States have begun to consider the potential benefits of a pollution control project prior to funding and implementing it. For example, Montana reports that the Flathead River and Lake system—known for its high quality—began to show signs of accelerated eutrophication that prompted the State to take several steps to rectify the problem. Among these steps were phosphorus limits imposed on all State-permitted effluents in the drainage area. In addition, several wastewater treatment plants will be required to upgrade their treatment processes and the water quality monitoring program will be expanded to better measure phosphorus contributions to the lake. The two counties comprising the lake's watershed have passed ordinances restricting the sale of phosphorus-containing laundry detergents. To help justify these measures, the State considered their relative benefits and costs. Montana believed that the value of using and preserving the condition of the Flathead River/Lake system far outweighed the likely costs of implementing the phosphorus control strategy.

Other States are evaluating the extent of damages attributable to nonpoint source pollution, since the sources of these pollutants and their resulting damages are becoming more evident as point source pollution discharges are reduced. Iowa, for example, has estimated the potential benefits and costs of both erosion control measures and improved fertilizer management. Although a great deal of uncertainty is involved in this estimate, it does illustrate how the worth of nonpoint source control programs can be evaluated against the costs of current agricultural practices.

Some of the preliminary findings of this assessment were that:

- The cost of crop losses and farm structure damage related to sediments in Iowa may be as much as $13 million per year. Damages to rural road networks may average $1.6 million a year, and costs for treating sediment-degraded water supplies is about $1 million a year. Switching to certain soil conservation practices, on the other hand, was estimated to potentially increase farm income by over $20 million a year.
- Fertilizer loss due to surface runoff from Iowa corn and soybean fields each year causes a direct economic impact. The study estimates an annual loss of 39 pounds of total nitrogen per acre. At a cost of $300 per ton for nitrogen, this represents over $180 million spent unnecessarily every year by Iowa farmers.

Rather than assess the beneficial outcomes of its water quality programs, Maine asked its Regional Water Quality Advisory Committees whether Maine's water cleanup effort over the past 15 years had provided sufficient benefits to justify its costs. Of the 163 respondents, 76 percent felt the benefits exceeded the costs, 6 percent felt the opposite was true, and 18 percent were not sure. The survey found that respondents agreed that water cleanup efforts had maintained water quality for farming, industrial, logging, and small business purposes. In addition, 72 percent felt that local residents had benefited from Maine's program, and 74 percent believed that the tourism industry had improved as a result of progress made in the State's water programs. Although surveys like Maine's are somewhat subjective in their approach, they do begin to address the issue of public perceptions of the success of State water quality programs.

Clamming in Tillamook Bay, Oregon.

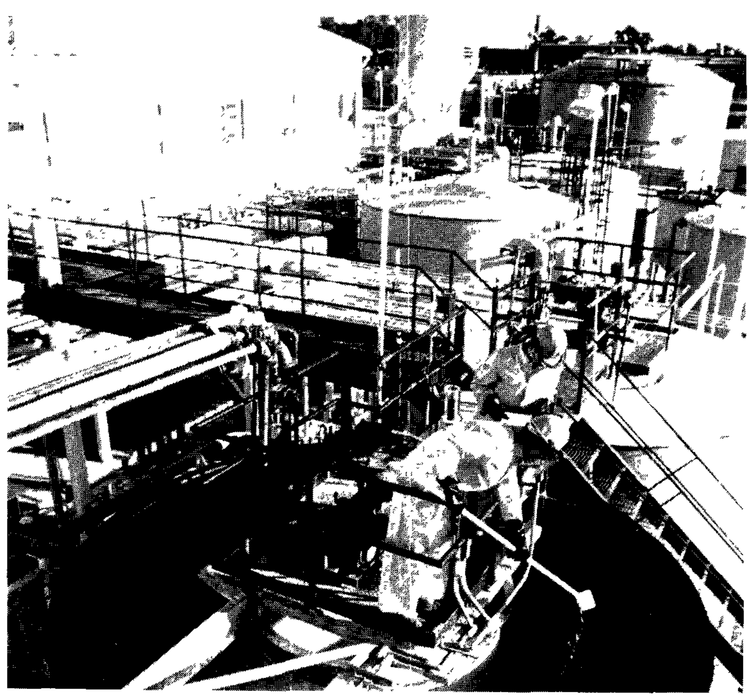
State Recommendations

In their 1986 reports, 29 States and territories provided discussion and recommendations for program actions needed to make additional progress toward the Clean Water Act's goal of fishable and swimmable waters. These recommendations are often expressed in terms of State objectives or continuing needs, and cover a range of actions at the Congressional, Federal, State, and local levels. These recommendations are discussed below. It should be emphasized that this discussion is restricted to the recommendations reported by the States themselves in 1986, and does not attempt to analyze their appropriateness. However, many of the State recommendations for action also reflect EPA program priorities.

The State recommendations may be grouped around the following ten major topics, based roughly on the frequency with which they are reported: municipal facility funding; ground-water protection; nonpoint sources; criteria and standards development; toxics identification and control; monitoring; sewage treatment plant operation and maintenance; pretreatment; permitting and enforcement; and wetlands. Other less frequently cited topics include combined sewer overflows, acid rain, lake protection, sludge disposal, and stormwater runoff. In addition, a variety of other State-specific actions were also recommended, such as the cleanup or study of a particular waterway.

Municipal Facility Funding: Financing to upgrade existing sewage treatment facilities and construct new, more advanced facilities is a high priority in many States. The Federal funding share under the construction grants program was reduced in most cases from 75 percent to 55 percent beginning in FY 1985, and several States cite an inability to meet waste treatment and water quality goals without consistent, adequate Federal assistance. Others recommend the development of new State financial assistance programs such as revolving low interest loan/grant programs to meet State needs. EPA support in the use of Federal funds to "seed" these programs is another common theme.

Ground-Water Protection: Ground-water recommendations cover a wide range of issues. Common needs are for more monitoring to map ground-water resources and the extent of contamination; additional research into ground-water problems and the development of ground-water standards; and more effective and coordinated management of monitoring data. Completion of comprehensive State and Federal control strategies is also cited by several States, as is the need for continued Federal support of State ground-water activities and the identification, cleanup, and control of hazardous waste disposal sites having a potential to contaminate ground water.



Nonpoint Sources: The States generally agree that considerable progress has been made recently in heightening awareness of nonpoint source problems and in conducting a variety of nonpoint control activities such as demonstration projects and localized implementation of best management practices. However, a common recommendation among many States is the development of well-defined statewide management strategies to coordinate control efforts, determine costs, assess problem waters, and set priorities. Cooperation and coordination between the many Federal and regional State agencies with jurisdiction over nonpoint-related programs would be a high priority of these strategies. Increased financing for nonpoint controls, including cost-sharing and alternate funding mechanisms, is also recommended.

Criteria and Standards: One major limitation to the identification and analysis of toxic pollution in the U.S. is the lack of numeric toxic criteria. The States urge more development of fish, sediment, and water criteria for toxics to protect human health and aquatic life. These criteria must then be incorporated into State standards. EPA is requested to continue working with the States to provide these guidelines and/or update existing criteria. Development and refinement of some existing non-toxics criteria, such as the fecal coliform limits used to determine recreational potential, are also recommended by some States.

Toxics Identification and Control: The underlying need expressed in State discussions of toxics control is to expand monitoring and identification of toxics problems. Several States report that limited laboratory capability prevents the expansion of toxic monitoring programs, and recommend increased financial support from EPA in this area. Integration of toxic control efforts on a statewide basis is another priority cited by some States.

Several states report that limited laboratory capability prevents them from expanding their efforts to monitor for toxics.

James Platkin

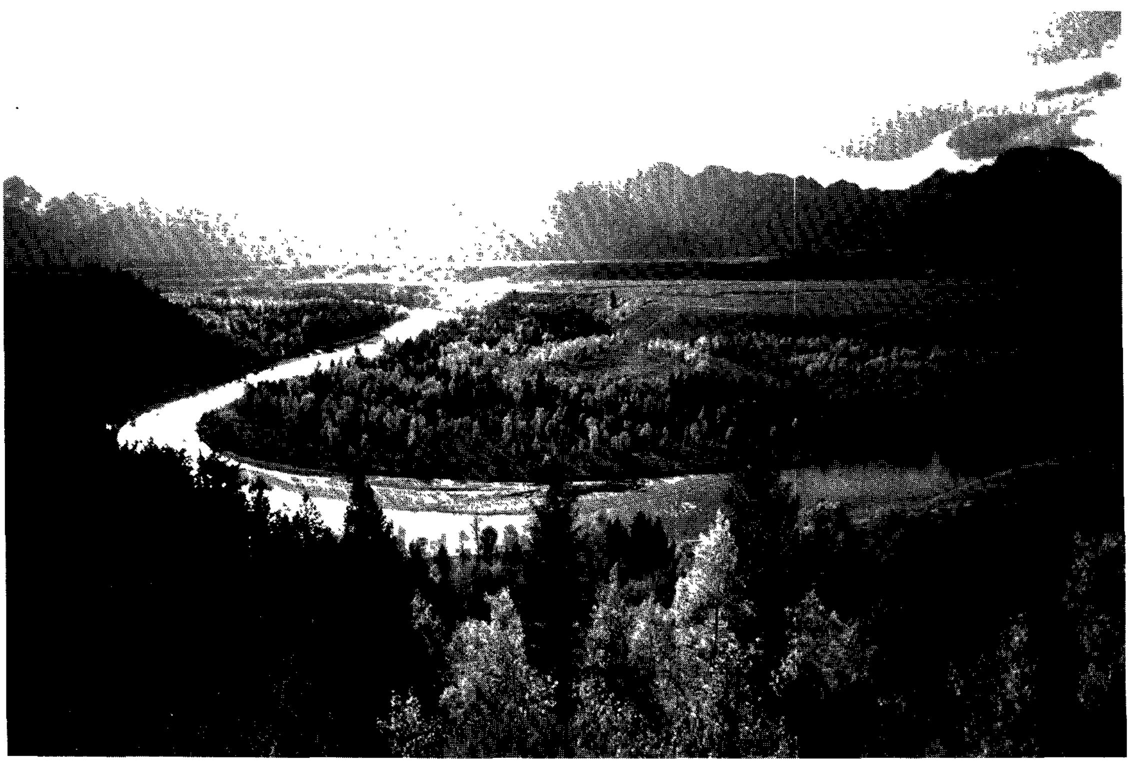
Monitoring: The States recommend increased water quality monitoring. Monitoring to assess the extent of nonpoint source problems is currently a high priority, as is the development and expansion of biomonitoring capabilities. Funding constraints have limited some State monitoring efforts; this poses a barrier to evaluating the success of control programs, assessing previously unassessed waters, conducting trend analyses, and detecting emerging water quality problems.

Operation and Maintenance: Recognizing that proper operation and maintenance of existing sewage treatment facilities is key to increasing permit compliance and improving water quality, a number of States stress the importance of operator training and certification, and of preventive maintenance of facilities. Several States recommend increased Federal support to meet O&M needs, including funding and technical assistance.

Pretreatment: Common recommendations regarding pretreatment of industrial waste include evaluating State pretreatment needs; encouraging greater municipal participation in pretreatment programs; and providing more resources for the management and regulation of pretreatment systems.

Permitting and Enforcement: The States report that permitting and enforcement activities are critical to achieving water quality progress. Strengthening enforcement responses to permit noncompliance and enhancing State inspection programs are recommended.

Wetlands: The most common State recommendation concerning wetlands protection is to continue the mapping and inventory of wetland areas. Several States recommend development of additional regulatory authority for wetland protection.



Bruce Zander

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Appendix
Excerpts from the State Reports

ALABAMA

For a complete copy of the Alabama 305(b) report, contact:

Alabama Department of
Environmental Management
Water Division
1751 Federal Drive
Montgomery, AL 36130

Surface Water Quality

During the 1984-85 reporting period, Alabama assessed 12,101 miles of its streams and rivers and found that 90 percent were supporting their designated uses. Of the 10 percent not fully supporting their designated uses, approximately one-third are the subject of some form of permit modification or Departmental action which should result in improvements in water quality within the next two years. One hundred percent of assessed lake acres and 95 percent of bay/estuarine square miles fully support their designated uses.

A review of those waters not fully supporting their designated uses reveals the pollutants most responsible for this nonsupport to be oxygen deficits, sedimentation, toxics, dissolved solids, pathogenic organisms, and excess nutrients.

As in the past, the Alabama Department of Environmental Management (ADEM) is concerned about the presence of pollutants such as PCBs, DDT, and mercury in the State's environment. In all of the known incidents involving these pollutants, the source has been identified and controlled, and the Department is either monitoring the cleanup or tracking the pollutants' dissipation from the environment.

Individual assessments of the major river basins show the Black Warrior River Basin to be the most severely impaired as a result of the dense population and heavy industrialization of the metropolitan Birmingham area. The Mobile River Basin is also affected by these factors and, along with the Upper and Lower Tombigbee River Basins, will require more intensive management in the future as a result of the development of the Tennessee-Tombigbee Waterway.

Since 1972, Alabama has reduced the discharge of less than secondarily treated effluent from 68 million gallons per day (MGD) to 1 MGD. This was accomplished through the construction of 93 public wastewater treatment facilities completed since the construction grants program began.

Industries within the State exhibit a permit compliance rate of approximately 92 percent. In the past two years, ADEM has become more aggressive in its enforcement of discharge permit limits and, if resources allow, this policy will continue.

Nonpoint source pollution continues to be a concern in Alabama. ADEM is joining in cooperative agreements with other State and Federal agencies to attempt to control the many causes of this problem.

With the passage of the Gramm-Rudman-Hollings Act and its resulting impacts on funding, ADEM's main concern is securing the financial resources necessary to maintain and continue improvements in water quality. Other special concerns include ground-water protection, operation and maintenance of municipal wastewater treatment facilities, sludge management, natural resources extraction, and nonpoint source pollution.

Ground-Water Quality

Approximately 54 percent of Alabama's population uses ground water as its primary source of domestic water. Currently, the major efforts in this area involve the development and passage of legislation allowing the ADEM to establish a comprehensive regulatory program, and immediately addressing the problems caused by underground storage within the State.

Underground storage tanks, regulated hazardous waste sites, surface impoundments, and on-site industrial landfills were ranked as the major sources affecting ground water in Alabama.

ALASKA

For a complete copy of the Alaska 305(b) report, contact:

Alaska Department of
Environmental Conservation
P.O. Box 0
Juneau, AK 99811

Surface Water Quality

Alaska's water resources are so vast that only a tiny fraction have been assessed. However, the Alaskan population and the area that can be affected by human activities are so small that only a small proportion of Alaskan waters is subject to use impairment. Most Alaskan waters are pristine.

Designated uses are not fully supported in about half of the 5,025 stream miles in Alaska. The major causes of nonsupport of designated uses on these 2,300 stream miles are placer mining, timber harvesting, sewage, urban runoff, and gravel mining.

The trend is toward improvement. About 618 degraded stream miles are expected to achieve fishable/swimmable goals within a decade. Only 227 miles are not expected to meet Clean Water Act goals.

Two-tenths of a percent of Alaska's lake acres—27,513 acres—have been assessed. Impairment of designated uses has been detected in approximately half of these assessed waters. It is presumed that designated uses in the remaining lakes are essentially unimpaired. The major causes of nonsupport of designated uses on the affected lakes are uncontrolled sewage discharges, placer mining, gravel mining, urban runoff, land development, and oil pollution.

As with streams, the trend is toward improvement: over half of the affected acreage is expected to achieve fishable/swimmable goals within ten years. Only 510 acres are not expected to meet these goals.

Alaska has approximately 223,000,000 acres of inland and tidal wetlands. Only about 19,200 acres have been assessed. However, effects on designated uses have been detected in most of the wetlands that have been assessed. The major causes of wetland impacts result from oil and gas activities on the North Slope and Kenai Peninsula.

Over 81,000 acres of bays and estuaries have been assessed. Designated use impairment has been observed in about 25,700 of these acres. The major causes of nonsupport of designated uses in the affected areas are seafood processing, oil and gas production, uncontrolled sewage discharges, land development, oil pollution, and urban runoff. Impacts on the remaining area are attributed to pulp mill effluents, log transfer facilities, and municipal sewage outfalls. Two-thirds of the impaired waters are expected to meet Clean Water Act goals within ten years.

Ground-Water Quality

Although nearly half of Alaska's population obtains its drinking water from ground-water sources, very little is known about ground-water quality.

Until recently, the most serious known ground-water problems were in northcentral Alaska, where elevated levels of arsenic and nitrate were detected in approximately 86 private wells and 14 public wells. These contaminants are believed to stem from natural sources. In southcentral Alaska, reserve pits for oil drilling muds in the vicinity of the Kenai Moose Range are suspected sources of ground-water contamination, but no problems have yet been documented. Statewide, contamination by bacteria or petroleum hydrocarbons has been detected in about 150 wells. In a variety of scattered instances, levels of benzene (as well as toluene and xylene) have been detected in private wells. Levels are generally low, but in some instances have ranged to the parts per million levels.

In recent years, the department has increased its efforts to enforce monitoring regulations for public drinking water supplies, and a substantial increase in monitoring has resulted. However, problems related to contamination of private wells continue to appear, emphasizing the need to develop a comprehensive approach to ground-water quality management.

AMERICAN SAMOA

For a complete copy of the American Samoa 305(b) report, contact:

American Samoa
Environmental Quality Division
Office of the Governor
Pago Pago, American Samoa 96799

Surface Water Quality

There are approximately 120 streams in American Samoa. Of these, twelve are sampled for biological contamination on a monthly basis. Five major streams emptying into Pago Pago harbor are sampled for physical and chemical parameters.

Monitoring data indicate that fecal coliform bacteria standards are consistently exceeded in almost every stream. Streams are degraded by erosion, animal pens, agricultural practices, individual sewer systems, laundry and shower discharges, and careless solid waste disposal.

Nonpoint source pollution is a problem in many of American Samoa's streams, coastal areas, and embayments. Discharges from agricultural wastes, domestic wastes, indiscriminate littering, and illegal dredging and filling activities contribute to water quality degradation. Water quality in Pago Pago harbor does not meet water quality standards due largely to discharges from two tuna canneries. A study was begun in 1984 to develop plans for wasteload reduction from these canneries.

Ground-Water Quality

Ground water is the primary source of potable water in American Samoa. During times of drought, normal pumping rates have led to elevated chloride levels in many wells. A problem with high turbidity and coliform contamination has also occurred in some of the wells during the rainy season. However, results of inorganic and radiological sampling indicate that ground-water quality meets Safe Drinking Water Act standards.

ARIZONA

For a complete copy of the Arizona 305(b) report, contact:

Arizona Department of Health Services
Division of Environmental Health
Bureau of Water Quality Control
2005 North Central Avenue
Phoenix, AZ 85004

Surface Water Quality

In 1986, Arizona reported that 43 percent of its 1,412 assessed river miles fully supported their designated uses. Twenty-eight percent partially supported uses, and 29 percent failed to support designated uses. Industrial and nonpoint sources are the principal causes of use impairment in rivers and streams; mine effluents are also cited as a leading cause.

Of Arizona's 34,811 assessed lake acres, 85 percent fully support uses, 12 percent partially support uses, and 3 percent do not support uses. The leading causes of use impairment in lakes are recreation impacts and the use of contaminated ground water to fill urban lakes. Eutrophication and sedimentation are other leading sources of use impairment in lakes.

Toxics have been found in some of Arizona's surface waters, channel sediments, and fish. Mine effluents are generally acidic and contain trace metals. Toxaphene and metabolites of DDT continue to be found in sediment and fish tissue in the Gila River downstream of agricultural areas near Phoenix. Fish and sediments in recreational lakes along the lower parts of Indian Bend Wash and the Salt River contain residues from pesticides and from the discharge of ground water contaminated with industrial solvents.

In the State's urban areas, the most significant achievement is the maintenance of water quality in the presence of rapid population and economic growth. The number of significant NPDES permitted facilities (municipal and non-municipal categories) that were meeting permit requirements in 1984 reached a new high of 24 (63 percent). Enforcement actions were initiated for 38 wastewater systems during 1984 and 1985.

Special concerns cited in the Arizona 305(b) report include insufficient surface and ground-water quality monitoring, and problems from interstate and international pollution discharges. Significant improvements in the environmental protection program are expected since the passage, in 1986, of State legislation providing new legal, technical, financial, and organizational resources.

Ground-Water Quality

Ground water is protected statewide for drinking water supply. Although no statewide ground-water monitoring program exists for comprehensive parametric surveillance, numerous State and Federal programs provide data for water quality assessment. Of the State's 68,000 production wells, approximately 2,900 have been tested for regulated public water supply contaminants. Of the latter group, approximately 1,500 production wells have also been tested for priority pollutants or pesticides not covered by drinking water maximum contaminant levels (MCLs). Statewide, a total of 347 production wells have been documented as contaminated, including 200 that are used for drinking water supply. State health regulations and policies have minimized human exposure by blending, source replacement, or treatment. Of the 347 contaminated production wells, 115 contain pesticides (primarily DBCP or EDB), 173 contain volatile organic compounds, and 59 exceed conventional MCL limits. Pesticide sampling has been conducted only in two counties.

