

Soundings: A Minnesota Water Plan Assessment is a product of the Environmental Quality Board Water Resources Committee, prepared by Committee Director Marilyn Lundberg at Minnesota Planning. *Soundings* was approved at the September 1998 meeting of the Environmental Quality Board, and fulfills the requirement in MS 103A.43 for a report on water policy. Estimated cost of preparing this report in staff time and printing is \$46,500, excluding committee assistance.

The Environmental Quality Board, staffed by Minnesota Planning, draws together five citizens and the heads of 10 state agencies that play a vital role in Minnesota's environment and development. The board develops policy, creates long-range plans and reviews proposed projects that would significantly affect Minnesota's environmental, economic and social well-being.

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Soundings

A Minnesota water plan assessment

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Glossary

Aquifer A sand, gravel or rock formation capable of storing or conveying water below the surface of the land.

Best management practice Voluntary practices used to prevent or minimize sources of pollution.

Ecoregion An area with similar soils, land surface, natural vegetation and land use.

Erosion The wearing away of land surface by water or wind. It occurs naturally from weather or runoff, but often is intensified by human activities.

Hydrograph A graph showing the water elevation within a lake or well as measured over a period of time. Ground water elevation is often reported as the depth below ground surface to that point.

Nonpoint pollution Pollution that arises from diffuse sources such as runoff from cultivated fields or urban areas.

Nutrients Elements or compounds essential to growth. Phosphorus and nitrogen are the two most common nutrients that runoff in sediment.

On-site sewage system Individual sewage or waste-water treatment systems that rely on natural decomposition of wastes at the site where they originate. Most consist of an underground sewage tank where wastes are separated into layers. Liquids are distributed into a drain field or other soil-based system for filtering and natural decomposition.

Pesticide A chemical substance used to kill or repel pests. Pesticides include herbicides to kill weeds, insecticides to kill insects and fungicides to kill fungi.

Sustainable development Development that enhances economic opportunity and community well-being while protecting and restoring the natural environment.

Watershed The surrounding land area that drains into a lake, river or river system.

Wetlands Low-lying lands that frequently have standing water on them, such as swamps, marshes and meadows.

Summary

As the headwaters of three major North American river basins, Minnesota has a unique responsibility for protecting water quality and quantity. Regional drought, flooding and water quality issues are constant reminders of the vital role of water in everyday life. As Minnesota's population grows, as water demands increase and land uses change, the added pressure on water resources requires proactive measures to meet present and future water needs. To meet this challenge, the Minnesota Legislature charged the Environmental Quality Board with developing and implementing a long-range water resources plan every 10 years.

The 1991 *Minnesota Water Plan* presents a comprehensive approach to protect and conserve Minnesota's water. The plan was crafted to help water managers and policy-makers coordinate efforts and integrate water programs.

Soundings: A Minnesota Water Plan Assessment highlights progress in carrying out the 1991 plan, in anticipation of a new water plan in 2000. *Soundings* is a status report of accomplishments and needs relating to the plan's 14 objectives, summarized here.

- Make water management more understandable and directed toward meeting state goals
- Carry out a statewide water resources information and education strategy
- Establish a systematic approach to collecting, managing and using water-related information
- Uniformly enforce Minnesota law and fairly assign liability
- Ensure that Minnesota's infrastructure is maintained and enhanced
- Target resources to priority needs and expand revenues
- Adopt a coordinated, interdisciplinary approach to managing lakes
- Protect and restore wetlands
- Manage rivers with their related land resources
- Routinely consider protection of ground water quality and quantity in public decisions
- Build degradation prevention goals into all programs and practices affecting water
- Strengthen protection and management of water wells
- Develop a local and state program to ensure sufficient water for long-term needs
- Sustain environmental quality by recognizing water interconnections

Progress is focused in key areas

MORE EFFORTS ARE FOCUSED ON BIG-PICTURE MANAGEMENT. Governments and other entities are focusing on sustainable

development, ecosystem management and basin management at all levels. These types of endeavors provide a unifying influence and offer a way to examine programmatic goals in a larger context. Rivers and watersheds are an increasing focus, with major activities targeted at large basins such as the Minnesota River.

LOCAL WATER PLANNING IS PROGRESSING. Local water planning, initiated in 1985 in Greater Minnesota and in 1982 in the Twin Cities area, is an integral part of most state and federal initiatives in Minnesota. State agencies are cooperating with local water planning groups in actions ranging from monitoring to best management practices and are looking to local water plans for priorities and for targeting program funds. Many local efforts are leading to more effective water protection and management. In the Twin Cities area, which has had mixed success in water planning and management, counties are becoming more active.

COORDINATION IS INCREASING. Interagency cooperative projects abound, along with numerous task forces, special committees and other joint approaches to water needs. Growing local expertise is leading many cooperative efforts.

COMPUTERS ARE CHANGING METHODS OF EDUCATING, INFORMATION SHARING AND ACCESSING DATA. The use of web sites, listservers and e-mail provides almost instant access to information to a growing number of computer users. Technology is also affecting educational opportunities; in addition to conventional methods, more guidance is offered electronically.

MORE MONITORING IS PROVIDING BETTER INFORMATION. Several state monitoring efforts were initiated, expanded or refocused, such as the increase in monitoring for contaminants in drinking water supplies, and the growing number of state and local monitoring efforts of lakes and for pesticides. As a result, environmental information is multiplying and reaching more people.

NEW EFFORTS ARE PREVENTING AND CORRECTING PROBLEMS. The 1990s saw added legislation, enforcement and funding to safeguard water resources, including protections for wetlands and requirements for on-site wastewater treatment systems as well as a stronger focus on conservation. Prevention efforts resulted in reducing toxic material releases and reducing and recycling solid waste. Problems have been corrected, such as upgrading or removing thousands of leaking tanks and sealing unused wells.

Some areas need more work

PRIORITY SETTING IS VARIABLE. Priority setting helps meet objectives relating to resource protection and management, funding and infrastructure. When priorities are not set in a systematic manner, important needs may not be identified or addressed. Systems for setting priorities for state assistance should be evaluated and reevaluated. Priority-setting should look beyond program needs to resource needs and beyond resource needs to community needs, focusing on prevention.

COORDINATION NEEDS MORE EMPHASIS. Coordination is an essential part of meeting nearly every objective, and while it is increasing, long-range comprehensive strategies are generally lacking. Coordination within Minnesota tends to revolve around program needs rather than taking a broad comprehensive approach. It does not generally occur in a systematic and inclusive manner — local, federal and state agencies may be left out. At the local level coordination may be lacking between neighbors, between cities and counties, and between special purpose and general purpose governments. Comprehensive strategies should be developed to coordinate water resources based on sustainable development principles and focused on resource systems. Surface water and ground water should be treated as an interconnected resource.

INFORMATION SHARING AND EDUCATION IS NEVER FINISHED. Information should be enhanced for ground and surface water systems, trends and interactions, including sustainable yields and effects of various land uses. Data should be evaluated, interpreted and made available to decision-makers and the public through broad-based educational efforts. Policy-makers should be armed with information they need to safeguard water resources.

FUNDING ASSISTANCE MAY NOT RELATE TO PRIORITIES. Objectives for resource protection and management as well as for preventing pollution tie funding and other assistance to priority needs. Some new funding has been earmarked for specific needs, such as feedlots or wetland protection. However, without a comprehensive approach and better priority setting and evaluation, it is not clear if funding is going to the highest priorities. Priorities need to be set for the state, not only for agencies and programs.

WITHOUT EVALUATION, PROGRAMS MAY MISS THE MARK. Periodic evaluation is needed to understand whether programs or activities are accomplishing their mission, or whether the mission has changed. Few evaluations are in place and analysis of data showing progress is also sporadic. Sustainable development principles are an effective tool; their use should be continued and expanded. In addition, local water plans should be tied to comprehensive plans including community-based plans of cities and counties. Programs and best management practices should be evaluated for relevance and progress toward achieving their objectives.

The *Minnesota Water Plan 2000* should be developed with input from all levels of government and various public interests. Ultimately, the plan should provide guidance in meeting long-term, broad-based objectives and strategies to coordinate water resources based on sustainable development principles and focused on resource systems.

Planning for Minnesota water

Minnesota water goals are two-fold: to safeguard Minnesota's water resources for the future and to meet current needs, while recognizing water's limits and interconnections, its changing and variable nature.

The 1991 *Minnesota Water Plan* set an ambitious agenda for protecting and conserving water. The plan was designed to guide water managers and policy-makers by providing a foundation for state efforts to coordinate and integrate water programs. State agencies agreed to carry out specific actions to fulfill the plan's objectives. The plan also communicated the state's commitment to local water planning as a key to managing water.

Soundings: A Minnesota Water Plan Assessment summarizes progress in carrying out the 1991 *Minnesota Water Plan*. The Water Resources Committee of the Environmental Quality Board compiled supporting information for the assessment. *Soundings* is part of a biennial series of water policy reports developed since the 1991 *Minnesota Water Plan*; previous reports focused on monitoring, water supplies, wastewater treatment and ground water protection.

Soundings looks at progress on the plan's 14 objectives, presented in chapters that parallel the 1991 report: integrating water management, focusing on the resource, protecting and conserving water resources and managing water's interconnections. *Soundings* also suggests directions and needs, setting the stage for the next comprehensive water plan due in 2000.

Otter Tail County improves lake quality

Lakes were a priority in the Otter Tail County's local water plan. A challenge grant from the Board of Water and Soil Resources funded a study that found a high phosphorus load coming from one of the two rivers flowing into Big Pine and Little Pine lakes. A closer look at land use pointed out possible problems from feedlots, septic systems and cropland and streambank erosion. Measures such as feedlot pollution abatement systems, septic system upgrades and erosion control measures are underway to reduce the nutrient load.

Integrating water management

Six objectives tie into Minnesota's water management strategy to make state government more understandable and responsive, to unify goals and build partnerships between state and local governments. Several objectives target efforts in communication, education, information and research to meet water management goals; others focus on water laws, infrastructure and funding.

10-YEAR OBJECTIVE: TO MAKE WATER MANAGEMENT IN MINNESOTA MORE UNDERSTANDABLE, EFFICIENT AND DIRECTED TOWARD MEETING STATE GOALS.

To reach this objective, the 1991 *Minnesota Water Plan* recommended establishing a coordination strategy, strengthening local water plans and making them a highly visible element of the strategy.

NUMEROUS EFFORTS STRENGTHEN COORDINATION. To help citizens and local entities understand and better participate in Minnesota's complex system of water management, the plan envisioned a strategy that would coordinate various entities and define roles. While such a strategy has not been developed, many groups are routinely coordinating their efforts. A big-picture framework helps unify an increasing number of efforts such as sustainable development as well as ecosystem and river basin management.

Numerous groups meet regularly to coordinate efforts. The Environmental Quality Board is legislatively charged with developing state water policy priorities and coordinating activities of all levels of government. In addition, the board coordinates a number of water assessments, prepares a water policy report each even-numbered year and develops the state water plan every 10 years. The Water Resources Committee, composed of two citizen board members, state water-related agencies, the Metropolitan Council and the University of Minnesota, helps the Environmental Quality Board carry out its water mission. *Soundings* is an evaluation of current directions and progress in meeting water plan objectives. *Saving Resources: Meeting Minnesota's Water and Wastewater Needs*, published in 1996, analyzed information affecting several agencies as well as local government. Staff work loads and competing pressures often limit the board's ability to carry out the broad legislative charge.

The 1997 interagency water monitoring initiative was a joint product of the Environmental Cluster, a group of state environmental agency heads that meets weekly. Numerous ongoing cooperative efforts among agencies and other interests tackle such issues as nonpoint pollution, ground water monitoring and surface water monitoring. Water managers meet routinely and staff from various entities work together on specific programs. Other groups are also more closely tied into state decisions, such as the Metropolitan Council that now reviews appropriation permits and participates with local water planning committees and boards.

To stretch resources and maximize program impact, local, state and federal agencies frequently share staff positions. The University of Minnesota Extension Service and the Natural Resources Conservation Service implemented education and information efforts with the Environmental Quality Incentive Program. The Board of Water and Soil Resources funded engineers and technicians in 11 regions to design local water quality projects. A Natural Resources Conservation Service employee has served as a water quality liaison with the Pollution Control Agency for the past six years.

Another coordination approach suggested in the plan is to combine state agency regional offices, which are rarely in the same town. While agencies have generally supported combining regional offices, few changes have been made. An overall strategy and significant funding are lacking.

Overall, coordination tends to be programmatic rather than systematic and inclusive. Local and federal agencies may be left out. With few exceptions, there are no mechanisms or guidelines in place for programs to be coordinated comprehensively; retooling programs for broader purposes is difficult without common goals or priorities.

Cass County water plan spurs action

Cass County embraced local water planning to effectively protect and manage its water resources, involving many in the planning process. Outcomes included developing a comprehensive plan, adopting a zoning ordinance and septage disposal ordinance, developing an exotic species program and stepping up enforcement.

REPORT RECOMMENDS OPTIONS FOR WATER MANAGEMENT. In 1996 the Minnesota Legislature requested a study of how environmental services could better address certain goals and outcomes. Minnesota Planning published *Crosscurrents*, which reported that the water management system, while complicated, is what the Legislature intended. Agencies such as agriculture or health advocate particular missions and program assignments that reflect the desires of state constituency groups. Barriers were identified such as inflexibility of funding requirements or difficulty in changing statutes or rules.

