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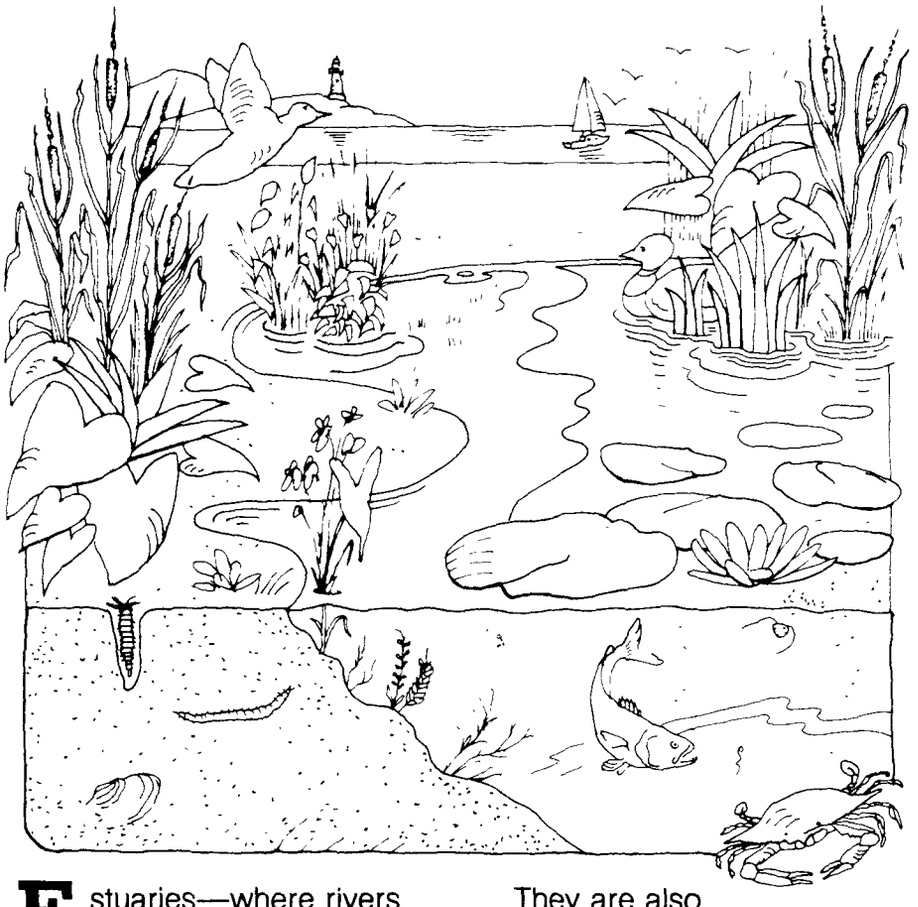
United States
Environmental Protection
Agency

Office of Water

National Estuary
Program

Saving Bays and Estuaries: A Handbook of Tactics

Introduction



Estuaries—where rivers meet the sea, and fresh water mixes with salt—are among the earth's richest and most productive habitats. They serve as the principal spawning grounds and nurseries for at least two-thirds of our Nation's commercial fisheries, provide irreplaceable recreational and aesthetic enjoyment, and are home to valuable and diverse species of fish, shellfish, and wildlife.

They are also home to people. Already, 70 percent of the U.S. population lives within 50 miles of a coastline, and that number is growing. But with people comes pollution, and our estuaries are clearly in trouble, threatened by toxic and bacterial contamination, sewage discharges and agricultural runoff, oxygen-depleted waters, and loss of fish and wildlife habitat.

Learning Through The National Estuary Program

There are no easy answers to these problems, but we have learned some lessons. One is that estuaries are complex ecological systems with subtle dependencies among many species and habitats. If conditions change in one area, they will also change in others. In estuaries, there are very few purely local effects.

We've also learned that conventional, "end-of-pipe" pollution controls are not enough. Agricultural runoff and other nonpoint sources contribute pesticides and excess phosphorus and nitrogen to bays hundreds of miles away; the wind carries in toxics that contaminate bottom sediments in otherwise pristine waters. Yet how do we regulate homeowners who put too much fertilizer on their lawns? How does one State control air pollutants coming from another State on the other side of the country?

Finally, we've learned that saving our estuaries and

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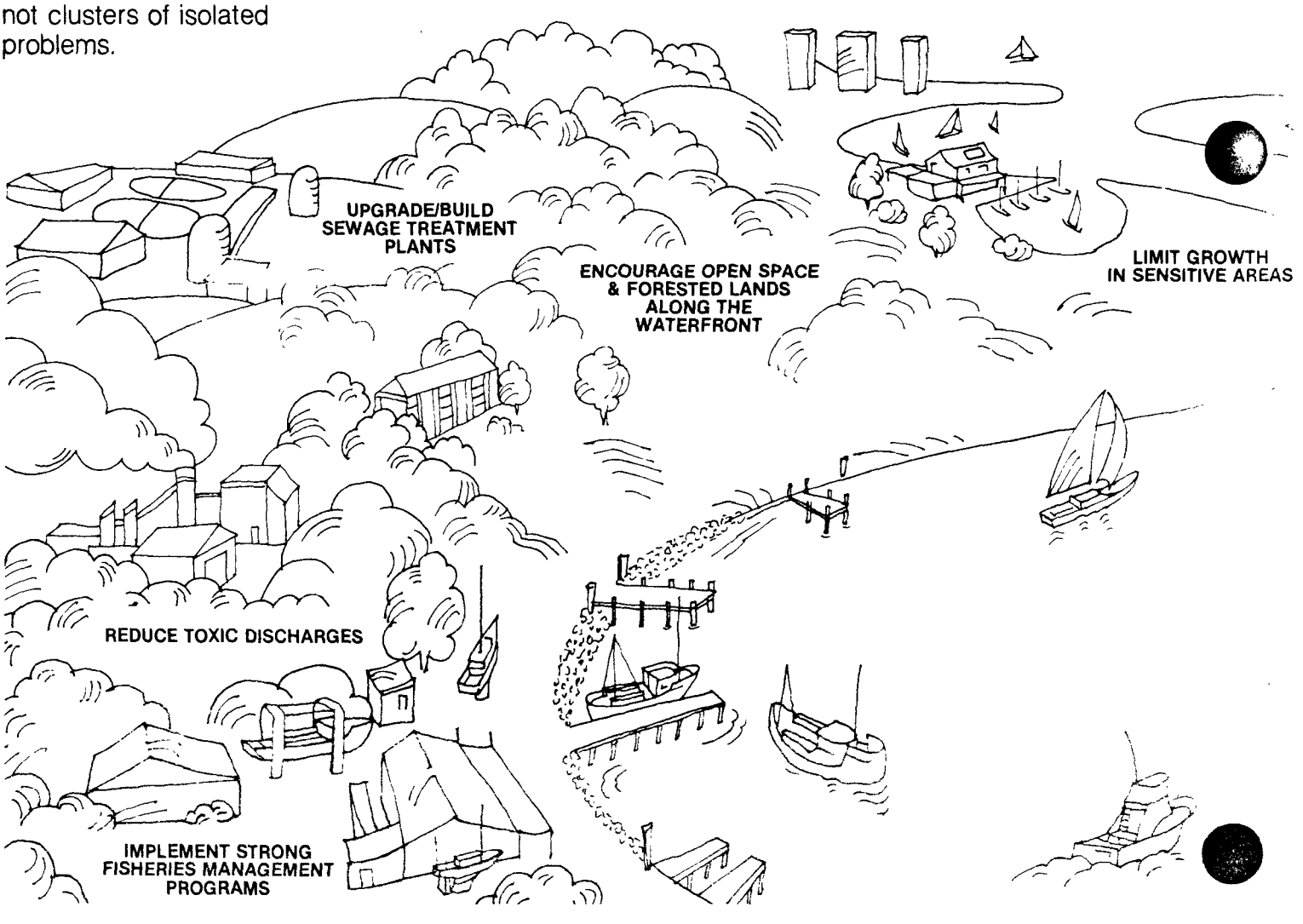
Strategies for Protecting

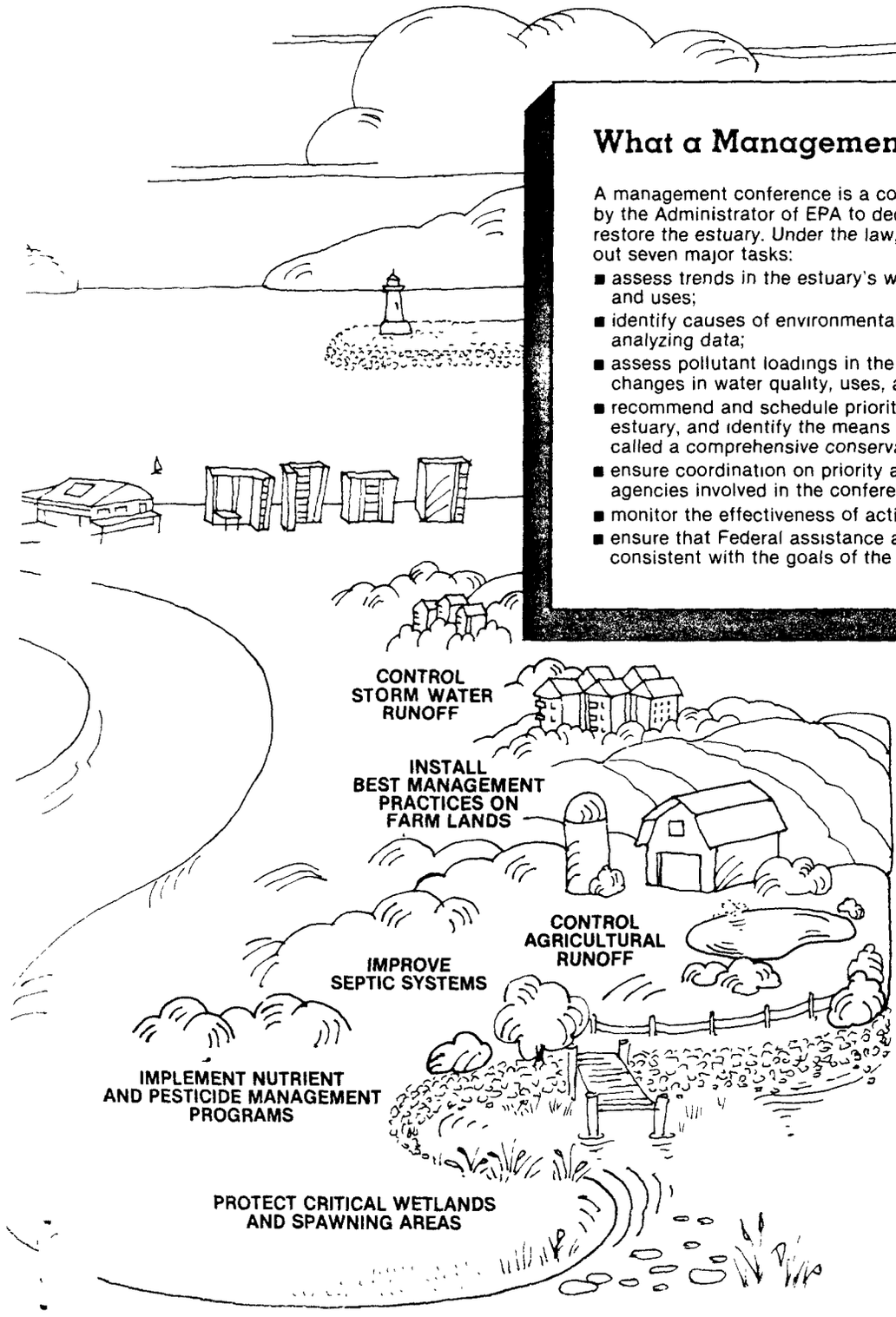
coastal waters is a long-term process. It will demand heavy commitments of time, money, *and support from everyone* who affects or uses or benefits from their resources. Just as important, it will require a fresh approach to solving environmental problems, one that recognizes we are dealing with integrated ecosystems, not clusters of isolated problems.

EPA's National Estuary Program provides an opportunity to apply these hard-won lessons. Under the law, its mission is to protect and enhance water quality and living resources in estuaries by helping States to develop and carry out basin-wide, comprehensive programs to conserve and manage their estuarine resources.

This handbook shares some of the experience gained in this process in estuary programs throughout the country and demonstrates many innovative tactics for



Bays and Estuaries



What a Management Conference Does

A management conference is a committee convened for a specific estuary by the Administrator of EPA to decide what actions to take to protect or restore the estuary. Under the law, a management conference must carry out seven major tasks:

- assess trends in the estuary's water quality, natural resources, and uses;
- identify causes of environmental problems by collecting and analyzing data;
- assess pollutant loadings in the estuary and relate them to observed changes in water quality, uses, and natural resources;
- recommend and schedule priority actions to restore and maintain the estuary, and identify the means to carry out these actions (this is called a comprehensive conservation and management plan);
- ensure coordination on priority actions among Federal, State, and local agencies involved in the conference;
- monitor the effectiveness of actions taken under the plan; and
- ensure that Federal assistance and development programs are consistent with the goals of the plan.

dealing with major estuarine and coastal problems. Three ecosystem management areas are covered: water and sediment quality; living resources; and land and water resources. Other areas of interest include technical support and financial resources.