ARKANSAS

For a complete copy of the Arkansas 305(b) report, contact:

Arkansas Department of Pollution Control and Ecology
Water Division
8001 National Drive
Little Rock, AR 72209

Surface Water Quality

Of the 11,438 stream miles assessed in Arkansas in 1984-85, 52 percent are meeting all designated uses. Water quality in the State has remained relatively stable. A decline in the percentage of waters supporting uses, as compared to 1984 information, reflects two factors: redesignation of the State's waters to include a primary contact use, and redistribution of the ambient monitoring network to waters most affected by point source dischargers.

Arkansas' Delta Region is heavily influenced by nonpoint sources, particularly agricultural runoff. A decline is evident in the detection of pesticides in this region. The Gulf Coastal Region of southern Arkansas still exhibits the effects of petroleum production. High chloride concentrations are common throughout the oil-producing area. The Ouachita Mountain Region continues to be widely used as a recreational area with extremely high quality water. One of the major concerns is the potential for erosion from clear-cutting practices; turbidity is one of the more commonly exceeded parameters in the region. In the Arkansas River Valley Region, past coal strip mining practices have left many streams damaged. Current natural gas production practices have the potential to cause surface water degradation throughout the region. Concerns in the Boston Mountain Region, which is sparsely populated and highly used for recreation, center around continued development. Potential water quality degradation may be tied to conversion of hardwood hills to pastures, expansion of confined animal operations, and even-aged timber management. Lastly, water quality in the Ozark Highlands Region is degrading due to accelerated development. Nutrients and fecal coliform bacteria are leading problems in this region.

Ground-Water Quality

Ground-water problems in Arkansas are localized and include contamination, poor natural quality, overdraft, and low yields. Contamination of shallow domestic wells by human and animal wastes is the most prominent problem, and is evident in high nitrate concentrations. Some surficial aquifers appear to have been contaminated by industrial wastes that include both heavy metals and organic chemicals.

Contamination of fresh ground water by saline water has occurred in several places due to large-scale pumping. The most prominent sites of contamination include the Sparta Sand aquifer in Independence, White, Monroe, Lincoln, Desha, and Chicot Counties, and in areas adjacent to the Arkansas River. Continued large-scale pumping has the potential to increase problems in these areas. In some locations, saltwater contamination appears to be of natural origin and not the result of human activity. Some salt-water contamination in south Arkansas is due to oil and gas exploration, production, and disposal practices.

Potential ground-water problems are found statewide. A large number of waste impoundments, landfills, and open dumps pose potential threats to ground water, especially those located in moderate to high aquifer recharge zones. Contamination from waste impoundments and dumps has occurred and may continue. Hazardous substances transported by pipelines, vehicles, and trains, as well as storage tanks containing hazardous substances, are other sources of potential contamination.

CALIFORNIA

For a complete copy of the California 305(b) report, contact:

California State Water
Resources Control Board
Division of Technical Services
P.O. Box 100
Sacramento, CA 95801

Surface Water Quality

Water quality in California was generally good in 1984-1985. Of those surface water resources assessed, 80 percent of the streams, 61 percent of the lakes, 99 percent of the mainland coast, and 95 percent of the harbors and bays are classified in the good to medium range. The major pollution sources in California streams are municipal point sources, agriculture, international sources originating in Mexico, abandoned and active mines, and other nonpoint sources.

Agriculture and nonpoint sources are the principal causes of pollution in marine waters. Tomales Bay and Suisun Marsh are affected by these sources. Urban storm runoff and erosion are major nonpoint pollution sources in San Francisco, San Diego, Newport, and Mission Bays.

Lakes are mostly polluted by natural causes and agricultural return flow. Agricultural pollution of lakes is dominated by irrigation return flows to the Salton Sea.

California's surface waters have been improved or protected from overall degradation from point sources. There do not appear to be significant changes in the overall quality of marine and estuarine waters, although major improvements in bacterial quality have been noted in Humboldt/Arcata Bay, portions of San Francisco Bay, and San Diego Bay.

Ground-Water Quality

Ninety percent of the State's ground-water basins are classified in the good to medium range. However, the State notes that there has been a noticeable decline in the quality of ground water.

Pollution of ground-water supplies can occur from many sources. These include septic tanks, solid and liquid waste disposal sites, underground chemical storage tanks, surface spills of toxic substances, applications of agricultural chemicals, urban runoff, deep injection well disposal, and other sources. Areas with the most numerous and widespread ground-water problems are the San Francisco Bay Region, the Central Valley Region, and three South Coastal Regions of Los Angeles, Santa Ana, and San Diego.

COLORADO

For a complete copy of the Colorado 305(b) report, contact:

Colorado Department of Health
Water Quality Control Division
4210 East 11th Avenue
Denver, CO 80220

Surface Water Quality

Water quality in Colorado is discussed by hydrologic river basin. Constituents that were routinely analyzed during the reporting period include fecal coliforms, toxic metals, un-ionized ammonia, and dissolved oxygen.

In the Platte River Basin, man's activities have affected water quality in the South Platte area. Violations of water quality standards for dissolved oxygen, unionized ammonia, fecal coliforms, and metals have been identified within the basin. Phosphorus, nitrates, and dissolved solids concentrations in parts of the basin are generally among the highest in the State. Total suspended solids concentrations, however, are comparatively low.

Water quality in the Arkansas River basin reflects early mining activity in the Leadville area, burgeoning population in the middle basin, (especially the Fountain Creek subbasin), and agriculture in the lower basin.

Overall, the quality of water in the Colorado River mainstem and its principal tributaries is probably the best in the State. This quality has been maintained by the investment of considerable manpower and fiscal resources in the basin since the early 1970s. Since much of the region's economy depends on outdoor recreation and water-based activities, it is a priority area for the State's water quality program. Planned energy development during the 1970s posed an additional threat to the quality of the basin's water; however, low energy prices during the 1980s dampened much of the growth, leaving many communities with excess wastewater treatment plant capacities.

In the Green River Basin, the Yampa and White Rivers and their tributaries met water quality standards. Exceptions were copper in the Yampa River below the Little Snake, and cadmium in the Yampa River above Oak Creek. Neither of these exceedances are related to point source discharges. No problems were identified which relate to municipal wastewater.

The San Juan basin has high quality water except for the Animas River at its headwaters near Silverton. Previous mining activities have resulted in high metals loads to the mainstem and several tributaries. These metals have significantly affected aquatic life support uses. Planned recreational developments in the upper reach of the San Juan River and above Electra Lake may threaten those waterbodies. High suspended solids and total dissolved solids occur on several stream segments in the basin.

In the Rio Grande Basin, metals impairment of several stream segments is the only identified water quality problem. No water quality problems have been identified in the Republican River basin.

Ground-Water Quality

Ground water is the primary water source for 75 percent of the public water supply systems of the State. Ground water is also heavily used for the production of crops and livestock. An estimated 200,000 acres are presently being irrigated with ground water and approximately 12,500 well permits have been issued for livestock watering.

No testing of either private or agricultural water supply wells is required in the State. Therefore, the severity and extent of ground-water contamination cannot be reliably determined. Many existing ground-water contamination incidents affect localized ground-water areas. In those cases, the contamination occurs near population centers and generally in industrial zones. This is also true of regionalized high nitrate levels attributed to agricultural practices. Existing and potential point sources of ground-water pollution include surface impoundments, materials stockpiling, and spills.

CONNECTICUT

For a complete copy of the Connecticut 305(b) report, contact:

Connecticut Department of Environmental Protection
Water Compliance Unit
122 Washington Street
Hartford, CT 06106

Surface Water Quality

Great progress has been made in improving the quality of the State's waters since 1972. As of 1986, 68 percent of Connecticut's 880 major river miles fully support designated uses. This is a significant improvement over 1972, when 35 percent of major river miles fully supported uses.

In Connecticut's major rivers and streams, less than full support of designated uses is attributed to municipal sewage treatment plants (40 percent), toxic and conventional pollutants from industrial discharges (30 percent), municipal combined sewer overflows (20 percent), and nonpoint sources (10 percent).

Approximately 89 percent (by area) of the State's 70 major recreational lakes are known to fully support recreational uses. The most common water quality concern is the growth of nuisance weeds and algae caused by nutrient enrichment. Nutrient inputs to these lakes are attributed to natural sources (68 percent), plus a variety of nonpoint sources such as septic systems, fertilizers, erosion and sedimentation, and stormwater runoff (32 percent). The elimination of Federal funding under Section 314 of the Clean Water Act seriously reduces the ability of the State to conduct additional studies or implement recommendations for previously studied lakes.

Long Island Sound, the major marine resource in Connecticut, has benefited from improved municipal and industrial wastewater treatment. The most heavily polluted areas are the urbanized harbors and tidal portions of the major tributary rivers. Approximately 20 percent of the 600 square miles assessed are suspected of having water quality problems. The sources of pollution in areas not fully supporting designated uses are combined sewer overflows and urban runoff (55 percent), municipal sewerage systems (19 percent), failing septic systems (14 percent), and toxic and conventional pollutants from industrial sources (12 percent). However, there has been a dramatic increase in the amount of oysters and lobsters harvested over the last 10 years in the Sound. This has been partially attributed to improved water quality.

Progress in the construction grant program has been slowed by reductions in Federal authorizations. In 1986, the State legislature created a new State financial assistance program that would establish a revolving low-interest loan/grant program in order to meet project needs.

Connecticut reports that for significant industrial facilities, permit compliance has increased from 24 percent in 1972 to 77 percent in 1985 as measured by effluent compliance and compliance with Abatement Order schedules. The State administers a pretreatment program that currently regulates about 350 industrial dischargers.

Ground-Water Quality

Approximately 32 percent of Connecticut's population depends on ground water for potable water supply. The vast majority of the State's ground-water resources should be suitable for drinking without treatment. However, impacts from improper solvents handling and disposal, leaking underground petroleum storage tanks, landfill leachate, pesticides, and improper road salt storage have resulted in the contamination of about 928 water supply wells as of April 1986 (726 private wells and 202 public water supply wells). Ground-water monitoring activities include potability monitoring, investigatory and compliance monitoring, and ambient ground-water quality monitoring. Ensuring the availability of adequate unpolluted ground water for public consumption is an important goal of the State's water pollution control program.

DELAWARE

For a complete copy of the Delaware 305(b) report, contact:

Delaware Department of Natural Resources and Environmental Control
89 Kings Highway
P.O. Box 1401
Dover, DE 19901

Surface Water Quality

Delaware's surface waters are for the most part in good condition. Of the 516 stream miles assessed, 309 fully support designated uses, 184 partially support uses, and 23 do not support designated uses.

The major water quality problem in this State is elevated levels of fecal coliform bacteria. In most cases, these levels are not so excessive as to suggest public health hazards or total loss of use of those waters for recreation. Additionally, questions have been raised concerning the accuracy of past and present measures of the healthfulness of waters for contact recreation.

Depressed dissolved oxygen levels are also a common finding in Delaware streams. This situation is believed to be typical in turbid estuarine waters during warmer weather. However, low oxygen concentrations can signal problems with loadings of organic materials from point source discharges or agricultural operations.

Toxic substances do not appear to be present at unacceptable levels in most Delaware waters. The State is concerned about information regarding toxic contamination of fish and sediment in Red Clay Creek, and is working to gather data on the types, sources, and effects of the toxins. The State is also addressing other basins where toxicity is a potential problem. A strategy is being developed to evaluate and handle toxic situations affecting the surface waters of the State.

The majority of water quality problems in the State are believed to originate from nonpoint sources. Identifiable sources of this pollution include runoff from land surfaces, ground-water seepage, and direct rainfall. Natural sources of pollution, such as wetlands runoff, have been blamed for many water quality problems in the past. Violations of bacteria and dissolved oxygen standards in tidal rivers appear to be caused by runoff from adjacent wetlands. These problems, which account for much of the non-attainment of uses listed in previous reports, are now considered to be normal unless there is evidence to the contrary.

Ground-Water Quality

Ground-water quality in the State is generally good, although at least four areas of concern are noted. First, abandoned dumps and industrial sites have been found to contain large amounts of toxic metals and organic compounds. These substances have shown the ability to move offsite and contaminate wells used for domestic purposes. A second problem is leaking underground storage tanks. Wells have been tainted by various fuels, resulting in a need to find alternative water supplies, while fish kills have occurred in at least one stream that received leaked fuel oil from ground water.

A third concern is the increasing levels of nitrate in domestic wells in downstate agricultural areas. Nitrate, which may have adverse health impacts, enters ground water from sources such as fertilization of farmlands and closely spaced septic systems. In fact, any indiscriminant disposal practice for nitrogen-bearing compounds can cause nitrate contamination of ground water. A fourth ground-water concern, saltwater intrusion, is occurring in the growth areas of coastal Sussex County. Overpumping of the limited ground-water supplies has rendered numerous wells unusable, and has forced larger municipal suppliers to move their wells farther from the coast.

DELAWARE RIVER BASIN COMMISSION

For a complete copy of the DRBC 305(b) report, contact:

Delaware River Basin
Commission
P.O. Box 7360
West Trenton, NJ 08628

Surface Water Quality

Water pollution control in the Delaware River is the joint responsibility of the Federal government, the four Delaware River Basin States, and the Delaware River Basin Commission (DRBC). The Commission conducts monitoring, regulatory, and other water quality management programs as part of its basinwide responsibilities. In the 1986-1987 period, a major effort of all concerned parties will be the development of a use attainability study for the Delaware Estuary. The study will examine the aquatic uses currently being achieved, potential uses that can be attained, and causes of any use impairment. Other new efforts of the Commission include seasonal disinfection studies and a basinwide well registration. Nonpoint sources, toxics, and thermal impacts are among the special concerns for the future.

The Delaware River and Bay comprise part of the boundaries of four States—Delaware, New Jersey, New York and Pennsylvania—and include 120 miles in the National Wild and Scenic Rivers System. From Hancock, New York to the mouth of the Delaware Bay, the Delaware River flows 330 miles, draining one percent of the land area of the U.S. Over 10 percent of the Nation's population relies on the Delaware River Basin for potable and industrial water.

The tidal Delaware River Estuary extending from Trenton, New Jersey to Liston Point, Delaware flows through the Nation's fifth largest urban area: the Philadelphia-Camden metropolitan area. This area is one of the world's greatest concentrations of heavy industry, the second largest U.S. oil refining/petrochemical center, and the world's largest freshwater port. Although the Delaware Estuary has historically been one of the Nation's most grossly polluted rivers, major water quality improvements have been documented in recent years.

The 782-square mile Delaware Bay is biologically productive and the home of commercially important finfish and shellfish. Recreation and navigation are important as well.

The water quality of the Delaware River, the Delaware Bay, and the interstate portion of the West Branch of the Delaware River was assessed for the 1984-85 period. Of the total river miles assessed (339 miles), it appears that 88 percent meet the fishable and swimmable goals of the Clean Water Act. Thirteen percent of the basin's river miles have known or potential problems with toxic substances. Point and nonpoint sources are both significant causes of use impairment in the basin.

Special concerns cited by the DRBC include nonpoint sources, toxics, oil spills and spills of other substances, wastewater treatment facilities that fail to meet their effluent limitations, increasing recreational use of the Delaware River, and potential adverse impacts from waste heat sources.

DISTRICT OF COLUMBIA

For a complete copy of the District of Columbia 305(b) report, contact:

DC Department of Consumer and Regulatory Affairs
Water Hygiene Branch
5010 Overlook Ave. S.W.
Washington, DC 20032

Surface Water Quality

In the District of Columbia, surface waters partially to fully supported their designated uses during the 1984 and 1985 water years. The Potomac River enjoyed generally good water quality, as evidenced by the increase in recreational use of the river for boating, fishing, and windsurfing. The Anacostia River, on the other hand, still suffers from several pollution problems. The overall water quality of the District's small tributaries is good; however, there are exceptions with pollution problems specific to individual tributaries.

The water quality in the Potomac River from Fletcher's Boathouse to Rosier Bluff was good. Nutrient and sediment loading from upstream sources continues to account for a substantial portion of the Potomac River estuary nutrient budget. Within the District, improvements made at the Blue Plains Wastewater Treatment Plant have helped to maintain a downward trend in total phosphorus downstream of the plant. Also, the construction of nitrification facilities at the plant resulted in lower levels of nitrogen and increased nitrates downstream of the plant. Recent improvement in dissolved oxygen concentrations have been recorded at the Woodrow Wilson Bridge.

No significant algae blooms were observed in District waters, although submerged aquatic vegetation produced dense beds just below the District line in 1984 and 1985 that proved to be a nuisance to recreational boaters. The principal violation of the Potomac River's designated uses was high bacterial counts resulting from combined sewer overflows and nonpoint sources. Other forms of pollution occasionally impacting the Potomac during the study period included small, isolated oil spills.

The Anacostia River continues to suffer from a variety of pollution problems. Chief among these are excessive sediment loading, high bacterial counts, high nutrient levels, high un-ionized ammonia levels, and occasional low dissolved oxygen concentrations.

A high rate of erosion continues to result in the filling of the navigational channel, making the river unsuitable for navigation by large boats. High sedimentation has led to low water clarity, which in turn has affected other biological parameters. Combined sewer overflows (CSOs) remain the primary source of bacterial contamination. Other sources of pollution include the discharge of pollutant-laden waters from the Anacostia's tributaries. Frequent trash dumping directly into the Anacostia channel and trash carried from upstream also add to the Anacostia River's pollution problems.

The District has joined Maryland in an Anacostia Watershed Restoration Strategy. This agreement calls for the cleanup of the Anacostia River through combined sewer overflow abatement within the District and implementation of erosion control measures in the Anacostia watershed. As a result, Maryland will reclaim surface miles that have contributed heavily to the sediment load to the river.

The District has committed itself to a major program for the abatement of combined sewer overflows. This program consists of a $70 million construction project with EPA financing 85 percent of the cost. It is anticipated that after completion, the frequency of CSO discharges will be reduced by over 70 percent.

FLORIDA

For a complete copy of the Florida 305(b) report, contact:

Florida Department of Environmental Regulation
2600 Blairstone Road
Twin Towers Office Building
Tallahassee, FL 32301

Surface Water Quality

The majority of Florida's waters are of good quality. Designated uses were met in 68 percent of assessed stream miles, 63 percent of assessed lake acres, and 59 percent of assessed estuarine square miles.

Where water quality problem areas occur, their distribution closely follows the distribution of Florida's population. The sparsely populated northwest and west-central sections of the State have very good water quality. The exceptions are the Fenholloway River area, which is affected by the pulp mill industry, and the Perdido Bay basin, which is also affected by the pulp mill industry and by rapid coastal and bay urban development. Other basins in Florida with good overall water quality are in the south-central portion of the State, extending from Lake Kissimmee to the Everglades. Most of Florida's east coast basins from Jacksonville to Miami have fair overall quality. There are many areas with very good water quality within these basins; however, there are also many problem areas in and around the major cities of Jacksonville, Orlando, Cocoa, and in the area which extends from West Palm Beach to Miami. Fair overall basinwide water quality is found only in the Tampa Bay area and in the Peace River basin. The only basin found to have poor overall quality in the State is the Taylor Creek-Nubbin Slough basin located just northeast of Lake Okeechobee. Every reach in this river basin has fair to poor water quality due to low dissolved oxygen levels, and elevated nutrient and bacteria concentrations. The source of these problems includes runoff from dairy and farming operations plus discharge from a sewage treatment plant.

The majority (55 percent) of water quality problems in the State are caused by point sources, including both municipal and industrial. Nonpoint sources account for about 42 percent of the water quality problems. Many reaches are affected by a combination of point and nonpoint sources of pollution. One percent of the problem areas are caused by natural conditions, primarily low dissolved oxygen and pH caused by drainage from wetland areas. Two percent of the problem areas have no identifiable pollutant sources.

Ground-Water Quality

Florida's population is dependent upon ground water for 92 percent of its drinking water supplies. Twenty percent of this water is drawn directly from private wells and is generally untreated. Although individual water supplies are monitored on a regular basis for contamination, there has been a long-standing need to look at ground-water systems as contiguous reservoirs which have connections to surface waters and any accompanying surface water contamination.

Florida has committed to a four-year program to assess ground-water quality, with special emphasis on areas that receive heavy applications of agricultural chemicals. This program will include as many as 1,500 new monitoring wells and sampling of as many as 1,000 existing wells.

The State has a ground-water rule designed to protect ground water from the introduction of hazardous materials. The rule encourages the recycling and storage of waters in a manner compatible with aquifer protection. Other ground-water programs include underground injection control, storage tank inspection, septic tank management, and pesticides tracking.

GEORGIA

For a complete copy of the Georgia 305(b) report, contact:

Georgia Department of Natural Resources
Environmental Protection Division
270 Washington St. SW
Atlanta, GA 30334

Surface Water Quality

Water quality in Georgia's streams, lakes, and estuaries during 1984-1985 was good. Data from State monitoring programs revealed that 95 percent of the stream miles, 87 percent of the acres of publicly owned lakes, and 98 percent of the square miles of estuaries in Georgia fully supported designated water uses. No significant decreases in water quality were documented during 1984-1985. Improvements have been documented throughout the State, most notably in the Conasauga River downstream of Dalton, in the South River downstream of metropolitan Atlanta, and in the Ochlocknee River below Moultrie.

