

**IMPROVING AND PROTECTING WATER QUALITY THROUGH
EROSION AND SEDIMENTATION CONTROL:
The Need for a Great Lakes Basin Program**

Thomas R. Crane¹, and Tom Ciaglo²

ABSTRACT: Soil erosion and the deposition, or sedimentation of soil particles in the Great Lakes and their tributaries have profound impacts on water quality in the Great Lakes basin and result in tremendous costs to society. Nonpoint sources of pollution, particularly agricultural land use activities, have been identified by a number of sources as significant contributors to the erosion and sedimentation problem in the Great Lakes. In November 1987, the Great Lakes Commission's Soil Erosion and Sedimentation Task Force recommended that the federal government develop and implement a Great Lakes Basin Water Quality Program to protect water quality in the Great Lakes from the impacts of agricultural sedimentation. This paper outlines the need for such a program, describes in detail its goals, elements, and activities, and discusses progress in generating support for the program. This paper also identifies key policy and legislative challenges in establishing this program as a result of unique aspects of the Great Lakes' ecosystem.

KEY TERMS: Great Lakes basin; sedimentation; erosion; Great Lakes Basin Water Quality Program; Great Lakes Commission.

INTRODUCTION

Erosion and the subsequent deposition, or sedimentation, of eroded soil particles have a profound impact on the quality of water in the Great Lakes basin. Conventional pollutants such as nutrients as well as toxins attach to eroded soil particles which transport these contaminants to streams, tributaries, and the Great Lakes during periods of rain.

Excessive sedimentation accelerates the eutrophication process of the Great Lakes by transporting nutrients, especially phosphorus, into the Lakes. Particulate phosphorus readily attaches itself to soil particles and, once in water, becomes available to aquatic plants. As the loadings of nutrients to the Lakes becomes excessive, the natural process of eutrophication is accelerated leading to tremendous blooms of aquatic plants. As these plants die, the decomposition process reduces the levels of dissolved oxygen in the water. Major algal blooms in Lake Erie in the early 1970's caused dissolved oxygen levels to drop to zero in parts of the Lake leading researchers to call Lake Erie dead.

¹ Natural Resources Management Specialist, Great Lakes Commission, 400 S. Fourth St., Ann Arbor, MI 48103.

² Associate, ICF Incorporated, 9300 Lee Highway, Fairfax, VA 22031.

Sediment can also transport pesticides, heavy metals, bacteria, and viruses into the Lakes. Eutrophic conditions and the presence of excessive levels of contaminants in the Lakes make the water unsafe for drinking, can lead to fish kills, and otherwise significantly disrupt the Lakes' ecosystem.

Clean sediment, without contaminants attached, can also degrade water quality. Sediment adversely affects fish and wildlife as it settles on stream and lake bottoms, covering gravel beds used by organisms low on the food chain such as invertebrates and baitfish. Sediment also covers the spawning beds of sportfish, can clog the gills of fish and invertebrates, and can critically impact the production of future generations of fish. Excessive soil erosion and sedimentation also increases the turbidity of water. Increased turbidity in turn limits the penetration of sunlight thus reducing photosynthesis, and negatively impacts recreational activities such as boating and swimming.

Excessive sedimentation also causes a suspended solids problem in water used for public supplies. As a result, drinking water treatment plant operators must clean filtration equipment more regularly, increase the use of chemical coagulants, and treat and dispose of increased amounts of sludge. Sedimentation also increases the need for dredging and maintaining navigational channels, supply reservoirs, and a variety of water conveyance facilities such as sewers, roadside culverts, and agricultural drainage ditches. In fiscal year 1985, the U.S. Army Corps of Engineers spent over \$33 million to dredge nearly 9 million cubic yards of material from Great Lakes recreational and commercial harbors (Great Lakes Commission, 1988a). These dredging activities also impact Great Lakes water quality by resuspending sediments contaminated with a variety of synthetic organic chemicals and heavy metals.