The case study format is designed to present information clearly and quickly, and also identifies sources of additional information. We encourage readers to use the handbook along with the *Estuary Program Primer*, a manual for establishing and managing estuary programs, and hope that these case studies will alert managers to

innovative management tools and help them avoid costly mistakes. We also hope that users will find new ways to apply the lessons presented in these case studies and that participants in other programs will share their experiences. We plan to expand the handbook as new approaches and lessons emerge with experience.

The National Estuary Program welcomes comments and suggestions for additions to this handbook. For more information contact:

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The National Estuary Program

The purpose of the National Estuary Program is to identify nationally significant estuaries, protect and improve their water quality, and enhance their living resources. Estuaries are to achieve these goals through collaborative efforts called *comprehensive conservation and management plans (CCMPs)*; development of CCMPs is carried out by oversight committees called *management conferences.*

The legislation that established the National Estuary Program named 11 estuaries to receive priority consideration to be in the program. These are Albemarle/Pamlico Sounds, Long Island Sound, Buzzards Bay, Narrangansett Bay, Puget Sound, San Francisco Bay, Galveston Bay, Sarasota Bay, Delaware Bay, Delaware Inland Bays, and New York-New Jersey Harbor. Santa Monica Bay was added to this list in the Fiscal Year 1988 Appropriations Act.

The Administrator of EPA selects estuaries for the program in response to nominations by State governors, or at the Agency's initiative in the case of interstate estuaries. Estuaries are selected based on their potential to address issues of significant national concern, as well as their demonstrated institutional, financial, and political commitment to carry out protective actions. Once an estuary is selected, the Administrator formally convenes a management conference.

Management conferences provide a framework for interest groups to work together to develop comprehensive plans and timetables (the CCMPs) to protect and restore the estuary and coastal areas. Conference members must include citizen and user interest groups, scientists, government officials, and resource managers from Federal, State, and local agencies.

Representatives from these groups sit on an oversight committee that serves as tne formal management conference and oversees development of the CCMP. Other technical, policy, and citizen advisory committees may provide supplemental advice and help. This committee structure approach was first developed in the Chesapeake Bay and Great Lakes programs and has worked very well. We expect it will work equally well for other estuary and near coastal water programs.

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Point Source Controls: The Potomac River Cleanup

Restoring a river through cooperation and consensus

WASHINGTON METROPOLITAN AREA

Characteristics

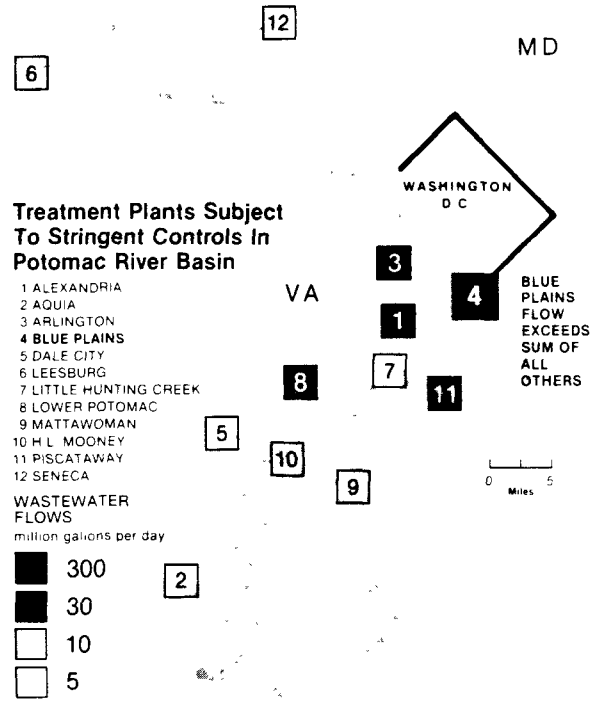
- 14,670 square mile drainage basin has approximately 100 tributaries
- Large quantities (averaging 456 million gallons/day) of treated effluent are released from the Washington, D C area
- Approximately 3 million of the basin's 4 million residents live in the Washington metropolitan area which is adjacent to the estuary, population is projected to increase 20 percent by 2000

Resources

- The river is a major spawning area for anadromous and semi-anadromous fish species, e.g , shad, perch, and striped bass
- 1985 commercial finfish landings were valued at over $2 million
- Recreational activities include sport fishing and boating
- Municipal water supply withdrawals averaged approximately 370 million gallons per day (in 1985)

Issues

- Municipal treatment plants are the only major point-source loading
- Nutrient loadings encouraged algal blooms, which have led to low oxygen levels, fishkills, and changes to the ecosystem
- Estuary cleanup has required a concerted cooperative effort among the Washington region's principal local jurisdictions



Introduction

In the late 1960's, local, State, and Federal officials began a coordinated and sustained effort to clean up the Potomac River.

Historically, the Upper Potomac River Estuary had suffered from severely degraded water quality. Noxious odors, large mats of floating algae, blue-green algae, depleted oxygen concentrations, and turbid water were frequent conditions. Pollution-sensitive fish (such as large-mouthed bass) and submerged aquatic vegetation had largely disappeared from the river. Bacterial contamination and viruses prevented safe water contact recreation.

Efforts by scientists and local, State, and Federal officials in the past 20 years to implement and upgrade point source controls, however, have dramatically reversed the trend of declining water quality. The States of Maryland and Virginia and the District of Columbia implemented stringent point source discharge limits based on analysis of the upper estuary's assimilative capacity and the capabilities of wastewater treatment technology. These actions have reduced biochemical oxygen demand (BOD) and phosphorus discharges to the upper estuary by 95 percent. Algal blooms are now infrequent, and submerged aquatic vegetation and many species of sportfish have reappeared in the river. Potomac River area residents now benefit from commercial and recreational river uses.

Overview and Characteristics of the Problem

The Potomac River drainage area encompasses portions of the States of Pennsylvania, Virginia, West Virginia, the District of Columbia, and Maryland. About 95 percent of the land in the basin is forested or in agriculture. In sharp contrast, the upper estuary, which extends 54 miles from the northwest boundary of Washington, D.C. to Maryland Point, is highly urbanized. The upper estuary receives the largest volume of flow from treated wastewater discharges. Industrial discharges are insignificant.

The Potomac supports two critical water uses in the Washington area. As a major water supply, the free-flowing part of the river provides about 75 percent of metropolitan Washington's drinking water. The Potomac is also profoundly important to the area as a recreational and aesthetic resource. The river supports boating, fishing, and, in some areas, swimming. Hundreds of miles of parkland border the Potomac, including the Washington, D.C. Tidal Basin, site of several major memorials and tourist attractions.

For much of this century the Potomac has suffered from pollution stresses. During the 1950's it was described as an open cesspool. Rapid development of the Washington metropolitan region was a major factor in the river's decline. Between 1940 and the early 1970's, population growth repeatedly outstripped sewage treatment plant capacity, despite expansions intended to meet demands for years to come. Raw or partially treated sewage was regularly discharged into the Potomac as a consequence of overloaded plants and inadequate sewer capacity.

Of the 11 major treatment plants that serve the Washington metropolitan area, the Blue Plains facility is the largest point source to the estuary. This regional plant, managed by the District of Columbia, serves the city and some of suburban Maryland and Virginia. In 1985, the Blue Plains plant discharged about 309 million gallons a day directly to the estuary—about 65 to 70 percent of the entire wastewater load for the year.

Chronology of the Cleanup Effort

In the late 1950's conferees at the first Federal-State Potomac Enforcement Conference meetings, convened by the U.S. Public Health Service to address water quality problems, recommended secondary wastewater treatment. By 1965, however, water quality in the Potomac had worsened because rapid population growth and accompanying increases in sewage flows had outstripped plant capacities. President Lyndon B. Johnson called national attention to the Potomac when he proposed making it a model for a national water quality improvement campaign. Following his appeal, Congress passed the Water Quality Act of 1965, which required States to establish water quality standards. Jurisdictions in the Washington metropolitan area agreed to adopt a fishable-swimmable standard.

The Federal-State Potomac Enforcement Conference was reconvened in 1969. Conferees developed discharge limits based on an assessment of the estuary's assimilative capacity and available treatment technology. Conferee recommendations, which were strenuously debated, pushed treatment technologies to their limits. Nevertheless, the recommendations were formally accepted in 1970 by the District of Columbia, Maryland, Virginia, and local jurisdictions through the Memorandum of Understanding (MOU) on the Washington Regional Water Pollution Control Plan. upgrades to the Blue Plains regional wastewater treatment plant, allocated capacity for the plant to the District of Columbia and its suburban users, and proposed a schedule for siting and constructing another regional plant to absorb the anticipated increases in treatment demands on the Blue Plains facility.

What appeared to be a workable intermunicipal framework for addressing Potomac pollution problems quickly broke down as the population continued to grow and sewage flows to Blue Plains exceeded jurisdictional flow allocations. Threats of lawsuits to enforce these allocations led to a new agreement in 1971 for interim treatment at Blue Plains. In addition, building moratoria established to restrict sewage treatment demands were not strictly enforced, and demand for treatment continued to grow. Thus, in 1973, the Commonwealth of Virginia filed suit against the Washington Suburban Sanitary Commission (the agency responsible for sewage in the suburban Maryland counties and at that time the prime source of the excess flows). Fairfax County, Va., the District of Columbia, and the Federal government joined the suit.

The parties to the suit ultimately reached an agreement in 1974, the basis for a consent decree that, among other things, limited the amount of sewage each jurisdiction could send to Blue Plains. It also established a formula for jurisdictions using the plant to take responsibility for sludge disposal. A key feature of the decree, lacking in previous agreements, was accountability. Violations, including delays, would constitute a contempt of court and would be punishable.

Throughout the 1970's new treatment technologies were installed and plants constructed and expanded. Potomac water quality began to improve. The upgrading of treatment plants, however, exacerbated an old problem. Advanced waste treatment processes produced substantially larger quantities of sludge than secondary treatment alone had. Difficulties in locating sludge disposal sites led to legal actions in which the District of Columbia sued Maryland's Washington Suburban Sanitary Commission to force disposal of sludge as agreed in the 1974 consent decree.

Anxious to overcome the interjurisdictional squabbling and court battles of the 1970's, representatives from area jurisdictions and treatment plant operators began to form standing committees to negotiate agreements, monitor progress, resolve differences, and plan for future needs on a regular basis. The first and most prominent committee was made up of chief administrative officers (CAO's) representing the principal Blue Plains user jurisdictions and agencies. This committee, known as the Blue Plains CAO's, was organized in 1980 under the auspices of the Metropolitan Washington Council of Governments, which provided neutral grounds for meeting and support staff.

The Blue Plains CAO's Committee undertook the reworking of the wide array of existing agreements, some of which dated back to the 1950's. Committee staff worked diligently, and at one stage met weekly for municipal agreement for managing sewage treatment and sludge disposal through 2010. An informal but im-

portant ground rule that has been credited with promoting agreement was the commitment of all participants to stay on at certain critical meetings until the issues at hand had been fully resolved.

The resulting Blue Plains Intermunicipal Agreement was signed by area jurisdictions in September 1985. In addition to sewage and sludge management, the agreement formalized annual funding support to a coordinated program for monitoring and tracking Potomac water quality. This program, managed by the Metropolitan Council of Governments, provides a common and comprehensive data base to enable a scientific approach to water quality planning and decision-making. Another important component of the agreement included the specification of conditions that would regulate or stop a user's commitments for system extensions if its sewage flows exceeded its allocated capacity at Blue Plains. The lack of such a provision in earlier agreements had been a significant problem during the 1970's.

Another important group, the Potomac Studies Policy Committee, was formed in 1985 to develop consensus positions of common interest to the Washington area wastewater treatment community. The policy committee evaluates technical issues associated with Washington area water quality management programs and standards. It addresses estuary-wide problems and the contribution of upstream Potomac pollution loading sources that affect regional water quality, and provides a unified voice for negotiating with water quality regulators. The policy committee strives to achieve balance between treatment technology, costs to users, and water quality standards.