The major areas of poor water quality in the State continue to be downstream of major metropolitan areas. Although improvements have been made, additional control efforts are needed, many of which are presently in progress. Many municipalities are participating in the construction grants program and are in need of additional funding to complete current projects.

Municipal sources are the leading causes of use impairment in Georgia, affecting 84 percent of impaired streams and 96 percent of impaired lakes and reservoirs. Nonpoint sources affect 15 percent of impaired streams and 2 percent of impaired lakes. Industrial sources are cited as the cause of use impairment in 1 percent of streams and 2 percent of lakes and reservoirs. In Georgia's estuaries, 80 percent of use impairment is attributed to natural sources, 15 percent to industrial sources, and 5 percent to municipal sources of pollution.

Leading parameters of concern identified by the State include dissolved oxygen, nutrients, temperature, toxic substances, turbidity, and fecal coliform bacteria.

In 1984-1985, high priority was placed on: 1) water quality monitoring, including estuarine monitoring/modeling and increased toxic substance monitoring; 2) implementation of the National Municipal Policy; 3) issuance and enforcement of NPDES, pretreatment, and land application system permits; 4) water quality management, including standards revisions and nonpoint source assessment; 5) construction grants management; and 6) implementation of approved pretreatment programs for industrial wastewaters discharged to municipal facilities.

Construction activities resulted in the completion of 25 new publicly owned water pollution control plants and the elimination of 19 inadequate plants in 1984-85. Approximately 59 percent of Georgia's 5.6 million people were served by public sewerage systems, 35 percent by septic tank systems, and 6 percent by inadequate treatment facilities. Approximately 90 percent of the oxygen-demanding pollutants generated by municipalities were removed by wastewater treatment in 1985.

GUAM

For a complete copy of the Guam 305(b) report, contact:

Guam Environmental
Protection Agency
P.O. Box 2999
Agana, Guam 96910

Surface Water Quality

During the past two years there has been no major improvement or quantifiable deterioration in Guam's water quality. This is important to note, as there has been and continues to be a very high growth and development rate that could have severely affected water quality if not properly regulated.

Guam's major water quality problem is bacteriological contamination of surface waters. Although bacteriological contamination has been significantly reduced at many locations as a result of the sewer construction grant program, most rivers and streams remain contaminated greater than 25 percent of the time. This is a result of surface runoff of animal wastes, a large number of individual on-site waste treatment facilities, and storm drains.

At times, high residue or turbidity values may also be in violation of water quality standards. These violations result from heavy silt loads that are carried by rivers in the south following periods of heavy rain. Although some erosion is natural, much of the turbidity is associated with man's activities such as development and farming. Another major factor influencing siltation is the extensive grassland fires that occur in southern Guam. Most of these fires are intentionally set by man. The repeated burning of the southern hillsides has denuded many areas and exposed them to erosion.

Ground-Water Quality

Guam's drinking water, although high in calcium and magnesium carbonates due to the composition of the territory's coral aquifers, is unusually pure. Several instances of saltwater intrusion have occurred and were caused by improper well location and overpumping. Guam's ground water contains 2 to 2.5 ppm nitrate-nitrogen, twice the national average. The exact cause of this is unknown, although leachate from many small feedlot operations and on-site waste disposal systems are suspected to be major causes. Continual, comprehensive ground-water monitoring is part of Guam's recently revised monitoring strategy. Results of this sampling continue to verify that ground-water contaminants are well below the recommended maximum contaminant levels (MCLs) established by the Safe Drinking Water Act.

HAWAII

For a complete copy of the Hawaii 305(b) report, contact:

Hawaii Department of Health
Environmental Protection and
Health Services Division
P.O. Box 3378
Honolulu, HI 96801

Surface Water Quality

Water pollution problems in the State of Hawaii are to a large extent determined by the State's location and geography. Unlike the coterminous United States, the islands of Hawaii have no major river basin systems. Each of the major islands is considered a discrete hydrological system of small streams and related small drainage areas. Island streams can change rapidly from normally low or non-existent flows to flood stage during periods of heavy precipitation. The flows resulting from the high runoff are among the major factors affecting the quality of coastal waters.

The chemical quality of Hawaii's surface water is excellent near the headwaters of streams. However, before reaching the ocean these streams can accumulate significant amounts of dissolved solids, nutrients, and coliform bacteria from surface runoff, sewage effluent, industrial wastes, irrigation, and urban runoff.

Fourteen coastal water areas, primarily embayments and estuaries throughout the State, have been identified as waters that do not meet water quality standards and will not meet them even after point source effluent limitation requirements are applied. In almost every case, nonpoint sources are the reason for water quality degradation. These nonpoint sources include unconfined irrigation tailwaters carrying silt, cane wastings, chemical fertilizers, and pesticides from agricultural activities; sedimentary materials eroded by heavy rain, storm runoff from urbanized areas, and construction areas; and cesspool seepage from unsewered areas. Nonpoint sources of pollution are major contributing factors to the high concentrations of nitrogen and phosphorus, coliform bacteria counts, and turbidity in all identified problem areas. However, the report notes that continued improvement of sewage treatment and abatement or removal of municipal waste sources have markedly enhanced water quality over the past several years and have reduced public health hazards from swimming beaches. Recovery of coral reef systems has also been noted.

Ground-Water Quality

Most of Hawaii's drinking water supply comes from ground water, which is generally of good quality. All ground water developed and approved for public and domestic purposes is chemically suitable for use without treatment. The concentrations of all constituents are within the limits of U.S. drinking water standards. However, some degradation of ground-water quality has occurred. Possible reasons include, but are not limited to, increased population pressures, the legal use of pesticides, the illegal disposal of pesticides, industrial activities, irrigation, solid waste disposal, and subsurface waste disposal practices. The State is in the process of developing and implementing a comprehensive ground-water quality protection strategy to address these and other issues.

IDAHO

For a complete copy of the Idaho 305(b) report, contact:

Idaho Department of Health and Welfare
450 West State Street
Statehouse
Boise, ID 83720

Surface Water Quality

Idaho's surface water is of good overall quality. Of the 7,310 river miles assessed for designated use support, 6,046 supported uses, 572 partially supported uses, and 692 did not support uses. A total of 362,718 lake acres were assessed; 362,624 acres supported uses and only 94 acres partially supported uses.

Nonpoint source activities account for 78 percent of the use impairment in Idaho's rivers and 90 percent of use impairment in its lakes. The major sources of nonpoint water quality impacts in Idaho are agriculture, forestry, and mining. Agriculture and related activities (grazing, feedlots, and dairies) account for 38 percent of nonpoint source impacts statewide. Forestry, including road construction, accounts for 19 percent and mining accounts for 9 percent. If natural and upstream sources are added to the above three categories, 91 percent of the total nonpoint source impact statewide is accounted for.

The major water quality pollutants of concern in Idaho reflect the predominance of nonpoint source impacts. Excessive sediment, nutrients, and bacteria are produced by agricultural activities. Forestry activities result in increased sediment and nutrients and may cause temperature increases and reductions in dissolved oxygen. Mining can cause excessive sedimentation and metal toxicity. In general, excessive sedimentation is the most critical water quality problem resulting from nonpoint source activities. Impacts on fisheries are particularly severe.

Point source impacts in Idaho are minor when compared to nonpoint source impacts. Pollutants of concern for municipal and industrial discharges include nutrients, suspended solids, bacteria, and oxygen-demanding materials. Metals and chemical toxicity are a concern with mining discharges. Permit compliance rates are high; therefore, water quality impacts from point source discharges are minimal.

Ground-Water Quality

Idaho ranks among the five States with the greatest use of ground water, by volume. Sixty-four percent of its total ground-water withdrawal is for irrigation purposes and 33 percent for industrial purposes. Ninety percent of Idaho's drinking water comes from its aquifers.

Idaho's ground-water quality is generally excellent. Most ground water is suitable for use for drinking water, irrigation, and industrial purposes including aquaculture. Naturally high levels of dissolved solids, fluoride, or hardness affect some ground water. Known contamination has only affected three percent of ground water statewide. The potential for ground-water contamination is high, however, as the most vulnerable aquifers are located in areas of most intense land use.

A priority ranking of potential sources of ground-water contamination in Idaho rates the six leading sources to be petroleum handling and storage, feedlots and dairies, landfills and hazardous waste sites, land application of wastewater, hazardous material handling, and pesticide handling and use. Major ground-water contaminants of concern include volatile and synthetic organic chemicals, pesticides, nitrates, fluorides, metals, and bacteria.

ILLINOIS

For a complete copy of the Illinois 305(b) report, contact:

Illinois EPA
2200 Churchill Road
Springfield, IL 62706

Surface Water Quality

In 55 percent of Illinois' assessed stream miles, designated uses were fully supported, 28 percent were partially supported with minor impairment, 15 percent were partially supported with moderate impairment, and 2 percent were not supported. Degree of support in this case is equated with the suitability of water quality to protect aquatic life. Agricultural nonpoint pollution was most often cited as the probable cause of use impairment, followed by municipal wastewater treatment plant effluents and urban runoff.

Of the lake acres assessed in 1984-85, 7 percent fully supported designated uses, 45 percent partially supported uses, and 48 percent did not support uses. Major problems identified in Illinois' lakes were sediment pollution and aquatic weeds and algae. Eighty-nine percent of the lakes monitored were classified as eutrophic and the remainder as mesotrophic. Nonpoint sources contributed to problems in 75 percent of the lake acreage; municipal sources in 15 percent; and industrial/other sources in 10 percent. The major parameters contributing to inland lake problems were suspended solids and turbidity from nonpoint sources, and phosphorus and nitrogen from all sources.

An assessment of Lake Michigan water quality over the past ten years shows considerable improvement. Beach closures due to fecal coliform bacteria have been reduced in frequency, primarily because of the diversion of discharges from the North Shore Sanitary District from Lake Michigan to the Des Plaines River basin.

Ground-Water Quality

A preliminary survey conducted by the Illinois EPA in 1984 found that over one-third of the State's public water supply wells are located in geological areas that are highly vulnerable to ground-water contamination. The survey found a definite relationship between these "susceptibility" ratings and verified contamination. The majority of verified problems were caused by bacteria or nutrient contamination; data on contamination by organics were not available. Of the wells surveyed, 9 percent were suspected of having problems or of being threatened by contamination from a known source.

A significant portion of the contaminated or threatened wells coincide with urban/industrial areas. The major threats are from hazardous waste sites, landfills, industries, and road salting practices. In addition, water supply wells can be affected as a result of deficient well construction techniques. Another significant threat to ground water is from coal mining and oil production, which can be particularly important since these activities occur in areas of sparse ground-water supply and can pollute the only available source of water. Other problems include materials storage and gasoline leaks from petroleum storage facilities.

INDIANA

For a complete copy of the Indiana 305(b) report, contact:

Indiana Department of
Environmental Management
105 South Meridian Street
P.O. Box 6015
Indianapolis, IN 46206-6015

Surface Water Quality

Since 1972, water quality in Indiana has improved in approximately a thousand stream miles, and there remain only about 200 miles where aquatic life is seriously depressed. No additional stream miles have been degraded on these permanent streams. The greatest improvements have occurred in the upper and middle West Fork of White River, the East Fork of White River, the Wabash River, the Maumee River, the Muscatatuck River, the Grand Calumet River, and many smaller streams. In the 1984-1985 reporting period, the most serious remaining problems were in the Little Calumet and Grand Calumet River basins in Lake County, and in Trail Creek at Michigan City.

Few, if any, public beaches on Indiana lakes and reservoirs have been closed recently because of high bacterial counts. Those closures that did occur could be traced to upsets in sewage treatment plant operations or spills and were short-term occurrences (1-2 days). About 60 percent of the stream sampling stations where fecal coliform bacteria were monitored did not meet the recreational use designation; however, while standards were not always met, the maximum and average values for fecal coliform concentrations have dropped dramatically at most stations in recent years.

Indiana's largest body of water is the 154,000 acres of Lake Michigan. It is used extensively for sport and commercial fishing, swimming and boating, and both potable and industrial water supply. The swimming use has occasionally been impaired. However, no Indiana beaches have been closed recently, and water quality along all of the shoreline has improved. A lakewide fish consumption advisory is in effect for certain species due to high concentrations of chlordane, dieldrin, DDT, and PCBs.

Ground-Water Quality

Nearly 59 percent of the State's population uses ground water for drinking water purposes and 426 public water systems, using some 1,775 individual waterwells, are directly dependent on ground water for their supplies.

Over the past 20 years, and most notably the past 5 years, nearly 400 separate wells were documented to have been contaminated in Indiana. Alternate water supplies or water treatment were used in most of the cases, while a cleanup of the contamination also occurred in about a fourth of the incidents.

Leading sources of ground-water contamination include hazardous material spills; underground storage tank systems; solid and hazardous water disposal; above-ground storage of materials; and pits, ponds, and lagoons. Substances contaminating ground water in Indiana include volatile organic chemicals, petroleum and petroleum products, metals and heavy metals, chlorides and salts, and nitrates.

Indiana is developing a ground-water protection policy. A ground-water protection strategy, which identifies substantive issues and formulates action plans to resolve short- and long-term problems regarding ground-water protection, was also planned for development in 1986.

IOWA

For a complete copy of the Iowa 305(b) report, contact:

Iowa Department of Natural
Resources
The Wallace State Office
Building
Des Moines, IA 50319

Surface Water Quality

This report provides use assessment results for about 4,300 river and stream miles (24 percent of the State's total) and for 129 publicly owned lakes and impoundments. Although available chemical and bacterial water quality results were considered, the major basis for the assessment was information compiled in 1985 in developing Iowa's portion of the nonpoint source report for the Association of State and Interstate Water Pollution Control Administrators.

Of the river and stream miles assessed, two percent were found to fully support designated uses. Ninety percent of the miles assessed were found to partially support uses, and eight percent were found to not support uses.

The relatively large percentage of stream miles either partially or not supporting uses reflects the predominant influence of agricultural nonpoint source pollution on surface water quality in Iowa.

Impacts from municipal wastewater treatment facilities accounted for 3 percent of impaired waters, while industrial discharges affected 0.2 percent of the miles assessed. Although point sources account for a small percentage of miles that do not fully support uses, they do cause severe localized water quality impacts in Iowa streams.

Of the 81,200 acres of publicly owned lakes and reservoirs in Iowa, 73,771 acres were assessed for support of designated uses. Seventy-three percent of assessed lake acres were found to support designated uses. Twenty-seven percent of the acres were found to partially support designated uses, and one 40-acre lake (Lake Hendricks in Howard County) did not support designated uses.

Because the discharge of municipal and industrial effluents to State-owned lakes is prohibited, the primary source affecting designated uses in Iowa lakes is nonpoint source pollution, especially that associated with agricultural practices. In all 39 lakes not fully supporting their designated uses, nonpoint source pollution was identified as the cause of use impairment. Thirty-six of these lakes had uses impaired by sediments and nutrients from agricultural nonpoint sources. Designated uses of three oxbow lakes along the Missouri River were impaired by hydrological modification of the river channel and urban runoff.

Several studies of toxic contaminants in fish were conducted during 1984 and 1985. The pesticide chlordane was frequently found in low concentrations in fish, and at unusually high levels in fish from an urban impoundment in Cedar Rapids. The suspected source of the contamination is drainage from the foundations of buildings that have been treated with chlordane to control termites.

Other pesticides whose use has been banned, such as aldrin and DDT, were only occasionally found in Iowa fish. However, the compounds into which these two pesticides eventually break down (dieldrin, DDD, and DDE) were frequently found. Although the levels of both these pesticides and their breakdown products were never high enough to be of concern to human health, dieldrin frequently exceeded the levels recommended for the protection of fish-consuming wildlife.

Low levels of polychlorinated biphenyls (PCBs) were found in 37 percent of the fish samples from around the State. Nearly half of these were collected in a special study of the Mississippi River near Davenport, where a disposal site for PCB-contaminated oil was being investigated. Except for a single composite sample from downstream of that site, all samples were well below the level considered to be of concern to human health. Corrective measures are currently underway at that site.

Ground-Water Quality

Ground-water studies completed during 1984 and 1985 focused primarily on contamination involving nitrates, pesticides, and other man-made organic chemicals. High levels of nitrates were more frequently found in shallow wells than in deep wells. Private wells more commonly exceeded the health limit than public water supplies.

All of the commonly used pesticides were detected in Iowa's ground water. The herbicide atrazine was the most frequently detected. In addition to pesticides, 17 other man-made organic chemicals were reported in various studies of wells serving Iowa's public water supplies. These contaminants were not found as frequently in treated water as in well water. However, in several instances the concentrations were high enough to be considered a health threat for long-term exposure.

KANSAS

For a complete copy of the Kansas 305(b) report, contact:

Kansas Department of
Health and Environment
Bureau of Water Protection
Water Quality Assessment
Section
Forbes Field
Topeka, KS 66620

Surface Water Quality

All streams and lakes in Kansas are affected or threatened by nonpoint source pollution. Nonpoint source pollutants include biochemical oxygen demand, nutrients, dissolved and suspended solids, bacteria, metals, and pesticides. While runoff from urban and mined land areas may carry a greater number of different pollutants, runoff from agricultural land is much more widespread and affects a greater fraction of the State's surface water resources.

The most significant nonpoint source pollutant in all streams and in most lakes in Kansas is suspended solids. The frequency of pesticides detection is increasing over time. Since 1977, pesticides have been detected in 19 of 58 lakes sampled. Pesticides in fish tissue have exceeded National Academy of Sciences and National Academy of Engineering guidelines at 65 percent of the 24 stations sampled.

Point sources of pollution in Kansas include municipal wastewater treatment plants and industrial discharges. These point sources, controlled by the State through the administration of the National

Pollutant Discharge Elimination System, did not contribute pollution to the streams in 1984 and 1985 in quantities that would violate the State standards if the facilities were properly operated and maintained.

Natural conditions such as low flow and mineral intrusion may result in violations of the dissolved oxygen, boron, fluoride, and metals criteria during summer months or in some parts of the State.

Ground-Water Quality

Ground water supplies about 85 percent of the water used in Kansas. Public and rural systems provide ground water to almost 1.2 million people, about 49 percent of the State's population. Approximately 93 percent of the ground water withdrawn is used for irrigation.

While no significant statewide ground-water quality problems exist, the Kansas Department of Health and Environment is aware of many isolated, site-specific ground-water problems and expects to find many more. These problems are generally the result of human activity, although in several cases they have been attributed to natural sources.

At identified contamination sites, pollutants such as chlorides, heavy metals, petroleum, and organic chemicals have been detected. The more common sources of ground-water contamination in Kansas include industrial waste disposal practices, improperly constructed or abandoned oil or gas wells, leaking underground petroleum storage tanks, and surface storage of brines and other wastewater. Much of the ground-water contamination found is suspected to be the result of past waste management practices. Current State regulatory programs seek to minimize potential future pollution by setting construction standards for wells and surface ponds, eliminating certain types of disposal techniques, upgrading replacement requirements for storage tanks, and monitoring potential contamination sources.

KENTUCKY

For a complete copy of the Kentucky 305(b) report, contact:

Kentucky Department of
Natural Resources and
Environmental Protection
Division of Water
18 Reilly Road
Frankfort, KY 40601

Surface Water Quality

Approximately 5,700 of Kentucky's 18,500 stream miles were assessed in the 1984-85 reporting period. Forty-five percent of the total miles assessed experienced some degree of use impairment. Uses were not supported in 12 percent of the assessed miles. The major causes of use impairment were coal mining activities, oil production operations, and municipal and industrial wastewater discharges. A water quality ranking of thirty-one hydrologic units encompassing most of the State reveals that the seven watersheds with the lowest water quality ranking contain 58 percent of the stream miles not supporting designated uses. These hydrologic units include: Mud River and Pond River within the Green River basin; the northern half of the Salt River basin; the upper mainstem of the Kentucky River basin including the Red River; Tug Fork and Blaine Creek within the Big Sandy River basin; and the Little Sandy River.

More than 90 percent of Kentucky's publicly owned lake acreage was assessed. Of the 362,403 acres assessed, 326,483 acres (90 percent) support designated uses. The five lakes constituting the 573 acres not supporting designated uses are McNeely, Carpenter, Corbin, Loch Mary, and Sympson.

Natural conditions contribute to 77 percent of the documented use nonsupport in lakes. This is largely due to impacts on domestic water supplies from hypolimnetic water released from large reservoirs, which contains excessive levels of iron and manganese. Nonpoint sources are the second largest cause of use impairment (17 percent). Sedimentation from surface coal mining is by far the most significant nonpoint source pollutant. Another pollutant of growing concern is brine discharged from oil-producing facilities.