Combined, the impacts of erosion and sedimentation result in a tremendous cost to society. The most widely cited estimates of annual sediment damage in the U.S. range between \$4.2 to \$16.9 billion (Clark et al., 1985; Crosson, 1988). These estimates, however, do not account for damage to ecological systems and therefore underestimate the true costs of sediment damage.

A number of scientific investigations have concluded that sediment resulting from agricultural activities is the greatest component of nonpoint source water pollution in the U.S. (International Joint Commission, 1978 and 1983; Great Lakes Water Resources Planning Commission, 1987; National Research Council et al., 1985). Other sources of eroded soil and sediment include forest and pasture land, streambanks, shorelines, and urban construction activities. The U.S. Department of Agriculture estimated in its 1982 Natural Resources Inventory that more than 900 million tons of soil are eroding each year in the eight Great Lakes States. This is enough soil to fill 53 million standard dump trucks, or, stated another way, an average of 28 tons of soil are eroding each second. With the amount of soil loss so great and the impacts of sedimentation so severe, society needs to consider what can be done to protect the productivity and the quality of the Great Lakes's land and water resources. The most promising course of action is to develop public policy that responds directly to the causes of the problem.

THE NEED FOR A COMPREHENSIVE FEDERAL GREAT LAKES BASIN WATER QUALITY PROGRAM

Traditionally, conservation programs aimed at controlling erosion have focused on maximizing the on-site productivity of cropland and have largely ignored opportunities to minimize the water quality impacts and other off-site damages from excessive sedimentation. Most recently, the Conservation Reserve Program (CRP)

under the Conservation Title of the Food Security Act of 1985 offers to pay landowners to place their highly-erodible cropland in reserve. However, the CRP bases its determination of "highly-erodible" cropland on the Tolerable Soil Loss factor "T". "T" is the maximum rate at which a particular soil type can erode without adversely affecting crop productivity. Much of the cropland acreage in the Great Lakes basin, especially cropland most likely to contribute to the sediment loadings to the Lakes, is not considered "highly-erodible" and therefore is not eligible for set-aside under the CRP (Great Lakes Commission, 1988b). Thus, the Food Security Act does not place enough emphasis on the severity of the off-site damages of erosion and sedimentation and does little to control the sedimentation problem in the Great Lakes basin.

The federal Nonpoint Source Management Program under Section 319 of the Water Quality Act of 1987 focuses on improving water quality through nonpoint source pollution control but fails to adequately target agricultural soil erosion and the subsequent sedimentation problems. Section 319 funds cannot be used for cost-share payments to individual farmers for the installation of conservation practices necessary to control water quality impacts from erosion and sedimentation (Rodgers and Rosenthal, 1988). Cost-share programs are perhaps the most effective way of encouraging farmers to adopt conservation practices. An emerging issue for the Great Lakes States is communicating to Congress the importance of appropriating the funds necessary to implement Section 319.

An expanded role for the U.S. Government, drawing on its ability to provide leadership and financial assistance, is absolutely critical to addressing the problem of erosion and sedimentation in the Great Lakes basin (Ciaglo, 1989). All Great Lakes States have erosion and sedimentation control programs, but the problem requires interagency coordination, resources, expertise, and a higher overall degree of attention afforded by the federal government. The sedimentation problem in the Great Lakes also has an international component thereby requiring federal involvement in addition to state and provincial programs. The U.S. Government has obligations under the Great Lakes Water Quality Agreement signed with Canada to control its share of rural nonpoint sources of pollution. In addition, protection of the basin's soil and water resources is vital to the regional economy. The Great Lakes region is a top agricultural producer of a number of commodities with cash receipts from crops and livestock sales totalling nearly \$34 billion in 1988 (Great Lakes Commission, 1990a). The Great Lakes region also generated almost \$5 billion in federal tax revenues in 1986 from travel and tourism, and supports a sport-fishery estimated to be worth about \$4 billion (Great Lakes Commission, 1989).