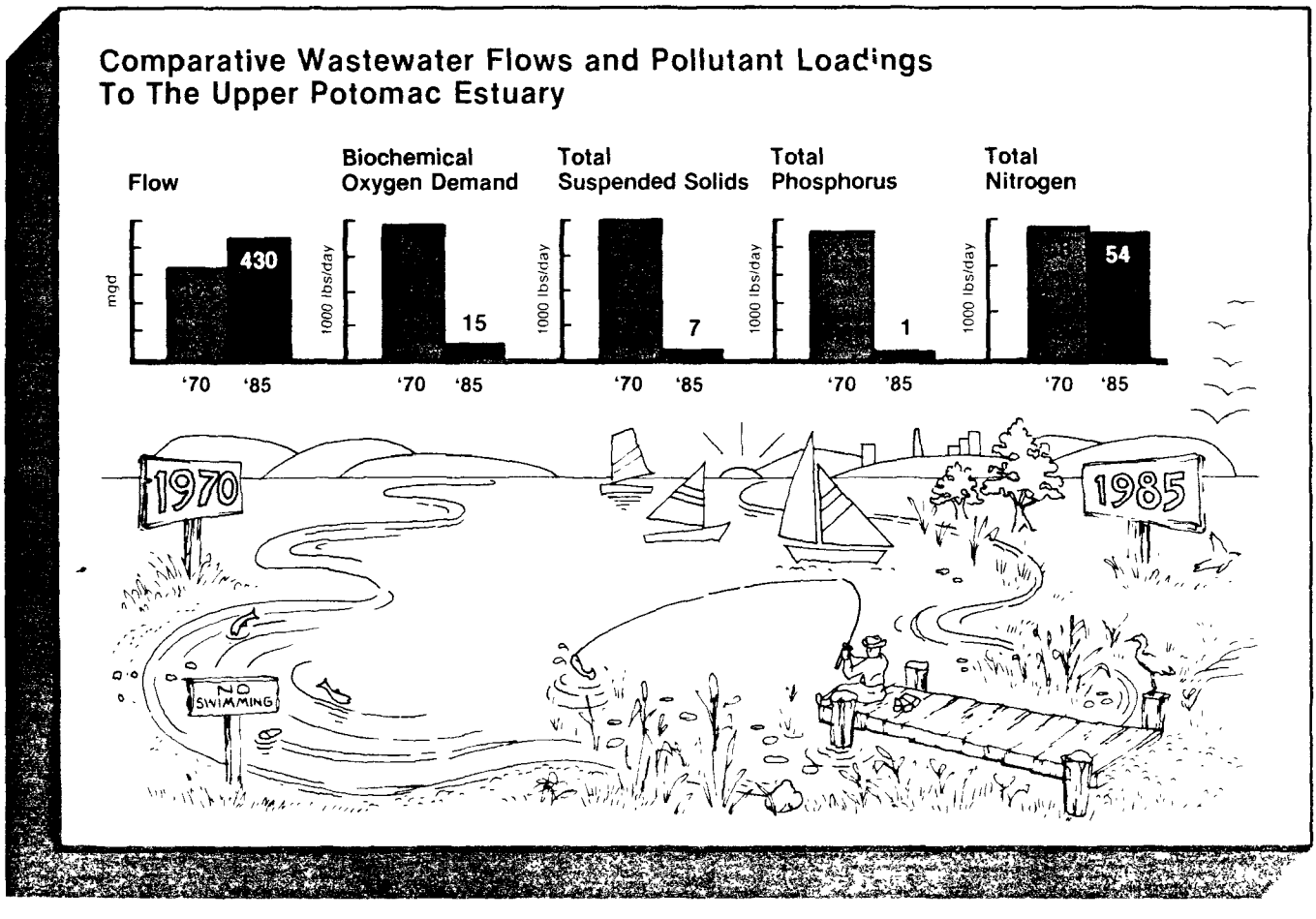
The Blue Plains and Potomac Studies Policy Committees have proven themselves to be valuable forums for ongoing resolution of regional water quality concerns and issues, preventing the crisis atmosphere that pervaded the preceding decade. Participants are pleased with the cooperation achieved between local jurisdictions and wastewater treatment plant operators thus far and are optimistic that it will continue.

Financing

The success of the Potomac cleanup to date has been hard won, taking over 20 years of sustained effort and more than $1 billion investment in capital facility improvements. The 1972 Federal Water Pollution Control Act's Construction Grants Program covered 75 percent of plant construction, expansion, and upgrading costs. Remaining funds came from local government expenditures and State grant programs. The annual operating costs to meet plant discharge requirements now exceed $100 million per year at the Washington region's principal discharges. These costs are financed through local user fees.

Results

Although the original goal, established in the late 1960's, of obtaining fishable-swimmable conditions year-round in the upper estuary remains to be fully real-



ized, significant improvements in Potomac water quality have been made. The improvement in the upper estuary has, in turn, contributed to dramatic improvement in the lower estuary.

Reductions of nearly 95 percent in biochemical oxygen demand and total phosphorus point source discharges highlight the accomplishments.This has been achieved through stringent nutrient limits for municipal wastewater discharges. For example, the current effluent phosphorus limit for Blue Plains is 0.18 mg/L. Effluent limits assigned to Washington area treatment plants could be met only by upgrading secondary treatment plants to advanced waste treatment facilities, which use additional filtration, nutrient removal processes, and chlorination. Improvements to other facilities have also enhanced water quality in the basin. The improvements included increases in sewer transmission and wastewater treatment plant capacities, and improved operational procedures to substantially reduce the incidence of wet weather overflows. Most of the Washington metropolitan area's sewer system is now connected to advanced waste treatment facilities, either on-line or under construction. The Blue Plains plant is one of the largest advanced waste treatment plants in the United States.

Signs of a healthy river that were missing from the estuary during the 1950's and 1960's are now reappearing. Submerged aquatic vegetation and accompanying desirable species of fish and wildlife have returned in abundance to many portions of the river. At the same time, the growth of nuisance blue-green algae has been greatly reduced.

As river water quality has improved, commercial and recreational activities along the river have also reemerged. The waterfront now provides an attractive location for parks, recreational facilities, and restaurants. Boating and fishing are common along the urban stretch of the estuary.

Other sources of pollution have increased in relative significance as Washington area point source loads have been cut. Discharges of nutrients, biochemical oxygen demand, and sediment loadings from upstream point sources, nonpoint sources, and nutrient releases and oxygen demand from river bottom sediments all contribute to pollutant loading inputs to the upper estuary.

The participants in the Potomac cleanup program have turned their attention to meeting the new challenges. The existing regional monitoring network and data base are already being used, and the 1970 Memorandum of Understanding has been revised and reaffirmed. The regional framework developed to confront point source removal is providing a ready forum for addressing emerging issues.

While some pollution problems remain, further progress will require improved wastewater treatment at smaller facilities upstream and downstream of the Washington, D.C. region. Implementation of effective nonpoint source controls, particularly for agricultural nonpoint source loadings, will also be needed.

Lessons Learned

The latest round of Potomac River cleanup activities has taken two decades to reach its current level of success. The effort has been difficult, but it has worked. Its success was due to people who insisted on more than the status quo. They invested in technologies required to meet stringent effluent limits to protect the estuary. They strove for cooperative agreements and held others to them, going to court when necessary. It took technical talent – the scientists who developed the models and analyzed the data, the treatment plant operators and engineers who implemented the requirements. It took money – a combined local, State, and Federal investment exceeding $1 billion in capital facilities, and user fees of over $100 million a year in plant operation costs. Most important, the cleanup succeeded because of the initiative, cooperation, and sustained commitment of local agencies to hammer out and implement the interjurisdictional agreements necessary to make it work.

Improving conditions in the Potomac required an enormous effort to overcome resistance to building moratoria, legal suits, press coverage, and a charged atmosphere among the participants. Ultimately, however, a high level of cooperation among local governments and the regulatory agencies led to the dramatic improvement in water quality conditions that area residents now enjoy. Through the efforts and battles along the way, a strong and lasting framework for cooperation has evolved.

The Potomac's cleanup was facilitated under the regional policy and technical committee structure which evolved in the 1980's to track progress and evaluate future water quality management needs. This structure has proven quite effective as a forum for developing consensus positions on regional water quality management issues and programs. It derives its strength and continuity through a collective local government commitment to the support of a centralized technical staff, data base, and reporting function dedicated to the assessment and resolution of Potomac water quality issues.

But for all the achievements, the greatest lesson from the Potomac's experience may be that strategies for pollution control must be flexible and continually evolving. New problems and questions have emerged as a result of regional successes in reducing point source loadings. For example, environmentally sound and cost-effective sludge management programs, acceptable to both regulatory agencies and local communities, must be found and agreed upon. Area decisionmakers and residents must evaluate to what extent they are willing to protect area water quality and identify the most cost-effective, practical, and acceptable management programs.

For further information, contact Stuart Freudberg or Cameron Wiegand, Metropolitan Washington Council of Governments, Washington, DC, or Mark Alderson, EPA Project Manager, Washington, DC.

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A Phosphorus Strategy for the Great Lakes

Improving water quality through intergovernmental agreements

UNITED STATES/CANADA

Characteristics

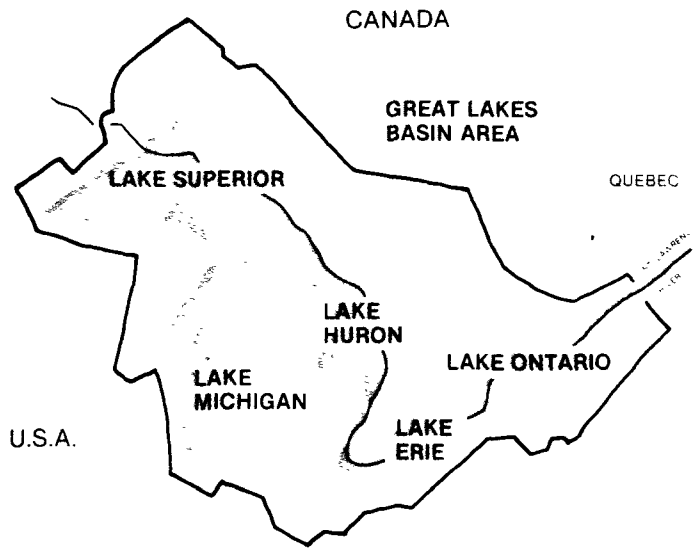
- The largest freshwater bodies in the world, the Great Lakes comprise:
  - 20 percent of the earth's fresh surface water,
  - 95 percent of North America's fresh surface water,
  - 6 billion gallons of water discharged per hour via the St. Lawrence River.
- Retention times for water in the lakes range from less than 3 years to over 200 years

Resources

- The Great Lakes are the center of U.S. heavy industry.
- $155 billion of economic activity occurs annually
- $3 billion in recreational activity occurs annually
- 24 million Americans depend on the lakes for drinking water

Issues

- Loss of commercial fishing continues.
- Aesthetics and recreation are impaired.
- Drinking water resources are affected
- Public health risks from food consumption continue.



Introduction

Recognizing the importance of the Great Lakes, the U.S. and Canadian governments have operated a long-term intergovernmental program to control direct and indirect sources of pollution, monitor conditions, and assess trends in the water quality and biological health of the lakes. By the late 1960's the effects of years of pollution in the Great Lakes were alarming, particularly in Lake Erie and Lake Ontario. Eutrophication – a natural process of nutrient enrichment and silting – was accelerated by high levels of phosphorus entering the lake. As a result, oxygen depletion was widespread and many previously abundant fish species and other aquatic organisms were virtually eliminated.

By setting pollution control goals that the two countries could agree on, the Great Lakes Water Quality Agreements of 1972 and 1978 have guided a successful cleanup and restored a viable fishery for the world's largest freshwater system. These joint initiatives address conventional pollutants (such as plant growth-inducing nutrients) as well as toxic contaminants entering the lakes from land-based activities. The nutrient control aspects of the program are discussed here.

Overview and Characteristics of the Problem

The Great Lakes contain 95 percent of the fresh surface water in North America. This vast resource supports commercial and recreational fisheries, water supply, shipping, and aesthetic enjoyment. The five Great Lakes, their interconnecting channels, and the St. Lawrence River outlet to the Atlantic Ocean are integral components of the U.S. and Canadian economies. The Great Lakes basin supports one fifth of all American industry. Over $180 billion in annual economic activity is based on the Great Lakes: the Canadian portion of the Great Lakes Basin accounts for $27 billion in economic activity; the U.S. portion accounts for $155 billion.

In the past 170 years, the population of the Great Lakes basin has increased more than a hundredfold. Today, the basin is home to nearly 37 million people, comprising a third of the Canadian population and a seventh of the American population. This growth was accompanied by increasing point and nonpoint source pollutant inputs to the ecosystem. By the 1930's, the impacts of these pollutants were becoming apparent in the biological, physical, and chemical components of the Great Lakes ecosystem. Commercial fish species (lake trout, blue pike, whitefish, sauger, and lake herring) declined sharply; the once-abundant mayfly disappeared from western Lake Erie, Green Bay, and Saginaw Bay; and populations of opossum shrimp vanished from Lake Erie. Algal production, however, not only increased, but shifted from predominately free-floating forms valuable as food for fish fry toward more troublesome species typical of elevated nutrient conditions. Long-term changes in both open-lake and near-shore water chemistry reflected eutrophic conditions from nutrient enrichment.

The dramatic changes in fish communities and other aquatic organisms were directly linked to decreased oxygen levels. Linkages were particularly well documented in western Lake Erie, Green Bay, and Saginaw Bay. In the central basin of Lake Erie, for example, roughly 70 percent of the bottom waters developed pronounced oxygen deficits each year.

Program Development

The institutional framework for the Great Lakes cleanup was actually established in 1909 by a Boundary Water Treaty between the United States and Canada. The treaty established the International Joint Commission, which was asked in 1964 by the U.S. and Canadian governments to study the water quality conditions in Lakes Erie and Ontario (the "Lower Lakes") and the St. Lawrence River. In 1970, the commission reported its findings:

- Lake Erie (and particularly the Western Basin) was already in an advanced state of eutrophication, and the eutrophication of Lake Ontario was accelerated. In both cases, current and historic nutrient loadings were at fault.
- Phosphorus is the only nutrient required for growth whose level can be effectively controlled with current technology such as widespread improvements in existing municipal and industrial wastewater treatment plants.
- The major phosphorus source to the lakes is municipal sewage; agricultural runoff and industrial wastes are the only significant nonsewage phosphorus sources.
- Detergents contribute 70 percent of U.S. and 50 percent of Canadian sewage phosphorus.

Based on these findings, the commission recommended that the Governments of Canada and the United States enter into agreement on an integrated phosphorus control program, to include

1 An immediate reduction in detergent phosphorus content (to a minimum practicable level) followed by the complete replacement of detergent phosphorus with environmentally less harmful materials, by December 31, 1972;

2. An 80 percent reduction in nondetergent residual phosphorus in municipal and industrial waste effluents discharging to Lakes Erie and Ontario and the international portion of the St Lawrence River by 1975, with subsequent reductions to the maximum extent possible by economically feasible processes; and

3. General reductions in agricultural inputs of phosphorus to Lakes Erie and Ontario and the international portion of the St. Lawrence River.