As a result of the implementation of a toxics control strategy during 1984-85, a partial assessment was made of the extent of toxic substances in the State's waters. The results of acute and chronic toxicity tests below 15 municipal and industrial wastewater discharges indicate that a total of 155 stream miles are being adversely affected. During 1985, fish consumption advisories were issued for two streams totalling 115.5 miles in length because of the presence of PCBs from industrial sources. Another toxic pollutant that is emerging as a potential health threat is chlordane, which has been detected in fish tissue and sediment samples at a number of stream stations. Toxics are not considered to be a problem in any State lakes.

Brine discharges from oil production facilities are cited as a special concern in Kentucky. In the eastern oil production region, documented impacts from brine discharges are observed in 191 stream miles. A number of State and Federal actions have been initiated to control the problem. Another special concern in the State is the loss of wetland resources. Kentucky estimates that half of its original wetland acreage is gone; remaining areas have been degraded by pesticides, acid mine drainage, siltation, oil brine, or domestic and industrial wastes. Competing land uses and poor land management practices are continuing threats to wetlands in the State.

Ground-Water Quality

With some exceptions, the quality of Kentucky's ground water is good. However, there are a number of ground-water contamination and depletion incidents, particularly in the karst region of the State, that underscore the need for an effective ground-water management program. In the Drakes Creek watershed, PCBs were originating from an industrial discharge to a sinkhole. Cities such as Elizabethtown and Georgetown are undergoing rapid economic development and depend on ground water for community water supplies. These supplies come from karst aquifers that are very susceptible to pollution. The trend toward use of ground-water heat pump systems for large office buildings may cause a depletion of the Louisville aquifer. Bowling Green has a history of point and nonpoint source ground-water pollution problems associated with industrial, urban, and agricultural activities over major karst aquifers.

The development of a comprehensive ground-water management program was mandated by the Water Management Plan approved by the Governor in November 1984. Since that time, the Division of Water has initiated such activities as the development of a ground-water data base, implementation and administration of the State water well drillers program, identification and classification of Kentucky's aquifers, and development of a statewide ground-water policy/strategy.

LOUISIANA

For a complete copy of the Louisiana 305(b) report, contact:

Louisiana Department of Environmental Quality
Water Pollution Control Division
P.O. Box 44091
Baton Rouge, LA 70804-4091

Surface Water Quality

The quality of Louisiana's surface waters is fair to good, with seasonal fluctuations observed.

A use-impairment index was utilized to determine the degree of designated use support in rivers and to identify each parameter's contribution to overall use impairment. Approximately 50 percent of the 2,500 assessed river miles fully support their designated uses, 32 percent partially support their designated uses, and 18 percent do not support their designated uses.

The major causes of water quality degradation are nonpoint source pollution (46 percent), municipal discharges (26 percent), natural conditions (17 percent), and industrial sources (7 percent). Other/unknown causes are cited in the remaining 4 percent of waters. Violations of the fecal coliform bacteria criteria are widespread and result from both point and nonpoint source pollution. Chronic and seasonally depressed dissolved oxygen concentrations may impair the propagation of sensitive aquatic organisms and can result from a combination of natural and man-induced sources. The use impairment index was not able to address heavy metals, other toxics, or nutrients since the numerical criteria for these parameters have not been defined in State standards.

According to conventional trophic indices, most lakes in Louisiana fall into the eutrophic category due to their shallow depths and high nutrient levels. However, these lakes support diverse, productive fisheries and provide tremendous recreational opportunities for residents and visitors of the State.

Approximately 87 percent of Louisiana's assessed lake acres fully support their uses, 12 percent partially support their designated uses, and less than 1 percent do not support their designated uses. Use impairment in lakes was attributed primarily to nonpoint sources.

Approximately 41 percent of the assessed estuarine square miles fully support their designated uses, 31 percent partially support their designated uses, and 28 percent do not support their designated uses. The areas which do not support their uses have been closed to the harvesting of shellfish due to bacterial contamination from untreated and inadequately treated sewage and from pasturelands and wildlife.

Ground-Water Quality

The quality of water in the State's major aquifer systems remains excellent. Testing by the U.S. Geological Survey and public water distribution systems reveals that the deeper aquifers remain free from contamination. Of specific concern in Louisiana, however, are the shallow aquifers and water-bearing zones that are not used as major sources of water. Site-specific contamination of these shallow strata presents a direct threat to the major aquifers by means of leakage through well bores, stratigraphic interconnections, and fractures. In addition, individual wells are located in these shallow strata and may become directly contaminated.

Major sources of ground-water contamination in Louisiana are surface impoundments, oil and gas brine pits, abandoned hazardous waste sites, and underground storage tanks. Substances that contaminate ground-water in the State include volatile and synthetic organic chemicals, brine/salinity, nitrates, fluorides, and metals.

MAINE

For a copy of the 1986 Maine 305(b) report, contact:

Maine Department of
Environmental Protection
State House Station No. 17
Augusta, ME 04333

Surface Water Quality

In general, Maine's water is of very good quality. Many of the rivers and lakes that were grossly polluted earlier in the century have recovered since the passage of the Clean Water Act in 1972. Most of the western and northern portions of Maine contain waters that are relatively pristine and are affected primarily by atmospheric deposition, timber harvesting activities, and natural disasters such as forest fires.

This report includes an assessment of all of Maine's 31,672 miles of rivers and streams. For the period covered by the report, monitoring data exist for about 19 percent of Maine's total estimated river, stream, and brook miles. Roughly 97 percent of Maine's rivers, streams, and brooks fully support designated uses. Of those waters that do not fully support the swimmable goal of the Clean Water Act, many are in violation of their bacteria standard due to a combination of factors such as urban stormwater, combined sewer overflows, and untreated or inadequately treated domestic wastewater discharges.

All of Maine's 5,779 lakes and ponds attain bacteriological standards for the protection of swimmers and biological standards for habitat protection. Despite this apparently suitable water quality, 4 percent of Maine's lake and pond acres are classified as priority problem waters due to periodic algal blooms and a resultant lack of transparency.

Over 98 percent of Maine's estuaries, bays, and near shore waters fully support their designated uses. Thirty-six square miles of near shore waters do not fully support these uses due to high bacteria levels. Because bacteria standards are more restrictive for shellfish harvesting than for swimming, 28 square miles of these nonattainment waters support the swimming use but not shellfish harvesting.

In the more populated areas of Maine, water quality is affected by a combination of point sources such as industrial and municipal effluents, and nonpoint sources such as urban and suburban stormwater runoff, combined sewer overflows, agriculture, silviculture, construction-related runoff, and waste disposal practices. Given the difficulties of controlling nonpoint sources, the low number of remaining untreated point sources and the emergence of ground-water quality and hydropower as major concerns, it is doubtful that future water quality improvements will continue at the same rate as has occurred recently.

Ground-Water Quality

There are many sources of ground-water contamination in Maine, with septic tanks, underground storage tanks, road salt storage, and municipal landfills estimated to cause the greatest problems. The Department of Environmental Protection has programs to study and abate pollution from the latter three sources. These studies have found more than 300 contaminated domestic and public wells near underground storage tanks, sand-salt piles and municipal landfills in Maine. Additionally, 41 wells are known to have been contaminated by hazardous waste dumps.

Protection of Maine's ground water is becoming an issue of increasing concern at the local, regional, State, and Federal level. Programs for assessing the quality of ground-water resources, including ground-water classification and aquifer mapping, are underway in many parts of the State. More are planned for the future.

MARYLAND

For a complete copy of the Maryland 305(b) report, contact:

Maryland Department of the Environment
Water Management Administration
201 West Preston St.
Baltimore, MD 21201

Surface Water Quality

Overall, Maryland's surface water quality is good. However, serious impacts do occur statewide. The most serious of these problems is the continuing accumulation of nutrients in both tidal waters and impoundments. The primary sources of the nutrients are agriculture, urban runoff, and municipal discharges. Suspended sediments carried by nonpoint source runoff continue to be a problem in both flowing and tidal waters. Locally elevated bacterial levels are found throughout the State and in severe instances have resulted in some areas being closed to shellfish harvesting or bathing. Acid mine drainage from many abandoned coal mines in western Maryland remains a long-standing and difficult problem to solve. Finally, toxic heavy metals and organic compounds have been found in certain sediments and fish tissue, indicating a long-term pollution problem with an as yet unknown impact on water quality and aquatic resources in the State. Primary sources of toxics include municipal and industrial discharges and agricultural and urban runoff.

Of the 7,440 river miles assessed by the State in 1986, 6,852 supported uses, 449 partially supported uses, and 139 did not support uses. A total of 32,583 acres of lakes were assessed; of these, 24,616 supported uses and the remainder were primarily in partial support of uses. Finally, of 1,822 square miles of estuaries/oceans assessed, 1,159 fully supported designated uses and 663 partially supported uses.

Nonpoint sources are the leading cause of use impairment in those assessed waters not fully supporting uses. Sixty-five percent of impaired lake acres and 50 percent of impaired stream miles and estuarine square miles are affected by nonpoint sources.

Findings of a number of Federal, State, and local studies have implicated nonpoint source pollution as a major source of water degradation in the Chesapeake Bay. These findings have resulted in the development of programs to control nonpoint pollution sources statewide. Federal, State, and local agencies are involved in many of Maryland's nonpoint source control programs.

To address Federal and interstate agreements to protect and restore the Chesapeake Bay, the State implemented a series of initiatives in 1984 to focus on point and nonpoint source pollution, restoration and enhancement of aquatic and wetland/shoreline resources, education, monitoring, and research.

Special concerns cited by the State include atmospheric deposition, acid mine drainage, and wetlands preservation.

Ground-Water Quality

The quality of the State's ground water is generally good. Most ground-water quality problems are localized and do not affect entire aquifers or other geologic formations. The most serious ground-water quality problem is bacterial contamination. This problem generally occurs as a result of malfunctioning septic systems and deteriorating wells. Elevated nitrate levels in ground water are of some concern, particularly on the Eastern Shore, with the problem occurring statewide as well. Sources are widespread and diffused. Reports of ground-water contamination from leaking underground storage tanks have increased in recent years. Finally, saltwater intrusion into aquifers in coastal areas is also of prime concern.

MASSACHUSETTS

For a complete copy of the Massachusetts 305(b) report, contact:

Massachusetts Division of Water Pollution Control
Westview Building
Lyman School Grounds
Westborough, MA 01581

Surface Water Quality

Massachusetts' surface water quality has improved considerably since the 1972 Federal Water Pollution Control Amendments were enacted. Of the 10,704 river miles in Massachusetts, 1,676 major miles have been surveyed. 48 percent of these river miles fully support their designated uses and 34 percent partially support their uses. 92 percent of the lakes and ponds acres assessed met oligotrophic or mesotrophic status, and 25 percent of the harbors and bays fully met their water quality classification.

Use impairments are attributed to municipal sources (26 percent), nonpoint sources (24 percent), combined sewer overflows (16 percent), natural conditions (14 percent), in-place sediments (7 percent), industrial sources (6 percent), and other sources (7 percent). The major pollution problems in rivers and harbors are bacteria/pathogens, dissolved oxygen depletion, biochemical oxygen demand, and nutrients. PCB and heavy metal contamination severely affect a few basins and harbors, resulting in fish consumption advisories and toxic aquatic conditions.

An increase in shellfish closures due to bacterial contamination has been found through more monitoring and reclassification. It appears that coastal water contamination is more widespread than realized, and special actions and programs are now being initiated by the Department.

The NPDES and construction grants programs have been responsible for the reduction of BOD, bacteria, and solids problems in the State's rivers. A continuation of these programs will further upgrade river water quality.

The present focus of the Division of Water Pollution Control is on the complex problems of combined sewer overflows, toxic contamination, and eutrophication. These problems are difficult to assess and expensive to correct; abatement projects are less likely to be funded as Federal support is reduced.

Ground-Water Quality

Ground-water contamination in Massachusetts is becoming apparent due to the increasing number of ground-water public water supplies being closed. Forty-six communities have had to close part or all of their public water supplies due to contamination; 45 of these closures involved ground-water. The sources of the water supply contamination are industrial activities, accidental spills, road-salting, landfills, over development, and pesticides. Organic chemicals have caused the contamination in 67 percent of the State's closures.

Programs are being established to protect the ground water in the Commonwealth. Funds and authority are available to prevent and clean up contaminated public water supplies. Protection of the Commonwealth's ground-water resources is further provided through resource information maps, land acquisition, and a ground-water discharge permit program that classifies ground-waters according to their most sensitive use. Each discharge permit is reviewed on a case-by-case basis and strict discharge limits and monitoring requirements must be met.

MICHIGAN

For a complete copy of the Michigan 305(b) report, contact:

Michigan Department of Natural Resources
Surface Water Quality Division
Stephens T. Mason Building
P.O. Box 30028
Lansing, MI 48909

Surface Water Quality

Water quality in Michigan's lakes and streams is generally quite good, with high quality waters found in most areas of the State. With a few localized exceptions, the inland waters of Michigan's upper peninsula and the northern half of the lower peninsula are of excellent quality and contain diverse aquatic communities. Lakes and streams in the southern half of Michigan's lower peninsula are typically of good quality and support warmwater biological communities. This southern portion of the State contains Michigan's major urban areas; much of the remaining rural land is in agricultural production. Consequently, some rivers and lakes in this area have been affected by surface water runoff from agricultural land and urban centers as well as by municipal and industrial wastewater discharges. This has caused eutrophication and toxic material problems in some locations, particularly down-stream of metropolitan areas.

Of Michigan's 36,350 total river miles, roughly 497 are not meeting designated uses. Approximately 157 additional miles are known to be affected but the degree of water quality degradation is not known, nor is it known if designated uses are not being met. The major sources of contamination are nonpoint source pollution, in-place toxic materials, combined sewer overflows, industrial and municipal point source dischargers, and the leaking of contaminated ground water into surface waters. The primary pollutant materials are nutrients (phosphorus and nitrogen), suspended solids, toxic organic compounds, heavy metals, and existing oil and grease sediment deposits.

Four of the five Great Lakes border Michigan. Lakes Superior, Michigan, and Huron are considered to be oligotrophic and of excellent water quality. Water quality in Lake Huron's Saginaw Bay has improved considerably in recent years. Conditions in Lake Erie have also improved and, though it is still considered to be eutrophic, biological communities are becoming more balanced and there are fewer problems with low dissolved oxygen levels. The State is currently preparing remedial action plans to address the pollution problems of Great Lakes nearshore areas of concern.

Toxic contaminants continue to have a major impact in several areas of the State. These materials have contaminated some fish stocks in certain inland waters and the Great Lakes, necessitating the issuance of public health advisories against consumption of some species.

Ground-Water Quality

At least 24 Michigan municipal well systems are known to have been affected by toxic contaminants as of February 1986. Over 200 private residential wells have become polluted, which has resulted in a need for alternative water supplies. Even greater numbers of public and private wells are potentially affected by contaminated sites.

Of known point sources of ground-water contamination, the largest number of problems is associated with underground storage tanks. This has resulted in new legislation requiring underground tank registrations that provide important information such as tank age, location, and contents. Other major contamination sources include landfills, metal plating and production facilities, chemical products manufacturing, salt storage, and agriculture/food-related activities.

MISSISSIPPI

For a complete copy of the Mississippi 305(b) report, contact:

Mississippi Department of
Environmental Regulation
Bureau of Pollution Control
P.O. Box 10385
Jackson, MS 39209

Surface Water Quality

Surface water in Mississippi is generally of good quality. Most water bodies either meet all applicable water quality standards or fully support their designated uses.

Of the 10,000 miles of rivers and streams assessed, 90 percent currently support their designated uses, with the remainder partially supporting uses. At present, it is anticipated that all but those streams classified for lower uses will attain support of the fishable/swimmable use goal.

Of 995,000 acres of lakes and reservoirs assessed, 96 percent supported their designated uses. The remainder partially supported their uses. With implementation of best management practices it is anticipated that all of the lakes and reservoirs assessed could meet the fishable/swimmable use goal.

Approximately 133 square miles of estuaries were assessed for this report. Of these, 118 square miles supported their designated uses, 14 square miles partially supported their uses, and one square mile did not support its designated uses. All 133 square miles could eventually support the fishable/swimmable use goal with implementation of nonpoint source controls.

For rivers and streams, the major cause of nonsupport was nonpoint sources (72 percent). In addition, significant impacts were noted from municipal sources (23 percent). Nonsupport of designated uses in lakes and reservoirs is attributed entirely to nonpoint sources. Uses in estuaries were impaired by nonpoint sources (56 percent), municipal sources (31 percent) and industrial sources (13 percent).

Approximately 811 miles of streams and 12,673 acres of lakes are adversely affected by toxic substances in Mississippi. All of these waters are located within the Yazoo River Basin, which is affected by extensive agricultural activities.

The Bureau conducts a study each summer to determine bacteria levels in swimming areas along the Mississippi Gulf Coast. This study points out a continuing problem with high bacteria counts related to improperly treated wastewater and urban runoff.

Ground-Water Quality

Ground water is the principal source of drinking water in Mississippi. It is used for municipal, industrial, domestic, and agricultural purposes. Ground water is found in 14 major aquifers and is available in large quantities almost everywhere in the State. It requires little or no treatment and is used extensively compared to surface water, which requires treatment for most uses.

Current issues of concern are the extent of pollution caused by oil and gas industry operations and underground storage tanks. The unknown extent of pollution from currently unmonitored sources, which include many types of surface impoundments, nonhazardous landfills, and agricultural operations, is also an important issue.

Evaluation of potential sources of ground-water pollution and associated regulatory programs are currently underway. When these are complete, specific recommendations for each will be made, if necessary.

MINNESOTA

For a complete copy of the Minnesota 305(b) report, contact:

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155

Surface Water Quality

Monitoring data from 1,896 miles of assessed rivers and streams in Minnesota show that 83 percent of the mileage fully met the fishable use designation during the 1984-85 reporting period. The causes of partial and nonsupport were found to be pollutant loadings from nonpoint sources (51 percent), point sources (42 percent), and combinations of point and nonpoint sources (7 percent). A ten-year trend analysis indicated that water quality impacts from point sources are declining as a direct result of improved wastewater treatment. However, nonpoint sources continue to degrade water quality, particularly in highly agricultural areas of the State.

A trophic status assessment of 28 percent of Minnesota's total lake acreage showed that 28 percent of the assessed lake acreage fully supported designated uses (meso and oligotrophic), 63 percent partially supported uses (eutrophic), and 9 percent did not support uses (hypereutrophic). The highly eutrophic lakes exhibited nuisance conditions that detracted from the resource's value. An estimated 90 percent of Minnesota's lakes may be affected by nonpoint sources of nutrients which accelerate lake eutrophication. The near-shore waters of Lake Superior fully supported designated fishable/swimmable uses.

Fish tissue samples taken from 1975 to 1984 in 404,765 acres of lakes showed that 45 percent of the lake acreage fully supported fisheries uses and did not require fish consumption restrictions. Fish consumption advisories were issued for the remaining 55 percent of lake acreage, primarily due to mercury contamination in some northeastern Minnesota lakes. In addition, fish tissue assessment of 968 miles of rivers indicated that 30 percent of the mileage supported designated fisheries use, 45 percent partially supported, and 25 percent did not support this use The major causes of nonsupport were PCB contamination, particularly downstream from large population centers. It should be noted that fish tissue monitoring focuses on areas where there are potential problems, and so these figures may not be representative of all Minnesota waters. A trend analysis of PCB concentrations in Mississippi River fish species showed a promising decline over the last ten years.

Ground-Water Quality

Minnesota's ground water is a valuable resource, yet it is also vulnerable to stress from contamination and over-withdrawal. Ninety-four percent of the State's public water supply systems and 75 percent of domestic supply systems draw from ground-water sources. Ground water also supplies about 88 percent of the water used for agricultural irrigation. These withdrawals totaled more than 250 billion gallons in 1984 alone.

The natural quality of Minnesota's ground water is quite good. However, ground-water contamination problems have resulted from land use practices and improper storage of wastes in areas where natural soils and geological formations afford little protection for ground-water aquifers. Continual progress is being made to investigate and conduct remedial actions at 120 identified sites of contamination.

Major sources of ground-water contamination are industry/manufacturing (on-site spills, illegal or uncontrolled disposals, and impoundments); solid waste landfills and dumps; storage and transportation of petroleum and other products; and agricultural activities. Contaminants include metals, organic chemicals, industrial solvents, pesticides, gasoline, and nitrates.

MISSOURI

For a complete copy of the Missouri 305(b) report, contact:

Missouri Department of Natural Resources
Division of Environmental Quality
P.O. Box 176
Jefferson City, MO 65102

Surface Water Quality

Missouri's water quality is generally good. Just over half the State's classified waters are fully meeting Clean Water Act goals and most of the remaining waters are partially meeting those goals. Most of those waters not fully meeting the goals of the Act have sedimentation and substrate instability problems caused by natural soil and geologic conditions aggravated by accelerated soil erosion from agricultural practices and land use conversions. The fact that this kind of problem is extensive and partially of natural origin will make it difficult and expensive to treat.

The impacts of certain nonpoint sources are more localized and more amenable to treatment. Some of these areas are now being treated by the Department of Natural Resources with funds provided by the Office of Surface Mining. Point source impacts are a lesser problem due to Missouri's essentially rural nature and the State and Federal grants to cities to upgrade or replace aging sewage collection and treatment facilities.