THE GREAT LAKES BASIN WATER QUALITY PROGRAM

Given the problem of impacts of erosion and sedimentation on water quality in the Great Lakes and the heretofore inadequate control efforts, the Great Lakes Commission, an eight state compact agency founded in state and federal law, has recommended that the federal government establish a line-item Great Lakes Basin Program in the federal budget. The program was developed by a task force representing the eight Great Lakes States, U.S. Department of Agriculture Soil Conservation Service (SCS), U.S. EPA, and others (Great Lakes Commission, 1987). The goals of the program are:

- to protect and improve water quality in the Great Lakes basin by controlling erosion and sedimentation;
- to limit the input of associated nutrients and toxic contaminants;
- and

- to minimize off-site damages to harbors, streams, fish and wildlife habitat, recreational facilities, and the basin's system of public works.

The objectives of the program are:

- to achieve special legislative recognition for the water quality problems associated with erosion, sedimentation and the delivery of nutrients and toxic contaminants to the Great Lakes;
- to provide dedicated, reliable, long-term funding for erosion and sediment control programs in the basin;
- to better coordinate efforts, roles, and initiatives between federal, state, and local soil conservation and pollution control agencies and groups in the basin;
- to recognize sediment as an important pollutant, its role in the transport of chemicals and to improve the linkage between erosion control and water quality programs;
- to support the development and implementation of urban and rural nonpoint source management programs and sediment components of Remedial Action Plans under terms of the Great Lakes Water Quality Agreement;
- to build coalitions and networks to support a Great Lakes Basin Program and to share information and educate groups and individuals with similar interests and goals; and
- to protect and enhance the region's water quality for the benefit of all economic and environmental interests.

To achieve these objectives, the Great Lakes Basin Program comprises five principal elements:

- (1) Program grants and technical assistance;
- (2) Financial assistance and demonstration grants;
- (3) Demonstrations and special projects;
- (4) Evaluation and monitoring activities; and
- (5) Education and information activities.

Program grants and technical assistance will provide incentives to states to develop soil erosion and sedimentation control programs that lock in water quality priorities. Program grants will be allocated by a lead federal agency to expand existing programs compatible with the goals and objectives of the Great Lakes Basin Program as well as to establish new programs. The lead federal agency will allocate funds to other federal agencies, state agencies, and local entities in each of the eight Great Lake States based on an explicit grants application process and formula. Technical assistance programs will involve establishing local environmental extension services emphasizing water quality improvements through such methods as changes in land use practices, fertilizer and pesticide management, animal waste management, and soil and water conservation. Technical assistance programs will be administered by agencies experienced in providing this type of function such as the SCS, the U.S. EPA, state Departments of Agriculture, Natural Resources, Environmental Protection, and their equivalents, university extension services, soil and water conservation districts, and others.

Financial assistance and demonstration grants will be made available for site specific projects tied to the state and local programs developed under the Great Lakes Basin Program program grants provisions. Financial assistance and demonstration grants can be used in conjunction with long-term cost-share contracts with individual landowners to carry out approved soil conservation and water quality management practices. They can also be used to fund innovative urban and rural erosion control projects that focus on the surface and ground-water quality impacts of land disturbing practices. The Great Lakes Basin Program will allocate and disburse the financial assistance and demonstration grants through the same means identified above.

Demonstrations and special projects will expand and support the application of scientific knowledge to the control of erosion and sedimentation in the basin. Examples of demonstrations and special projects include:

- determining the effects that erosion and sedimentation control practices (e.g., conservation tillage) have on ground-water quality;
- quantifying the amounts and types of contaminants that eroded soil particles transport into the Great Lakes;
- demonstrating and quantifying the off-site impacts of sedimentation in the basin;
- developing methods that relate Tolerable Soil Loss factors to off-site damages of erosion and sedimentation that will enable states to establish standards that meet water quality objectives; and
- coordinate research efforts among the various federal, state, and local agencies, universities, and research organizations.