KEY COMPONENTS OF NUTRIENT CONTROL STRATEGY

- PHOSPHATE DETERGENT BAN
- AGRICULTURAL NONPOINT SOURCE CONTROLS
- STRINGENT MUNICIPAL AND INDUSTRIAL POINT SOURCE CONTROLS

The findings and recommendations of the commission indicated the severity of the problem, the need for major pollution control actions, and the need for broad political support. To meet these needs, it was determined that an international agreement must be forged to implement a binational cleanup effort. As a result, the first Great Lakes Water Quality Agreement was signed by the United States and Canada on April 15, 1972, agreeing to the need for a phosphorus reduction program based on commission findings.

Then during the mid-1970's additional modeling work was completed, which

- Quantified how much phosphorus entered the system from point, nonpoint, and atmospheric sources and determined how many tons of phosphorus reduction per year would be needed to meet the target reduction in each lake;
- Set target phosphorus concentrations for each lake to achieve a healthy ecosystem.

Using these modeling tools, a new agreement was signed in 1978 that

- Allocated these phosphorus reduction requirements to each country, and
- Determined how many tons of phosphorus reduction per year would be needed to meet the target concentration for each lake.

Control Program

Point source controls, especially on municipal wastewater treatment plants, provided the basic thrust of the phosphorus reduction program. A treatment level of 1 mg/L phosphorus in treatment plant effluent was established for all plants of 1 million gallons per day or greater capacity under the 1978 agreement Reaching this level required plants to use advanced wastewater treatment. It was also recognized that effluent controls alone would not meet the goals, and additional reductions from agricultural nonpoint controls and phosphate detergent bans would be necessary.

Although great progress occurred during the 1970's, the 1983 update of the Great Lakes Water Quality Agreement mandated development of U.S. and Canadian Phosphorus Management Plans. The U.S. plan, submitted in 1986, states that if nonpoint source controls do not achieve the necessary additional reductions in total phosphorus loadings (to be determined in a scheduled 1988 progress review), municipal treatment plants will be required to meet effluent phosphorus levels below the current 1 mg/L limit. The plan further states that the water-quality based controls mandated in the Clean Water Act will be implemented if the combined effect of advanced wastewater treatment and nonpoint source control do not meet the in-lake phosphorus concentrations required by the agreement.

Responsible Authorities and Financing

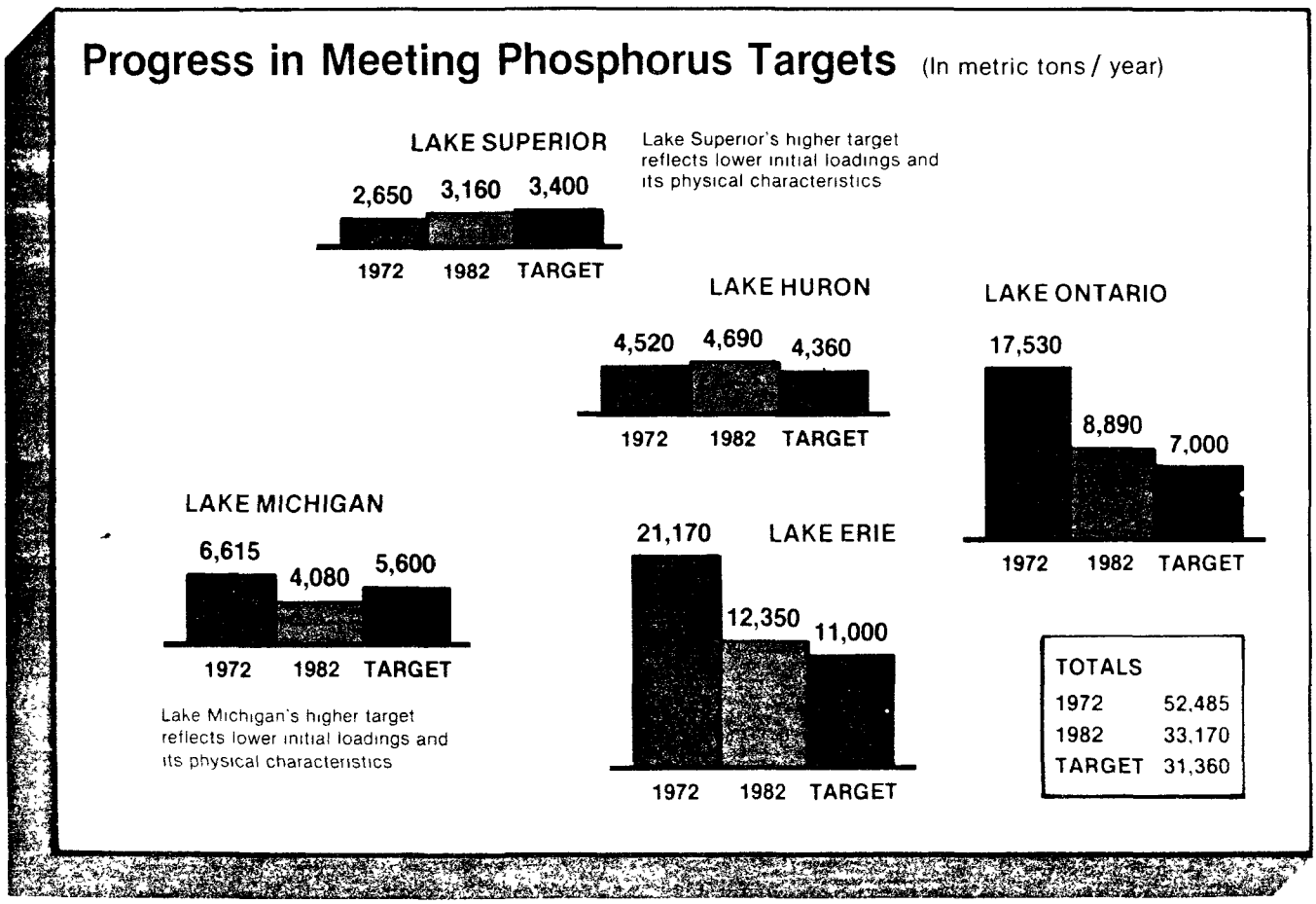
In the United States, the primary implementing agencies are the U.S. EPA and the eight States bordering the Great Lakes. The Great Lakes National Program Office was established within EPA to monitor the progress and effectiveness of U.S. efforts toward achieving the goals of the agreement, as well as to provide technical and management assistance to States, counties, and local jurisdictions in implementing the agreement. In Canada, primary responsibility for implementing the agreement rests with Environment Canada and Ontario's Ministry of the Environment.

In the United States, new NPDES discharge permits were issued for essentially all major point source dischargers in the 1974-1975 period. EPA tracked these permits with a compliance monitoring system to flag frequent or large violations. Compliance with the permitting system was high, but Federal and State-level administrative enforcement (violation notices, compliance orders, etc.) was also a major factor in the program's success in achieving phosphorus load reductions from point sources.

Nonpoint control programs have centered on controlling soil erosion. A variety of programs conducted by USDA entities (Soil Conservation Service, the Agricultural Stabilization and Conservation Service, Forest Service, Farmers Home Administration, and the Cooperative Extension Service) to promote soil conservation and erosion control have proven useful. Several Federal/State/local cooperative demonstration projects have been conducted to test farm management practices, such as conservation tillage. A major field test of conservation tillage for phosphorus control was funded through EPA's Great Lakes Program Office (under section 108 of the Clean Water Act) in 31 counties in Indiana, Ohio, and Michigan.

Results

Since 1972, over 1,000 municipal treatment plants have been constructed or upgraded. At the same time, in-



fluent phosphorus loads to these and other plants were reduced through broad enactment of legislation to control phosphorus in household detergents. As a result, most municipal wastewater point sources of over 1 million gallons a day capacity have now achieved or exceeded the 1 mg/L effluent phosphorus limit and the average point source phosphorus load reduction goals of the agreement are being attained. As a result of the phosphorus control provisions of the agreement, significant decreases in phosphorus levels are reported in all the Great Lakes. Excepting certain localized areas, the Upper Lakes (Superior, Huron and Michigan) are no longer overenriched. In the Lower Lakes, Lake Ontario exhibits reduced overall phosphorus concentrations and diminished algal biomass. In Lake Erie, the levels of free-floating microscopic plants in the open water have decreased and shifted toward species found in balanced-nutrient systems. U.S. phosphorus loadings to Lake Erie from municipal treatment plants decreased by 62 percent from 1972 to 1978, and by 1982 the load had dropped to only 16 percent of the 1972 level. Within five years of the 1972 agreement, 64 percent of the municipal treatment plants and 76 percent of the industries on the U.S. side were in compliance with the point source limits established to meet the goals of the agreement. The corresponding Canadian figures were 89 percent and 50 percent, respectively. To date, more than $7.5 billion have been spent or obligated in the United States and Canada for municipal sewage construction in the Great Lakes basin (resulting in an 80-90 percent reduction in municipal phosphorus loads), with another $1 billion from local governments and industries. In the United States, the majority of this money has been spent through the section 201 Construction Grants Program, under the Clean Water Act.

Lessons Learned

A principal reason for the success of the Great Lakes phosphorus control initiative was the degree of commitment made to its objectives at the highest levels of the affected governments. This commitment was backed with Federal legislation and a multibillion dollar grant program.

Another reason for the program's success was the commitment of the government to continual response. Within two years of the International Joint Commission's 1970 report, a point source control program was in effect; within five years, enforceable point source limits for all major municipal and industrial discharges were in effect. Although many technical questions were unanswered in 1972, responsible governmental officials on both sides of the basin decided that sufficient information existed to support a coordinated, programmatic response. Further scientific research on problem definition and understanding has continued in parallel with, and with the financial support of, the overall phosphorus control program.

The Great Lakes Water Quality Agreement provides the legal basis for nutrient management of the Great Lakes ecosystem. Under the authority of the agreement, the Great Lakes National Program Office reviews major municipal and industrial point source discharge permits for adherence to the phosphorus management goals of the agreement. This unique feature ensures that local dischargers conform to the terms of the agreement.

Development of Great Lakes Phosphorus Strategy

- Agreement renegotiations under way.—1987
- U.S. Phosphorus Management Plan finalized.—1986
- Agreement update signed, re-emphasizing phosphorus and toxics control programs, and requiring development of phosphorus control plans by the U.S. and Canada.—1983
- Second agreement signed, continuing the phosphorus control initiative while ushering in a new era of awareness and control of toxics pollution.—1978
- NPDES permits issued for essentially all major U.S. point sources.—1975
- First Great Lakes Water Quality Agreement signed, containing a phosphorus control focus as well as general pollution control provisions.—1972
- Joint Commission report issued. Report indicated serious eutrophication problems in the Lower Lakes, identified phosphorus as the causative nutrient and recommended an aggressive phosphorus control program, focusing initially on wastewater treatment effluent.—1970
- Joint Commission was requested (by United States and Canada) to assess degree and extent of eutrophication problems in the Great Lakes.—1964
- Boundary Waters Treaty signed by U.S. and Canada, creating the International Joint Commission to resolve disputes regarding use of Great Lakes waters forming the border between the two countries.—1909

For further information contact: Dr. Martin P. Bratzel, Jr., International Joint Commission, Windsor, Ontario; or Paul Horvatin, EPA, Chicago; or Mark Alderson, EPA Project Officer, Washington, DC.

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Strategies for the Preservation of an Estuarine Watershed

Preserving watersheds through land purchases and protective designations

APALACHICOLA BAY/FLORIDA

Characteristics

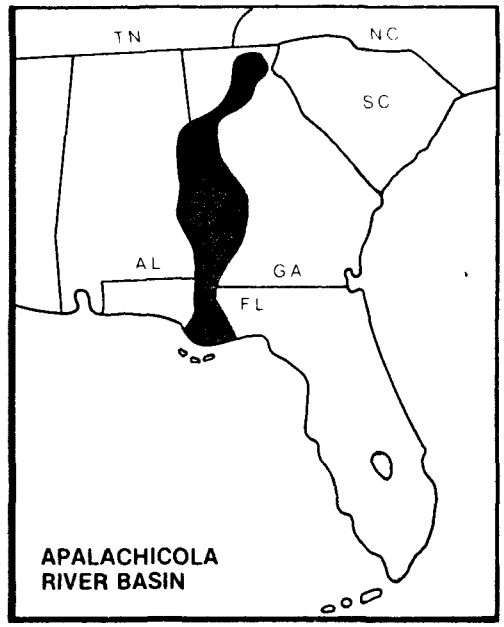
- The estuary covers approximately 210 square miles.
- The basin drains 19,600 square miles in Alabama, Georgia, and Florida, with 12 percent of the basin in Florida.
- The Apalachicola River is the largest river in Florida in terms of flow.
- Forty percent of the Apalachicola Bay is suitable for growing oysters.

Resources

- The bay produces 90 percent of the Florida oyster harvest, and 10 percent of the national harvest.
- The bay is a major spawning ground for blue crab and shrimp.
- Annual seafood landings in Franklin County (which surrounds the main estuary) are valued in excess of $14 million.
- The upper basin is an area of unusual biological diversity

Issues

- The pollution and proposed dredging projects threatened the bay's productive seafood industry.
- Protection and preservation of the river and bay floodplain and sensitive areas around the bay became a priority of the State and local authorities.
- Maintenance of existing flow from northern States was threatened.