Crosscurrents highlighted some strides toward improving delivery systems. Agencies work cooperatively on planning, enforcement and assistance efforts, developing partnerships to reduce the challenge of navigating a governmental permit maze. To do this, agencies and all levels of government have had to be more flexible in their requirements. The report suggests options to improve coordination since "citizens and local units of government must know who is in charge and whom to contact" in the state's complex system of water management.

LOCAL WATER PLANNING IS PROGRESSING. Strong local water efforts are considered key to good water management. Seventy-three of 80 outstate counties have updated state-approved, comprehensive local water plans, effective August 1998. The plans include newly required components on wellhead protection, wetland preservation areas, ground water sensitivity and urban storm water. Adding these components increases local awareness of potential problems, making prevention easier. The Board of Water and Soil Resources, created in 1987 from a merger of three boards, is charged with approving the plans.

Local water planning accomplishments in 1996-97 included:

- One-half of all counties in greater Minnesota engaged in the revision or adoption of comprehensive plans or ordinances as a result of water plans.
- Counties participated in an average of one watershed or lake assessment project and monitored the water quality of seven lakes and streams.
- All counties implemented land and water treatment projects.
- All counties undertook inventory activities, including feedlots, septic systems, abandoned wells, drained wetlands and streambank and shoreline erosion sites.

Watershed districts are also updating water plans. In the last five years about one-third of the 43 watershed districts have revised their plans and the remainder will be done in the next five years. Most of the approved metropolitan plans are by watershed districts, although some watershed management organizations have also produced effective plans. District activities have expanded beyond traditional flood control projects to include a greater emphasis on water quality and watershed management.

THE TWIN CITIES REGION ORGANIZES WATER PLANNING DIFFERENTLY THAN THE OTHER 80 COUNTIES. The metropolitan area uses watershed management organizations, which could be a watershed district, or county leadership for surface water plans. Forty-six watershed management organizations were created in 1982 to develop water plans required by law. Each local unit in a watershed management organization was to develop and implement a water plan consistent with the overall plan, including the adoption of official controls for such things as reducing erosion and protecting wetlands.

Several plans were never developed. As required by statute, the Board of Water and Soil Resources developed rules for "second generation" plans in 1992. Eleven of the remaining 36 planning entities have second generation plans. The board has developed a priority phasing schedule for the remaining plans, however, some plans will not be due until 2001 or later.

Counties are assigned ground water planning. Four of the seven counties have state approved ground water plans with two working on plan updates. Two counties have nearly completed plans and one developed a ground water assessment outside of the official ground water planning process.

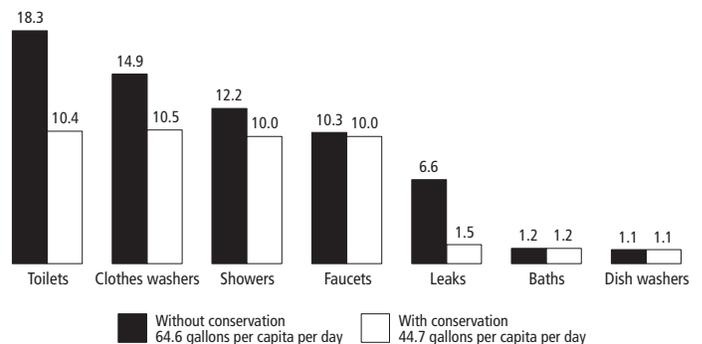
County roles are growing in Twin Cities area water planning. In 1997 the Board of Water and Soil Resources examined water management organizations in Scott and Carver counties. It found that all the joint powers organizations in Carver County and most in Scott County were self-terminated or noncompliant with water planning requirements. With no viable watershed management organization, all counties except Ramsey and Hennepin are required by law to assume watershed planning duties, and Carver and Scott counties have done so. They are also investigating integrating ground and surface water planning and management efforts. Meanwhile, Washington and Hennepin counties are examining how water management is structured locally.

Legislative changes have strengthened the ties between land use and water management in the region. Required local comprehensive plans must contain water supply plans, as well as plans for wastewater systems and surface water management. Watershed management organization plans must be consistent with ground water plans.

LOCAL WATER PLANS USEFUL TO MANY. State and federal agencies use the local water planning process to bring their programs to the local level or for direction on where to target program dollars. Agricultural producers who apply for the USDA Conservation Reserve Program receive additional environmental points for local water plans and water quality priority areas. In 1997, the entire state of Minnesota was designated a water quality priority, giving state producers a competitive edge nationally for program funds. Local planning also gives local government a mechanism to communicate specific resource protection priorities to state and federal agencies.

State agencies are participating with local governments as they develop their water plans, often providing staff liaisons to help local entities readily get information and assistance about such topics as understanding geologic conditions, managing data and preventing pollution. State water managers meet with local governments early in the water planning process to ensure that state concerns get addressed in each local plan and to avoid agencies not approving plans. The Metropolitan Council assists watershed management organizations and counties in developing

HOUSEHOLD WATER USE CUT WITH CONSERVATION



Source: American Water Works Association and the Environmental Protection Agency

water plans and helps local communities incorporate water elements into comprehensive plans.

Needs and directions

- Develop a multi-year statewide coordination strategy of agreed upon goals, assigned leadership and an action plan to ensure that coordination is systematic and inclusive.
- Encourage counties, cities, watershed districts and soil and water conservation districts to coordinate their water plans and to recognize source water protection, basin planning and water supply and demand management.
- Improve and expedite water planning in the Twin Cities area by watershed management organizations and counties.

Arrowhead collaborates on water priorities

Six counties in the Arrowhead region have worked together for six years to address county water plan goals, and review local water priorities and budgets. The Arrowhead water quality team, made up of county water plan coordinators and state, extension, education, soil and water conservation districts and regional representatives, has secured several grants for such things as best management practices fact sheets, a shoreland volunteer program, videos and a newsletter focusing on safe drinking water and shoreland management.

10-YEAR OBJECTIVE: TO DEVELOP AND CARRY OUT A STATEWIDE WATER RESOURCES INFORMATION AND EDUCATION STRATEGY AS AN INTEGRAL PART OF THE STATE'S NEW ENVIRONMENTAL EDUCATION PROGRAM.

To reach this objective the 1991 *Minnesota Water Plan* recommended launching a major environmental education initiative, opening lines of communication among all levels of government and citizens and strengthening training efforts.

ENVIRONMENTAL EDUCATIONAL EFFORTS AROUND DESPITE MOVES AND CHANGES. To direct environmental educational efforts, 1990 legislation established environmental education goals, created the Office of Environmental Education, the Environmental Education Advisory Board, affiliated the board and office with the State Planning Agency, and gave environmental education responsibilities to the Department of Education. The Office of Environmental Education was abolished in 1993, and the advisory board was moved to the Office of Environmental Assistance. Lack of funding and frequent changes hamper statewide information and education strategies, leaving most agencies to single-handedly undertake educational efforts.

A *GreenPrint for Minnesota: State Plan for Environmental Education* was published in 1993 by the Office of Environmental Education under

the direction of the Minnesota Environmental Education Advisory Board. It outlines recommendations and strategies for achieving Minnesota's goals for environmental education over a 10-year period. The Office of Environmental Assistance recently reevaluated implementation of the Waste Management Act and concluded that environmental education was critical. It is working with the Environmental Education Advisory Board to update *GreenPrint*.

In 1992, working with an interagency task force, the Environmental Quality Board developed *Toward a Minnesota Nonpoint Source Information Strategy and a Nonpoint Source Information and Education Materials Inventory*. This strategy was incorporated into the 1994 Minnesota's Nonpoint Source Management Program. The Minnesota Pollution Control Agency and University of Minnesota Extension Service share a position to help carry out the strategy.

FUNDING SUPPORTS NUMEROUS EDUCATIONAL OPPORTUNITIES. Many local water plans have educational goals and use state funds to carry them out, or receive direct legislative support. The Minnesota River Educational Initiative, for example, links five counties with Extension to reduce phosphorus and to encourage whole farm plans in the Blue Earth River basin.

The U.S. Department of Agriculture's new Environmental Quality Incentives Program provided \$533,000 in 1997-98 for educational activities for local units, American Indians and others. Colleges located at Leech Lake and Fon du Lac are working to educate American Indian tribes and individual land users on USDA programs, environmental concerns and possible solutions. Another grant went to the Blue Earth River Area Local Work Group to conduct the Land Stewardship Opportunities for Women Conference. This effort has helped to inspire women, who represent roughly 35 percent of the region's landowners, to become more involved in land stewardship decisions.

From 1994 to 1998 the Metropolitan Council offered grants to implement nonpoint source pollution control efforts. Of the nearly \$8 million available, about 30 percent has gone to education programs. The WaterShed is one example.

Do you know your watershed?

More than 100,000 Twin Cities area residents can answer "yes" after visiting the WaterShed, an interactive exhibit demonstrating the effects of urban runoff and highlighting what individuals can do to protect urban lakes and streams. WaterShed Partners is a coalition of 33 agencies, educational institutions and nonprofit organizations working together to provide education on nonpoint source pollution prevention. The WaterShed's four learning stations have been displayed at community festivals, schools and libraries, malls and the State Fair; duplicates of two learning stations are now part of a permanent display at the Science Museum.

TRAINING AND ASSISTANCE FOR LOCAL GOVERNMENTS GEARED TO PROGRAMS AND ISSUES. Agencies provide a variety of training and assistance; however, most are programmatic rather than comprehensive. A sampling of current efforts are:

- Assistance for pesticide and nutrient management to protect water resources is available from the Department of Agriculture, which re-designed its monitoring program to focus on local cooperatives such as the Lake Harriet Awareness Project. The department uses local water plans to identify potential partners.
- The Pollution Control Agency offers assistance with lake water quality assessments, countywide monitoring programs and water quality data analysis. Basin plans serve as guides for water quality protection efforts and "basin information documents" will compile available water quality data. The Department of Natural Resources provides information about enforcement issues.
- Several agencies conduct periodic geology and hydrology training for local governments and agency staff. The Natural Resources Conservation Service and various partners provide a total resource perspective for conservation planning and implementation to local resource personnel.
- The Department of Health coordinates supply and wastewater management training, assistance for wellhead protection and water well training.
- The Board of Water and Soil Resources provides Wetland Conservation Act training, as well as engineering and leadership training with the Natural Resources Conservation Service and Minnesota Association of Soil and Water Conservation Districts.
- The Shoreland Volunteer Program offers interdisciplinary workshops for shoreland property owners. Volunteer support is provided through a partnership with Extension Service, soil and water conservation districts, water plan coordinators and state agencies. Extension Service is involved in river watch programs and is expanding its shoreland volunteer programs to rivers, starting with the Rum River.

ENVIRONMENTAL EDUCATION AVAILABLE IN MANY VENUES. New courses and programs about water issues are available for teachers, students and interested adults. Hamline University offers an Internet and CD-ROM class, Rivers of Life, focusing on the Minnesota and Mississippi rivers. The Metropolitan Council and The Tarlton Institute for Marine Education, the nonprofit arm of the Underwater World aquarium at the Mall of America, are offering environmental education courses at the mall as an add-on to school field trips. The council also participates with the Science Museum, offering courses to teachers and others.

State curriculum-based programs foster greater awareness and comprehension of water-related issues. Students and volunteers in the River Watch program monitor water chemistry and insects, loons, dragonflies and wetlands. The Department of Natural Resources sponsors interdisciplinary elementary and secondary activity guides for students and teachers, such as Project WET, a nationally developed curriculum that has trained more than 2,000 teachers and main-

tains a statewide network of workshop facilitators. It also sponsors MinnAqua, a fisheries and aquatic habitat education program. The Department of Agriculture offers Ag in the Classroom, a program that exposes urban students to food and farm issues.

Education reduces pollution load to Lake Harriet

To stem water quality deterioration, the Lake Harriet Watershed Awareness Project reduced the quantity of pesticides and nutrients entering this urban lake. Homeowners were surveyed about lawn care habits, informed about how these habits affected the lake, then asked how the project changed their actions. Lake Harriet was monitored for pesticides and nutrients in storm water runoff, rainfall and lake water runoff before and after distributing educational materials to quantify changes brought about through homeowners' actions.

Herbicides or weedkillers were found in 80 percent of the storm runoff events, in addition to agricultural herbicides in rainfall samples and in 35 percent of the storm water samples. Phosphorus peaked twice a year, in the spring and in the fall from sources such as fertilizers, leaves and grass clippings. A decrease was noted in average herbicide loads after efforts to inform homeowners about how their lawn care habits affected water quality. The Department of Agriculture, Minneapolis Park and Recreation Board and the University of Minnesota Extension were project sponsors.

COMPUTERS CHANGE METHODS OF INFORMATION SHARING. Increasing volumes of water-related data are on the Internet, making information accessible and immediate. Foundations for Integrated Access to Environmental Information, led by the Department of Natural Resources with funding recommended by the Legislative Commission on Minnesota Resources, assesses state environmental data needs for web development.

Most state and federal agencies have web sites and many public and private organizations provide electronic water-related information. For example, the Pollution Control Agency's web site offers lake, stream and ground water information; the Department of Natural Resources site has climate, streamflow, lake and fisheries data, and logs about 80,000 hits a month. The University of Minnesota Soils Department sponsors a site for the Minnesota River.