Evaluation and monitoring activities will provide funds to allow the lead agency to track the progress of erosion and sedimentation control in the Great Lakes Basin. The evaluation and monitoring provision will promote opportunities for modeling and expanded use of remote sensing and geographic information system techniques to track the progress of control initiatives and identify new areas of concern. These activities are intended to facilitate the exchange of information and cooperation between the U.S. EPA, the U.S. Geological Survey, the U.S. Army Corps of Engineers, NOAA's Great Lakes Environmental Research Laboratory, and state water quality agencies to expand and enhance present evaluation and monitoring systems.

Education and information activities will promote the Great Lakes Basin Program and its goals of controlling the water quality impacts of erosion and sedimentation through education programs targeting landowners, the agricultural community, environmental interest groups, and civic organizations. Education and information activities will encourage interested individuals and groups to build coalitions and networks to communicate the goals and objectives of the Great Lakes Basin Program to an even wider audience.

PROGRAM FUNDING

The Great Lakes Basin Program will require a committed, dedicated source of funds for 10 years totaling \$10 million for the first year, \$15 million for the second year, and \$25 million for each year thereafter. These figures were derived from a 1987 survey report documenting the needs of the eight Great Lakes States to implement erosion and sedimentation control programs in the Great Lakes Basin (Great Lakes Commission, 1987). For the first two years, funds will be used primarily to (1) help states develop plans to implement the Great Lakes Basin Program and the portions of their nonpoint source management plans that relate to erosion and sedimentation, (2) help agencies develop evaluation and monitoring programs to establish baseline data, and (3) identify erosion and sedimentation research needed to support various aspects of the program. Funds for years three through ten will be used to carry out the elements of the program discussed above. States will be required to share not less than 25 percent of the costs of any of the principal elements of the program.

In the 1987 survey of the Great Lakes States' needs, respondents estimated that the total cost of operating soil erosion and sedimentation control programs in the basin in fiscal year 1990 would be \$109 million. These figures have been supplemented with a needs assessment of the cost of managing nonpoint source pollution at the field office level. This was accomplished through a recent survey report of the 189 soil conservation districts in the Great Lakes basin prepared by the Great Lakes Commission for the National Association of Conservation Districts Committee on the Great Lakes (Great Lakes Commission, 1990b). In that report the Great Lakes basin Soil and Water Conservation Districts listed a full package of incentives and needs totaling \$48.5 million, or about \$242,500 per district to encourage landowner participation in conservation programs, \$14 million for additional personnel, and about \$4 million for equipment.

PROGRESS IN ESTABLISHING SUPPORT FOR A GREAT LAKES BASIN PROGRAM

Since 1988, when the Great Lakes Commission first developed and adopted the Great Lakes Basin Program, the support for a comprehensive erosion and sedimentation control program in the basin has grown steadily. A number of developments have occurred that deserve mention:

- The National Association of Conservation Districts (NACD) has formed a Committee on the Great Lakes to serve as a bridge between the NACD and the U.S and Canadian federal, regional, state, provincial, and local interests involved in Great Lakes water quality management. The Committee on the Great Lakes recently conducted a survey of 189 Soil and Water Conservation Districts in the Great Lakes basin to establish an information data base to underscore the value and role that districts play in managing nonpoint source pollution and to document the need for increased funding at the field level in the Great Lakes basin (Great Lakes Commission, 1990b).
- The Great Lakes basin Soil and Water Conservation Districts have expanded the focus of their traditional conservation programs to accommodate changing demographics, land use activities, and public demand for clean water. Districts are establishing programs in areas related to urban nonpoint source pollution, waste management, and overall water quality improvement.