Introduction

The Apalachicola River basin may be the most protected estuarine system in the United States. For over 10 years the State of Florida, in conjunction with Federal and local authorities, has taken a variety of actions to preserve the relatively pristine Apalachicola drainage basin. The protection of the unique natural resources of the Apalachicola system has been accomplished by three major types of actions including (1) land acquisition, (2) establishment of protective designations, and (3) basin management. Extensive research to document the ecology of the Apalachicola Bay system helped focus basin management actions.

The Apalachicola River is formed by the convergence of the Chattahoochee and Flint Rivers, which originate in northern Georgia. The river drains into Apalachicola Bay which produces 90 percent of the State's oyster harvest; is a major spawning ground for blue crab and shrimp; and also provides a finfish (spot, croaker, and sea trout) harvest. In the early 1970's the Apalachicola system was threatened by proposed navigation projects that would substantially modify the river's hydrodynamics, clear-cutting in the lower basin that would increase sediment and nutrient loads, development pressures, and poor sewage treatment.

Overview of Bay Characteristics and Problems

The Apalachicola estuary is located on the Gulf Coast of Florida at the mouth of the Apalachicola-Chattahoochee-Flint (ACF) River system. The estuary is a relatively shallow lagoon and barrier island system. It has an average depth between 6 and 9 feet, and covers approximately 210 square miles. The waters of the ACF basin are used for diverse purposes, including commercial and recreational fishing; commercial navigation; recreation; hydropower; municipal, industrial, and agricultural water supply; sewage effluent discharge; and fish propagation.

The major urban areas are in Georgia and Alabama, whereas the Florida portion of the basin is sparsely populated. The six Florida counties adjacent to the

basin have low population densities of 30 people per square mile and are predominately forest.

In the early 1970's, periodic closings of the oyster beds in Apalachicola Bay threatened the viability of the local seafood economy. The sewage treatment plant often discharged raw sewage to Apalachicola Bay. At the same time, the Corps of Engineers proposed constructing four dams in the Apalachicola River. Concerns about the freshwater retention incorporated in these proposals increased the interest of the local citizens. Proposed land development for the area added to these concerns.

Major Components of the Program

Protection efforts focused on land acquisition, protective designations, basin management, and research.

Land Acquisition

Public land acquisition has proven to be a cornerstone of the effort to protect the Apalachicola ecosystem. Over 100,000 acres of land have been purchased for a variety of purposes.There are currently two State land acquisition programs active in the region: the State's Conservation and Recreation Lands Program (CARL), and the Save Our Rivers Program.

These programs have purchased lands along the river floodplain, the lower portion of the river, the bay front, and nearby islands.

In CARL, the State has purchased 14,475 acres for $6.4 million. Under Save Our Rivers, the State purchased over 35,000 acres of bottomland hardwood swamp for $10.3 million and is negotiating for the purchase of 42,000 more acres of floodplain. An additional 31,863 acres were acquired through an earlier program at a cost of $22.8 million. Additional acquisitions around the bay have a high ranking on the current CARL list. The Florida Department of Natural Resources is responsible for the selection and negotiations for land acquisition; however, all final purchases must be approved by a six-member interagency committee that includes the Governor and his cabinet.

Protective Designations

State, Federal, and international protective designations have also been instrumental in protecting the river and bay. Each of these designations serves a different role in protecting the system. Together, they have drawn attention to the system, which has impacted permit, treatment, and land use decisions. The primary designations used have been Aquatic Preserve, Outstanding Florida Water (OFW), National Estuarine Research Reserve (Sanctuary), Area of Critical State Concern, and International Biosphere Reserve.

Basin Management

An effort to manage the basin as a system was proposed by the Northwest Florida Management District in 1976, but received no support. In 1979, when the Apalachicola estuary was declared a National management was connected to the release of Federal funds.

In 1982, interest in systemwide management of the basin was revived by the Department of Environmental Regulation. In 1983, an interstate Memorandum of Understanding (MOU) was signed by Florida, Georgia, and Alabama to develop a basinwide drought management plan, a water management strategy for the system, and a navigation maintenance plan.

Major Protective Designations

Outstanding Florida Water

The majority of the Florida portion of the basin is designated as Outstanding Florida Water. This designation prevents a permanent point source discharge from degrading the receiving water. The OFW designation imposes reduced allowances for waste disposal and assimilation. It restricts new long-term pollutant discharges such as sewage, industrial effluent, dredging, and filling. OFW restrictions help to ensure that recreational and ecological integrity of the area are preserved.

National Estuarine Research Reserve

Through the Office of Coastal Zone Management the lower Apalachicola River and Bay was designated as a National Estuarine Sanctuary, now known as National Estuarine Research Reserve. The Apalachicola Reserve is the largest in the country: 193,758 acres, or twice the size of the other 17 reserves combined. The Apalachicola Reserve includes floodplain, fresh and saltwater marshes, open water, and barrier islands. Through this program Federal and State funds are used for land acquisition, research, and education. The Apalachicola National Estuarine Reserve Advisory Council (ANERAC), an 11-member board, serves as a forum for coordination among local interests, State environmental agencies, and the Federal government. The Estuarine Research Reserve plays a key role in the effort to use scientific understanding to manage the resource.

Area of Critical State Concern

The Apalachicola Bay area was designated an Area of Critical State Concern through the Apalachicola Bay Area Protection Act. This designation allows for State oversight and control of government decisions and ordinances. The intent of the act is (1) to protect the water quality of the bay area, (2) to financially assist Franklin County and its municipalities in upgrading and expanding their sewage systems, (3) to monitor activities in the area to ensure resource protection, and (4) to educate the residents of the area in order to preserve its natural resources. The act also puts the Resource Planning and Management Committee in an advisory role to support Franklin County in enacting land development regulations related to stormwater systems, correct onsite sewage treatment systems, and develop a map of pollution-sensitive segments of the critical shoreline Since its designation the county has imposed an ordinance which provides a buffer between land development and the estuary The Apalachicola Bay Area Protection Act also provided money to upgrade the municipal sewage system in Apalachicola.

Aquatic Preserve

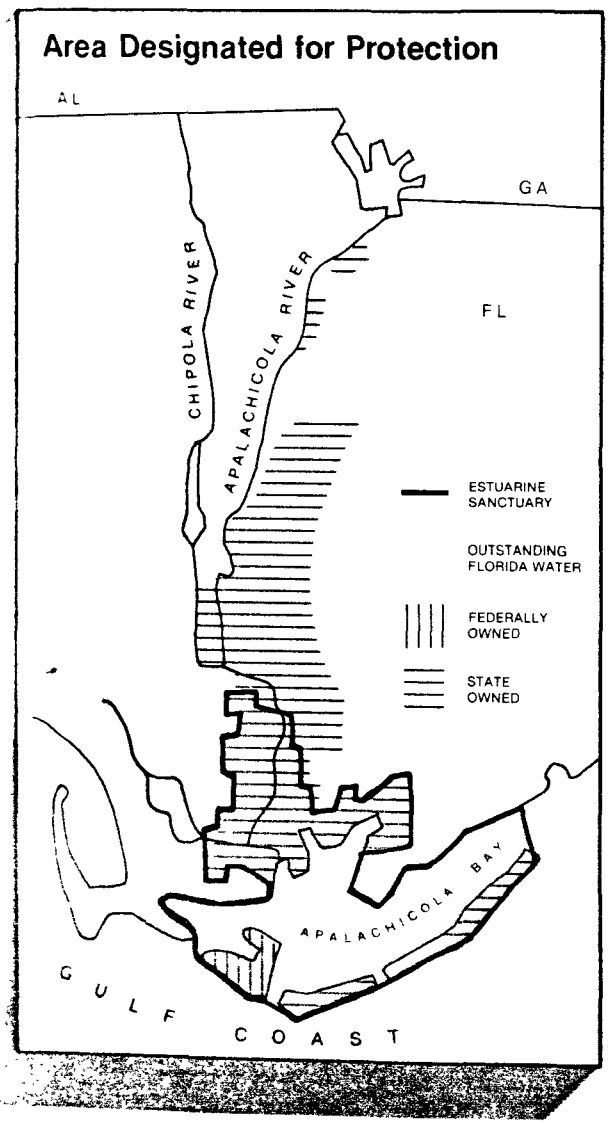
The estuary was designated an aquatic preserve in 1975 This designation requires the State to develop a management plan to ensure the long-term protection of the aquatic resource.

International Biosphere Reserve

This international recognition for the area by the United Nations was received in 1984

In 1983, the Governor appointed an Apalachicola Task Force to work under the Coastal Zone Interagency Management Committee (IMC) to deal with the problem of frequent closing of the bay to oystering because of sewage. The task force membership includes the Department of Community Affairs, the Department of Health and Rehabilitative Services, Department of Commerce, Department of Natural Resources, and the Department of Environmental Regulation. This task force was instrumental in developing the Apalachicola Bay Protection Act of 1985, which designated the region as an Area of Critical State Concern.

The Navigation Maintenance Plan helped resolve a 10-year-old disagreement between Florida, which resisted year-round use of the river channel on environmental grounds, and Alabama, Georgia, and the Corps of Engineers, which felt Florida's resistance was suppressing the regional economy. The plan allowed navigation if no further degradation of the environment occurred. Some proposed structural modifications were abandoned and maintenance practices revised to meet this goal. The Corps finally judged that, without the structural modifications, flow was not sufficient for year-round use in most years.



Responsible Authorities and Financing

Major funding and consistent research support have come from the Florida Sea Grant College (National Oceanic and Atmospheric Administration) and Franklin County Board of Commissioners. Supplementary funding has been provided by private industry as well as by State and Federal agencies.

Many of the initiatives to protect the system originated in the Florida Department of Environmental Regulation. In 1979, the Department hired a staff person dedicated to coordinating and resolving problems impacting the river and bay system. After a year, funding for this position was covered by a grant from the Office of Coastal Zone Management until 1985 when the position was made permanent by the Apalachicola Bay Protection Act. Through this position the Department has helped initiate a comprehensive program to manage and protect the system. Money for the CARL Program comes from taxes on minerals, oil and gas, and possibly from real estate taxes in the near future. This money is put into a trust fund for land acquisitions and drawn on as needed. An estimated $40 million in revenue will be put into the CARL program this year.

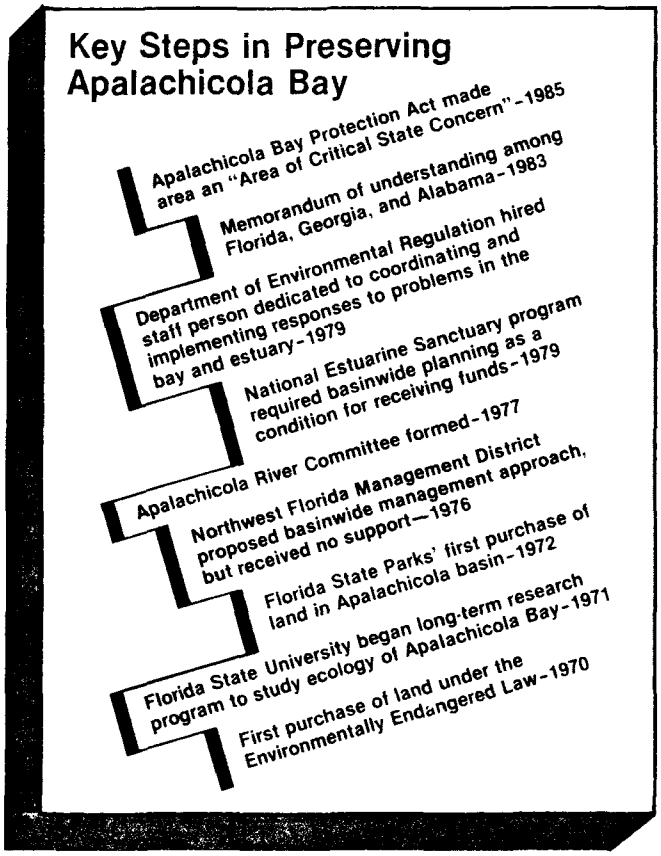
Process

In the early 1970's a broad-based effort to protect the Apalachicola ecosystem was undertaken because the people of Franklin County recognized the need for a management program to protect this resource.

In 1972, a field monitoring program began in Apalachicola Bay to gather scientific information for the purpose of applying it to practical problems. Scientists from Florida State University, United States Geological Service, Fresh Water Fish and Game Commission, Department of Environmental Regulation, and many others have investigated biological, chemical, and physical characteristics of the river and bay. Major contributions for this research have come from Florida Sea Grant College (National Oceanic and Atmospheric Administration) and the Franklin County Board of Commissioners. This monitoring project has continued for over 10 years and continues today.

Local efforts to protect the area have included adoption of county-wide zoning regulations in the 1970's and a comprehensive plan in 1981 in Franklin County. The State and the Northwest Florida Management District efforts have included land acquisitions, a number of protective designations, and a resource planning and a management committee.

A critical factor influencing long-term protection of the resource is communication and coordination among all involved parties. Over the past decade, the State has made a considerable effort to involve local county commissioners, developers, the scientific community, and the public in the decisionmaking process. In 1977, the Apalachicola River Committee was formed to bring the Departments of Environmental Regulation



and Natural Resources and other State and local agencies together to strengthen local planning efforts through the provisions of data and technical assistance. Representatives on the committee included the six counties bordering the river, and State and Federal resource agencies. It was chaired by the Apalachee Regional Planning Council. The committee was especially concerned with navigation issues and since Florida law required local government approval of dredging permits, the committee wielded some power.