An interactive directory is now available. Sharing Environmental Education Knowledge lists Minnesota resources for environmental education on the web at www.seek.state.mn.us. Developed by the Office of Environmental Assistance and the Environmental Education Advisory Board, the SEEK directory is a clearinghouse for resources ranging from articles to lesson plans, from performances to displays. This resource network serves environmental organizations and agencies in compiling, cataloging, evaluating and disseminating environmental education materials.

Listservers, where users can share information, are an increasingly popular communications forum. The Water Monitoring listserv, established by Minnesota Planning's Land Management Information Center in 1995, gives water professionals a venue to circulate information about their monitoring activities and findings. The STEEL listserv was launched in 1998 for state agencies working on environmental education, particularly for employees whose primary job responsibilities do not include environmental education.

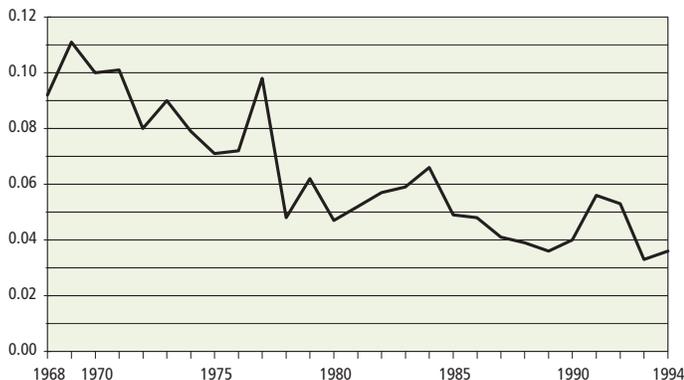
BROCHURES, GUIDES AND OTHER APPROACHES HELP INTERPRET STATE'S COMPLEX WATER MANAGEMENT SYSTEM. The Pollution Control Agency published *Ground Water: A Directory of Minnesota's Programs and Resources* in 1995, and a companion directory for surface water; both are now posted on the agency web site. *A Guide to Land and Water Resource Management Programs in Minnesota*, published by the Department of Natural Resources in 1992, offers an extensive listing of regulatory, funding and other programs.

The Water Billboard newsletter is published by the Board of Soil and Water Resources with contributions from other agencies. Citizens can call the Minnesota Water Line sponsored by Extension Service at 1-800-455-4526, in partnership with several state agencies and the private sector, to ask questions about water quality.

Needs and directions

- Expand basic public information relating to water quality and quantity issues; use a variety of approaches to reach different interests.
- Help local and state decision-making by interpreting scientific data and communicating what programs are available for assistance.
- Evaluate educational efforts, including Internet use, to ensure they accomplish their purpose, are coordinated, reach the right audiences and deliver appropriate messages.

**WATER QUALITY IMPROVES IN ST. LOUIS RIVER
Phosphorus in milligrams per liter**



Note: Water in the St. Louis River drains to Lake Superior. Water quality improved due to upgraded wastewater treatment systems and reduced nonpoint pollution.
Source: Minnesota Pollution Control Agency

- Increase collaboration between state agencies and the Department of Children Families & Learning to provide effective water resource education in Minnesota's schools.

Interagency program recognizes farmers

The Minnesota River Friendly Farmer Program is a nationally recognized, private interest effort that recognizes farmers when they satisfy 10 environmentally beneficial criteria such as reducing tillage, using filter strips and employing best management practices for fertilizer, manure and pesticides. During the past three years, 311 farmers from 34 counties, primarily in southern Minnesota, were recognized.

10-YEAR OBJECTIVE: TO ESTABLISH THE FOUNDATION FOR SOUND PUBLIC POLICY AND MANAGEMENT DECISIONS THROUGH A SYSTEMATIC APPROACH TO RESEARCH AND COLLECTING, MANAGING, AND USING WATER-RELATED INFORMATION.

The 1991 *Minnesota Water Plan* recommends supporting long-term research needs, improving the state's geographic information systems so users can easily access and integrate water and related land data and carry out the Water Monitoring Plan.

NEED FOR BETTER WATER RESOURCE INFORMATION PROMPTED A NEW INITIATIVE. Understanding water quality and quantity conditions and real or potential changes is essential for ensuring sustainability. An interagency committee on monitoring used the Environmental Quality Board's 1992 *Water Monitoring Plan* to propose the 1997 Legislative Monitoring Initiative.

Accomplishments of the Legislative Monitoring Initiative include:

- Established a citizen stream-monitoring program, administered by the Pollution Control Agency. Strengthened the agency's biomonitoring program, which assesses water quality by directly looking at the health of fish and macroinvertebrates.
- The Department of Agriculture expanded the areas monitored for pesticides and nutrients through a state and local partnership called Local Monitoring Cooperatives.
- The Department of Health has increased its efforts to automate the well record database and plans to have well data accessible through a web site next year. The department is also working with counties to interpret well water quality data, and has bolstered the interagency fish tissue monitoring program which looks at contaminants such as mercury, PCBs and dioxin.
- The Department of Natural Resources continues to drill exploratory holes and observation wells, is increasing efforts to collect, interpret and deliver surface water and climate data to the public; added staff will expedite county atlas reports. The

department will provide long-term maintenance of 40 flood warning gauges constructed with federal funds.

MONITORING APPROACHES ARE ALTERED FOR BETTER RESULTS. The Pollution Control Agency has made a number of significant changes to its surface water quality monitoring program, echoing its shift to a basin management approach. These changes include increases in biological monitoring, as opposed to traditional water chemistry; sampling statistically based sites, which provides a new ability to estimate the condition of the state's rivers and streams; and monitoring "least impacted" streams to establish a basis for reasonable water quality goals. The result is a more broad-based view that looks at how the physical, chemical and biological components work together to make up the water resource.

The Department of Health is monitoring 956 community water supplies. The department conducted about 20,000 tests for contaminants in 1991, jumping to 66,441 in 1997. The types of pollutants tested for also increased from about 25 to 118 pesticides, industrial contaminants, bacteria, nitrate and inorganic chemicals. Results in 1997 showed one system above the federal standard for an industrial chemical; 27 systems tested positive for bacterial contamination; three systems exceeded the nitrate standard including a multicounty system in southwest Minnesota; and one nonmunicipal system tested above the federal standard for arsenic.

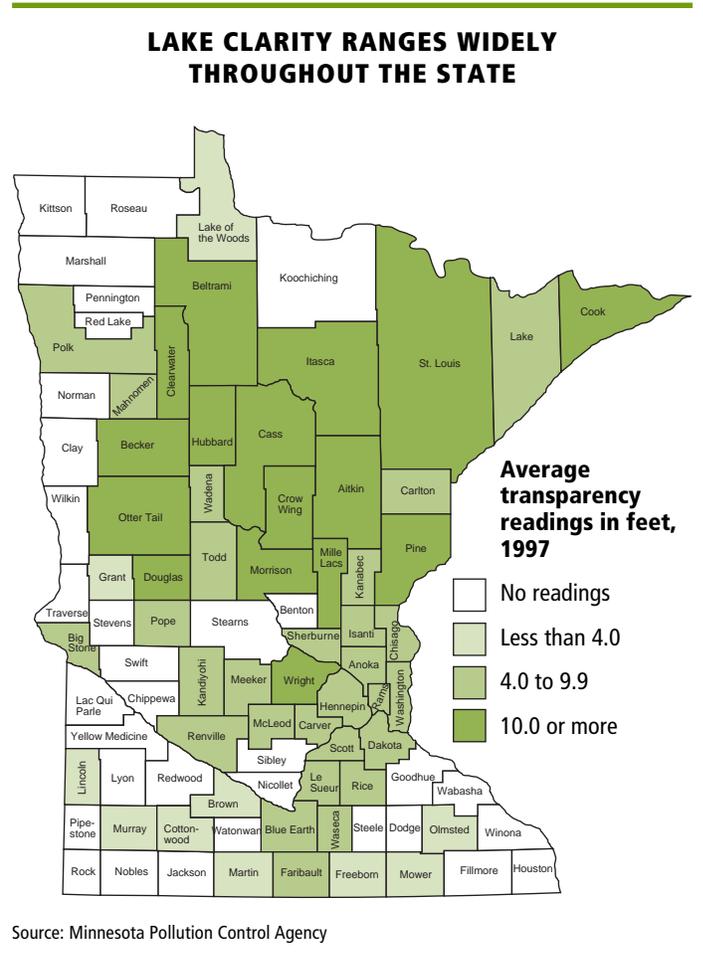
Eight agencies, led by the Pollution Control Agency, are coordinating ground water monitoring efforts, including the exchange of data through an interagency group. Its success spawned a surface water group and the two groups routinely meet. The second biennium of the Minnesota Environmental Indicators project will develop a framework for monitoring key indicators of environmental health, which should help assess data needs to better show environmental threats and progress. Additional monitoring efforts are noted in the Focus on the Resources chapter.

DATA ACCESS AND GEOGRAPHIC INFORMATION SYSTEMS MAKES MAJOR STRIDES. The Ground Water Clearinghouse and the Stream Information System were developed by the Land Management Information Center as tools for integrating analysis and mapping information from several agencies and levels of government. Several problems surfaced: integrating many diverse data collections swamped the system; achieving current data was difficult because databases were continually updated; and achieving access to the system from disparate systems was problematic. Today, with increased Internet access and more and better data available through the web, agencies are considering linking electronically rather than integrating data.

State and federal cooperative efforts are building information layers for mapping. A nearly complete, eight-year project led by LMIC, Base Maps for the 1990s, is providing aerial photographs, selected topographic map updates and digital orthophotographs on county CD-ROMs and digital elevation models. Another product, the Digital Raster Graphic, a digital image of the quad sheet, georeferenced, can be used as background.

Updates are underway for land use and land cover, public land survey coordinates, hydrologic features and geology. The Pollution Control Agency is working in partnership with the U.S. Environmental Protection Agency on Minnesota's surface waters for the National Hydrographic Dataset. The Department of Transportation has road and hydrologic network data available; proposals have been developed to improve this data set to promote GIS hydrologic applications. Survey information from the U.S. Fish and Wildlife Service National Wetland Inventory is digitized, but needs continual updating.

Soil conditions are an important GIS component, but few soil surveys are ready for digitizing. The age of the survey and the type of photography used for the base map determines readiness; the condition of readiness is highly variable across the state. All but three counties have soil surveys completed by the Natural Resources Conservation Service. Sixteen are suitable for digitizing; the others need recorelation, field work or updating. Soils for the seven metropolitan counties are part of the Metropolitan Council's GIS. Determining the suitability of a soil survey for digitizing is very complex. *County Soil Surveys: Guidelines for Digitizing* prepared in June 1997 by the Minnesota Governor's Council on Geographic Information provides guidance for developing digital soil maps.



The Department of Health and Minnesota Geological Survey are working to upgrade the County Well Index system to make it more user friendly. The new format will be directly accessible to GIS. County Well Index is the main location for information relating to wells and geologic conditions. The department is automating new well locations through the use of Global Positioning Systems or field checks on all newly inspected wells, about 2,500 to 3,000 annually. Field-verified locations will be available for a significant subset of new wells and efforts to add existing wells are increasing.

The Governor's Council on Geographic Information has developed an approved GIS metadata standard, which promotes consistency in GIS data documentation. The Land Management Information Center operates a node — a means for searching for GIS data — on the National Geospatial Data Clearinghouse.

LMIC published a revision to the Geographic Data Compatibility Guidelines in 1995 that describes data compatibility requirements. Guidelines address issues of data quality, output formats, documentation, acceptance testing and transfer media. Water data compatibility guidelines are under revision.

The Water Resources Center at Mankato State University is one resource for sharing regional data. The center works with 13 counties that are developing and implementing local water plans and gathers existing data, generates new data and distributes data and maps to counties.

BIENNIAL WATER REPORTS ARE REASSIGNED. To keep abreast of water-related trends, the Legislature assigned a series of biennial reports to state agencies. The Environmental Quality Board prepared a number of water reports in 1992 assessing water availability, water quality, monitoring and research needs and evaluating water quality programs. The Legislature reassigned the responsibility for water availability trends to the Department of Natural Resources in 1994, and water quality and monitoring trends to the Pollution Control Agency with review by the EQB, which retained responsibility for a research report, a biennial water policy report and the development of a water plan every 10 years. The Board of Water and Soil Resources is assigned to report on ground water education activities. Reports were developed in 1994 and 1996 on water monitoring and trends, water use, ground water education, water and wastewater needs.

The Environmental Quality Board convened a Water Research Advisory Committee in 1991 to prepare a *Water Research Needs Assessment*. There has been no committee activity since; however, some research needs have been noted in later biennial reports. Recommendations from the board's 1996 report included identifying the extent of aquifers and what rate of use is sustainable, researching conversion of nonpotable water into a viable source and examining how wastewater research results and technology used in other states or countries could be adapted for Minnesota. Long-term research and monitoring projects generally have a difficult time obtaining and sustaining funding. Without an integrated examination, needs are identified programmatically.

Needs and directions

- Document and routinely analyze ongoing monitoring efforts and verify that the information gathered is useful and known to other potential users.
- Connect information from monitoring and research to those making decisions
- Emphasize long-term trends
- Research the extent of water available for sustained use.
- Expedite the development of GIS layers such as digitizing soil surveys.
- Expand and improve information available through the Internet and make linkages so access is simplified.
- Assess how to identify priority research needs.