The five most important pollutants and pollutant sources in the State are: sediment deposited in streams from soil erosion; acid mine drainage (acidity, sulfate, iron, and deposition of coal waste solids) from abandoned coal mines; municipal sewage treatment plant effluent (BOD, ammonia); deposition of lead-zinc mine tailings (sand-silt sized mineral particles, bioavailable lead and zinc); and releases from reservoirs (low dissolved oxygen, dissolved manganese, rapid temperature changes, velocity and stage changes).

Missouri discusses special State concerns that are not being adequately addressed because of lack of manpower, money, or authority. Stream channelization is causing both loss and degradation of aquatic habitat; increases in stream-bank erosion, frequency and severity of flooding, and water temperatures; and reduced dissolved oxygen levels. Abandoned lead-zinc mining areas are degrading habitat due to high rates of sediment deposition or inflow of high levels of bioavailable heavy metals. Lake of the Ozarks, a large reservoir, is experiencing high density residential and commercial development in areas where sewage collection and centralized treatment are impractical. Cleanup of abandoned hazardous waste sites is proceeding very slowly.

Ground-Water Quality

Ground waters yield good quality water in about 60 percent of the State. Aquifers in the remainder of the State are not potable due to naturally high salinity associated with very slow recharge and ground-water movement. Localized contamination of potable aquifers does occur and some public drinking water wells have been contaminated. Alluvial aquifers appear to be most vulnerable. Improperly cased or uncased private wells in shallow bedrock aquifers in areas of rapid ground-water recharge are believed to be frequently contaminated by septic tanks, feedlots, and surface runoff. The most important sources of ground-water contamination in the State are, in order of decreasing importance, abandoned hazardous waste sites, surface impoundments, underground storage tanks, and septic tanks.

The Department of Natural Resources' ground-water protection goal is to maintain the quality and quantity of the State's ground water at the highest level possible. Important components of a protection strategy include identifying contaminant sources that currently affect or threaten ground-water uses, recommending remedial or other action toward the contaminant sources, and directing resources against the identified problems.

MONTANA

For a complete copy of the Montana 305(b) report, contact:

Montana Water Quality Bureau
Department of Health and Environmental Sciences
Cogswell Building
Helena, MT 59620

Surface Water Quality

Nonpoint sources are by far the leading cause of water quality degradation in Montana, affecting 95 percent of waters not fully supporting their designated uses. Agriculture, hydromodification, land disposal, and mining are the leading nonpoint sources in the State. Three percent of impaired waters are affected by municipal sources and two percent by industrial sources, primarily oil production water discharges to the Powder River system. The five pollutant categories most responsible for water quality degradation in Montana are sediment/turbidity; salinity/dissolved solids; heavy metals; nutrients; and *Giardia lamblia*, an intestinal parasite.

Of the 19,505 stream miles assessed in Montana during the reporting period, 12,184 support their designated uses, 6,934 partially support uses, and 387 do not support uses.

Montana's largest and highest priority river is the Clark Fork, which suffers from toxic metals contamination, nutrient enrichment, and other perturbations. The Clark Fork River Basin Project has been established in the Governor's Office to coordinate water quality management efforts and to seek long-term solutions to the river's problems.

Four lakes with a total area of 13,250 acres do not support their designated uses and eight lakes with a total area of 20,595 acres only partially support their designated uses. The remaining 1,972 lakes (629,518 acres) that were assessed support their designated uses.

Flathead Lake is the largest natural lake in the western U.S. and Montana's highest priority lake for water quality management. The State implemented a six-point phosphorus control strategy after accelerated eutrophication was documented in 1983. The Flathead Basin Commission serves to oversee and coordinate management and regulatory activities affecting water quality in the Flathead River Basin.

Relatively little information is available regarding water quality in Montana wetlands. This is probably because the principal use of wetlands is for wildlife habitat and the water quality of most Montana wetlands has not been shown to impair this use. Concerns regarding wetland water quality result from the haphazard use of pesticides and herbicides and increasing salinity from poor agricultural practices.

Ground-Water Quality

Approximately two percent of the total amount of water used in Montana is ground water. However, ground-water sources provide potable water for 55 percent of Montana's population. Irrigation consumes the largest part of ground water used in Montana. Irrigation is followed, in order of decreasing consumption, by public water supply systems, industrial, rural domestic, and livestock uses.

Although there is no major threat to ground water in Montana, more local problems occur each year. Some major contaminants include fertilizers, pesticides, hydrocarbons, and heavy metals. During the last two years, 14 ground-water pollution control permits were issued, and about 40 incidents were investigated for possible pollution Four sites revealed cyanide from mining leach operations, and 15 locations were investigated for fuel leaking into the ground water. Seven businesses are planning stringent monitoring programs as part of completing applications under the Montana Hazardous Waste Act. Additionally, Montana now has seven Superfund sites, and 24 more sites are being investigated for inclusion in the CERCLA program. All of these sites include ground-water investigation, and in some cases, actual cleanup work.

The State has not developed a formal ground-water management strategy. However, it has implemented several programs to identify and address ground-water quality and quantity problems. These programs can be used in the future as building blocks for a statewide ground-water management strategy. The programs are directed towards quantification of water resources, control of potential sources of ground-water pollution, and identification and review of important issues.

NEBRASKA

For a complete copy of the Nebraska 305(b) report, contact:

Nebraska Department of
Environmental Control
Box 94877
State House Station
Lincoln, NE 68509

Surface Water Quality

During 1984 and 1985, primary contact recreational and aquatic life uses were fully supported in 2,717 stream miles, or 57 percent of Nebraska's assessed stream miles that were assigned one or both of these uses. Partial support of assigned uses occurred in 1,135 miles, while 942 miles did not support these assigned uses. In general, aquatic life uses were fairly well supported; most of the impairments were of primary contact (e.g., swimming) uses.

Nonpoint source pollution is responsible for water quality degradation in about 92 percent of stream miles with use impairment. The principal nonpoint source in Nebraska is agricultural runoff, which increases levels of fecal coliform bacteria, suspended solids, and certain pesticides. Domestic point sources are responsible for the impairment of about 8 percent of degraded miles, while industrial point sources cause the remaining beneficial use impairment to streams (less than 1 percent). Domestic sources contribute ammonia and fecal coliform bacteria, while problems with heavy metals are suspected to be due to industrial sources.

Although several toxic parameters have been detected in water samples and fish tissue samples, only cadmium and chlordane were detected at levels that would indicate water quality impairment. High levels of these parameters were responsible for partial support of the aquatic life use in 177 stream miles.

Of the lake acres assessed, 97 percent fully supported all assigned uses while 2 percent exhibited partial support and only 0.5 percent exhibited nonsupport. The partial support ratings were due to occasional dissolved oxygen problems from the decay of large amounts of algal biomass in six highly productive lakes and unexplained excessive mercury concentrations in one lake. Agricultural nonpoint source pollution and the inherent characteristics of the lake appear to be responsible for the high productivity in these lakes. The nonsupport rating was due to prolonged low dissolved oxygen concentrations in one lake. This problem is believed to have been caused by the operation of a new hydroelectric facility.

A number of water quality issues have been identified as areas of concern or problems of statewide importance. These include the failure to support primary contact recreation in designated stream segments; the widespread impacts of nonpoint source pollution; increasing trends in the detection of certain toxic pollutants; continued funding of publicly owned treatment works; and the increasing threat to ground-water quality. Future financial needs are projected to be greatest in the areas of nonpoint source pollution control, continued funding of the construction grants program, and ground-water pollution abatement.

Ground-Water Quality

Ground water is an extremely important resource in Nebraska, supplying water for domestic, municipal, agricultural, and industrial uses. It supplies approximately 67 percent of the water used for irrigation and approximately 77 percent of the public water supplies.

Identified ground-water quality problems in Nebraska can be grouped into four general categories: nitrate-nitrogen, synthetic organic compounds, hydrocarbons, and other contaminants. Nitrate-nitrogen concentrations in ground water are increasingly being detected at levels greater than the drinking water maximum contaminant level of 10 milligrams per liter. Synthetic organic compounds have been detected in municipal water supplies at several locations in the State. Hydrocarbons and related chemicals leak from fuel and chemical storage tanks or are possibly spilled from other sources. Other contaminants, such as sulfuric acid and detergents related to industrial activities, have also been detected in ground water.

The Nebraska Ground-Water Quality Protection Strategy was recently completed. It put forward a plan for ground-water quality protection that emphasizes the prevention of ground-water contamination. Many of the elements of this plan are currently being pursued with a number of legislative measures passed by the 1986 Legislature.

NEVADA

For a complete copy of the Nevada 305(b) report, contact:

Nevada Department of Conservation and Natural Resources
Division of Environmental Protection
201 South Fall St.
Carson City, NV 89710

Surface Water Quality

The 1986 Nevada 305(b) report assesses the quality of the Colorado, Truckee, Carson, Walker, and Humboldt River systems, and Lake Tahoe. Runoff from agricultural areas, rangeland, and urban drainage systems are cited as the leading sources of pollution in Nevada, along with septic system discharges.

Agricultural and rangeland sources contribute large sediment loads to waters of the State. Urban runoff contributes nutrients, heavy metals, and organic loads. The agressive administration of the State's nonpoint source control law and implementation of best management practices are necessary to achieve reductions in nonpoint source loads.

The nonpoint source problems caused by existing on-site disposal of wastewater will be resolved by implementation of sewerage projects which eliminate septic systems. Strict enforcement of regulations for on-site disposal and permitting of subsurface disposal systems will prevent such disposal methods from causing future ground-water pollution or nonpoint source problems.

The implementation of proposed sewerage projects through FY87, along with implementation of best management practices for new and existing development and on farms and ranches, should result in improvement of the Truckee, Carson, Humboldt and Colorado River systems as well as some minor river systems. This will provide for a high degree of protection and propagation of fish and wildlife and allow recreational activities in and on the water.

Ground-Water Quality

The Nevada Division of Environmental Protection established a ground-water section in 1985. Major work responsibilities include developing and implementing a State ground-water protection plan. Programs with the highest priority are Underground Injection Control (UIC) and Underground Storage Tanks (UST). The State is currently developing a UIC program so as to seek program delegation from the EPA. Nevada is implementing the tank notification requirements of the UST program, but will not develop regulations until after the Federal regulations are developed, currently scheduled for February 1987.

NEW HAMPSHIRE

For a complete copy of the New Hampshire 305(b) report, contact:

New Hampshire Water Supply and Pollution Control Commission
Hazen Drive
P.O. Box 95
Concord, NH 03301

Surface Water Quality

The overall water quality in New Hampshire remains excellent. Evidence for this is the ever expanding water-based recreational use of the many miles of rivers and streams and 1,300 lakes in the State. In the past two years, 94 river miles have been upgraded to fishable/swimmable status. About 71 percent of the State's assessed waters are meeting fishable/swimmable standards.

Parameters of major concern in New Hampshire are bacteria, dissolved oxygen, turbidity, pH, and nutrients. Primary sources include municipal wastewater treatment facilities; runoff from urban; agricultural, and construction areas; septic systems; acid precipitation; and natural causes.

New Hampshire's lakes and ponds are the focus of tremendous growth in second home and condominium construction. Increased population growth has also resulted in the conversion of cottages to year-round homes. The increased loading on older inadequate septic systems is of concern and may be a factor in the accelerated eutrophication of smaller lakes and ponds. Acid precipitation has also affected the salmonid fishery especially in remote, high altitude ponds with poor buffering capacity. Acidification is also felt to be responsible for reducing species diversity in lakes and ponds as well as increasing corrosivity in municipal water supplies.

Continued Federal, State, and local funding is in order to resolve the State's remaining municipal pollution problems. Many of the required municipal and community wastewater treatment facilities and associated sewers have been designed and await construction grants funding. Similarly, existing facilities that must be upgraded and municipalities needing separation of storm and sanitary sewers are awaiting funding.

The remaining problems from industrial discharges are relatively few. Problems include biotoxicity from several textile manufacturing operations, the need to provide or upgrade pretreatment prior to discharge into municipal sewers, and the upgrading of industrial wastewater treatment facilities in New Hampshire and Vermont which currently degrade the Connecticut River.

Ground-Water Quality

Incidents of ground-water contamination in New Hampshire are widely scattered; most of the State's ground-water resource is of high quality. Episodes of ground-water contamination from leaking petroleum products in underground storage tanks have occurred. In recognition of the need to better monitor and upgrade such facilities, regulations were passed in 1985 that require regular testing of all existing tanks and set new standards for all new installations. Groundwater pollution from landfill leachate, hazardous waste sites, and septage lagoons has also become more common. Contamination of public and private water supplies from volatile organic compounds and other toxic constituents has created a financial burden on communities to search for new supplies, extend water mains to affected areas, and take remedial action on suspected pollution sources. The mapping of potential pollution sources on a town-by-town basis has created a greater awareness of the problem and increased demand on local and State government to address the issue.

NEW JERSEY

For a complete copy of the New Jersey 305(b) report, contact:

New Jersey Department of Environmental Protection
Division of Water Resources
Monitoring and Planning Element
P.O. Box CN-029
Trenton, NJ 08625

Surface Water Quality

Water quality conditions in New Jersey rivers and streams continue to be relatively stable. The fish propagation and maintenance goal is being attained throughout most fresh waters. Increases in dissolved oxygen and reductions in nitrogen concentrations have occurred throughout the past 5-8 years. In addition, no new toxics contamination of freshwaters has been identified. Only 12 percent of the monitored fresh waters are considered not meeting or partially meeting the fishable goal. These waters are all located in the State's urbanized areas, and suffer from large amounts of point source effluent and nonpoint runoff.

New Jersey's rivers and streams contain excessive fecal coliform concentrations and, as a result, only 29 percent of the monitored fresh waters currently meet the swimmable goal. Sixty-three percent do not attain the swimmable goal, and eight percent are considered to be periodically meeting this goal. Runoff from developed and agricultural lands is thought to be the prime source of fecal coliform. Other sources include improperly operating/discharging sewage treatment plants, on-site septic systems, and natural sources.

Point sources have been recognized as the major water pollution problem in the State for a number of years. Most larger waterways in New Jersey have at least one point source discharger, although the greatest concentration of point sources is found along the State's urbanized tidal waters.

A recent nonpoint source assessment identified pathogens, sediments, and nutrients to be primary nonpoint pollutants affecting rivers and streams. The primary sources were agricultural lands, urban areas, and land disposal practices (including on-site septic systems). Also thought to be a serious nonpoint source water quality problem in New Jersey's urbanized areas is oil and grease being discharged during storm events.

New Jersey's lakes are being increasingly threatened with significant loadings of sediments, nutrients, and toxic substances. This may be leading to eutrophication and deteriorating water quality. In the 1985 New Jersey Nonpoint Source Assessment prepared for the Association of State and Interstate Water Pollution Control Administrators, almost 19,000 acres of the State's lakes were assessed for designated use impairment from nonpoint sources. Over 5,000 acres were known to have moderate or severe degradation, with over 11,000 acres listed as threatened with impairment. An additional 1,400 lake acres suffer from both point and nonpoint source water pollution.

Nonpoint sources affect water quality throughout the State's estuarine waters, but most impacts are minor and localized. The primary nonpoint source is urban/suburban runoff, with fecal bacteria being the main pollutant. Less than 15 percent of the State's estuarine waters are severely or moderately degraded solely from nonpoint sources. Another 15 percent are affected by both point and nonpoint sources.

The New Jersey Department of Environmental Protection (NJDEP) has found high levels of PCBs and certain pesticides (primarily chlordane) in finfish from New York-New Jersey interstate waters. As a result, commercial fishing bans and recreational fishing advisories have been issued by the State for these waters.

Sixty-six percent of the State's estuarine and ocean waters are identified as meeting the swimmable/fishable goals of the Clean Water Act, while 18 percent are classified as partially meeting the goals and 16 percent are classified as not meeting the goals. The elimination of ocean-discharging primary sewage treatment plants and the regionalization of many small facilities have resulted in a net gain of nearly 18,700 shellfish growing acres (or 10 percent) to open status since 1976. This improvement in water quality can be considered a major highlight in the State's water pollution control efforts. Additional regionalization and upgrading of municipal treatment plants will continue along the coast.

Ground-Water Quality

About half of the State's population, about four million people, rely on ground water for their drinking water. Although New Jersey's ground water is of generally good quality, man-induced pollution from 1970 to 1985 led to the closure of 109 municipal supply wells and 667 domestic supply wells. During this same time, the NJDEP responded to nearly 700 ground-water pollution cases. The primary causes of well closure are high levels of hydrocarbons and other organic chemicals. In addition, the presence of minute amounts of organic chemicals and metals generally not hazardous to public health have been found to be widespread throughout New Jersey's ground-water systems. Significant causes of ground-water degradation include the State's large number of known and suspected hazardous waste sites, leaking underground storage tanks, industrial site pollution, spills, and overpumpage.

NEW MEXICO

For a complete copy of the New Mexico 305(b) report, contact:

New Mexico Environmental
Improvement Division
Surface Water Quality Bureau
P.O. Box 968
Santa Fe, NM 87504-0968

Surface Water Quality

There are 3,500 miles of perennial rivers and streams in New Mexico. The quality of surface waters varies according to locality. Generally, water originating in the high mountains is of excellent quality. At lower elevations, water is frequently of lesser quality. Due to the presence of readily soluble minerals, good quality water may be subjected to degradation through use as it flows downstream.

Available information indicates that designated or existing uses are partially impaired in 48 reaches totalling 360 stream miles. The fisheries use is partially impaired in 336 miles, the irrigation use in 47 miles, the domestic water supply use in 21 miles, and the primary contact recreation use in 10 miles.

Seventy-four percent of all stream miles judged to have partially impaired uses are being affected by nonpoint sources of pollutants. Point and unknown sources are each responsible for the partial impairment of 8 percent of the affected stream mileage, followed by hydrological modification (7 percent) and natural conditions (2 percent).

Sediment is by far the major pollutant affecting designated uses in New Mexico's streams. Plant nutrients and temperature are also important pollutants impairing uses.

Of New Mexico's 5,725 acres of unclassified lakes, 201 acres (two lakes) have partially impaired designated uses. The fisheries use was impaired in these waters. Nonpoint sources are totally responsible for lake use impairment, contributing sediments, and plant nutrients.

It should be noted that although water quality problems have resulted in the partial impairment of fisheries and primary contact recreation in some of New Mexico's rivers and lakes, all waters can be said to meet the goals of the Act in that the fisheries, wildlife watering, or recreational uses are not known to be precluded.

Ground-Water Quality

Ground water is an extremely important resource in New Mexico. Approximately 87 percent of the population depends on ground water for drinking water, and it is the only source of water in many parts of the State.

About 4.4 billion acre-feet of recoverable fresh and slightly saline ground water are estimated to be present in New Mexico. Overall, the quality of this water is good. There are, however, significant pollution problems known to affect limited areas around the State.

From the 1920s until the present, approximately 71 public water supply wells in New Mexico have been affected by pollution caused by human activities. Of these, 52 had to be taken out of use for human consumption. As of mid-1986, only 12 out of 1,365 public water supply systems were found to exceed any inorganic standards.

Significant ground-water pollution problems have been identified in five areas of special concern. The Albuquerque South Valley has serious longstanding ground-water pollution problems and includes one site included on the Superfund National Priorities List; possible causes include agricultural practices, industrial contamination, and private sewage systems. In Lea County, ground-water pollution occurs from a variety of causes including oil and gas production and sewage disposal. The Grants Mineral Belt is an area of concern because of effects of past uranium mining and milling activities; two mills are designated as Superfund sites and one abandoned refinery has been nominated. The San Juan Basin is of concern due to a variety of causes including landfill problems and oil and gas production. The concentrated dairy areas of the Lower Rio Grande Valley are also of concern due to the existing and potential effects on ground water of dairy waste disposal practices.

NEW YORK

For a complete copy of the New York 305(b) report, contact:

New York State Department of Environmental Protection
Division of Water
Bureau of Monitoring and Assessment
50 Wolf Road
Albany, NY 12233-0001

Surface Water Quality

In 1986, designated uses were supported in 78 percent of New York's assessed major rivers and streams, 80 percent of its assessed lakes and reservoirs, and 71 percent of its assessed tidal waters. This is a significant improvement over 1982. However, as in 1982, only 14 percent of New York's Great Lakes waters supported their designated uses.

Causes of nonsupport in rivers and streams were cited as municipal discharges (40 percent), industrial discharges (20 percent), combined sewer overflows (CSOs) (13 percent), nonpoint sources (11 percent), acid precipitation (9 percent), and contaminated sediments (7 percent). In tidal waters, municipal sources were again the leading cause of use impairment, affecting 38 percent of impaired waters. CSOs affected 31 percent, contaminated sediments affected 25 percent, and industrial discharges affected the remaining 6 percent.

Nonpoint sources were the leading cause of use impairment in lakes, affecting 75 percent of impaired lakes acres. Municipal discharges (12 percent) and acid precipitation (9 percent) were also major causes of use impairment, followed by contaminated sediments and industrial discharges (2 percent each). Use impairment in New York's Lake Ontario was attributed to sediment contamination primarily by the pesticide Mirex, which has resulted in a lakewide fishing advisory.