In conjunction with the Memorandum of Understanding adopted by the three States and the Corps in 1983, an Interim Coordinating Committee consisting of representatives of each State and the Corps was established. This committee was responsible for dealing with interstate water management and navigation issues and was intended to terminate after three years. However, since the arrangement has worked well, all parties agreed to continue the committee as the Interstate Coordinating Committee. The final Navigation Maintenance Plan (NMP) adopted by this committee included a provision requiring that before any measures listed in the NMP are implemented in Florida, public meetings would be held in the affected areas to provide information and to receive public input.

Results

Efforts to date have left hope and optimism that the foundation exists for the Apalachicola system to be protected over the long term. Continued work is necessary, however, and results are contingent upon the involvement and acceptance of the effort by local government and citizens.

To date the State has purchased over 85,000 acres in the basin. At least 40 percent of floodplain is publicly owned and by the end of 1987 it is hoped that almost 90 percent of the wetlands in the Apalachicola floodplain will be publicly owned. Efforts to acquire more land in the Apalachicola basin will continue, but it is uncertain how much additional land will be purchased. By the end of the land acquisition program the State hopes to have the floodplain of the river intact and in public ownership.

Protective designations have brought significant attention to the system and have provided some measure of protection to the area. These designations, however, can lull the public into a false sense of security. For example, many people mistakenly believed the Estuarine Reserve would impose strict limits and controls on anything and everything that would harm the estuary. The Reserve actually has no authority to regulate development, but instead promotes research and education.

Perhaps most important, all parties are interested in continuing and expanding efforts to protect the system. Several State agencies have full-time staff specifically assigned to working on the system, as does the Florida Defenders of the Environment.

Lessons Learned

The Apalachicola experience shows that a river basin can be managed and protected. Litigation, acquisition, the State permitting process, the education of local citizens, planning and management, and public pressure have all played major roles in this effort. The combined efforts of local, State, Federal, and university programs in the Apalachicola River basin have been extremely important.

The education of all concerned parties has been a key to the program's success. There has been little turnover among State and Federal agency staff, with many having five to 10 years experience working on the system. Consequently, many have become quite knowledgeable about the system. And, after dealing with resource management issues in the basin for the past 10 to 15 years, county officials have also gained an appreciation for the system's ecology and have integrated this to some extent into the decisionmaking process.

For further information contact Pamela McVety, Florida Department of Environmental Regulation, Tallahassee; Stephen Leitman, Florida Defenders of the Environment, Tallahassee; or Mark Alderson, EPA Project Officer, Washington, DC.

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A Comprehensive Source Control Program for Protecting Shellfish Waters

Citizen action preserves shellfish resources

TILLAMOOK BAY/OREGON

Characteristics

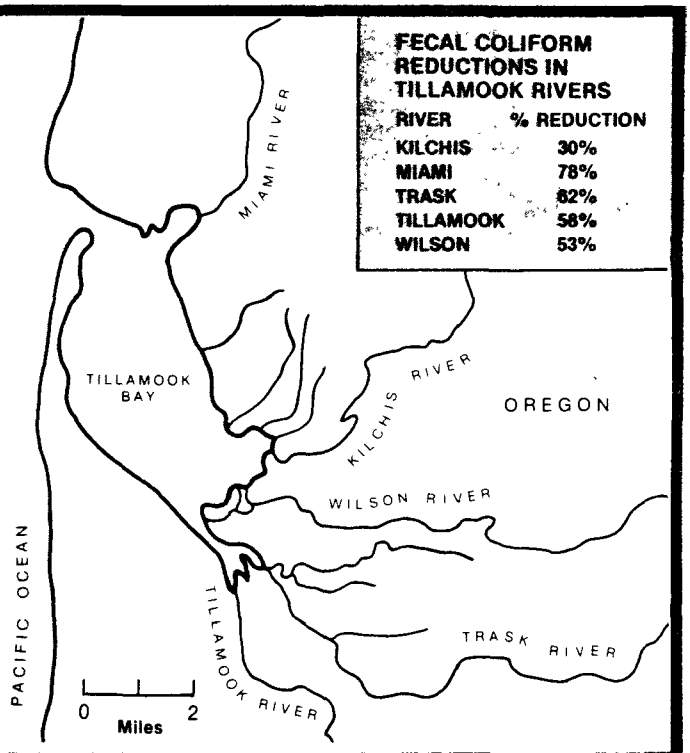
- The basin has five individual watersheds containing 363,520 acres:
  - 89 percent forestland
  - 6 percent agricultural land with intensive dairy farming adjacent to the bay.
- *Annual precipitation averages from 90 to 150 inches*

Resources

- Tillamook Bay is the most productive oyster and clam growing water in Oregon.
- Lowland areas are used intensively for dairy farming.
- Recreational activities (e.g., boating, fishing) attract more than a million tourists each year.

Issues

- Concentrated livestock wastes and the region's wet weather create severe runoff problems and contaminated conditions.



Introduction

The State of Oregon has implemented a program to protect the shellfish in Tillamook Bay from recurring incidents of bacterial contamination. Tillamook Bay is Oregon's most productive oyster and clam growing area—80 percent of the State's commercially harvested oysters come from its waters. The State program, which has been supported by Federal agencies and local governments, focuses on controlling point and nonpoint pollution sources.

The lowland areas surrounding the bay are neither highly industrialized nor densely populated overall. Several small towns exist, but most of the land is devoted to intense dairy farming. Runoff from agricultural operations in combination with sewage treatment discharges from the local towns had created the bacterial contamination problems in Tillamook Bay. High fecal coliform contamination threatened shellfish harvesting and the local economy.

The Oregon Department of Environmental Quality and others addressed the problem by implementing best management practices on the dairy farms and upgrading local sewage treatment plants to control bacterial pollution. These actions have kept the bay open for safe shellfish harvesting.

Overview of Bay Characteristics and Problems

Tillamook Bay drainage basin is located 60 miles west of Portland on the northern Oregon coast. Five major rivers drain 97 percent of the basin and discharge to Tillamook Bay. Most of the bay is shallow. At high tide the bay's average depth is just 6 feet; at extreme low tide, water is confined mostly to the narrow channels. Ninety percent of the basin is steep, mountainous, forested terrain and sparsely populated. Eight percent of the land area is relatively flat and devoted to agriculture and population centers.

Shellfishing in Tillamook Bay includes recreational and commercial clamming, and commercial oyster harvesting. Annual harvest approaches 600,000 pounds of clams and 175,000 pounds of oysters. The bay and its

tributaries support a good finfishery for salmonid species (chinook, silver chum, salmon, and steelhead). Because of the popularity of the northern Oregon coast, many tourists camp, fish, and bike along the bay.

In the lowlands, 118 farms with nearly 20,000 cattle line the lower portion of the Tillamook watershed. Approximately 13,000 people live in the bay basin. A little less than half the population is served by sewers; the remainder uses on-site sewage systems. Together, the presence of concentrated livestock wastes (280,000 tons of manure per year) and the region's wet weather (average rainfall 90-150 inches per year) created severe problems of bacterial pollution via runoff.

Following moderate to large storms, fecal coliform counts were often high in the bay. Coliform bacteria reside in the intestinal tract of warm-blooded animals; their abundant presence in water indicates significant fecal contamination. In addition, when fecal coliform counts are high, other more harmful bacteria and pathogens from warm-blooded animals may also be present. These high bacterial counts are the basis for closing the bay to shellfish harvesting. The bacterial problem created a serious human health hazard and threatened an important industry.

Problem Characterization

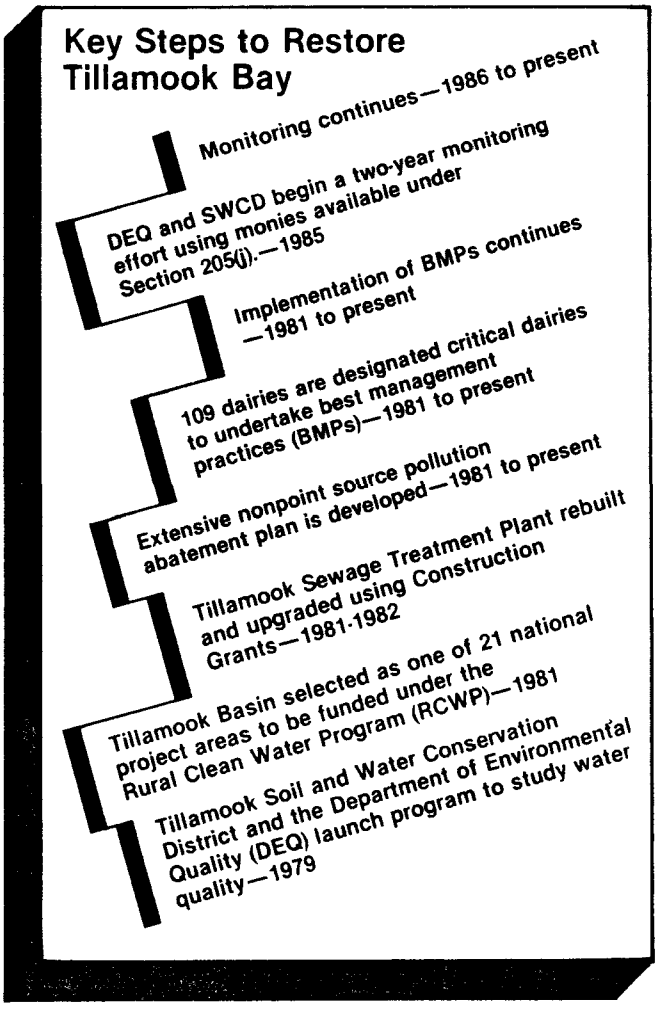
In 1979, a program between the Tillamook Soil and Water Conservation District and the Oregon Department of Environmental Quality was set up to monitor water quality in the bay. This program included a review of existing data and collection of additional water quality data. Using information gathered during the initial study, the Department of Environmental Quality conducted a project to specifically identify the sources, extent, and dynamics of fecal pollution occurring in the bay and its watershed. During the investigation six major potential fecal sources were examined: (1) sewage treatment plants, (2) recreation, (3) forestry activities, (4) industries, (5) agricultural operations, and (6) on-site subsurface sewage disposal systems. A comprehensive Tillamook Bay Fecal Waste Management Plan was developed for protecting the shellfish resource.

The study concluded that fecal coliform bacteria detected in the bay originated from farms (manure), poor sewage treatment plants in the river subbasins, and inadequate subsurface drainage. Of these, the study identified malfunctioning sewage treatment plants and dairy operations as the primary sources.

Process

The Tillamook study was conducted through a combined effort of Federal, State, and local government officials and the cooperation of the local dairy industry. Local citizens were actively involved throughout the study and development of a management plan. A group of citizens met regularly to review the data collected and analyzed by the Department. These same people also worked cooperatively with the Department and the Soil Conservation Service to develop the management options for controlling the problem. Dairymen working with the Soil Conservation Service helped develop the solutions to the dairy problems. County and State sanitarians developed control strategies for the septic tank problems. Sewage treatment plant owners and operators developed the strategy for minimizing impacts from their plants.

Meetings as well as phone calls and personal contacts with the study team have involved the public in the policymaking process. Implementation of the management plan was rendered less controversial and more effective because the local citizens knew why a control plan was necessary and were able to communicate their concerns and contribute their suggestions from the beginning. A local coordinating committee, including both State and local officials, continues to meet regularly to discuss the progress of the program. The County Extension Service also organizes important interagency meetings (EPA, FDA, DEQ). The Extension Service conducts a comprehensive educational and information program, including media releases, talks to civic groups, and tours. These tours are often for other farmers from outside the county who are interested in the practices being used in the Tillamook area.