Using GIS to predict archeological sites

Transportation and land use planners need to know where potential archeological properties exist to maximize their preservation and protection. The Department of Transportation's Mn/Model will incorporate a variety of environmental data useful to physical scientists, planners and others in predicting archeological sites. The model will save money by helping users avoid these high potential areas during project development.

10-YEAR OBJECTIVE: TO UNIFORMLY ENFORCE MINNESOTA LAW AND FAIRLY ASSIGN LIABILITY THROUGH IT SO THAT THE ENVIRONMENT IS FULLY PROTECTED AND THE BURDEN ON PEOPLE INNOCENTLY EXPOSED TO WATER MISUSE IS MINIMIZED.

The 1991 *Minnesota Water Plan* recommended a consistent state approach to fairly and equitably assigning liability for water misuse, recovering costs from permit and enforcement activities and enhancing the state's environmental compliance strategy.

STATUTORY CHANGES AND NEW APPROACHES ENHANCE ENFORCEMENT. The Environmental Enforcement Act of 1991 established felony criminal penalties for certain knowing violations of state hazardous waste, toxic water pollutant and hazardous air pollutant laws. In addition, the law recognized that individuals, along with incorporated organizations, can be subject to criminal enforcement. County attorneys, working closely with state agencies, have increased criminal prosecution of the most egregious violations, particularly for deliberate illegal discharges to surface waters. Also, the U.S. Attorney has prosecuted violators under similar federal laws.

The Legislature has also created administrative enforcement remedies for water and other pollution violations. The Minnesota Pollution Control Agency and the departments of Agriculture and Health have authority to issue administrative penalty orders and impose civil penalties for violations of agency rules. Administrative penalty orders have become a common enforcement tool.

The Department of Health was given this administrative penalty authority under the Health Enforcement Consolidation Act of 1993. This legislation has allowed the department to consolidate its enforcement activities across regulatory programs and create consistency in their application. Cost may be a problem, however, since funding comes from the agency’s operating budget.

The Department of Natural Resources lacks administrative penalties; to take action against a water appropriation permit holder, the department has to suspend or terminate the permit, severe actions.

In 1996 Minnesota counties requested and received authorization from the Legislature to develop a county administrative penalty order system for solid and hazardous waste violations. In this case, the State Auditor must evaluate the program and report to the Legislature during the 1999 Session. While similar to the process used by state agencies, the level of penalty and procedures varies slightly from the state authority.

Agencies are pooling resources to improve enforcement. The Pollution Control Agency and Department of Natural Resources jointly issue field citations for illegal disposal of waste and jointly investigate and enforce feedlot-related violations. The agency and the Department of Health coordinate inspection of wastewater treatment facilities serving mobile home parks, resorts and campgrounds.

MORE COSTS RECOVERED FROM ENFORCEMENT ACTIONS AND REGULATIONS. The Pollution Control Agency and departments of Agriculture and Health have established procedures and mechanisms for determining the amount to impose in an administrative

civil penalty order. Procedures are designed to consider factors such as environmental harm and economic savings in setting the penalty, and also to create consistency and fairness in the process.

The Pollution Control Agency has increased permit fees to cover enforcement costs. The Metropolitan Council recovers costs for discharges of toxic material into the regional wastewater collection system through industrial strength charges imposed by the Industrial Waste Program. This effort led to a regional toxic collection and recycling program that has dramatically reduced toxic discharges to the wastewater system.

Needs and directions

- Grant the Department of Natural Resources statutory authority to issue administrative penalty orders for various laws, including administrative penalties for such actions as overpumping.
- Continue to explore cooperative enforcement efforts and assess ways to ensure that funding is available for enforcement.

Prosecution results in convictions and record award

Intentional discharge of water pollutants into the Blue Earth River exceeding permit limits and falsifying required reports were alleged in federal criminal complaints against Darling International by the U.S. Attorney’s Office, assisted by the state Attorney General’s Office, the Department of Natural Resources and the Minnesota Pollution Control Agency. The company, located near the City of Blue Earth, pled guilty to criminal charges and agreed to pay \$3 million in penalties and \$1 million in restitution to the City of Blue Earth, Faribault County and Ducks Unlimited. Each recipient agreed to match the restitution award and to spend the money for water quality improvements on the Blue Earth River in Faribault County. Two defendants pled guilty to federal water pollution felonies, one was convicted by a jury of a federal felony and a fourth was acquitted.

REIMBURSEMENT CLIMBING FOR AGRICULTURAL CHEMICAL CLEANUP

Fiscal year	Number of claims	Reimbursement amount	Revenue from surcharges
1991	5	\$35,951	\$795,764
1992	22	289,283	1,846,244
1993	49	1,272,361	1,948,470
1994	57	980,919	1,757,626
1995	40	1,054,913	2,127,185
1996	65	1,405,496	1,907,920
1997	59	1,750,688	1,224,441

Note: The Agricultural Chemical Response and Reimbursement Account administered by the Department of Agriculture receives revenue from surcharges on pesticide and fertilizer products and licenses. The account reimburses costs incurred in cleaning up agricultural chemical incidents.

Source: Minnesota Department of Agriculture

10-YEAR OBJECTIVE: TO ENSURE THAT MINNESOTA’S WATER INFRASTRUCTURE IS MAINTAINED AND ENHANCED TO KEEP PACE WITH NEW DEMANDS FOR PROTECTION OF PEOPLE AND THE ENVIRONMENT.

The 1991 *Minnesota Water Plan* recommended upgrading water infrastructure such as dams and wastewater treatment systems, ensuring money is set aside for infrastructure maintenance and improvement and developing cost estimates and ways to meet water and wastewater treatment needs.

SEVERAL SURVEYS SHOW EXTENSIVE NEEDS. To assess whether water infrastructure is keeping pace with needs, present and projected costs need to be gathered. Surveys and estimates provide a snapshot of some costs.

- 1.2 billion in projected wastewater treatment needs over five years, according to an assessment prepared in 1998 by the Minnesota Pollution Control Agency with Public Facilities Authority
- \$900 million in total individual sewage treatment system needs estimated in 1998 by the Minnesota Pollution Control Agency and Department of Agriculture; \$250 million over the next five years.
- \$1.1 billion in total agriculture and other nonpoint source capital investments estimated in 1998 by the Minnesota Pollution Control Agency and Department of Agriculture; \$110 million over the next five years.
- \$2.4 billion in water supply construction needs over 20 years from Drinking Water Infrastructure Needs Survey in 1997, a random sample of water systems in Minnesota conducted by the Environmental Protection Agency.
- \$271 million in projected 1995 to 2000 wastewater treatment, water supply and stormwater needs of 44 cities outside the Twin Cities as surveyed by the Coalition of Greater Minnesota Cities.
- \$2 million per biennium in Department of Natural Resources estimates for essential work on public dams.

SEWER SEPARATION IMPROVES WATER QUALITY. About \$331 million of government funding was earmarked for storm sewer separation in St. Paul, Minneapolis and South St. Paul between 1986 and 1995. The project has eliminated the overflow that occurred during heavy rains containing both storm water and sewage into the Mississippi River. Measurements of fecal coliform bacteria below Minneapolis showed average concentrations of more than 300 organisms per 100 milliliters in the 10 years before 1985 and less than 150 in the 10 years after, well within the water-quality standard of 200. At the same time, pollution-sensitive mayflies have returned to the Twin Cities stretch of the river after a 30-year absence, and fish population diversity has recovered from three species to more than 25 species.

REPORTS DOCUMENT NEEDS AND RECOMMENDS CHANGES. The Environmental Quality Board's *Saving Resources: Meeting Minnesota's Water and Wastewater Needs* reported in 1996 that federal funds for wastewater treatment decreased substantially from the 1960s, leaving the state and local governments with increased burdens.

Saving Resources stated that water supplies or wastewater treatment systems are not adequately considered in land use decisions, causing high costs and environmental problems. Communities may locate an industry needing large quantities of water without considering water supplies or build subdivisions without planning for wastewater treatment needs. Some current high-cost projects reflect poor land use practices. The report presents recommendations to safeguard water supplies and ensure adequate wastewater treatment.

Wastewater Infrastructure Funding Program, published by the Minnesota Public Facilities Authority and the Minnesota Pollution Control Agency in 1997, discusses fund use and makes recommendations to the 1998 Legislature. The funding program was created to supplement loans with grants for communities with high-cost wastewater treatment needs. Much of the program funding has gone to large sewer projects in lakeshore areas. The report recommends ways to reduce program costs and refocus on small rural communities, and to improve coordination between the program and the USDA Rural Utilities Service (formerly FmHA) grant and loan program for water and wastewater treatment projects.

The 1998 Legislature adopted the report's recommendations for the Wastewater Infrastructure Funding program. It also increased and targeted funding to matching grants with USDA Rural Utilities Service grants and loans for small rural communities and to multi-jurisdictional projects to connect areas with failing septic to existing treatment systems.

Needs and directions

- Incorporate municipal water supply and wastewater planning into local water plans and into comprehensive plans including community-based plans.
- Develop an inventory of water-use increases based on projected growth and link costs to use.
- Ensure local government maintains its infrastructure and assumes responsibility for costs arising from serving undeveloped areas or from imprudent development choices.

**FUNDING MIX BACKS STATE REVOLVING LOANS
(in thousands)**

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Federal grants	\$17,336	\$0	\$55,697	\$35,712	\$35,327	\$21,920	\$24,639	\$37,083	\$14,165	\$0
State match	3,467	180	11,766	7,174	7,979	4,435	3,126	7,417	2,833	0
PFA bonds		45,858	100,831	86,598	0	0	87,793	10,404	61,285	123,693

Note: The State Revolving Loan Fund combines grants from the Environmental Protection Agency, state matching funds and bonds issued by the Public Facilities Authority. Since the fund was established in 1989, federal grants have contributed about \$242 million, state matching funds \$48 million and PFA bonds \$516 million.

Source: Minnesota Public Facilities Authority

Flooding costs are high

Minnesota suffered from two major floods in this decade. Especially hard hit were communities along the Minnesota River and the Red River of the North. Total damages from the 1997 flood alone have been estimated at more than \$1.5 billion. As recommended by the Governor’s Flood Recovery and Redevelopment Planning Council, the 1997 Legislature provided \$125 million state flood recovery funding. Federal flood recovery funding reached \$574 million. Prevention efforts include removing homes, raising levees, redesigning sewer systems and building dikes.

10-YEAR OBJECTIVE: TO PLACE STATE AND LOCAL PROGRAMS ON A SOUND FINANCIAL FOOTING BY TARGETING LIMITED RESOURCES TO PRIORITY NEEDS AND BY EXPANDING REVENUE SOURCES.

The 1991 *Minnesota Water Plan* recommended expanding revenue sources for state and local units, allocating funds to state priorities identified in the Minnesota Water Plan and in the comprehensive water plans at the local level.

GRANT MIX CHANGES, LOANS INCREASE. State Revolving Loan Funds, supported by the Environmental Protection Agency and a 20 percent state match, are now the predominant resource for wastewater treatment needs. The Water Pollution Control Revolving Fund, the official name of Minnesota’s Clean Water State Revolving Fund, provides about \$50 million to \$80 million annually for wastewater treatment.

The Wastewater Infrastructure Fund provides grants for communities with high-cost wastewater treatment needs. Initially funded at \$2.8 million, the Minnesota Legislature appropriated \$17.5 million in 1996, \$7 million in 1997, and \$15.3 million in 1998 to the fund, while federal grants declined. Establishing a system replacement fund at \$.10 per 1,000 gallons is one of the fund requirements.

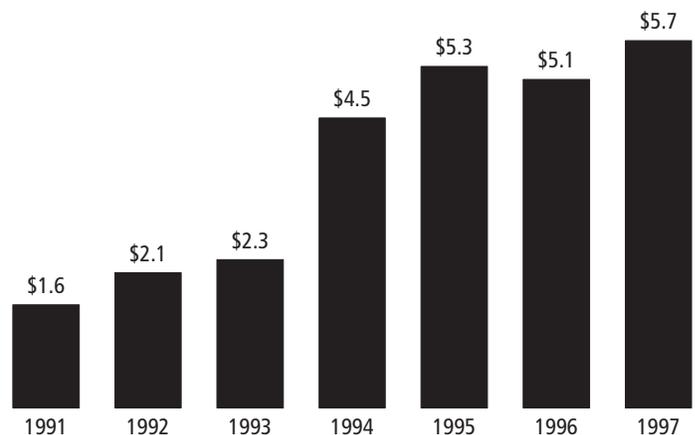
In 1994 the Legislature expanded the eligibility of projects that could receive low interest loans through the State Revolving Fund to include nonpoint pollution projects. From 1995 through 1997, 60 percent of federal capitalization grants totaling \$45.5 million went to nonpoint source projects, primarily through programs administered by the Department of Agriculture and the Pollution Control Agency. The department administers loans to farmers and individual landowners for rural best management practices, such as upgrading feedlots, sealing unused wells and improving septic systems. The Agriculture Best Management Practice Loan Program received federal capitalization grant funds ranging from \$7 million to \$10 million each year. The department reported an estimated \$4 million annually revolving at the local level from this program. The other major nonpoint source loan program is the Minnesota Pollution Control Agency’s Clean Water Partnership program.