The pollutants most responsible for nonsupport of designated uses statewide are pesticides/herbicides, heavy metals, pH, bacteria/pathogens, and other toxic organics. About 565 miles of rivers, 159 miles of estuaries, and 35,000 lake acres are affected to some degree by toxic pollutants. In addition, about 150 river miles, 130 estuarine miles, and 3,000 lake acres are affected to some degree by contaminated sediments.

Special concerns in New York include hazardous substances, Long Island ground water, nonpoint sources, PCB cleanup of the Hudson River, acid precipitation, and data management.

Ground-Water Quality

Approximately six million people in New York State use ground water as a source of water. Half of these people are on Long Island and the remainder are in upstate New York.

Ground-water quality is generally a more serious problem on Long Island than it is upstate. The Department of Health has reported 99 public water supply closures or abandonments statewide due to organic contamination. Of these, 50 water supplies on Long Island and 21 upstate remain closed; 28 have reopened.

Contamination by synthetic organic chemicals is the most significant threat to ground-water quality statewide. The three major categories of organic contaminants that are detected most frequently in ground water are: industrial/commercial synthetic organic solvents and degreasers, primarily trichlorethane, trichloroethylene and tetra-chloroethylene; gasoline and other petroleum products that contain the compounds benzene, toluene, and xylene; and agricultural pesticides and herbicides, primarily aldicarb and carbofuran.

To a far lesser extent, nitrate and chloride contamination have also been identified as ground-water quality problems.

NORTH CAROLINA

For a complete copy of the North Carolina 305(b) report, contact:

NC Department of Natural Resources and Community Development
Division of Environmental Management
Water Quality Section
P.O. Box 27687
Raleigh, NC 27611

Surface Water Quality

Overall, 67 percent of North Carolina's 37,000 miles of streams and rivers support their uses, 28 percent partially support uses and 5 percent do not support their uses. River basins located in the mountains tend to have the highest percentage of use support, while the more heavily developed piedmont or coastal basins have more stream mileage with use impairment.

Sediment, nutrients (especially phosphorous), ammonia, and heavy metals are the major causes of degradation statewide. It is estimated that nonpoint sources (especially urban and agricultural runoff) account for about 71 percent of the less-than-fully supporting stream mileage, while industrial sources are responsible for 12 percent and municipal sources for 17 percent. These ratios reflect the State's past emphasis on point sources. This emphasis has had great positive benefit. However, effective nonpoint source control is more difficult to implement, and it is anticipated that progress toward control of pollution from these sources will be slower.

Ninety-seven percent of the surface area of lakes and reservoirs in North Carolina support their designated uses, 2 percent partially support uses, and 1 percent do not support their uses. About 33 percent of the State's total lake area is threatened by eutrophication. The largest cause of partial and nonsupport has been coal-fired power plant discharges to two lakes (Hyco and Belews) which have resulted in excessive selenium levels in these lakes. Belews Lake no longer receives coal ash basin effluent while Hyco Lake will not receive effluent in the future. These actions should restore biota in both lakes. In addition, extensive efforts are underway to control eutrophication to two relatively new lakes (Falls and Jordan) which should reduce the threatened acreage.

Of the acreage of estuaries and sounds in North Carolina, 84 percent fully support their designated uses while 16 percent partially support uses. Nonpoint sources (primarily upstream pollution, coastal land clearing, and estuarine/barrier island development) are the main causes of less-than-full support. Several new efforts by the State are underway, including protection of primary nursery areas and control of coastal stormwater runoff to shellfish areas.

Since 1972, the State has had an intensive program to control point source pollution through the NPDES program. New or expanded programs to reduce the impact of point sources include new computerized data bases, bioassay monitoring and permit limits, pretreatment program implementation, and new or revised water quality standards. These actions should reduce the amount of pollution from point sources in the State.

Nonpoint pollution is a major cause of water quality problems in the State. Examples of efforts to control nonpoint sources include reduction of sedimentation and erosion from abandoned mines in the Appalachian Mountains, water supply protection in developing watersheds, and nutrient-sensitive waters. The latter program provides agricultural cost-sharing money to assist farmers with on-farm control of erosion and animal wastes.

Ground-Water Quality

About half of the people in North Carolina use ground water as their primary water supply. Ground-water quality is generally good statewide. The major source of ground-water contamination is leaking underground storage tanks, although spills and lagoons are also important. Comprehensive programs are underway to assess potential contamination sites and develop a comprehensive ground-water protection strategy for the State.

NORTH DAKOTA

For a complete copy of the North Dakota 305(b) report, contact:

North Dakota Department of Health
Division of Water Supply and Pollution Control
1200 Missouri Avenue
Bismarck, ND 58504

Surface Water Quality

The majority of waterbodies in North Dakota are eutrophic to hypereutrophic. Both point source and nonpoint source impacts are intensified by climate: point source impacts are most severe from July through November during seasonal low flows, while the major nonpoint impacts occur during spring runoff, from March through June. Of 792,375 lake acres assessed, 5,646 acres were affected by point source pollution but all 792,375 lake acres were affected to varying degrees by nonpoint sources. Of 5,684 river miles assessed, 288 miles were affected by point source discharges, with all assessed miles affected by nonpoint source pollution.

Surface water quality degradation resulting from point source discharges in North Dakota is being lessened; all municipalities in the State have had secondary treatment facilities installed since 1984. Beyond secondary treatment, the State needs systems such as overland flow, irrigation, and wetland uptake to strip nutrients and total suspended solids from effluents. Municipal storm sewer systems may require improvements or modifications to control urban runoff.

With the exception of one power plant, all industries are in compliance with the North Dakota Permit Discharge Elimination System program. Ammonia is the primary toxic pollutant in municipal and industrial discharges in North Dakota.

Many streams and lakes in the State are degraded due to high nutrients (primarily phosphates), sedimentation, wetland drainage, low flows, and alterations to stream banks and beds. Chronic low flows in major rivers and their tributaries result in high dissolved solids, high stream temperatures, and poor biological diversity. The slow trend toward more eutrophic conditions in the State's waters indicates that it is necessary to accelerate implementation of better management practices on land surrounding these aquatic systems. A primary goal for future water quality programs in North Dakota is better understanding and implementation of practices that control nonpoint source pollution.

The North Dakota Department of Health will continue to monitor rivers with emphasis on interstate and international waters. The ongoing lake water quality survey will continue until all lakes have been sampled and the data are analyzed. Priority waterbodies will be monitored in order to implement or intensify pollution abatement activities, provided necessary funding is available.

Ground-Water Quality

Ground water is one of North Dakota's most valuable resources. Over half the State's population currently relies on ground water for domestic use, and dependence on ground water will likely increase. Most smaller communities in North Dakota depend solely on ground water.

North Dakota is primarily agricultural, with limited industrial development. Consequently, it has experienced relatively minor ground-water quality problems. Ground-water monitoring of both municipal and private wells has indicated concentrations of arsenic, nitrate, and fluoride that exceed primary drinking water standards. High concentrations of arsenic in ground water have been confined to the southeastern part of the State. These concentrations are thought to be caused by a combination of natural arsenic released from the aquifer material and arsenic that was applied to soil as grasshopper poison in the 1930s. Elevated nitrate concentrations have been found in many private wells. These concentrations have been linked either to natural conditions or contamination from septic tank drainfields, nitrogen fertilizers, or feedlot operations. High natural concentrations of fluoride in ground water have accounted for all the fluoride primary drinking water standard violations.

Many of the contaminated ground-water sites identified by the State are affected by hydrocarbons and were located by reports of spills, leaks, or taste and odor problems in drinking water.

Ground-water protection programs in North Dakota include point and nonpoint source pollution programs, a public water supply program, an underground injection control program, the construction grants program, a solid waste management program, and the hazardous waste management program.

NORTHERN MARIANAS

For a complete copy of the Northern Mariana Islands 305(b) report, contact:

CNMI Department of Public Health and Environmental Services
Division of Environmental Quality
P.O. Box 1304
Saipan, Northern Mariana Islands 96950

Surface Water Quality

Tourism is the major industry in the Commonwealth of the Northern Mariana Islands. Problems associated with tourism include sewage disposal, ground-water protection, and the prevention of environmental damage from earthmoving activities. These problems have been exacerbated by the growth of other industries, including garment manufacture and the construction associated with the development of new low-cost housing subdivisions, a hospital/health center project, and several large hotel/resort complexes.

Ground-Water Quality

Protection of ground-water resources is a major concern in the Commonwealth. The growing construction and garment industries present potential adverse impacts to ground water. All of the Commonwealth's producing water wells are included in a monthly monitoring program to determine the fluctuations of water quality over time as well as the effects of pumping rates. The parameters measured include chloride, alkalinity, dissolved solids, conductivity, hardness, and pH. Saltwater intrusion is a major problem. Overpumping of wells into a seriously leaking distribution system continues. The laying of new pipelines in the southern villages of Saipan and a project designed to deliver better quality water from the Kagman area to San Vicente and the southern villages is expected to improve this situation.

In 1985, the Governor appointed a Water Resources Task Force to address the problems that affect the water resources of the Commonwealth. A major activity will be to compile all existing information on ground water in the Commonwealth and make recommendations that will lead to the development of a Water Resources Management Plan. A ground-water monitoring strategy will also be developed based on the information derived from this project.

OHIO

For a complete copy of the Ohio 305(b) report, contact:

Ohio Environmental Protection Agency
Division of Water Quality Monitoring and Assessment
P.O. Box 1049
Columbus, OH 43266-1049

Surface Water Quality

Of the total evaluated stream miles in Ohio, 60 percent (4,091 miles) are attaining their aquatic life use designations, 30 percent (2,043 miles) are partially attaining their aquatic life uses, and 10 percent (679 miles) are not attaining their aquatic life uses. The small percentage of the total stream mileage actually evaluated and the non-representative method of selecting streams for evaluation (i.e., a bias towards selecting stream segments in problem areas) preclude any projection of the percentage of total stream miles in Ohio that will meet clean water goals.

Of the 2,722 stream miles determined not to be fully achieving their aquatic life use designations, 36 percent were affected by municipal discharges, 16 percent by industrial discharges, 11 percent by combined sewer overflows, and 5 percent were altered due to the effects of channelization.

In addition, various nonpoint source problems contributed to approximately 25 percent of the non-attainment of aquatic life use designations. The primary individual nonpoint source problem appears to be acid mine drainage (affecting 3 percent of stream miles), followed by other nonpoint sources (urban and agricultural runoff, septic systems, stream bank erosion, feedlot waste, and landfill leachate). Most stream segment degradation was due to a combination of pollution sources.

Rivers in Ohio that were grossly polluted by sanitary wastes such as bacteria and deoxygenated water 30 to 40 years ago have substantially improved because of State and Federal water pollution control laws enacted in the 1960s and 1970s. Dramatic improvements in overall conditions have occurred in numerous major waterways in Ohio such as the Scioto River, the Great Miami River, and the Tuscarawas River. Partial recovery has also been noted in the Cuyahoga and Mahoning Rivers, both systems heavily influenced by industrial, municipal, and urban pollution sources. However, the increasing use of chemicals and our ever-improving ability to monitor and detect the influence of some of these chemicals in the environment indicate that pollution from toxic chemicals is a growing concern. The major pollution problems noted in Lake Erie harbors and nearshore areas include metal concentrations from municipal and industrial effluent and urban runoff; high nutrient (phosphorus) concentrations; high fecal coliform concentrations, particularly from CSOs; septic systems and sewage treatment plants; and deposition of sediments requiring harbor dredging and associated disposal problems for contaminated sediments.

Ground-Water Quality

Ohio's ground water is a critically important resource. It provides drinking water to almost half of all Ohioans. Some 700,000 rural households depend on private wells for drinking water and about 75 percent of the State's 1,600 community water systems rely on ground water for all or part of their water supply. Ground water is also widely used for manufacturing and cooling water and, to a far lesser extent, for irrigation.

Ohio's large population and the diversity of the State's economic activities generate many ground-water threats. Ground-water contamination by bacteria, viruses, nitrates, or toxic chemicals appears to be a growing threat.

The most serious sources or potential sources of ground-water contamination in Ohio include hazardous waste sites, solid waste landfills, leaks and spills, agriculture, septic tanks, mineral extraction, and improperly constructed and maintained wells.

OHIO RIVER VALLEY WATER SANITATION COMMISSION

For a complete copy of the ORSANCO 305(b) report, contact:

ORSANCO
49 E. Fourth Street
Cincinnati, OH 45202

Surface Water Quality

The States of Pennsylvania, Ohio, West Virginia, Kentucky, Indiana, and Illinois, which share the main stem of the Ohio River, have assigned the Ohio River Valley Water Sanitation Commission with responsibility to prepare the biennial water quality report on the Ohio River main stem. Those six States, together with New York and Virginia, comprise the Commission, an interstate agency created to administer a compact among the States to eliminate prêsent pollution and prevent future degradation of the waters of the Ohio River Basin. The Federal government is an active participant in the Commission's functions.

The Ohio River is 981 miles long and drains an area of almost 204,000 square miles. In 1980, the population residing within the basin was 20,814,324. The river supports a variety of uses including navigation, power generation, industrial processes, municipal water supply, fish and wildlife habitat, and recreation, including swimming, boating, water skiing, and fishing. The river also receives treated wastes from over 220 industrial and

126 municipal sources. The largest category of land use within the basin is agriculture. Another activity within the basin that can affect water quality is the extraction of resources, primarily coal mining and drilling for oil and gas.

In water years 1984-85, the Ohio River supported the uses of water supply and aquatic life habitat either partially or fully throughout its length. Contact recreation was not supported in one area, but was either partially or fully supported on most of the river. Water quality problems encountered in this period included levels of dissolved oxygen, metals, fecal coliform bacteria, and certain organic compounds which occasionally did not meet Commission stream criteria. Also, in several instances levels of polychlorinated biphenyls (PCBs) in fish exceeded guidelines for safe consumption. Causes of these problems include municipal and industrial discharges as well as nonpoint sources.

The major change since the last reporting period is the adoption of more stringent water quality criteria by the Commission for temperature, dissolved oxygen, copper, and zinc, as well as the receipt of new information on PCBs in fish flesh. During the reporting period, specific improvements were observed for fecal coliform bacteria and phenolics/cyanide. Parameters indicating poorer water quality conditions were temperature and dissolved oxygen.

Special concerns discussed in the Commission's assessment include the manufacture and transport of organic chemicals and other hazardous substances in the Ohio Valley; the effects of nonpoint sources; and the development of hydroelectric power at each of the Ohio River's navigation dams.

OKLAHOMA

For a complete copy of the Oklahoma 305(b) report, contact:

Oklahoma Department of
Pollution Control
P.O. Box 53504
Oklahoma City, OK 73152

Surface Water Quality

There are seven water quality basins identified in this report. The quality of water within each basin has been analyzed; the results of beneficial use determinations, goals assessment, and trend analysis are presented. Summaries are presented by basin.

Trend analysis for a number of pollutants in Oklahoma's waters reveals an apparent increasing trend for phosphorus. Possible control options for achieving a reduction in phosphorus levels include a ban on the use of phosphate based soaps, implementation of nonpoint source management practices, and/or phosphorus removal implemented at wastewater treatment facilities.

A decreasing trend in pH levels is also noted. Possible reasons include acid rain or humic acid entering streams from forested areas, and/or acid mine drainage.

An interesting phenomenon that has occurred during the last two years is the increasing number of violations of the numerical goal for total arsenic in sediment. All but one of the water quality basins indicate violations of this goal. During the last two years, the Oklahoma State Department of Health (OSDH) has expanded its sediment analysis program to include more stations. As a result, an increase in the number of occurrences of total arsenic violations has been seen. The OSDH is in the process of resampling, which will provide a larger database and a more definitive picture of the problem. A review of the numeric goals for sediment may be in order. However, further work is needed to clarify the relative contribution from natural or anthropogenic sources in the various regions of the State.

It is apparent that with decreasing Federal funding from EPA for water quality management programs and the loss of State revenues due to low oil prices, cuts in Oklahoma's basic water quality management programs will occur. These cuts will affect the programs dealing with inspection and compliance monitoring of both municipal and industrial facilities as well as the State's ambient trend monitoring program. These cuts could result in a reversal of progress made in cleaning up the waters of the State.

It is imperative that remaining funds be allocated prudently and wisely. In addition, it is critically important that programs be carefully evaluated to eliminate duplication of effort while promoting interagency cooperation, and that other sources of funding be identified to carry on the State's water quality management programs.

OREGON

For a complete copy of the Oregon 305(b) report, contact:

Oregon Department of
Environmental Quality
Executive Building
811 Southwest Sixth Ave.
Portland, OR 97204

Surface Water Quality

Of the estimated 90,000 stream miles in the State, nearly 28,000 miles have been cataloged. Of this total, 11,855 miles have been assessed as follows: 9,665 miles (82 percent) fully support designated beneficial uses, 1,915 miles (16 percent) partially support designated beneficial uses, and 275 miles (2 percent) do not support designated beneficial uses.

Major parameters of concern include fecal coliform bacteria, suspended solids, nutrients, and dissolved oxygen. Bacterial contamination results from different sources including failing septic tanks and drainfield systems, inadequately managed animal waste disposal operations, cattle grazing, sewage bypasses, inadequately treated sewage, and natural sources. Algae and aquatic weed growth occur at some stream sites due to the presence of nutrients, physical site conditions, and low flow. These conditions cause dramatic fluctuations in dissolved oxygen and pH which can affect cold water fisheries.

In 46 percent of stream miles with use impairment, nonpoint sources were cited as the primary cause of degradation. For the most part, Oregon's lakes are of excellent chemical and physical quality, and are low in mineral content. Many lakes are largely inaccessible and have excellent water quality. Many of the more accessible lakes also have good quality water. Nevertheless, as more demands for recreation and development are placed on these lakes and their drainage basins, the potential for water quality deterioration may develop. In Oregon, several lakes already show signs of deteriorating water quality.

Between 1972 and 1985, 65 lakes totalling approximately 200,000 acres were assessed. The most sensitive designated uses, swimming and fisheries, are supported in 59 percent of the 200,000 lake acres, partially supported in 39 percent, and not supported in 2 percent. Less than full support of designated uses is attributed to factors such as reduced depth due to sedimentation and erosion, and nuisance aquatic plant growths that occur naturally and are accelerated by human activity.

Bacterial standards were used for evaluating support of the shellfishing use in Oregon's estuaries. The assessment shows this use is fully supported in 6 percent of the estuarine acres. Shellfishing in the remaining 94 percent is partially supported because bacterial standards are exceeded during wet weather in the winter. It is estimated that nonpoint sources, including inadequate animal waste disposal practices and on-site sewage disposal, account for the largest contribution of fecal coliform bacteria. Sewerage system overflows during the winter months are significant contributors to bacterial pollution in Coos Bay. Tidal flushing characteristics, estuarine circulation patterns, and ocean upwelling are considered natural factors influencing fecal coliform values in excess of the standard.

Ground-Water Quality

In several areas of the State, ground-water pollution has been documented. Elevated nitrate-nitrogen concentrations and bacterial contamination have been two primary indicators of wastes seeping underground. Recently, however, data have been collected which suggest the need to investigate toxic chemical and hydocarbon contamination in ground water.

Major steps have been taken that emphasize prevention of ground-water pollution. A statewide protection policy was established in 1981 and amended in 1984. The important preventive measures of the policy include ensuring that domestic and industrial wastes are properly treated before disposal, especially where soils are porous and pollutants can seep through them easily; determining the extent to which unsewered development can be accommodated in a given area without harming ground water; and ensuring that drinking water wells are constructed according to State Water Resources Department regulations to protect public health.

PENNSYLVANIA

For copies of the Pennsylvania 305(b) report, contact:

Pennsylvania Department of
Environmental Resources
Division of Water Quality
P.O. Box 2063
Harrisburg, PA 17120

Surface Water Quality

Of the 6,225 river and stream miles assessed in Pennsylvania during the 1984-85 reporting period, approximately 3,332 or 54 percent attained uses; 1,242 miles or 20 percent partially attained uses; and 1,651 miles or 26 percent did not attain uses. Many of the State's remaining 44,000 stream miles which were not assessed are believed to support the designated fish and aquatic life use.

Mining is the single biggest cause of water quality degradation in Pennsylvania. Mining is responsible for water quality problems in at least 1,690 of the 2,890 stream miles reported as degraded (partially and not supporting uses). This represents 58 percent of the State's degraded miles. Acid mine drainage affects every major river basin in Pennsylvania. While some funds are available for abandoned mine drainage abatement, the immensity of the problem and difficulties associated with control have severely hampered abatement and treatment projects. These difficulties are expected to continue.

Other major causes of degradation reported in the State assessment are municipal discharges (13 percent), agriculture (8 percent), and industrial sources (7 percent). Municipal sewage treatment plants were responsible for degrading about 386 miles of streams. Municipal sewage discharges are found throughout the Commonwealth, but the areas reported as experiencing problems were the heavily populated areas in southeastern Pennsylvania (Delaware River basin), and southwestern Pennsylvania (Ohio River basin).