Management Plan Development and Implementation

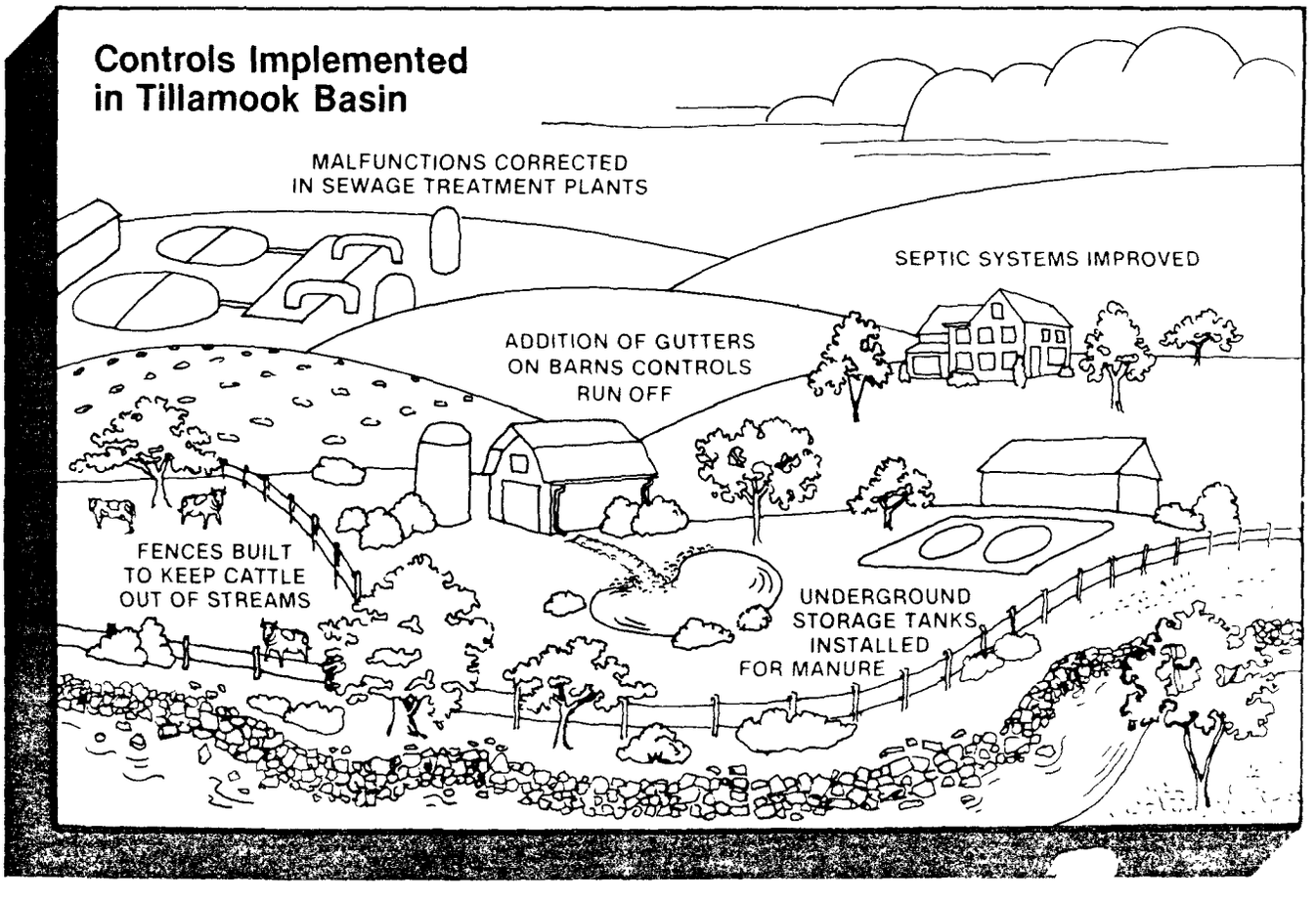
Interested citizens and the Department of Environmental Quality developed three management options to control shellfish contamination: (1) closing the bay to harvesting of shellfish until the problem corrected itself; (2) initiating new types of corrective actions aimed at reducing the pollution potential of the identified fecal sources and developing harvesting criteria for the bay; or (3) strengthening existing pollutant control programs and developing harvesting criteria for the bay. The last option was chosen because it was the most cost-effective and did not negatively impact the shellfish industry, which already had self-imposed limited harvesting during critical runoff periods.

Recognizing the need for immediate action to protect the public health and the long-term nature of the cleanup, the Department adopted a standard procedure for determining when to open or close the bay to shellfish harvesting. This procedure relied on five criteria that were developed by the Department of Environmental Quality and State Health Department. Any one of these criteria could be used to close shellfish beds for 5 to 10 days. The bay is automatically closed when a sewage treatment plant bypass or malfunction occurs, during high river flow, and during periods of frequent rainfall.

Since the dairy waste was considered to be one of the most pervasive problems, the Soil and Water Conservation District and the dairy community developed an extensive cleanup plan to address the animal waste problem. The strategy relied on two principles: (1) prevent rainwater and clean surface water from coming into contact with manure, and (2) when this is not possible, prevent contaminated surface water from reaching the streams or the bay. To implement the plan, 109 dairy farms were designated as critical dairies. To achieve the goal of a 70 percent reduction in fecal coliform loading, all critical dairies were encouraged to undertake best management practices (BMP's). Each farmer developed individual farm water quality plans. Each plan addressed the water quality problems of that farm, best management practices that would be used to alleviate them, and a 3- to 10-year schedule for implementing the practices.

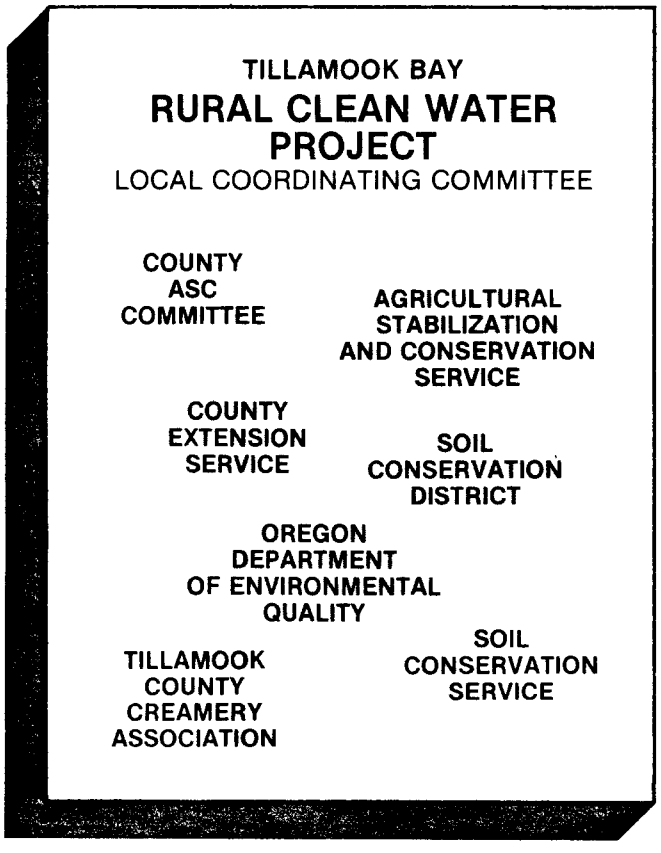
To ensure that the most critical sources were treated first, each farm was ranked based on factors such as the distance of confinement areas to open water, the acreage of poorly drained soils where manure is spread, the number of cattle per acre, and the farm's location in the watershed and floodplain. The BMP's applied by farmers included installing solid and liquid manure storage facilities, roofing animal manure accumulation areas, erecting streambank fencing, and managing roof water.

The other critical problem identified in the plan sewage waste, was addressed by the Department of Environmental Quality. Sewage treatment levels were determined to be adequate, but malfunctioning equip-



ment problems did occasionally occur. To rectify the problem, alarms and shutdown devices were installed at the sewage treatment plant. The Fecal Waste Management Plan instituted procedures to notify health officials of malfunctions so that shellfish beds could be closed. In addition, many failing septic systems have been eliminated as a pollution source by the expansion of a municipal sewer line.

The Fecal Waste Management Plan and Bay closure criteria were adopted by local and State agencies in July 1981. The criteria were implemented in 1982. Currently, the closure criteria are being re-evaluated based on continuing fecal coliform monitoring results.



Responsible Authorities and Financing

Funding for the program came from a variety of sources. The Tillamook Bay bacteria and water quality management plan study were originally funded by U.S. EPA 208 funds. Upgrades to the Tillamook sewage treatment plant were financed through EPA construction grants. The nonpoint cleanup effort was funded through USDA's Rural Clean Water Program, which provided a cost-share of up to 75 percent of the landowners' costs. The local Agricultural Stabilization and Conservation Service has received more than $4 million through this program to assist dairy owners in the implementation of BMP's. The farmers have also committed more than $3 million of their own money to support this effort. In 1986, the Department of Environmental Quality and the Soil and Water Conservation District began a new monitoring program funded by U.S. EPA 205(j) funds to assess the effectiveness of the management plan.

Results

Water quality and fecal contamination levels are improving basinwide from cleanup activities. Although implementation is not yet complete, the project has been able to show significant water quality improvements in both the rivers and the bay. In 1985 bay closures were invoked less frequently, and employment in Tillamook's oyster industry was the highest since 1952. Industries and dairy farming are still open for business.

Best management practices are working and water quality conditions are approaching desirable levels. Work on the farms is 45 to 50 percent complete. Recent water quality data analysis shows that fecal coliform contamination of the bay has already been significantly reduced between 1980 and 1985. Based upon the projected level of BMP implementation and the decline of fecal coliform concentration already observed, it appears that by 1991 Tillamook Bay will routinely meet shellfish water quality standards, although unusual weather conditions could cause a temporary problem.

Lessons Learned

Continued improvement of the water quality is expected for Tillamook Bay and its tributaries. With the knowledge of who, how, and when sources of pollution operate and discharge in a watershed and bay, point and nonpoint source discharges can be controlled to protect a shellfish industry.

The success of the plan is attributable to a number of factors:

- The County Extension Service Soil and Water Conservation District, the Agricultural Stabilization and Conservation Service, Soil Conservation Service, and the Creamery Association worked together closely from the beginning of the program. These agencies worked cooperatively to create strong public involvement. The involvement of local citizens throughout all phases of the project fostered local pride in the accomplishments and, more important, fostered a pride in the livability of the Tillamook area.
- Cost-sharing money became available and was adequate to show immediate progress.
- The project was very closely tied to an important resource, which made the community highly interested.
- The solutions were fairly easy to develop and implement.

For further information, contact John E. Jackson, Department of Environmental Quality, Portland, OR; or John van Calcar, U.S. Department of Agriculture, Portland, OR; or Mark Alderson, EPA Project Manager, Washington, DC.

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Maryland's Critical Area Program

Managing aquatic resources by controlling land-based activities

CHESAPEAKE BAY

Characteristics

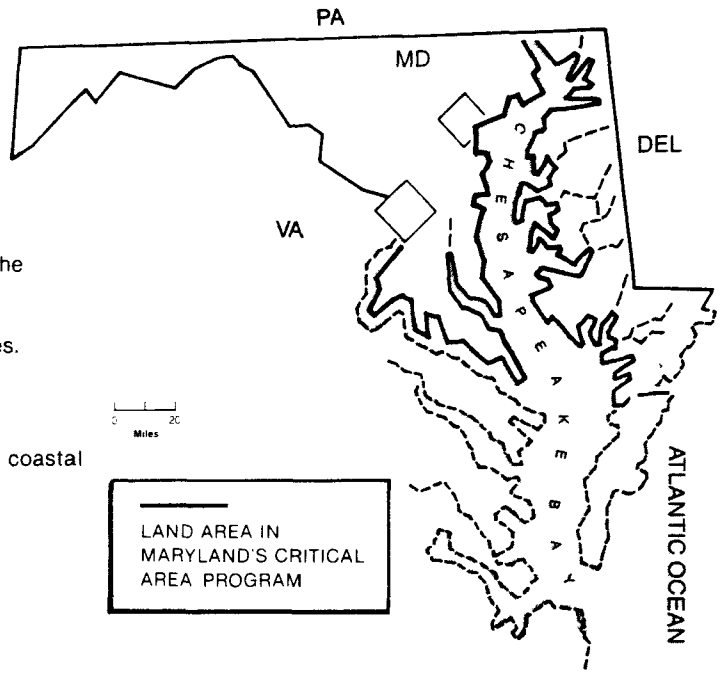
- The area includes 2,900 miles of shoreline and 614,000 acres of land.
- Land usage includes:
  - -35 percent tidal wetlands
  - -25 percent agricultural lands
  - -28 percent forest
  - -12 percent developed area.

Resources

- Over 200 species of finfish and shellfish inhabit the bay at some point in their life cycle.
- Bay produces 50 percent of blue crabs and 33 percent of oysters harvested in the United States.
- Canada geese, ducks, and other migratory waterfowl find winter habitat in the bay area.

Issues

- Development is increasing in the critical area of coastal counties at twice the rate outside critical area.
- Loss of wildlife habitat is a continuing problem.
- Nonpoint source pollution has been identified as major problem.
- Fish and shellfish resources are declining.



Introduction

The Critical Area Law focuses on land-based activities as a source of problems in Chesapeake Bay water quality. It is a program designed to balance the pressure for new development while checking its potential to increase the amounts of pollutants entering the bay from disturbed areas. Equally important, the Critical Area Law emphasizes the need to preserve the bay area's richly diverse habitats for fish, wildlife, and plants and to use its resources wisely.

Historically, the Chesapeake Bay has provided generous harvests of high quality seafood, abundant water-based recreation, deep international shipping lanes supporting Maryland and Virginia's industrial base, and a haven for wildlife. Rapid population growth and development and associated pollutant and sediment loads have threatened the bay's water quality, natural habitats, shoreline, and commercial integrity.

In the early 1980's, subsequent to the release of the Chesapeake Bay Program's research findings, concern for the bay was high – as demonstrated by the passage of 34 legislative and budget measures in the State of Maryland for bay cleanup. The Bay Critical Area Law was a major component of this initiative.

Overview of Bay Characteristics and Problems

Located on the Atlantic coastal plain, the Chesapeake Bay drains over 150 rivers in a 64,000 square mile area. The lands surrounding the bay support diverse uses: farming, forestry, industry, recreation, urban and suburban development, and unique natural habitats. Since the 1950's, these lands have developed rapidly. In fact, in Maryland, 17 percent of new coastal county development has occurred on only 9 percent of the available land area – within 1,000 feet of shoreline.

The health of the bay has been declining. Evidence includes decreased stocks of bay anadromous fish species and degraded water quality, particularly in the upper Chesapeake Bay and tidal estuaries. In these areas, increased nutrients have lowered available oxygen for fish and aquatic life; sediment has

decreased available light for submerged aquatic vegetation and shipping lanes and other channels; and toxic substances have reduced species diversity.