Demand has significantly increased for loan funds, particularly for wastewater treatment projects. This demand is being driven by several factors: population growth in many areas has put treatment facilities at their maximum capacity, systems built with state and federal grants 20 to 25 years ago have reached their useful life and need major rehabilitation, and more stringent on-site wastewater requirements have generated tremendous demand for municipal wastewater service in unsewered communities and lakeshore areas. The annual demand for wastewater treatment funding now exceeds \$250 million per year, while the annual projected lending capacity is approximately \$40 to \$60 million per year, depending on the amount of funds put into the nonpoint source programs. The Public Facilities Authority, the Minnesota Pollution Control Agency and the Department of Agriculture have been working to better define the overall point and nonpoint source needs and explore how the state revolving fund can best address those needs.

The Individual Sewage Treatment grant program, administered by the Minnesota Pollution Control Agency, is available for municipalities for individual and cluster on-site systems. Created in 1988 with \$1 million, the program received a one-time appropriation of \$900,000 in 1997, totaling \$1.3 million for the current biennium.

The Drinking Water Revolving Fund program was launched in 1997 to improve and maintain public water systems. Similar to the Water Pollution Control Revolving Fund, the new program was funded by annual grants from the Environmental Protection Agency and a 20 percent state match. Approximately \$46 million will initially be available for loans; requests for 164 projects totaling \$120 million were received in 1997. The drinking water program allows up to 10 percent of the funds to be awarded as grants for disadvantaged communities; criteria are similar to the Wastewater Infrastructure Fund program.

NATURAL RESOURCES GRANTS GROW
(in millions)



Note: Funding added in 1994 for the Wetland Conservation Act, Shoreland Management and feedlot programs.

Source: Minnesota Board of Water and Soil Resources

USDA Rural Utilities Service has been a major funding source for communities with populations under 10,000. Funding available for water and wastewater treatment increased steadily from the \$5.8 million in grants and \$13.5 million in loans in 1991 until 1996, when allocations were cut by one third. In 1998, \$8.6 million in grants and \$13.3 million in loans were available to Minnesota communities.

Funding mix used to clean up Cannon River

Dundas is a city of 500 residents located along the Cannon River near Northfield, Minnesota. The city had no wastewater treatment system and on-site treatment systems were discharging to the Cannon River.

Drinking water wells had high nitrate and coliform levels. A combination of grant and loan funds from the State Revolving Fund, Wastewater Infrastructure Fund, Rural Development's Water and Waste Loan and Grant, and Small Cities Development Block Grant paid for a \$4.5 million collection system to direct wastewater to Northfield's treatment plant. This creative funding approach was a key to the project's success.

GRANTS GROW FOR LOCAL WATER PLANNING. Natural Resources Block grants, available through the Board of Water and Soil Resources since 1990, have grown from about \$1.6 million annually to over \$5.7 million. About \$2.6 million fund local water planning base grants that also use an additional levy requirement to allocate \$37,500 annually to each county for water management. In addition to the base grant, the counties can apply for a portion of \$500,000 available biennially as competitive challenge grants. The remaining funding allocated \$500,000 for implementing requirements for the shore land program, \$850,000 for feedlots and \$1.7 million for wetland conservation. The board's grant program added \$344,000 to be awarded for 1999 matching grants to local government units for startup and development of local programs to implement state requirements for individual sewage treatment systems.

Local water planning can benefit from several funding opportunities. Clean Water Partnership, agricultural best management practices loan program, flood damage reduction grants and federal Clean Water Act 319 nonpoint source funding all require the project to be identified as a priority in an approved local water plan.

From 1987 to 1996, roughly \$13 million was provided to local units of government through the Department of Natural Resources Flood Damage Reduction Grant Program for activities such as acquisition of flood damaged structures, levee construction and flood proofing of public infrastructure. Following the devastating floods of 1997, the Legislature appropriated grants of \$17.9 million in 1997 and \$31.5 million in 1998. These funds will leverage about \$240 million in added federal funding for flood damage reduction projects. The U.S. Army Corps of Engineers estimates that existing flood control works have averted almost \$500 million in damages in Minnesota alone.

The Pollution Control Agency Clean Water Partnership loan fund received \$5 million in 1995, \$7 million in 1996, \$4.3 million in 1997, and \$3 million in 1998. For the first time in 1999, an estimated \$310,000 will revolve at the state level. The grant program has been funded for the past three bienniums at about \$2 million.

More than \$1 million in grants are available each year from the Office of Environmental Assistance for such activities as recycling, pollution prevention, sustainable communities and environmental education. Since 1993 the Board of Innovation's Competitive Grant Program has provided about \$700,000 annually to encourage innovative and cooperative approaches for intergovernmental services.

Soil and water conservation district base grants increased from \$953,000 in 1991 to about \$1.5 million in 1998. An additional \$2 million was allocated to districts in 1998 to help bring feedlots into compliance with the law. Cost-share grants administered by the districts increased from about \$1.6 million in 1991 to 2.1 million in 1993, with the additional funding going to Minnesota River efforts, to \$2.4 million in 1997.

From 1994 to 1998, the Metropolitan Council provided nearly \$8 million to local governments and organizations in water quality grants aimed at reducing pollution from nonpoint sources and phosphorus loads in the Minnesota and Mississippi rivers.

Federal funds are available through the USDA's Environmental Quality Incentives Program, which replaced the Agricultural Conservation Program. More than \$6 million was available in 1997 and \$4.5 million in 1998 in financial, educational and technical resources for local projects. Funding could increase significantly with proposals under consideration in Congress through the Clean Water Action Plan for a new Unified Watershed Assessment program.

Federal 319 grants, administered by the Pollution Control Agency, are another funding source for state and local implementation projects. The program received \$1.5 million in 1991 and reached a high of \$3.6 million in 1996, with \$956,623 available in 1998. President Bill Clinton's budget for the Clean Water Action Plan proposed additional funding of \$568 million for 1999, and \$2.3 billion over the next five years.

The Federal Water Resources Act Section 22, administered by the Corps of Engineers provides cost share funding to assist state and local government for water and land resources projects. Funding increased by \$300,000 annually in 1990 to \$500,000 currently.

Needs and directions

- Develop a process to ensure funds go to highest priorities and coordinate compatible application processes.
- Propose actions to secure additional state resources from the federal Clean Water Action Plan and other sources of federal dollars.
- Seek additional capitalization funds for the state revolving fund program for point source and nonpoint source projects.

Focus on the resource

The four objectives in this chapter focus on protecting lakes, wetlands, rivers and ground water through coordinated management.

10-YEAR OBJECTIVE: TO ADOPT A COORDINATED, INTERDISCIPLINARY APPROACH TO MANAGING THE MINNESOTA LAKE ENVIRONMENT.

The 1991 *Minnesota Water Plan* recommended developing a strategy for integrated lake management, expanding long-term monitoring and toxic research, ensuring that metropolitan area watershed plans effectively address lake issues and evaluating their outcome, as well as protecting Lake Superior.

STATE COORDINATION FOCUSES ON ASSISTING LOCAL EFFORTS. The state does not have an official interdisciplinary approach to lake management although many lake protection activities are coordinated with particular emphasis on developing tools and building capacity at the local level. Spurred by interest in having the state coordinate lake-related activities, an Interagency Lakes Coordinating Committee was created in 1993. Its focus has been helping local water planners and lake associations better understand and manage lakes. The committee developed *Lake and Watershed Data Collection Manual* in 1994, and *Developing a Lake Management Plan* in 1996, and is working closely with the Minnesota Lake Association on a pilot project to develop comprehensive lake management plans.

Examples of cooperative monitoring activities and data sharing abound:

- The Department of Natural Resources and the Minnesota Sea Grant are working with local governments on research and management efforts to prevent the spread of exotic species, such as milfoil.
- By 1997, 762 volunteers sampled 683 lakes in the Pollution Control Agency's Citizen Lake Monitoring Program, taking more than 10,000 Secchi readings. Started in 1973, the program is the oldest and largest citizen volunteer effort of its kind in the nation.
- The Department of Natural Resources is managing approximately 800 lake level gages and collecting some 20,000 lake level readings annually with the help of citizen volunteers and local governments.
- The Metropolitan Council and citizen volunteers sample about 70 lakes per year. Of the Twin Cities region's 950 lakes, 195 have baseline data to help determine trends.
- With state financial and technical assistance, Beltrami, Clearwater and Hubbard counties are monitoring 20 lakes.

Watershed restoration improves Lake Shaokaten

The water quality of Lake Shaokaten, a shallow prairie lake on the South Dakota border had severely deteriorated in the 1980's due to excessive nutrients from land use practices. Nuisance algal blooms were plentiful, occasionally producing algal toxins that may have contributed to the death of dogs and cattle. A diagnostic effort guided a watershed restoration program funded through the Clean Water Partnership. Three animal production facilities, four wetland complexes and shoreline septic-tank areas were rehabilitated improving lake conditions by about 70 percent. The county beach has reopened, fisheries appear to be rebounding and lakeshore real estate values have improved significantly.

LAKE QUALITY IS GOOD AND MANAGEMENT ACTIVITIES ARE FLOURISHING. Based on a 1996 assessment of almost 2,000 lakes by the Pollution Control Agency, 80 percent of Minnesota's lakes were considered suitable for swimming to some degree. However, 35 percent of the lakes evaluated were considered threatened or would only support swimming part of the time due to high nutrient concentrations that contribute to excessive algae blooms and reduced transparency. In addition, statewide pressures on lake resources are mounting from increases in shore land development, urban and agricultural runoff, reductions in near shore aquatic vegetation and increasing recreational use.

Local government plays a key role in lake protection and management. The Department of Natural Resources has worked with about 250 counties, cities and townships to adopt local land use ordi-

LAKE LEVELS ARE CONSTANTLY CHANGING Elevation in feet



Note: Hydrograph shows water levels of White Bear Lake in Washington County. Source: Minnesota Department of Natural Resources

nances containing statewide shoreland management standards. These regulations pertain to construction of buildings and alteration of vegetation and landscapes within 1,000 feet of lakes and 300 feet of rivers. The department is collecting information about shoreland development and analyzing trends.

Lakes are featured in many local water plans. Numerous counties, coalitions of lake associations and watershed districts are assessing lakes and addressing pollution problems in the watersheds and shoreline areas including agricultural and urban runoff problems. In various places, local water plans have prompted interest in cleaning up deficient individual, neighborhood and even municipal wastewater treatment systems.

Many counties are implementing best management practices. Douglas County examined land uses affecting lakes; it restored a wetland, and has corrected problems with on-site systems, feedlots and bank erosion. Crow Wing County will develop a management plan for each lake. Aitkin County's water plan will be a component of its comprehensive plan. Some counties are working with adjacent counties to protect and manage lakes.

Water Management Organization strives to protect lakes

Gun Club WMO, located in Eagan and parts of Mendota Heights and Inver Grove Heights, found some of its lakes, as well as ponds and basins suffering from water quality problems due to erosion and sedimentation. Corrective actions will identify water quality coming in to lakes and ponds and assess nutrient loading, and require municipalities to factor storm water pond maintenance in their water management plans.

SEVERAL INITIATIVES FOCUS ON PROTECTING LAKE SUPERIOR. The United States, Canada, Minnesota and other states recommended in 1992 that Lake Superior be a demonstration area and move toward zero discharge of toxic substances, inspiring the Binational Program to Restore and Protect Lake Superior.

With extensive citizen involvement, the Department of Natural Resources refocused fish management in Lake Superior, from a single species to a fish community approach, based on ecological principles. The new approach is moving the fish community toward a healthier species mix, with lake trout the major predator and lake herring the major prey species. The department is also working with all levels of government to establish a Minnesota Coastal Zone Management program.

Initiatives include the Pollution Control Agency's search for alternative wastewater treatment technologies for places near Lake Superior, since standard treatment systems are not feasible in many places. The Natural Resources Conservation Service, Board of

Water and Soil Resources and local soil and water conservation districts have several projects completed or underway to control lakeshore erosion. Measures are reducing sediment from the Nemadji River into the Duluth Harbor and Lake Superior after the rates and sources of sediment delivery were identified; and a project in Sucker Bay stopped an estimated 3,000 tons of sediment from eroding annually into Lake Superior.

Other lake research, information and educational efforts underway:

- The Pollution Control Agency's Lake Assessment program has produced more than 120 studies establishing baseline data to set the stage for local protection or restoration.
- The Phosphorus Strategy Task Force has developed a strategy for addressing phosphorus impacts on surface water. *Lake Prioritization for Protecting Swimmable Use* ranks lakes with good water quality for protection initiatives and identifies those with inadequate data.
- The Department of Agriculture is studying the impact of pesticides by monitoring surface water, looking at land use and is determining long-term trends.
- The Department of Natural Resources conducts an average of 600 lake surveys per year to monitor trends in fish population and aquatic habitat. It has prepared fisheries management plans for 3,000 lakes with recreational fishing.
- The University of Minnesota, Duluth, working with the Pollution Control Agency, synthesized and interpreted a five-year mercury deposition database and evaluated water quality and fish contamination trends for 80 high-value lakes compared to historic data. Study results indicated that 57 percent of the lakes showed mercury levels lower than five to 20 years ago, while 25 percent had greater levels and 17 percent were the same.
- The departments of Health and Natural Resources and the Pollution Control Agency are increasing the number of site-specific fish consumptive advisories.