Agricultural sources were responsible for degrading approximately 223 stream miles statewide. Of these, 135 miles (60 percent) were reported in the lower Susquehanna River basin. Specific contributors are runoff from cultivated fields, overgrazing, free access of livestock to streams, and manure management problems due to the high density of livestock.

Industrial sources were responsible for degrading about 203 miles statewide. Problems were caused by various types of industries and pollutants. Major river basins affected were the Ohio, the Delaware, the lower (main stem) Susquehanna, and the Allegheny. As with municipal sources, industrial discharges are usually dealt with through the permitting process

Special State concerns reported in Pennsylvania in 1986 include abandoned mine drainage, acid deposition, Chesapeake Bay initiatives in the Susquehanna River basin, oil and gas production, and wetlands protection.

Ground-Water Quality

Ground water provides over 90 percent of the fresh water in the State. On a statewide basis, ground water contributes approximately 70 percent of stream flow under average conditions and up to 100 percent during low flow periods. More than two-thirds of the public water supplies, and almost all private supplies in the State come from ground water.

Except for high iron, sulfates, hardness, and total dissolved solids concentrations in large portions of western Pennsylvania, ground-water quality in most of the remainder of the State is believed to be acceptable for drinking with little or no treatment. Heavy mining and oil and gas production activities are contributing to ground-water problems in western counties. Hardness, fluoride, and nitrate-nitrogen problems occur to a limited extent. Leaking underground storage tanks have contributed to local ground-water problems statewide. Ground-water depletion due to overpumping and contamination from malfunctioning on-lot systems, leaking underground storage tanks, landfills, toxic substance dumping, impoundments, and excessive use of fertilizers, pesticides, and road salts could cause problems in the future.

The Department of Environmental Resources has been aggressively involved in ground-water protection since the early 1960s. The current program relies on the development and implementation of regulations and permits to prevent and abate pollution from all major sources. New initiatives currently under development which address ground-water issues include the Ground-Water Quality Protection Strategy, the Ground-Water Quality Monitoring Strategy, Underground Storage Tanks, and Soil Dependent Treatment Systems for On-Lot Disposal.

PUERTO RICO

For a complete copy of the Puerto Rico 305(b) report, contact:

Puerto Rico Environmental
  Quality Board
Water Quality Standards
Development Division
P.O. Box 11488
Santurce, PR 00910-1488

Surface Water Quality

Water quality analyses conducted during 1984 and 1985 indicated that most surface waters in Puerto Rico are affected by fecal coliforms and low levels of dissolved oxygen. Of 2,243 stream miles assessed, 13 percent supported designated uses, 48 percent partially supported uses, and 39 percent did not support designated uses. Nonpoint sources were determined to be the leading cause of use impairment, affecting 63 percent of impaired stream miles; municipal sources affected 21 percent, industrial sources affected 11 percent, and the sources in the remaining stream miles were unknown.

Most of the lakes in Puerto Rico have eutrophication problems caused by nutrient loads from point sources (principally municipal sewage treatment plants) and nonpoint sources such as livestock enterprises and other agricultural activities. Common problems found in these eutrophic lakes are the presence of water hyacinths and other aquatic weeds; reduction of storage capacity due to siltation; turbidity; and lack of suitable bathing areas. Of the 7,250 lake acres assessed for support of designated uses, 18 percent were fully supporting, 46 percent were partially supporting, and the remainder were not supporting designated uses. Nonpoint sources were the cause of degradation in 46 percent of impaired waters, municipal sources were the cause in 17 percent, industrial sources in 11 percent, and unknown causes in 26 percent.

Sixty-six percent of 434 assessed coastal miles in Puerto Rico were fully supporting uses in 1984-85, 5 percent were partially supporting uses, and 29 percent were not supporting uses. Municipal sources were the leading cause of use impairment in Puerto Rico's coastal miles, affecting 43 percent of degraded waters; nonpoint sources affected 41 percent, industrial sources affected 14 percent, and causes in the remaining coastal waters were unknown.

Ground-Water Quality

Twenty-two percent of the water used in Puerto Rico comes from ground-water sources. Because of the use of ground water for public water supplies, four ground-water quality studies have been conducted between 1981-1985. These studies provide island-wide baseline data and reveal the presence of bacteriological, inorganic, and organic contaminants. Major sources of ground-water contamination in Puerto Rico are industrial spills and underground storage tanks, landfills, modified sinkholes, septic tanks, agricultural activities, and excess withdrawal/saltwater intrusion.

The main goal of Puerto Rico's ground-water program is to establish water quality standards to protect classified ground-water uses. Measures to protect ground-water quality in Puerto Rico include restrictions on underground injection and sinkhole discharges, establishment of a permit system for septic tanks and underground storage tanks, and requirements for integrity tests and leak detection systems for underground storage tanks.

RHODE ISLAND

For a complete copy of the Rhode Island 305(b) report, contact:

Rhode Island Department of Environmental Management
83 Park Street
5th Floor
Providence, RI 02903

Surface Water Quality

Rhode Island's overall quality is good and has been maintained over the last two years. Ninety percent (655 miles) of the State's river and stream miles, 97 percent (16,520 acres) of lakes and 91 percent (234 square miles) of estuaries/oceans support designated uses. However, only 81 percent of river and stream miles are fishable/swimmable, while 97 percent of the lakes and 94 percent of the estuaries/oceans are fishable/swimmable (Rhode Island fresh and salt water designations include Class C, which is fishable but not swimmable).

The top five causes of nonsupport are coliforms, dissolved oxygen, toxics, nutrients, and pH. In 1982, 1983, and 1985, priority pollutant scans of major industry and municipality effluents showed nickel, copper, and zinc at levels potentially hazardous to aquatic life, while cadmium, chromium, lead, mercury, silver, and cyanide levels appeared to warrant further study.

The major sources of nontoxic concerns are combined sewer overflows, urban runoff pollution, and septic system pollution. While more vigorous enforcement of septic system violations would abate some septic system pollution, an integrated program is needed that combines proper management, design, and siting of new development, repair and replacement of septic systems where possible, and extension of sewer lines where necessary.

The top five special concerns in Rhode Island are funding wastewater treatment facilities; municipal facilities' operation and maintenance; maintaining water quality in light of population shifts and industrial growth; toxics in general, and, specifically the toxicity of chlorinated compounds in wastewater treatment facility effluents; and algae blooms in Narragansett Bay.

Rhode Island is delegated to administer the construction grants program and the NPDES permit program. Since the delegation, permit backlogs have dropped from 100 to 10. Major construction to upgrade wastewater treatment facilities remains to be done in seven Rhode Island communities. In addition, four communities have combined sewage overflow (CSO) problems. The largest CSO problem is in Providence, where the Narragansett Bay Commission has undertaken a program of comprehensive study and abatement of CSO discharges. Pretreatment regulations were adopted by the State in 1984. Under these regulations, 13 publicly owned treatment works have been designated as control authorities; 12 pretreatment programs have been approved to date.

Ground-Water Quality

Ground-water resources supply 15 percent to 30 percent of the State's population. The quality of Rhode Island's ground water is good to excellent. Major sources of contamination include surface impoundments of liquid industrial, agricultural, and municipal wastes; solid waste landfills; hazardous waste disposal sites; leaking underground fuel storage tanks; septic systems and cesspools; road salt storage practices; and oil and chemical spills.

In 1985, the Rhode Island General Assembly passed a ground-water protection act which established broad protection policies for the ground waters of the State. The Division of Water Resources regulates the Underground Injection Control Program, the Underground Storage Tank Program, and has prepared draft regulations for the location and design of salt storage facilities. All of the State's ground water will be classified into four classes and water quality standards will be developed for each classification.

In 1985, the Division responded to more than 180 complaints involving possible contamination of ground water and took cleanup action in 50 major cases. The Division also began a year-long study in 1985 to evaluate ground-water quality associated with eight categories of land use.

SOUTH CAROLINA

For a complete copy of the South Carolina 305(b) report, contact:

South Carolina Department of Health and Environmental Control
Water Quality Planning and Standards Section
2600 Bull Street
Columbia, SC 29201

Surface Water Quality

South Carolina reports that 2,442 river and stream miles were assessed in 1984 and 1985. Of these, 86 percent fully supported designated uses, 8 percent partially supported uses, and 5 percent failed to support their uses. Pollution from municipal wastewater discharges and nonpoint sources contributed most to lowered water quality and partial or non-attainment of classified uses in the State's rivers.

Ninety-seven percent of the State's 405,555 assessed lake acres were fully supporting designated uses during the reporting period. Two percent partially met uses, and one percent did not support designated uses. In lakes, municipal and industrial wastewater discharges contributed most to lowered water quality and partial or non-attainment of State classified uses.

Of the State's 384 assessed tidal saltwater square miles, 89 percent fully supported uses, 4 percent partially supported uses, and 7 percent did not support designated uses. Pollution from nonpoint sources was the primary cause of degraded water quality conditions.

Total phosphorus concentrations were exceeded more often than other standards, criteria, or guidelines in the State's lakes and rivers. Phosphorus probably originates from municipal waste discharges as well as runoff from nonpoint sources.

Toxic pollutants are not widespread in South Carolina waters. Less than 10 percent of freshwaters had heavy metals in concentrations that exceeded EPA criteria recommended to protect aquatic life. Although more than 50 percent of saltwaters had metals in concentrations which exceeded these EPA criteria, the occurrence of the metals had no apparent adverse effects on the aquatic community and some occurrences have since been attributed to analytical interference. PCBs, pesticides, and organics were not detected in the water column at any location in the trend monitoring network. However, toxics were detected at certain sites chosen for special studies.

Department of Health and Environmental Control (DHEC) approval and implementation of industrial waste pretreatment programs for publicly owned treatment works have improved water quality by reducing toxic discharges from these facilities. Most point source agricultural waste discharges have been eliminated through the issuance of State construction permits that require alternate non-discharging treatment systems.

Implementation of a State Municipal Strategy has improved the municipal waste treatment facilities permit compliance record. The DHEC has issued orders placing all publicly owned treatment works not meeting final permit conditions on schedules to assure compliance with final effluent limits by July 1988. The DHEC also plans to accelerate enforcement activity in the areas of operation and maintenance and pretreatment compliance.

South Carolina's nonpoint source control strategy includes regulatory and voluntary programs. DHEC is involved in nonpoint source pollution control through water quality certification of Federal permits (mostly Army Corps 404 permits) as required by Section 401 of the Clean Water Act; stormwater control requirements on some NPDES and construction permits for wastewater treatment facilities; and "best management practices" requirements to control oil and hazardous and toxic substances at industrial facilities. Numerous State and local agencies are involved in nonpoint source control programs.

Ground-Water Quality

The overall quality of ground-water in South Carolina is excellent. There are, however, 156 instances of localized ground water contamination where contaminants exceed drinking water standards. Contamination sources have been diverse and include industrial and agricultural activities, accidental spills and leaks, and municipal waste disposal. Except for certain waste-disposal sites and industrial sites that require ground-water montoring under existing permitting regulations, the detection of ground-water contamination has been nonsystematic and has often involved citizen reporting. The DHEC has made an effort to educate the public about ground-water contamination. The Department has attempted to minimize ground-water contamination by requiring the licensing of well drillers, establishing well construction standards, and regulating underground storage tanks.

SOUTH DAKOTA

For a complete copy of the South Dakota 305(b) report, contact:

South Dakota Department of
Water and Natural Resources
Office of Water Quality
Joe Foss Building
Pierre, SD 57501

Surface Water Quality

South Dakota has a total of 9,937 miles of rivers and streams. Of these, 3,987 miles have been assessed for water quality. Currently, 47 percent of these assessed waters are fully supporting their assigned beneficial uses, 28 percent are partially supporting uses, and 25 percent are not supporting their uses. Nonsupport of designated uses is caused by the following factors: natural conditions (49 percent), nonpoint sources (34 percent), inadequate municipal wastewater treatment (9 percent), industrial discharges (4 percent), and unknown sources (4 percent).

Water quality seems to have been maintained or slightly improved, even though comparisons between the 1984 and 1986 designated use support percentages and stream impairment rankings may seem to indicate otherwise. Unusually high amounts of precipitation throughout much of the State had a distinct effect on water quality during 1984 through 1986. The Cheyenne, White, Grand, and Moreau Rivers showed drastic increases in total suspended solids concentrations due to the highly erosive nature of the soils located within these basins. Fecal coliform concentrations fluctuated with runoff events and dilutional flows.

Approximately 41 stream miles were improved during the reporting period due to EPA construction grants program projects. A total of 66 communities have completed EPA-funded wastewater treatment facilities; this has contributed tremendously to improved water quality.

In addition to rivers and streams, South Dakota has 799 lakes and reservoirs totalling 1,003,987 acres. Approximately 98 percent of use impairment for lakes can be attributed to nonpoint sources. Natural events account for the remaining 2 percent. Roughly 57 percent of the total lake acres assessed support their designated uses; 55 percent of this total are threatened. Only 0.5 percent of lakes partially support uses, 8 percent do not support uses, and 35 percent are unknown.

Most lakes in the State are characterized as eutrophic to hypereutrophic. Runoff, carrying sediments and nutrients from agricultural land, is the major nonpoint pollution source. Smaller lakes are more severely affected by nonpoint sources than larger lakes, which have so far been able to withstand these pollution sources.

Ground-Water Quality

Ground water is of highly variable quality but is generally suitable for domestic, industrial, and agricultural (including irrigation) uses. Many of the deeper aquifers contain higher concentrations of dissolved salts. Shallow aquifers are easily contaminated. Ground-water degradation results from improperly located and/or constructed wastewater treatment lagoons, septic systems, feedlots, landfills, leaking artesian wells, improperly sealed or placed wells, and hazardous materials spills.

Potential ground-water contamination incidents have increased substantially over the last ten years. This is primarily due to increased public awareness and reporting requirements. Over 13 percent of spilled substances such as petroleum products and fertilizers entered ground water or had the potential to do so.

Ninety-three percent of the State's 908 public drinking water systems (PWS) are drawn totally from ground-water sources. Many of these PWS do not meet federally recommended criteria for dissolved solids (287 PWS), chloride (27 PWS), sulfate (210 PWS), iron (210 PWS), manganese (265 PWS), and sodium (325 PWS). These constituents are all naturally occurring, as are fluorides. Twenty-five PWS exceed the standard for fluoride, five exceed the standard for nitrate, and one exceeds the standard for triohalomethanes.

South Dakota is aggressively attacking ground-water pollution. Ongoing ground-water projects include: the Oakwood/Poinsett Rural Clean Water Project; petroleum brine pits studies; a test hole plugging study; assumption of the Underground Injection Control, Resource Conservation and Recovery Act, and Underground Storage Tanks programs; and cleanup activities from hazardous materials spills.

TENNESSEE

For a complete copy of the Tennessee 305(b) report, contact:

Tennessee Department of
Health and Environment
Office of Water Management
T.E.R.R.A. Building
150 Ninth Ave, North
Nashville, TN 37219-5404

Surface Water Quality

Overall, Tennessee has good water quality, with 66 percent of assessed stream miles supporting designated uses. This assessment was based on the streams' ability to meet established criteria for the fish and aquatic life, recreation, and water supply classifications. Twenty percent of the assessed stream miles supporting uses are threatened with potential water quality impairment in the future. Nineteen percent of assessed stream miles are moderately impaired. Fifteen percent are severely impaired and do not support designated uses.

The largest single cause of nonsupport in Tennessee streams is surface mining, both active and abandoned sites. Major pollutants emitted by surface mines include acidity, sediment, and toxic materials. In certain areas of the State, water quality in entire watersheds has been destroyed. Most aquatic degradation caused by surface mining is concentrated in the Cumberland Plateau region of the State.

Other pollution sources

causing nonsupport in Tennessee streams are: agricultural runoff, municipal discharges, industrial discharges, hydrologic modification, land disposal, and urban runoff. Nonpoint sources (surface mining, agricultural runoff, hydrologic modification, and land disposal) account for 76 percent of the total stream degradation in Tennessee.

Of the 538,603 lake acres in Tennessee, 70 percent are considered to be fully supporting designated uses. Ten percent of the total lake acres supporting uses are threatened with future use impairment. Seventeen percent are currently moderately impaired. Three percent of lake acres are severely impaired and do not support designated uses.

Small lakes (less than 1,000 surface acres) were subjected to further evaluation, since they tend to have different water quality problems than do large reservoirs. Most of these reservoirs are managed by State or municipal agencies. Only 42 percent of these small lakes currently fully support designated uses.

Eutrophication causes 74 percent of the nonsupport in Tennessee lakes. Other reasons for nonsupport in Tennessee lakes are low dissolved oxygen, fecal coliform contamination, toxic materials, low pH, and sediment.

Almost half of the nonsupporting acres in Tennessee lakes have agricultural runoff as a source of pollution. Other important sources of pollutants causing nonsupport in lakes are urban runoff, hydrologic modification, municipal discharges, surface mining, land disposal, malfunctioning septic tanks, artificial fertilization, and industrial discharges. In lakes less than 1,000 acres, artificial fertilization is by far the largest source of nutrients and the leading cause of eutrophication.

Ground-Water Quality

Ground-water quality is very good statewide. Ground-water contamination problems appear to be localized. Between 1980 and 1984, contamination was discovered in 91 private wells, 10 public wells, and one industrial well. This amounts to a negligible percentage of the ground water in Tennessee.

Suspected major sources of ground-water contamination in Tennessee include septic tanks, underground storage tanks, land application/treatment, and municipal landfills. Although there is no known, widespread ground-water contamination in the State, the increasing potential for contamination is a concern. A Ground-Water Management Strategy is currently being developed by the State to provide long-term protection for Tennessee's ground-water resources.

TEXAS

For a complete copy of the Texas 305(b) report, contact:

Texas Water Commission
Water Quality Division
P.O. Box 13087
Capitol Station
Austin, TX 78711-3087

Surface Water Quality

Of the 15,942 classified stream miles in Texas, 1,110 miles (7 percent) are not currently considered fishable and swimmable, and 976 miles (6 percent) do not meet segment-specific standards. In comparison with historical water quality, these figures indicate that water quality in the State is being maintained, and in some cases improved, despite a rapidly increasing population. Approximately 70 percent of the 1,110 stream miles rated unsuitable for fishing and swimming are adversely affected by six major metropolitan areas: Houston, Dallas-Fort Worth, San Antonio, Austin, the Rio Grande Valley Cities, and Beaumont-Port Arthur. Major improvements in sewage treatment facilities are planned or underway for these areas.

Approximately 71 percent of the stream miles that are not achieving designated uses in Texas are affected primarily by dissolved oxygen depletion and elevated fecal coliform levels caused by discharges of treated domestic sewage. An additional 4 percent of use impairment is caused by dissolved oxygen reduction due to industrial discharges. The remaining impaired surface waters are affected by a combination of impacts from multiple or undetermined sources including nonpoint sources and natural conditions. Nonpoint sources have been estimated to impair uses in only 133 stream miles. Designated uses in an additional 372 stream miles were considered threatened but not impaired by nonpoint sources.

Concerns for health and aquatic life have prompted an expanded program of toxic monitoring and regulation for surface waters. Although definitive cases of use impairment due to toxic pollution are rare, the large number of permitted industrial discharges in Texas (737 as of February 1986) underscores the need for a strong surveillance program. The Texas Water Commission is developing a more comprehensive strategy for implementing toxic controls. The initial steps of this strategy will include increased monitoring and control of effluent toxicity, a review and expansion of statewide surface water monitoring, and a new series of intensive priority pollutant surveys in selected surface waters.

Ground-Water Quality

Approximately 75 percent of the total water used by Texans for domestic, municipal, industrial, and agricultural purposes is supplied by ground-water sources. A major form of ground-water contamination is saltwater intrusion from natural sources. Saline conditions are sometimes aggravated by ground-water withdrawals. In the past, oil and natural gas extraction activities have been suspected of causing saline contamination in some areas. Improvements in brine disposal, well-plugging, and underground injection procedures have reduced these problems in recent petroleum operations.

A ground-water quality monitoring network consisting of some 5,827 observation wells is currently maintained by the Board with approximately 750 wells being sampled annually for the common constituents of natural ground water. Local, regional, and other State and Federal agencies are also involved in additional monitoring of the quantity and quality of Texas' ground-water resources.

UTAH

For a complete copy of the Utah 305(b) report, contact:

Utah Bureau of Water Pollution Control
Division of Environmental Health
288 North 1460 West
P.O. Box 16690
Salt Lake City, UT 84116-0690

Surface Water Quality

Data analyzed from October 1983 through September 1985 generally indicate that total phosphate levels are moderately exceeding the criteria for assigned beneficial uses statewide. Increases in total phosphates are attributed to increased amounts of overland flow and inundation of vegetated areas. Total phosphates come from natural, agricultural, construction, recreation, mining, and municipal sources. Minerals containing phosphorus are natural sources of total phosphates. Phosphate fertilizers contribute total phosphate to stream systems from overland runoff where these fertilizers have been applied. Phosphorus is also a component of domestic wastewater and is carried through the treatment process.