- The NACD Board of Directors accepted and approved the district water quality survey report presented by the Committee on the Great Lakes at its semi-annual meeting on October 15-16, 1990 in Seattle, Washington. The report calls for new funds of \$48.5 million dedicated to the development and implementation of a Great Lakes Basin Program to improve water quality through erosion and sedimentation control.
- The 1991 federal appropriations requests for the Veterans Administration, Housing and Urban Development, and Independent Agencies, recently signed by the President, include a \$1 million line item for Great Lakes Sedimentation and Erosion Control. Discussions are underway to determine how these funds will be allocated between the eight Great Lakes states. Most likely, the majority of the funds will be earmarked for the Saginaw Bay with the remainder going to the states for erosion and sedimentation control program grants, technical assistance, and demonstration projects.
- In 1987 the SCS established water quality protection as a top priority. The policy states that SCS will integrate both surface and ground water quality management functions into its programs and activities to promote the improvement, protection, restoration and maintenance of surface and ground-water resources for beneficial uses. Over the past several years, earmarked funding for water quality projects including hydrologic unit area proposals and demonstration projects has increased consistently under the regular SCS Conservation Operations budget. In fact, water quality funding has been the only area under the Conservation Operations to consistently experience an increase over the past three years.

CONCLUSION

While support is growing for the Great Lakes Basin Program, much work remains. Little work has been done on the ground to date to stem the tide of erosion and sedimentation in the Great Lakes basin, and the costs of the resulting impacts are rising. Limited public funds may be better spent to control the erosion and sedimentation through the establishment of a Great Lakes Basin Program rather than used for remediation efforts after damage has already occurred. The federal Government has a responsibility to its citizens as well as to Canada to protect the soil and water resources of the Great Lakes basin. This commitment should come in the form of a dedicated, long-term appropriation of funds to initiate this erosion and sedimentation control program in the basin. In light of the current federal fiscal situation, many may see this program as costly, however, the long-term damage costs and environmental impacts of a piecemeal approach to controlling this problem will undoubtedly be greater.

REFERENCES

- Ciaglo, T. 1989. The Policy Link Between Agricultural Sedimentation and Water Quality in the Great Lakes Basin. Ann Arbor, MI.
- Clark II, E. H., J. A. Haverkamp, and W. Chapman. 1985. Eroding Soils: The Off-Farm Impacts. The Conservation Foundation, Washington, DC.
- Crosson, P. 1988. Economics of Sediment Damage and Abatement Measures. In: Political, Institutional and Fiscal Alternatives for Nonpoint Pollution Abatement Programs; V. Novotny, ed. Marquette University Press.
- Great Lakes Commission, 1987. Soil Erosion and Sedimentation in the Great Lakes Region: Final Report. Ann Arbor, MI.
- Great Lakes Commission, 1988a. Great Lakes Commercial and Recreational Harbor Dredging: Issues and Recommendations. Ann Arbor, MI.
- Great Lakes Commission, 1988b. Soil Erosion, Sedimentation and Water Quality in the Great Lakes Region. Ann Arbor, MI.
- Great Lakes Commission, 1989. Travel, Tourism and Outdoor Recreation in the Great Lakes States: A Statistical Profile. Ann Arbor, MI.
- Great Lakes Commission, 1990a. The Great Lakes: A Great Place to Live! Ann Arbor, MI.
- Great Lakes Commission, 1990b. Conservation Districts and Great Lakes Water Quality: Present and Prospective Roles. Ann Arbor, MI.
- Great Lakes and Water Resources Planning Commission. 1987. Water Resources for the Future: Michigan's Action Plan.
- International Joint Commission, PLUARG. 1978. Environmental Management Strategy for the Great Lakes System. Windsor, Ontario.
- International Joint Commission. 1983. Nonpoint Source Pollution Abatement in the Great Lakes Basin: An Overview of Post-PLUARG Developments. Windsor, Ontario.
- National Research Council of the United States and the Royal Society of Canada. 1985. The Great Lakes Water Quality Agreement. National Academy Press, Washington, DC.
- Rodgers, P. and A. Rosenthal. 1988. The Imperatives of Nonpoint Source Pollution Policies. In: Political, Institutional and Fiscal Alternatives for Nonpoint Pollution Abatement Programs; V. Novotny, ed. Marquette University Press.