Needs and directions

- Encourage more local governments to take an active role in lake management.
- Improve state priority setting and local assistance in protecting and managing lakes as demand for lakeshore development and recreational activities rise.
- Increase the state focus on evaluating critical limits for lake water quality and watershed development, which will also help local management.
- Develop strategies at state agency level to unify state and local interests and management of lake resources.

10-YEAR OBJECTIVE: TO PROTECT AND RESTORE WETLANDS WHILE RECOGNIZING THEIR IMPORTANCE IN WATERSHED-BASED MANAGEMENT STRATEGIES FOR LAKES, RIVERS AND GROUND WATER.

The *Minnesota Water Plan* recommended enacting comprehensive wetland legislation aimed at “no net loss,” providing a consistent definition of wetlands and incorporating provisions in metropolitan water management rules to safeguard wetland values.

LEGISLATION IS INSTRUMENTAL IN PROTECTING AND RESTORING MINNESOTA’S WETLANDS. While the state is still losing wetland acreage, Minnesota’s 10.6 million acres of wetlands are getting much more respect. Restoration efforts are increasing. Minnesota is moving toward “no net loss” of wetlands with help from Wetland Conservation Act of 1991 and its subsequent amendments. The act requires that anyone proposing a project that threatens a wetland should: avoid the wetland if possible; minimize effects, and replace if impacts cannot be avoided. The goal of no net loss may be hard to reach, since there are significant losses from actions that do not require approvals or permits.

The Board of Water and Soil Resources oversees the Wetland Conservation Act by gathering information from 492 local governmental units. The Department of Natural Resources provides enforcement through a hybrid of civil and criminal actions in which conservation officers encourage property owners to work with the local civil authority to obtain compliance. An important distinction of these enforcement efforts has not been the number of cease and desist orders issued, but the heightened awareness of the need to protect wetlands and the number of project locations changed to avoid wetlands.

Under the act, new measures were instituted to protect calcareous fens, which are rare and distinctive peat-accumulating wetlands dominated by distinct ground water inflows with specific chemical characteristics. The DNR must approve a management plan before activities impacting a calcareous fen can be authorized. The plan should contain information about fen location and characteristics along with the proposed project, various alternatives and permissible impacts. An intergovernmental task force is currently evaluating the effects of increased water use on a fen in the southwest Twin Cities region. In this case, the challenge is in understanding the interaction between ground and surface water. As pumping increases, it can affect surface water and the fen; and the legality of regulating ground water appropriations for surface water effects is not clear.

FEDERAL ACTIONS LESSEN WETLAND LOSS. Mitigation to achieve no net loss is a progressive option available if wetlands fall under compliance requirements of federal assistance programs administered by the Natural Resources Conservation Service. In 1995, 1,800 acres were enrolled in temporary and permanent easements under the agency’s Wetland Reserve Program. While the Water Bank program is not taking any new applicants, there are currently about 1,100 10-year contracts to retain wetlands, down from 1,400 in the

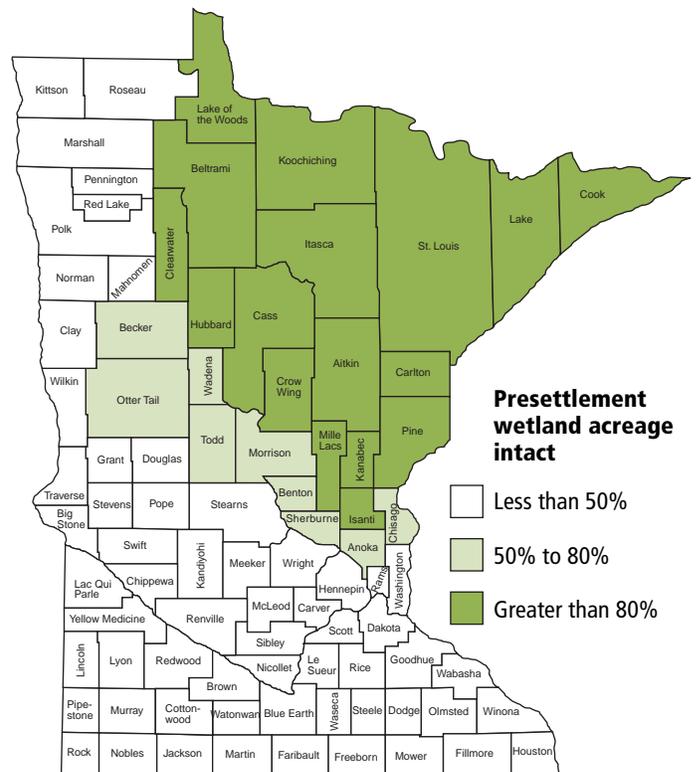
early 1990s. The 10- to 15-year contracts available through the USDA Conservation Reserve Program include protected wetland acreage.

It is unlawful to discharge dredged or fill materials into wetlands without a Corps of Engineers’ permit, authorized under provisions of Section 404 of the Clean Water Act. Permit conditions for excavation or filling of wetlands may require mitigation. Under the Federal Clean Water Act, the Pollution Control Agency has continued to review and make 401 water quality certification determinations on all federal permits that propose to discharge to state waters including wetlands. Other state agencies may comment on the permits, giving them a voice in federal permitting actions and state water quality standards.

Through its Partners for Wildlife Program, the U.S. Fish and Wildlife Service restores wetlands on private lands. The program has restored about 14,058 acres of wetlands on more than 3,898 sites throughout Minnesota since 1990.

WORK EVALUATES WETLAND VALUE AND QUALITY. Not all wetlands have the same function or value. The value for storing

MORE PRESETTLEMENT WETLANDS SURVIVE IN THE NORTH



Note: Wetland areas are derived from data in the 1860s and 1980s. In both data sets, Houston, Wabasha and Winona counties were reported to have no presettlement wetlands.

Source: Minnesota Board of Water and Soil Resources

excess water, filtering nutrients and sediments or providing habitat depends on many factors. A draft of the Minnesota Routine Assessment Methodology has been distributed to local governmental units to assist in identifying wetland functions and values, with plans to evaluate and to revise the methodology as needed.

Another way to view wetland quality is based on biological integrity or the ability of the wetland to support normal aquatic life. The Pollution Control Agency has developed two effective multiple-measure indices of wetland quality based on invertebrates and plants. Both indices are comprised of different invertebrate or plant community attributes, such as the number of kinds of leeches or vascular plants in the wetland. These measures directly reflect a wetland's biological integrity and can be useful tools to evaluate pollution stress, restoration success or other wetland management decisions.

Citizen assessments of wetland quality would be helpful to local governments in writing comprehensive local wetland plans. The agency has worked with the National Audubon Society to adapt assessment methods for citizen use, which are being tested in 1998 by Dakota County officials. Working with cities, schools, learning centers and other public and private entities, Dakota County enlisted volunteer teams to sample about 30 wetlands for a wetland health evaluation project. Results will be used in a brochure, slide show and educators workshop.

Studies and projects on wetlands include:

- Wetlands were mapped and digitized under U.S. Fish and Wildlife's National Wetland Inventory in 1993; without updates, changes in acreage cannot be tracked.
- The National Resources Inventory reported a wetland loss of about 27,000 acres between 1982 to 1992; 1997 inventory results will be available in 1999.
- The Metropolitan Council conducted long-term wetland research indicating the importance of monitoring and maintaining wetlands collecting storm water. It found a 12-year-old wetland treatment system at McCarrons Lake had degraded over time and was no longer providing adequate treatment of urban runoff.
- The Natural Resources Conservation Service is working on wetland studies in the Redwood River basin and the Straight River.
- The University of Minnesota Horticulture Department has a demonstration project on wetland reconstruction at the Minnesota Landscape Arboretum. Monitoring at 80 wetlands correlates land use with amphibians and birds.

WETLANDS PLAN AIMS TO UNIFY STATE AND LOCAL PRIORITIES. The 1997 *Minnesota Wetlands Conservation Plan* provides a framework to help link wetland policies at all levels, in addition to four management strategies: recognize and apply regional differences in policies and decisions; simplify the permitting system; develop and deliver better information to decision-makers about wetlands; and give resource agencies a common set of strategies for wetland restoration, protection and management.

The plan emphasizes the importance of local water plans in managing wetlands. Some local water plans have done a thorough job of identifying wetlands and developing official controls or other means to safeguard them. Rule changes in 1992 require Twin Cities watershed management plans to include information about the functional values of its wetlands and to identify high priority areas for wetland preservation, restoration and establishment.

Needs and directions

- Maintain and restore wetland quality and diversity, increasing overall quantity.
- Agree to benchmarks to show whether the state is achieving no net loss.
- Develop coordinated management and enforcement strategies.
- Consider ground and surface water as one resource.
- Institute laws to protect surface water resources from ground water pumping.
- Meet the wetland gain goal in the federal Clean Water Action Plan.

Wetland restoration benefits wildlife and communities

To compensate for some of the 100,000 wetlands lost to drainage in Becker County, U.S. Fish and Wildlife's North Star 2000 project is planning to restore 23,000 wetland acres, and develop 45,000 acres of upland grasses and 4,500 acres of cropland to provide food. The state's largest wetland restoration is the 275-acre Hamden Lake site, drained in 1905. The restoration will provide a prairie and wetland ecosystem with an exceptional network of wetland types and nesting upland, and ultimately, a resting and nesting habitat for 210 species of migratory birds, raptors and waterfowl.

The centerpiece of these restorations is 112-acre Bisson Lake. During the spring melt, while ditches are still blocked by ice, Bisson Lake and the surrounding wetlands attract more than 10,000 migratory birds, raptors and waterfowl. When Bisson Lake held water during the wet summer of 1992, the first American avocets were sighted in Becker County, and even more notably, they were nesting. Several nesting pairs of the declining bobolink have been spotted. Restoration of this historic area promises to boost migratory bird diversity and abundance, plus the increase in wetlands brings more water storage capacity to an area prone to flooding.

10-YEAR OBJECTIVE: TO MANAGE RIVERS, BOTH LARGE AND SMALL, WITH THEIR RELATED LAND RESOURCES, AS UNITS.

The *Minnesota Water Plan* recommended actions to identify priority rivers for comprehensive management, to establish private-local-state projects on priority rivers, to link local grants to comprehensive river strategies and to establish advisory teams on river systems.

MAKING THE MINNESOTA RIVER A PRIORITY. Because of efforts by all levels of government and other interests, the Minnesota River is no longer listed by the American Rivers as one of the nation's 20 most polluted waters. A 1992 proposal by Governor Arne H. Carlson aimed to make the Minnesota River fishable and swimmable within a decade. The Minnesota River Citizens' Advisory Committee was created; its assessment project report identified sediment, phosphorus and pathogens as major water quality problems and developed recommendations for addressing these issues. The Minnesota River Agriculture Team worked with the University of Minnesota on research and education projects relating to the Minnesota River. Research conducted in the basin has led to a better understanding of the discharge of nitrate and phosphorus from drainage tiles, which is applicable in other places. Between 1994 and 1996, the percent of lake acres swimmable in the Minnesota River Basin increased from 28 percent to 33 percent.

In 1995, 37 counties formed the Minnesota River Basin Joint Powers Board. The board's strategy, *Watershed Implementation from the Local Level*, positioned local teams to develop work plans for each major watershed of the basin to ensure consistency and coordination among county water plans. Pilots were launched in three major watersheds: Le Sueur, Blue Earth and Watonwan rivers.

The Conservation Reserve Enhancement Program has the potential to retire 100,000 acres of environmentally sensitive cropland in the Minnesota River in the next few years. Approved by the U.S. Department of Agriculture and the State of Minnesota, the voluntary program is designed to protect floodplain lands along the main stem of the Minnesota River and its tributaries by planting trees and native vegetation and using long-term and perpetual conservation easements. In addition, 50 percent of Reinvest in Minnesota easement targeting and \$500,000 per year of accelerated cost share funding goes to the Minnesota River.

Tailored watershed assessments are underway or slated for eight of the 13 watersheds that make-up the Minnesota River basin; the remaining five will also be assessed. Conducted through Minnesota's Clean Water Partnership program, the assessments are designed to build understanding and address the pollutant sources and contributions to riverine systems.

To reduce phosphorus in the river, a trading agreement was developed, the first of its kind in the nation. Phosphorus inputs from one categorical source could be traded for reductions and offsets in another source. Reducing city and industrial point sources has lowered

phosphorus contributions to the river system. Until 1994, about 30 percent of phosphorus in the Lower Minnesota Watershed was discharged from metropolitan wastewater treatment plants. A new biological removal process in 1995 dropped the plants' phosphorus discharge by 60 percent, from about 3 parts to 1 parts per million.

Students find water quality problems from development

Students found water in the upper Mississippi River high in dissolved oxygen and low in phosphorus and nitrogen, with gradual degradation as water sampling moves into areas of poor shoreline development.

The Mississippi Headwaters Board's River Watch Program provided students in 16 schools within eight counties with a hands-on introduction to river ecology, a practical outdoor science lab within their own communities. Preliminary comparisons indicate that as erosion and siltation increase, phosphorus levels increase. A positive correlation may be drawn with improper shoreline development. At many northern county sites, the phosphorus concentrations are too low for detection by the analytical method used. Higher phosphorus concentrations may be attributed to inadequate buffer zones along shorelines combined with agricultural uses and improper application of lawn fertilizer.