The Chesapeake Bay Critical Area Law

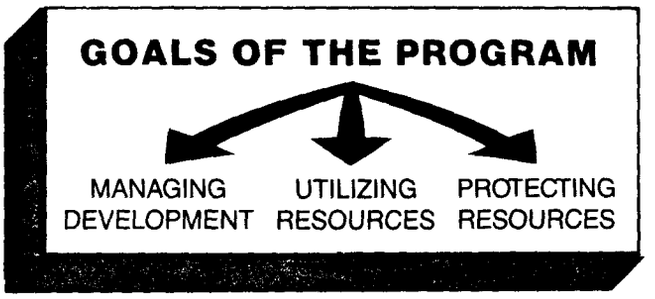
By passing the Chesapeake Bay Critical Area Law, the Maryland General Assembly recognized that land uses near the water's edge have important consequences for water quality and wildlife habitat. The law

- Identified lands within 1,000 feet of mean high water or landward of tidal wetlands as a "Critical Area";
- Defined goals to reduce the impact of development on water quality as well as on fish, wildlife, and plant habitats;
- Created an intergovernmental framework for comprehensive land use planning and habitat protection.

The law also established a commission of 25 members to develop criteria for implementing the program. The criteria established three broad categories for land use. The law requires local jurisdictions to develop programs to manage lands in the three categories as specified by the characteristics and criteria developed by the commission. The management of these lands is to include measures to address land cover and impervious surfaces; buffer areas; setbacks; open space, water access, and recreation areas; and timber harvesting. Each jurisdiction must submit its program to the Critical Area commission for review.

Goals

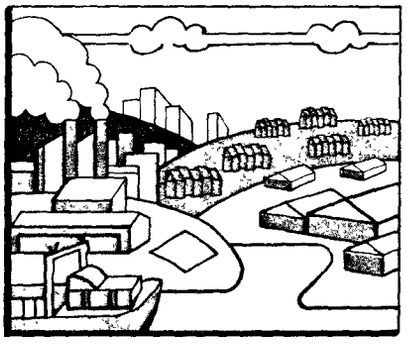
The implementation criteria, which were drafted by the commission with substantial public contribution and approved by the State General Assembly, address three resource management issues: development, resource utilization, and resource protection.



Managing Development. The commission designated three broad land use categories: Intensely Developed, Limited Development, and Resource Conservation Areas. In general, the rationale was to direct new growth in the Critical Area to already built-up areas because this would minimize the impact of growth on protective land uses and natural habitat. In the Limited Development Area, the existing pattern of development could continue, but the commission developed criteria, often in the form of performance standards, so that impacts to water quality and natural habitats would be

Characteristics of Land Classifications in Critical Area, and Criteria for Management

Intensely Developed Area



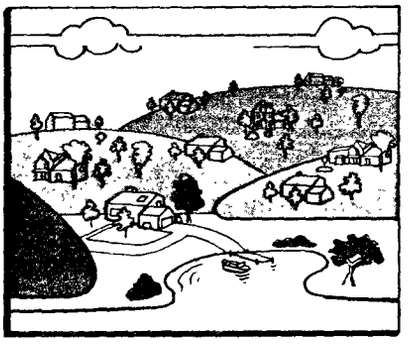
Characteristics

- Dense residential, institutional, commercial, or industrial uses
- 4 or more dwelling units per acre
- Public sewer and water serving 3 or more housing units per acre

Applicable Criteria

- Reduce pollutant loadings by at least 10% from predevelopment loads
- Reduce nonpoint impacts to streams and tidal waters from redevelopment
- Protect remaining wildlife and fish habitats

Limited Development Area



Characteristics

- 1 dwelling unit per 5 acres up to 4 per acre
- Areas with public sewer, or water, or both
- Mixture of land usage—not dominated by agriculture, wetlands, forest, or open space

Applicable Criteria

- Replace cleared forest land on an acre-for-acre basis
- Restrict removal of existing forest land to 20% when development occurs
- Restrict impervious areas to 15% of the land area being developed
- Encourage clustering of dwelling units to conserve natural habitats

Resource Conservation Area

Characteristics

- Housing density of less than 1 dwelling unit per five acres
- No public sewer or water
- Primarily open fields, wetlands, forest, and agriculture

Applicable Criteria

- Limit residential development to an overall density not to exceed 1 dwelling unit per 20 acres
- Encourage agriculture and forestry

minimal. The Limited Development Area was defined to include areas containing the protective land uses and natural habitats. The commission then considered the question of how to accommodate some development in the Resource Conservation Areas but still maintain such uses.

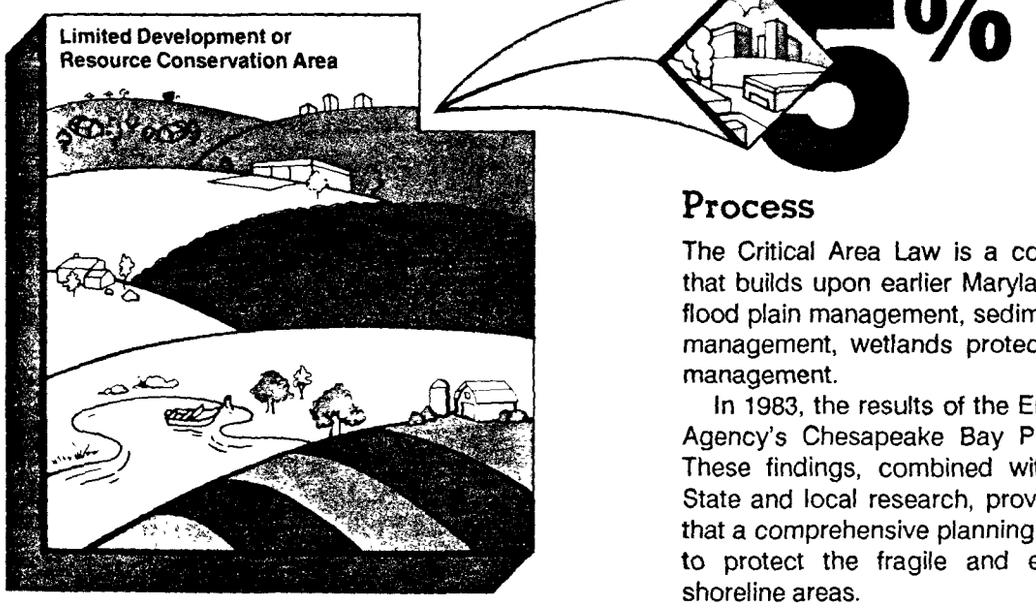
The law required local jurisdictions to assign their lands in the critical area to one of three categories by December 1985.

The criteria also allow for development of pre-existing lots and subdivisions through grandfather provisions and for expansion of development. Intensely Developed Areas and Limited Development Areas may be expanded by up to 5 percent of a county's land area, excluding the acreage in tidal wetlands or federally owned property from the formula. No more than one-half of this allocated expansion may occur directly in the Resource Conservation Area.

Utilizing Resources. The law also calls for improved management of forests, agriculture, and water-dependent facilities within the Critical Area. Specific requirements are

- Commercial tree harvest operations affecting one or more acres per year must have a forest management plan; limitations are imposed on timber harvesting within 1,000 feet of mean high water of the bay or perennial tributary streams;

Only 5% of Land May Be Reclassified to More Intense Use



- Soil conservation and water management plans and implementation of best management practices are required within five years on agricultural lands;
- A 25-foot filter strip must be established along tidal waters and streams until a soil conservation plan is implemented;
- Feeding or watering of livestock is prohibited within 50 feet of the water's edge; and
- New development within 100 feet of shoreline except in water-dependent communities, and new marinas are prohibited in Resource Conservation Areas.

Protecting Resources. The last component of the Critical Area Program provides for protection of nontidal wetlands, threatened and endangered species, species in need of conservation, and plant and wildlife habitat. These habitat and wildlife protection measures require local jurisdictions to

- Inventory and protect fish spawning grounds, threatened and endangered species habitat, colonial water bird nesting sites, historic waterfowl staging and concentration areas, and forest-interior-dwelling bird habitat;
- Create wildlife corridor systems to ensure that any new development in the Critical Area will preserve existing habitats;
- Establish a minimum 25-foot buffer zone around nontidal wetlands to prevent any future habitat modification; and
- Establish a minimum 100-foot naturally vegetated buffer strip around the bay in all nondeveloped areas.

Responsible Authorities and Financing

Implementation of the Critical Area Program is based on a well-defined State/local government partnership. Each of 60 local jurisdictions (16 counties and 44 municipalities) is to develop its own program to implement the Critical Area criteria. The commission performs an oversight function to ensure that these plans meet the stated goals of the criteria and coordinates implementation among the local jurisdictions. The operation of the commission and development of local plans are financed through general State revenues. The State provided funds to develop the maps and local programs.

Process

The Critical Area Law is a comprehensive approach that builds upon earlier Maryland programs, including flood plain management, sediment control, stormwater management, wetlands protection, and coastal zone management.

In 1983, the results of the Environmental Protection Agency's Chesapeake Bay Program were released. These findings, combined with facts uncovered by State and local research, provided powerful evidence that a comprehensive planning approach was required to protect the fragile and economically important shoreline areas.

Following this report, the Governor of Maryland created an interdepartmental task force to respond to the findings of the bay study. The Critical Area Program was one of the legislative and budgetary measures proposed by the task force. Local government participated early in the drafting process through the Maryland Association of Counties and the Maryland Municipal League. Committees of the Maryland General Assembly also reviewed the bill frequently throughout the drafting process. The bill was enacted on June 1, 1984.

From its early stages, the bill's intent was to maintain local planning authority. The enacted legislation provides for both a carefully defined local implementation process and comprehensive State oversight. The membership of the Critical Area Commission was important in developing the criteria, and local jurisdiction played a strong role. Of 25 members, 11 are residents, elected officials, or appointed officials of coastal counties; 8 members represent the commercial, recreational, and environmental interests of the bay. Only six commission members are from State agencies. All members are appointed by the Governor, with State Senate approval. The commission's executive director is selected by the commission chairperson.

Prior to drafting the criteria, the commission held seven public hearings during December 1984, at locations around Maryland's bay coastline, to enable local citizens and bay interest groups to voice their opinions.

Throughout the criteria development process, the commission continued to conduct formal meetings and public hearings. Commission members and staff also made numerous appearances before General Assembly committees, spoke at meetings organized by the many interest groups concerned with bay issues, and conducted television and radio interviews.

Following a final series of nine oublic hearings during July 1985 to review the proposed criteria, the commission substantially modified the criteria to address public concerns. The revised criteria were signed into law on May 13, 1986, 22 months after enactment of the Critical Area Law. These criteria are now guiding local jurisdictions in their development of Critical Area land use plans.

Program Status

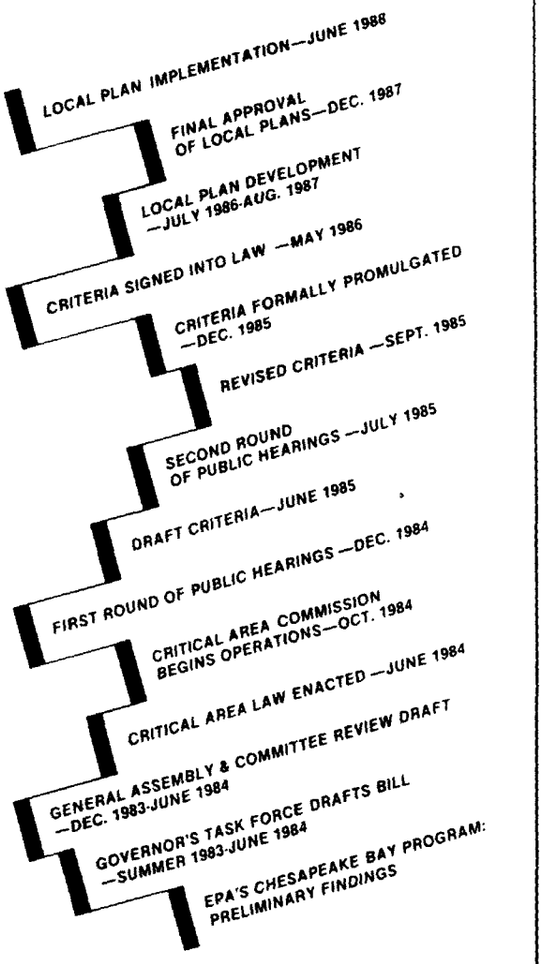
Local jurisdictions are developing program plans and amending their zoning ordinances as needed to meet Program goals. Final approval of all local plans is expected shortly.

The positive results of this process can be seen in local jurisdictions now working together to develop coordinated plans and continued support by citizens at their local government levels. Perhaps as important is the increased contact between State agencies and local jurisdictions – particularly the small jurisdictions – which has improved intergovernmental relations.

Lessons Learned

The Critical Area Program – the Critical Area Law, the commission, and the criteria – is a reality. It demonstrates that support for managing coastal development can be generated; that comprehensive State-level land use restrictions, typically fraught with controversy, can be established; and that a process of local implementation complemented by State oversight can be defined.

Origin and Development of the Critical Area Program



The active involvement of local officials and the public, the clear definition of respective State and local roles, and the protection of local planning authority were fundamental to this program's success.

The Critical Area Program may still face areas of resistance. If fully implemented, however, the program will fairly balance diverse interests and preserve the essential rights of local jurisdictions. By bringing local interests together with State regulators, a strong program was devised to protect the recovery of the bay. For Maryland, a State-level response worked; elsewhere a multi-county or multi-State program might be appropriate to protect estuarine environments.

For further information on this program, contact Dr. Sarah Taylor or Dr. Kevin Sullivan, Maryland Critical Area Commission, Annapolis, MD; or Mark Alderson, EPA Project Manager, Washington, DC.