Point sources of pollution can present water quality problems anywhere they are located, but are usually more significant in highly populated areas. An example in Utah is Jordan River in Salt Lake Valley. Regionalization of wastewater treatment facilities will provide high levels of treatment to maintain and improve downstream water quality in the Jordan River.

Many of the remaining water quality problems in Utah result from nonpoint sources rather than point source discharges. Nonpoint sources of pollution include natural geologic formations, failing individual wastewater disposal systems, urban sources, hydrologic modifications, agriculture, mining, recreation, construction, and silviculture. Natural sandstone formations in eastern and southern Utah contribute significant amounts of sediments through erosion. Natural deposits of salts, phosphates, fluorides, nutrients, and arsenic also contribute to water quality degradation in certain areas of the State.

Salinity will remain a water quality problem in Utah. High runoff has decreased total dissolved solid concentrations, but increased flows have increased total loadings to the Colorado and Sevier River systems. Salinity control projects have been implemented in the Uinta, Duchesne, Price, San Rafael, and Dirty Devil River Basins.

The Utah State Wastewater Loan Program was established by the State Legislature in 1983 in recognition of, and to offset, Federal funding shortfalls, increasing wastewater facility needs, and prevailing high bonding interest rates. The program provided a total of $20 million for the Water Pollution Control Committee to loan to communities and sewerage districts for constructing needed wastewater facilities. The Utah State Wastewater Credit Enhancement Agreement Program was also established by the State Legislature in 1983. The program will permit the State of Utah to enter into agreements with communities to improve the security and marketability of wastewater project obligations.

Ground-Water Quality

Utah's ground-water resources are important to the health and economic well-being of the State's citizens. Ground water furnishes about 20 percent of the State's total water needs. About two-thirds of the State's population is dependent on ground water as a source of public water supply.

Several independent programs monitor ground-water quality in Utah. Utah has developed a Ground-Water Quality Protection Strategy that reviews facts about ground water, describes government programs that affect ground water, and discusses potential sources of ground-water pollution. The strategy also provides management proposals for public consideration and comment. The purpose of these proposals is to generate discussion and provide a framework for a carefully crafted protection program. The public's comments will be used in the development of this ground-water protection effort.

VERMONT

For a complete copy of the Vermont 305(b) report, contact:

Vermont Agency of
Environmental Conservation
103 S. Main Street
Waterbury, VT 05676

Surface Water Quality

The water quality of Vermont's streams and lakes remains high and continues to improve, primarily due to continued wastewater treatment facility upgrading and construction. Of the 1,167 segmented river miles assessed (those rivers and streams watched closely due to potential impacts, primarily from point source pollution discharges), 76 percent support their designated uses, 99 percent meet fishable criteria, and 73 percent meet swimmable criteria.

The sources of pollution causing less than full support of water uses in Vermont's stream segments are nonpoint sources (50 percent), municipal discharges (22 percent), industrial discharges (11 percent), natural sources (11 percent), and other sources (6 percent). Nonpoint sources are primarily from land-based activities such as agriculture, forestry, mineral extraction, and development. Affected stream segments from hydropower dams are also included. Municipal sources include direct discharges from malfunctioning sewage treatment facilities, combined sewer overflows, stormwater, and untreated sewage. Industrial discharges are poorly or untreated industrial wastes, including toxics and wastes from other States. Natural sources include natural sloughing of stream banks into the water and unshaded shallow, slow-moving streams causing thermal pollution. Other sources are discharges from failed individual and commercial sewage treatment systems and untreated or poorly treated wastes from dairy plants.

The most common parameters of concern for Vermont's rivers and streams are sand/silt and fecal coliform bacteria. Violations of water quality standards for these parameters account for approximately 140 miles of the State's 285 miles of streams where standards are violated. They originate primarily from treated and untreated municipal and private wastes and nonpoint sources.

Vermont has a total lake acreage of 224,066 acres. Of this figure, 210,907 acres fully support their uses. All but 45 acres, or 99.9 percent, meet fishable/swimmable criteria. Based on measured springtime phosphorus concentrations, Vermont has 5,225 acres of eutrophic lakes, 9,730 acres of mesotrophic lakes, and 21,099 acres of oligotrophic lakes. The trophic status of the balance of 188,012 acres is unknown. Of the State's estimated 200,000 acres of wetlands, 60-70 acres are being lost each year due to filling, draining, dredging, and various other construction projects.

Nutrients, pH, and bacteria are the three major pollutant groups of concern in lakes and ponds. Approximately 70 percent of this pollution comes from nonpoint sources and the remainder from municipal combined sewer overflows and internal recycling of past nutrient loads to the lake. Acid rain appears to be the source of the high pH and loss of fish life in two southern lakes.

Ground-Water Quality

Ground water serves as the source of drinking water for approximately 55 percent of the State's population. Vermont's ground water has relatively few contamination problems compared to more populous industrial States. However, the State does have some ground-water problems, most of which are site-specific. Leaking underground storage tanks and spills containing petroleum products and solvents have contaminated approximately 50 wells, and approximately 40 wells have elevated levels of sodium and/or chloride. This has been caused by the use or storage of rock salt for roadway de-icing. Approximately 500 wells have varying levels of contamination due to their locations adjacent to salted roads or storage facilities. Fewer than ten wells have been identified as contaminated by fertilizers and/or septic systems. However, the suspected number of cases is on the order of 300 statewide. In order to prevent or mitigate future contamination problems, recently passed legislation requires the State to develop a comprehensive ground-water protection program.

VIRGIN ISLANDS

For a complete copy of the Virgin Islands 305(b) report, contact:

VI Department of Conservation
and Cultural Affairs
Division of Natural Resources
Management
P.O. Box 4340
Charlotte Amalie,
St. Thomas, VI 00801

Surface Water Quality

Water quality in the Virgin Islands has not significantly degraded in the past several years despite an increase in construction along the coastline. The exception to this finding, however, is the continued deterioration of the Mangrove Lagoon in St. Thomas.

Of the approximately 34 square miles of Virgin Islands coastal waters, 31 support designated uses, 1.5 partially support uses, and 2 do not support uses. Major causes of use impairment are municipal/domestic sources and nonpoint sources. Major parameters of concern are fecal coliform bacteria, turbidity, and dissolved oxygen.

An increase in heavy construction for major hotels on the coasts of the three main islands is expected to increase nonpoint source problems. Since these projects are not near main sewer lines, Territorial Pollution Elimination Discharge System (TPDES) permits may need to be issued for treatment and discharge of sewage into the open ocean.

Special concerns cited in this report include a need for improved monitoring in sensitive marine ecosystems; vulnerability to flooding and attendant nonpoint source problems; program funding; and saltwater contamination of ground-water supplies.

Ground-Water Quality

Some ground-water contamination occurs in the Virgin Islands, primarily in the form of elevated chloride concentrations caused by saltwater intrusion.

Nitrates and non-significant contaminants are also reported. An underground storage tank in St. Croix recently leaked about 900 gallons of low octane gasoline; efforts are underway to verify if ground-water contamination occurred. Broken sewer lines are another significant source of ground-water contamination.

VIRGINIA

For a complete copy of the Virginia 305(b) report, contact:

Virginia State Water Pollution
Control Board
Bureau of Water Control
Management
2111 North Hamilton St.
Richmond, VA 23230

Surface Water Quality

Virginia's surface waters generally meet or exceed water quality standards for dissolved oxygen, pH, and temperature. Natural conditions were primary reasons for noncompliance with these three standards.

Fecal coliform bacteria data present a different picture. The stringent fecal coliform bacteria standard, which applies to all Virginia waters, is intended to protect primary contact recreational uses (e.g., swimming). Waters at an estimated 48 to 75 percent of the State's monitoring stations failed to meet this standard, and about 3,400 stream miles statewide were estimated to have bacteria problems. Agricultural nonpoint sources, including animal waste runoff, accounted for about half of the miles affected (53 percent). Municipal point sources accounted for about 36 percent of the total miles. The majority of these miles affected by domestic sewage were located in southwestern Virginia, where many thousands of individual homes discharge directly to streams.

Virginia has about 129,600 acres of publicly owned lakes and reservoirs. The vast majority of lake acres—91 percent—fully meet designated uses. Seven percent of the State's lake acreage was affected by moderate pollution problems. Nonpoint source problems were the responsible cause in 98 percent of the affected acreage.

The State reports on three fishing advisories or bans in effect during this reporting period. One hundred and thirteen miles of the James River estuary are subject to seasonal commercial fishing restrictions due to contamination by the pesticide Kepone. However, sport fishing is allowed. In the North Fork Holston River, 81 miles are restricted to catch-and-release fishing due to mercury pollution. Lastly, 102 miles of the South River and the South Fork of the Shenandoah River are under a fish consumption health advisory due to mercury pollution.

Ground-Water Quality

Ground water accounts for approximately 22 percent of the water used in Virginia for purposes other than hydroelectric and thermoelectric uses. Eighty percent of Virginians use ground water either as their only water supply or as part of their supply.

Contamination of major aquifers in Virginia is not a serious problem. Most ground-water pollution incidents contaminate finite areas near the spill or accident. There are more than 500 documented cases of contamination incidents and approximately five new cases are added per month. Most of these are leaking underground tanks and associated piping. As this type of incident increases, an ever-increasing percentage of ground-water resources becomes contaminated. Once contaminated, the area within the plume is normally considered unusable for the foreseeable future.

Ground-water depletion incidents and well interference problems are found mainly in the eastern part of the State and are localized. Virginia's Ground-Water Act of 1973 was passed to control increased industrial demands on major aquifers in this area. In the future, as more information becomes available on geological and ground-water conditions in eastern Virginia, changes in the Act will be recommended to make it more effective.

Virginia plans to move ahead in designing new programs and maintaining existing ones to effectively manage ground-water resources. The State is in the process of developing and implementing a ground-water protection strategy. Specific ground-water program activities in Virginia include ground-water quality monitoring, a study of saltwater intrusion problems, complaint investigations, and disposal site evaluations. An underground storage tank program is being planned.

WASHINGTON

For a complete copy of the Washington 305(b) report, contact:

Washington Department of Ecology
Water Quality Management Division
Mail Stop PV-11
Olympia, WA 98504

Surface Water Quality

Of 160 river segments in Washington, 65 were found to be meeting the "fishable/swimmable" goal. In 48 segments, failure to meet the goal was attributed to natural or irreversible causes; in 7 segments, it was attributed to point sources, and in 39 to nonpoint sources. Primary parameters of concern in Washington's rivers include fecal coliform bacteria, temperature, turbidity, and nutrients.

Trophic status was assessed for 140 lakes totalling 288,830 acres. Fifty-eight lakes were determined to be oligotrophic, 24 lakes were mesotrophic, 45 were eutrophic, and 13 lakes were unknown. Nonpoint sources, primarily agriculture, were the cause of trophic problems in Washington's lakes.

A total of 56 marine segments were assessed. Of these, 31 were meeting the "fishable/swimmable" goal. Failure to meet the goal in marine waters was attributed to fecal coliform bacteria, and, to a far lesser extent, to dissolved oxygen, turbidity, and toxicity.

In the late 1970s, more attention was shifted to nonpoint source problems as many point source problems were being corrected. A subjective evaluation of the relative significance of nonpoint source problems in Washington resulted in the following priorities: agriculture (irrigated agriculture, dryland agriculture, and dairy waste management), silviculture, on-site disposal, and urban runoff.

More recently it has become necessary to undertake a renewed effort to regulate municipal and industrial discharges. Washington's municipal policy provides for compliance with Federal and State wastewater treatment requirements regardless of the availability of construction grants funds. Implementation of this policy has been identified as a high priority. Implementation of Best Available Technology requirements for the control of toxics discharges by industries also has been identified as a high priority.

Ground-Water Quality

Ground-water quality is being assessed on a local and regional basis. Collection of available data on concentrations of nitrates, chloride, total dissolved solids, synthetic organic compounds, metals, and naturally occurring contaminants is an ongoing effort that was given priority during FY 1986.

Priority ground-water quality problem areas identified for FY 1987 include Chambers/Clover Creek, the Spokane-Rathdrum Prairie, South King County, Island County, Vashon Island, Kitsap County, and the aquifers serving Gig Harbor, Redmond, and Issaquah.

The Washington Department of Ecology will complete a ground-water quality management strategy in early FY 1987. The purpose of the strategy is to provide a comprehensive approach to ground-water quality protection. Work has also begun on a statewide aquifer mapping project that will show geology, aquifer zones, water availability, and yields.

WEST VIRGINIA

For a complete copy of the West Virginia 305(b) report, contact:

West Virginia Department of Natural Resources
Water Resources Division
1201 Greenbriar St.
Charleston, WV 25311

Surface Water Quality

Of the approximately 22,000 stream miles in West Virginia, 18,244 miles were assessed using data from various sources and the judgment of State biologists and inspectors. Only 6 percent (1,388 miles) of the assessed streams did not support their designated uses. Another 29 percent (6,631 miles) were found to partially support their uses. Designated uses were fully supported in 45 percent (10,225 miles) of the assessed streams. About 20 percent were not assessed. Major reservoirs were also evaluated and, of the 16,158 acres assessed, only 11 percent (1,798 acres) did not support designated uses. The major causes of nonsupport were identified as mine drainage, sewage, and nonpoint sources. Comparison of current data with that in earlier reports showed very little change in water quality during the last few years.

In order to describe more specific problems, the State was divided into seven major river basins and 50 subbasins. The bacteria standard continued to be violated almost 100 percent of the time in the Big Sandy/Tug Fork and Guyandotte basins. Acid mine drainage problems were found primarily in the Monongahela Basin. Nonpoint sources affected water quality in most of the State but were a particular problem in the Little Kanawha and parts of the Kanawha basins. Organics were also a potential problem in the Kanawha. Dioxin, PCBs, and chlordane were found in fish flesh, although the levels were very low. Work is continuing to analyze the problem and locate possible sources.

Specific State water quality concerns in West Virginia include possible acidification of the Buckhannon River Basin, use of ammonia in the treatment of mine drainage, continued development of the oil and gas general permit, continuing abandoned mine drainage problems, adverse impacts on wetlands, development of a State ground-water strategy, development of a State sludge management strategy, and impacts and control of nonpoint sources.

Ground-Water Quality

Although ground water in West Virginia is generally of good quality, in most parts of the State it was found to be naturally hard and to contain elevated levels of iron and manganese. Major contamination problems in the central and western parts of the State included acid mine drainage and salt water intrusion caused by oil and gas well drilling operations. In the karst areas of the east, pollution problems from animal feedlots, domestic septic tanks, and other nonpoint sources were the principal concerns.

At present, there is no indication that contamination by synthetic organic compounds is a serious threat to water quality, although there is a potential for damage from accidental spills and nonpoint sources.

Based on U.S. Geological Survey data, drainage basins were ranked according to ground-water quality. The Gauley River Basin ranked the highest and the Guyandotte the lowest.

WISCONSIN

For a complete copy of the Wisconsin 305(b) report, contact:

Wisconsin Department of
Natural Resources
Bureau of Water Resources
P.O. Box 7921
Madison, WI 53707

Surface Water Quality

Water quality in Wisconsin has improved significantly since 1972. In 1972, nearly 400 stream miles were not supporting their designated uses, primarily due to pulp and paper mill and municipal wastewater treatment plant discharges. Currently, about 70 stream miles are not supporting designated uses due to point sources. However, significant problems remain to be addressed. Nonpoint sources affect about 30 percent of Wisconsin's stream miles, 40 percent of lake surface acres, and 25 percent of Great Lakes shoreline miles. An increasing number of toxic substances are being detected in the aquatic environment, including fish tissue and sediments.

The primary sources of nonsupport of designated uses are, in fact, nonpoint sources. Major nonpoint pollutant problems in streams include sediment, turbidity, oxygen-demanding material (e.g., barnyard runoff), and physical habitat alteration (e.g., dams, stream straightening). The major nonpoint source pollutants in lakes are sediments, turbidity, and plant nutrients (e.g., phosphorus, nitrogen) Agricultural activities are the most significant cause of nonpoint source impacts in the State.

The nature of water quality problems in the Great Lakes has changed over the past 15 years. Surface waters have improved considerably, particularly in levels of phosphorus and in the resulting adverse algae growths. To some extent, heavy metals such as mercury have also decreased as a result of control programs. These improvements are most evident in heavily used harbors and bays.

A major current concern is the presence of persistent toxic substances in the Great Lakes. Contaminated fish in some areas of the Great Lakes are one symptom of the larger problem of toxic substances that must be addressed. In addition, harbor sediments contaminated by toxic substances affect biological communities in harbors and act as a continuing source of contamination to the larger lake system.

Fish contaminant monitoring data for the Great Lakes generally show that levels of most contaminants are declining. However, health advisories remain in effect for certain species and size classes in all Great Lakes. Chemical contaminants are implicated in causing tumors in fish from certain rivers, harbors, and near-shore waters, and in causing deformities and reproductive impairment in several species of fish-eating birds.

Ground-Water Quality

Wisconsin relies heavily on its ground water. Ninety-four percent of the State's cities and villages and 67 percent of its residents use ground water for their drinking water. Agricultural and industrial activities are also dependent on ground-water supplies.

The contaminant most often tested for and most often found to exceed the State ground-water standard is nitrate. Nitrate can enter ground water from many sources, including nitrogen-based fertilizers, animal waste storage areas and feedlots, municipal and industrial wastewater, refuse disposal areas, and septic systems. Volatile organic chemicals are also a significant contamination problem, as are pesticides such as aldicarb.

The major sources of ground-water contamination in Wisconsin are landfills, industrial and commercial activities, pesticide application, and leaking underground petroleum storage tanks. While leaking petroleum storage tanks are the smallest of the major categories in percentage by source, petroleum constituents (namely benzene) have the highest toxicity level.

WYOMING

For a complete copy of the Wyoming 305(b) report, contact:

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Surface Water Quality

Generally, water quality in Wyoming remains good to excellent. Significant improvements have been made in reducing water quality impacts from municipal and industrial point sources. Additional progress in dealing with industrial and municipal wastes will be evident in the near future. Despite increased population growth throughout the State, water quality in the major river basins is improving or stable.

Wyoming reports that 17,386 river miles fully support their designated uses, 297 miles partially support uses, and 1,972 miles do not support designated uses. Of the State's 288,284 acres of assessed lakes and reservoirs, 235,016 fully support uses, 12,011 acres partially support uses, and 41,257 do not support designated uses.

Nonpoint sources are the leading anthropogenic cause of use impairment, affecting 43 percent of waters with impaired uses. Natural sources affect another 43 percent, industrial sources affect 10 percent, and municipal sources affect 4 percent.

Oil treaters are the most common industrial dischargers in Wyoming. Oil and grease and total dissolved solids are the primary contaminants associated with oil treatment facilities. Other industrial dischargers include coal and uranium mines. Because coal and uranium mining disturbs the land surface, erosion is a potential problem and may result in sediments entering surface waters.

In Wyoming, principal nonpoint pollutants are sediments (which often elevate turbidity values), total dissolved solids, and nutrients. The most significant nonpoint sources in Wyoming include crop and range lands, hydrologic modification, and land or resource-related development activities. The largest single contributor of nonpoint source pollution in Wyoming is erosion of rangelands and stream channels. Most of the rangeland erosion observed today is a result of past and present abuses including overgrazing, road construction, and other surface disturbances. Erosion from tilled and irrigated agricultural lands has been identified as locally important. The erosion from furrow irrigated row crops appears to have the largest impact. In addition, irrigation return flows laden with salt, silt, and nutrients are a threat to water quality. Channel erosion in irrigation return drains is significant in some areas.

Natural saline seeps underlying areas of irrigated agriculture are also a problem. Over-irrigation causes excess water to percolate into saline strata, reappearing as highly saline seeps some distance away. These saline seeps affect surface water quality and can prevent the use of water for public water supply, irrigation, and even livestock watering.

Ground-Water Quality

Approximately 65 percent of Wyoming's population depends on ground water as the source of its domestic water. The State's livestock industry is heavily dependent on ground water. The energy industry uses ground water in power generation, secondary and tertiary oil recovery, and uranium mining and processing. Although the amount of ground water used for irrigation is small in comparison with the amount of surface water used, it still accounts for almost half of the State's total ground-water use.

The ambient ground-water quality of the State's aquifers varies tremendously. High concentrations of fluoride appear to be the most widespread problem for Wyoming's drinking water aquifers. All basins have some wells showing levels of fluoride that exceed primary standards in at least one major aquifer. Selenium is also a fairly widespread problem. It should be emphasized, however, that these problems are local in nature and appear to result from natural conditions.

Most basins display some exceedances of the nitrate standard. These are usually detected in shallow wells and are thought to be man-caused.

Fertilizer and irrigation practices, septic tank leach fields, and livestock feedlot operations are known contributors of nitrates to shallow ground water. Small leaks in underground storage tanks pose a common pollution problem and contribute petroleum hydrocarbons and chemicals.

Wyoming's booming energy industry is rapidly creating other potential sources of aquifer contamination. At present, there are roughly 4,000 petroleum-related injection wells, 350 in situ uranium injection wells, and 400 underground coal gasification injection wells in the State. Other potential contamination sources include oil refineries and proliferating septic tank/leach fields.

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