BASIN MANAGEMENT GAINS NEW EMPHASIS. As a headwaters state, Minnesota has a responsibility to address the interconnections between upstream and downstream interests, the connection between ground and surface water, as well as impacts on neighboring countries and states. State and federal planning and problem-solving increasingly are focused on watersheds, basins and rivers, particularly on the largest problems and biggest rivers. Water quality conditions are stable or improving in many basins, however, many decisions are still made without considering watershed effects.

A nonprofit organization, the Rivers Council of Minnesota, was formed in 1996 to protect, maintain and restore Minnesota's rivers. The Red River Basin Board representing cities, counties, watershed districts, governor appointees and at-large members from Minnesota, Manitoba, North Dakota and South Dakota organized in 1997 to develop and implement a water management plan. Other state agencies established a committee to ensure interagency coordination and communication on Red River basin matters.

The Department of Health's water supply protection efforts are now concentrating on protecting surface water sources from degradation. Twenty-six community water supplies use surface water from lakes or rivers; nearly a million people use water supplies from the Mississippi River.

The Mississippi River Defense Network developed as an outgrowth of a Corps of Engineers study of water supply and spill response management upstream from the Twin Cities. Working to establish a

spill prevention and response program, the network received a Clean Water Partnership grant to assess nonpoint source affects on the river.

The Pollution Control Agency reorganized in 1994 to emphasize and plan for major river basins. Plans are complete for the Red River, Lake Superior and the Minnesota River basins, and information documents are expected in 1998 for the Upper Mississippi, Lower Mississippi and St. Croix basins.

The Department of Natural Resources is changing its river planning methods. Rather than planning for the narrow river corridor, the new approach examines watershed effects and community interests, working with local partners. Planning is underway in the lower St. Croix and slated for the Mississippi River Wild and Scenic River area, which extends from St. Cloud to Anoka, using a visual GIS component, maps and a web site. The DNR also initiated a watershed protection initiative aimed at saving the few remaining trout streams in the Twin Cities area and other highly sensitive trout streams.

The state provides pass through funding for several river-related groups, such as the Mississippi River Headwaters and the Red River Watershed Management boards. The Board of Water and Soil Resources is placing greater emphasis on a watershed perspective in local water plan revisions. Thirty-five projects are underway on Minnesota's rivers using some board funding. The Elk River project used funding for upland erosion and sediment control practices and riparian livestock exclusion.

Local governments have formed numerous joint powers boards to protect and manage rivers, including the St. Louis, Root, Roseau, Snake, Whitewater, Big Fork and Little Fork rivers, also eligible to be targeted under Clean Water Partnership program.

Local groups can identify watershed or river-related concerns, propose projects and apply for USDA funding. Producers can enroll land in riparian areas through the USDA Conservation Reserve Program; payments are allocated for both land treatment and rental.

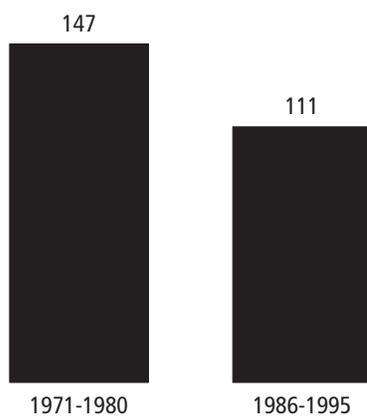
JOINT EFFORTS AID RIVERS AND WATERSHEDS. A 1996 low flow management plan will help maintain "run of river" operations on the Mississippi River during drought periods. The plan will minimize artificial flow fluctuations and protect aquatic resources and the needs of downstream users. The Department of Natural Resources and the Corps of Engineers helped develop the plan for the Mississippi River above St. Paul in cooperation with all nine main stem dam owners. Three hydropower operators were required to develop low-flow plans.

Results from a study of the origin and fate of phosphorus in the Mississippi River basin will be available to incorporate into the next permit of the Metropolitan Treatment Plant. The Metropolitan Council has been working with several agencies in Minnesota and Wisconsin on both point and nonpoint sources of phosphorus.

Partnerships benefit Big Sandy

After seeing water quality degrade in Big Sandy area lakes and streams, local residents formed a partnership with local, state and federal governments to protect their 413 square mile watershed. Residents depend upon clean water for drinking, healthy fish populations, business and recreation. The Clean Water Partnership has launched steps to prevent and correct problems such as installing protective easements on 200 acres of streamside wetlands along the Sandy River, and revegetating two large shoreland sites that had been eroding for several decades.

SEDIMENT DECLINES IN MINNESOTA RIVER AT MANKATO
Concentrations in milligrams per liter



Source: Minnesota Pollution Control Agency

Other efforts and integrated river assessments include:

- The Department of Health developed a communication strategy with Minneapolis and St. Paul addressing Mississippi River drinking water emergencies due to contamination.
- In 1988 Congress designated a 72-mile stretch through the Twin Cities as a National River and Recreation Area. The National Park Service developed a management framework to protect the river and provided funding to local governments to update their plans and ordinances.
- Two U.S. Geological Survey national water-quality assessments are nearly complete in the Red River of the North basin and in the Mississippi River basin.
- The National Park Service and state agencies from Minnesota and Wisconsin are jointly developing a basin water quality plan for the St. Croix River Basin.

- Minnesota, Wisconsin, the National Park Service and a local government-citizen task force are developing a new management plan for the St. Croix.

- Several state and federal agencies cooperated in developing biocriteria for fish and macro invertebrate communities in the St. Croix, Minnesota and Red river basins.

- To supplement routine stream monitoring, the Pollution Control Agency and Department of Natural Resources initiated a statistically based program of integrated assessments. Random sites were monitored for fish, macroinvertebrates, chemistry and habitat to determine conditions of the St. Croix and Lake Superior basins.

- The upper Mississippi is designated as an American Heritage River, giving 23 participating communities a federal priority for funding and expertise.

- The Ramsey-Washington Metro Watershed District has tackled several projects to improve water quality and restore the ecosystem such as reducing flood damages and restoring the eroded channel in Battle Creek Park; providing storm water treatment to improve Tanner Lake quality; using innovative landscaping, habitat improvements and wetland restoration in Phalen watershed.

MORE INFORMATION IS COLLECTED AND ANALYZED. Continuous stream gages increased substantially in the 1990s. The DNR cost-shares 32 continuous record stream gage stations and seven of the 96 stations in the U.S. Geological Survey and state agency cooperative network. The department is also working with the National Weather Service and U.S. Geological Survey to install 40 continuous recording, flood-warning gages with satellite and telephone telemetry throughout the state.

Gages to monitor precipitation increased from 1,383 in 1992 to 1,500 in 1996. The DNR has adopted protected flows for all streams used as sources of water for offstream use, and more detailed studies are underway or completed on 11 watersheds.

The Metropolitan Council's Watershed Outlet Monitoring Program, established in 1988, will add its 29th sub-watershed in 1998. The program collects chemical, physical and biological data at watershed outlets. Modeling will begin in 1998 to assign target pollution loads for all metropolitan area watersheds to meet local and regional water quality goals. The council also collects ambient river quality data on major rivers throughout the metropolitan area.

Needs and directions

- Protect small streams that are biologically important to river health.
- Sustain local efforts as federal and state funding and approaches fluctuate.
- Provide state assistance for local entities developing watershed management strategies.
- Encourage local governments to incorporate local water plans into community-based plans.

Nutrients tracked in Mississippi River study

A U.S. Geological Survey national water-quality assessment of the Mississippi River basin showed that nitrogen compounds and phosphorus concentrations were greater in tributaries draining agricultural areas than in forested land. At agricultural sites, the greatest nitrogen concentrations occurred in spring and summer, whereas at forested sites the greatest concentrations were in the winter. Phosphorus concentrations were greatest in spring and summer at all sites.

10-YEAR OBJECTIVE: TO MAKE PROTECTION OF GROUND WATER QUALITY AND QUANTITY A ROUTINE CONSIDERATION IN ALL GOVERNMENTAL DECISIONS.

The *Minnesota Water Plan* recommended setting priorities for protecting and managing aquifers as hydrologic units; establishing private, local and state projects on priority aquifers; and linking local grants to implementing comprehensive strategies. Other recommendations included establishing teams to advise about ground water issues, collecting and automating sufficient information for decision making, locating sensitive areas and formalizing a priority process for geologic work.

STEPS TAKEN IN AQUIFER MANAGEMENT. Measures in the 1989 Ground Water Protection Act eliminated some types of Mount Simon Hinckley aquifer use, and restricted new use to drinking water supplies to safeguard the quantity of this deep, high quality water source.

Additional steps have been taken to promote conservation and protect water supply wells. Planning requirements of large water suppliers are compelling many communities to consider water quality and quantity issues, to evaluate water demand in the context of the source of their supply and propose conservation and emergency measures.

INCREASING DEMANDS FOR GROUND WATER ARE DRIVING A NEED TO KNOW MORE. Ground water first exceeded surface water for public use in about 1980; today ground water provides 66 percent of public water supplies. Irrigation increased by 163 percent between 1986 and 1996; 81 percent is supplied by ground water.

Information about the complex ground water system is gathered through studies, geologic assessments, models and age dating, and is particularly helpful in areas under development pressure and where further exploration may identify more aquifers. The geological attributes and physical behavior of the deeper aquifers must be studied before innocent mismanagement causes irreversible damage. As the potential water supplies from aquifers are investigated, the consequences of pumping large volumes of water from the subsurface and the impacts at the interface between surface water and ground water will be better understood.

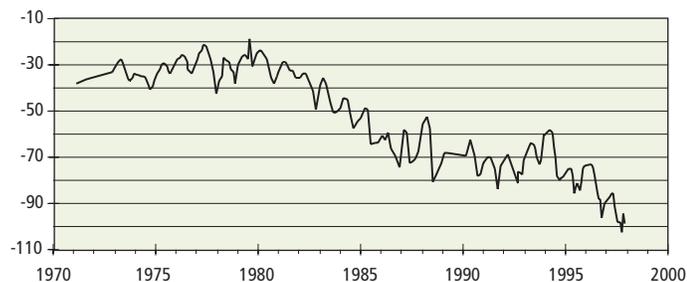
Explorations by the Department of Natural Resources identified aquifers previously unknown in relatively dry southwest Minnesota. Twelve county geologic atlases and five regional assessments have characterized local geologic conditions in 34 percent of Minnesota's land area affecting about 72 percent of the population. Since 1992 efforts to age-date ground water have produced more than 500 analyses. Water in Minnesota aquifers ranges in age from less than a year to more than 35,000 years old. Understanding ground water age helps show geologic sensitivity. The DNR's observation well network increased by nearly 100 wells, to 715 wells in 78 counties, increasing the understanding of aquifer response to human and natural induced changes.

SEVERAL AGENCIES ARE EXAMINING GROUND WATER IN THE MISSISSIPPI RIVER BASIN. The Department of Agriculture is instituting a central sand plain monitoring network for agricultural chemicals. The Department of Health is developing an interagency local aquifer protection project in the St. Cloud to Little Falls region, featuring a regional ground water flow model. The department is working with the U.S. Geological Survey to define ground water interactions and look at the roles for aquifer protection in the Mississippi River basin.

To provide a better assessment of water quality in Minnesota's principle aquifers, the Pollution Control Agency redesigned its Ground Water Monitoring and Assessment Program. From 1992 through 1996, the agency monitored a statewide network of about 1,000 wells, establishing baseline water quality conditions, identifying chemicals of concern and helping to determine where additional investigations are warranted.

Computer models offer unique opportunities to analyze cause and effect. The Twin Cities Metro Ground Water Model is providing a prototype as well as interpretive results, useful to other areas developing models. Numerous other ground water flow models have been developed at local and county scales to delineate wellhead protection areas and for other special purposes.

TWIN CITIES AQUIFER SHOWS DECLINE Depth to water in feet



Note: Water levels in a hydrograph of the Mount Simon-Hinckley Aquifer in the Savage area of Scott County shows a steady decline from increased water use in this growing area.

Source: Minnesota Department of Natural Resources

RESOURCES AVAILABLE FOR LOCAL GOVERNMENT TO HELP DEAL WITH COMPLEX GROUND WATER ISSUES. Fact sheets on nine ground water regions were developed by an interagency group led by the Pollution Control Agency. The Department of Natural Resources distributed preliminary assessments to all counties enabling them to develop maps showing estimated ground water sensitivity according to geologic materials at or near the surface. The DNR also published *Criteria and Guidelines for Assessing Geologic Sensitivity of Ground Water Resources in Minnesota*, June 1991. As local interest and capability increases, the state uses information from local water plans to make state agency program decisions such as where to develop monitoring efforts. As counties understand the value of gathering ground water data many are sharing costs and developing joint projects.

The Minnesota Geological Survey analyzed well data collected by nine southeast counties and the Pollution Control Agency Ground Water Monitoring and Assessment Program. The survey provided recommendations to county staff about how to interpret ground water information. The 1994 *Southeastern Minnesota Regional Ground Water Monitoring Study: A Report to the Southeast Minnesota Water Resources Board* reported good water quality overall, but some threats in shallow bedrock areas, demonstrated by elevated nitrate levels.

Some efforts to tackle ground water issues include:

- Nine counties in southeast Minnesota participated in a regional ground water monitoring cooperative, sampling 158 wells.
- Counties in the Twin Cities and state government assign staff to the Metro Area Ground Water Alliance to coordinate ground water management activities.
- Partnerships have formed for geologic atlases and wellhead protection projects.
- A U.S. Geological Survey National Water-Quality Assessment in the Red River basin looked at two areas underlain by sandy surficial aquifers where irrigated agriculture dominates the land use. Ground water from the eastern study area had significantly higher concentrations of nitrate and agricultural herbicides than ground water from the western area. Differences in rainfall, soil texture, depth to ground water and agriculture practices between these two areas can account for the water quality variance. The same factors may indicate changes in ground water quality resulting from agricultural land uses in other places within the region.
- St. Cloud area shows land use impacts on ground water quality. The Pollution Control Agency's Ground Water Monitoring and Assessment Program showed significant impacts by land use on the water quality of the surficial sand aquifer which underlies the study area. However, the level of risk to ground water users is relatively low in the aquifer's upper portion and nearly unaffected by land use in the lower portion. Parameters of concern included nitrates, volatile organic compounds in urban areas and atrazine in irrigated agricultural areas, although neither of the latter two exceeded drinking water standards at any monitoring point.

Geologic atlas help pick landfill site

In 1990 Olmsted County opened the Kalmar landfill, the only new municipal solid-waste site in Minnesota since 1985. The county geologic atlas had an integral part in the siting process. A task force used geologic criteria to determine which sites must be avoided or considered with caution. Potentially suitable sites were considered using these criteria: depth to bedrock greater than 100 feet, absence of karst features in the site area and contiguous 160 acre parcels, and presence of an effective confining layer above the usable aquifer system.

The geologic atlas also helped convince the public about the landfill, by graphically showing the unique characteristics of the Kalmar site for protecting ground water from pollution.

Needs and directions

- Set state priorities to build knowledge of ground and surface water systems including their interactions, natural variations, sustainable yields and effects of various land uses.
- Provide more state support to local governments for water supply and conservation planning.
- Make existing information about ground water systems widely accessible and more easily understood by decision-makers and others.
- Integrate information into activities outside the normal sphere of ground water programs.
- Integrate local data collection efforts into statewide activities and make local information readily accessible to others.

Protecting and conserving water resources

This chapter's three objectives focus on reducing environmental pollutants, protecting wells and conserving water.

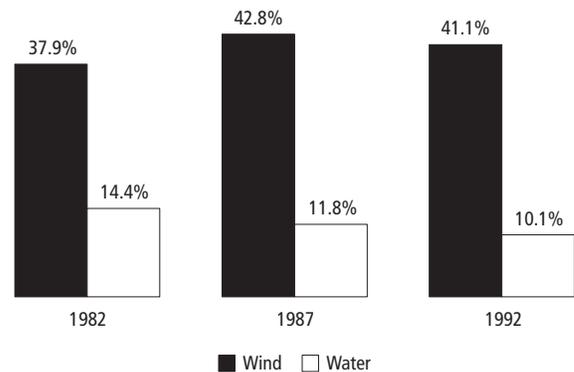
10-YEAR OBJECTIVE: TO BUILD DEGRADATION PREVENTION GOALS INTO ALL MINNESOTA PROGRAMS AND PRACTICES AFFECTING WATER.

The 1991 *Minnesota Water Plan* recommended evaluating how state programs meet clean water goals and changing programs if necessary; reducing use of polluting materials, wastes produced and pollutants entering the environment; and ensuring that agricultural activities are sustainable.

WASTE IS BETTER MANAGED. All 87 counties have pollution prevention programs to address household hazardous waste. More than 40 regional, local or mobile facilities are collecting about 1,800 tons annually from about 100,000 households statewide. The Department of Agriculture coordinates county and industry efforts by Minnesota growers to recycle empty pesticide containers for reformulation. State agencies in the capitol complex increased their recycling recovery rate from 41 percent in 1990 to 67 percent in 1997.

After evaluating reports from about 400 large facilities in the state, the Emergency Response Commission of the Department of Public Safety found the amount of toxic discharge to the environment had been reduced, even though toxic chemical use had increased. Toxic chemicals released into the air, water and earth dropped from 29,000 million pounds in 1993 to 24,000 million pounds in 1995.

EROSION RATES ON MINNESOTA CROPLANDS



Note: Intensive farming methods and loss of windbreaks contribute to wind erosion. Source: U.S. Department of Agriculture Natural Resources Conservation Service

The 1991 Toxics in Products statute aimed to reduce heavy metal use in ink, dyes, paints, pigments and fungicides. In 1994 mercury was eliminated from new batteries in Minnesota, banned from solid waste disposal and prohibited from certain toys.

The state places a high priority on reducing or eliminating toxic or hazardous materials in municipal solid waste. Heavy metals and toxic chemicals can be found in various household or commercial products such as batteries, fluorescent lamps, used oil and oil filters, video monitor and television picture tubes, printed circuit boards, paint, pesticides or cleaning products. The Office of Environmental Assistance offers education materials and assistance programs to help reduce hazardous product use and to ensure proper end-of-life management. The Minnesota Materials Exchange Alliance helps businesses and institutions make use of materials that would otherwise be discarded. A statewide household hazardous waste system collects discarded products that are not good candidates for municipal solid waste.

Through the efforts of local government, Minnesotans recycled 46 percent of their solid waste in 1996, compared to 23 percent in 1990. Volunteers in the DNR's Clean Rivers Program have helped reduce the amount of litter and waste going to rivers and streams.

PUSH TO ADDRESS ON-SITE AND FUEL STORAGE TANK PROBLEMS. Roughly 27 percent of state households rely on on-site wastewater treatment systems. Not adequately treated, waste water is a threat to water resources. Law and rule changes since 1994 require local governments to have ordinances regulating septic systems on all land, expanding the previous requirement for regulations only in shoreland areas. Wastewater installers and inspectors must comply with new training and certification requirements.

Because of the difficulty siting some on-site systems, the University of Minnesota Extension Service and the Natural Resources Research Institute are researching alternative wastewater systems, nutrient loading to ground water and household loading to septic tanks. Demonstrations near Duluth and Lake Washington in southern Minnesota will assess the effectiveness of alternative technology.

Extension and the Pollution Control Agency sponsored basic workshops around the state to train local government units, county staff and homeowners about proper maintenance. A 1997 satellite conference reached 62 downlink sites and an estimated 1,500 people. Some 35,000 copies of the *Septic System Owner's Guide* were distributed between 1995 and 1997.

A Pollution Control Agency program upgraded 5,206 underground storage tanks to 1998 standards, removed 23,459 and discovered 9,200 leaking tanks; 6,300 were investigated and

corrected. The job is far from finished: about 17,200 tanks still need to be upgraded or removed and about 1,300 leaking tanks need to be corrected.

Evaluations are conducted on some programs:

- The Blue-Ribbon Task Force on Funding Minnesota's Water-Quality Programs examined efforts to regulate dischargers of municipal and industrial waste into state waters. As a result of the evaluation, the Pollution Control Agency initiated a pilot project and began to implement changes designed to reduce permit backlog, increase inspections and improve efficiency; 97 percent of point source dischargers are in compliance.

- Based on a 1991 survey of member agencies, the Environmental Quality Board developed a *Water Quality Program Evaluation*, providing an overview of general trends in Minnesota's water quality efforts. The legislative requirement for program evaluation was transferred to the Pollution Control Agency in 1994.

- A new tool created by the Pollution Control Agency and Board of Water and Soil Resources tracks implementation and effectiveness of sediment control and phosphorus best management practices in the Local Government Annual Reporting System.

- The Environmental Quality Board staffs a generic environmental impact statement on animal agriculture. This statewide comprehensive study will review the economic, environmental and social impacts of the changing livestock industry in Minnesota. The Pollution Control Agency is revising the rules regulating feedlots.

- Best management practices to prevent or minimize sources of pollution are promoted by state and federal agencies and the University of Minnesota Extension Service. After revising forestry best management practices, the DNR conducted audits on their use and found long-term compliance.

Project reduces agricultural use

Over the past seven years, the USDA Anoka Sand Plain Water Quality Demonstration project has helped more than 100 producers manage nutrients on an average of 7,500 acres per year. The project helped reduce applied nitrogen by 1.4 million pounds and phosphorus by 388,721 pounds from 1994 to 1997; it also addressed manure and irrigation water management.

WORK IS PREVENTING EXCESS NUTRIENT AND PESTICIDE PROBLEMS. The Department of Agriculture's Pesticide Management Plan seeks to prevent degradation from pesticides. A committee recommended that atrazine be considered "commonly detected," suggesting that voluntary best management practices and preventive measures be pursued and evaluated. The department has established pesticide and nutrient management areas in

the central sands portion of the state where coarse textured soils predominate. Eventually extensive educational, promotional and evaluation efforts will occur in select places.

Various projects have reduced chemical use. Material developed for the Lake Harriet watershed project is now being adapted and distributed for other urban watersheds and will form the basis for pesticide and nutrient management programs in urban settings. The Department of Natural Resources and local governments have several watershed projects aimed at pollution prevention.

Nitrate contamination of ground water resources is a problem in many areas of Minnesota. The Department of Agriculture has adopted statewide, regional and situation specific best management practices to address elevated nitrate levels. A task force convened by the Department of Health is exploring how to address nitrate problems in Lincoln-Pipestone rural water system. The University of Minnesota is overseeing projects to assess the effects from potatoes and irrigation on nitrate levels in the sand plain aquifer that replenishes the Straight River in Becker County.

Maplewood controlling sediment runoff

A 1994 ordinance is limiting dirt washed or blown into streets and washed into waterways in Maplewood. The ordinance requires a refundable escrow deposit with every building permit, and the builder must submit an erosion and sediment control plan as well as a grading plan with the permit application. An inspection is required before construction begins. City staff considers enforcement the key to effectiveness: word gets around if escrow money is not returned or if a stop work order is issued. Cooperation is high, saving Maplewood's water supplies from a major cause of pollution.

SOIL EROSION IS AN ONGOING PROBLEM IN BOTH URBAN AND RURAL AREAS IN MINNESOTA. In 1992 more than 10 percent of cropland was eroded from water at levels exceeding tolerance (amount of soil loss at which cropland can remain productive) and at 41 percent due to wind. Minnesota's wind erosion rates are high nationally. Programs to take marginal land out of production and help prevent erosion include the USDA Conservation Reserve Program, which encompassed 1.8 million acres at its peak in the late 1980s, and Reinvest in Minnesota with about 74,000 acres. As CRP contracts expire and land returns to cropland, erosion could increase. In addition, conservation requirements in federal farm bills are to drop in the future, which could boost erosion.

Minnesota has required permits addressing erosion and storm water at construction and industrial sites since 1994. Construction permits for sites more than five acres require such measures as best manage-

ment practices. Industrial storm water permits require industries to manage storm water properly and keep it separate from wastewater.

To control the amount of sediment entering surface waters, the Pollution Control Agency requires a temporary and permanent erosion and sedimentation control plan according to state specifications. Plans must include use of such measures as detention ponds, seeding for site stabilization and silt fences. The agency has worked closely with several cities and counties to proactively address construction erosion. However, many cities and developers do not obtain permits and the state must rely on complaints for enforcement.

Second generation Twin Cities watershed management plans require uniform erosion control, storm water retention and wetland protection ordinances. The Board of Water and Soil Resources estimates that over half of first generation metro watershed plans resulted in a local ordinance. The Minnesota Water Plan recommended using state erosion control funding to spur erosion control ordinances, but few Minnesota counties have adopted them.

Needs and directions

- Evaluate the effectiveness of water quality programs.
 - Determine ground water quality and comply with nondegradation if the quality is getting worse.
 - Reduce high nitrate and phosphorus levels in surface and ground water.
 - Ensure erosion does not increase as federal farm programs change.
 - Continue to promote decreased use of toxic chemicals.
 - Adopt local ordinances for pollution prevention, erosion control and storm water management.
 - Document the effectiveness of best management practices.
-

New approaches to prevent pollution

The Rahr Malting Company planned to build a wastewater treatment plant discharging into the Minnesota River, which was under a pollutant cap order because of high levels of contamination. Pollution Control Agency staff agreed to let the company discharge to the river, as long as the effluent did not add to the river's pollutant levels. To resolve the load allocation issue, the agency created a trading framework to credit upstream reductions in nonpoint sources against Rahr's point source discharge. The unique trading agreement was a condition of Rahr's permit, which outlined categories of best management practices to lower nonpoint pollution, with a special multipollutant format that gave Rahr credit for reducing phosphorus in the watershed. As part of the process, Rahr bought land that had suffered from flooding and erosion.

10-YEAR OBJECTIVE: TO STRENGTHEN PROTECTION AND MANAGEMENT OF WATER WELLS AT THE STATE AND LOCAL LEVEL.

The 1991 *Minnesota Water Plan* recommended strengthening the well code, which covers well construction and sealing, developing a system for private well testing, encouraging innovation and implementing wellhead protection for public and private wells.

WELL MANAGEMENT AND WATER TESTING STRENGTHENED. The state has enhanced field surveys and currently inspects 30 percent of new wells. Ninety percent of inspected sites have no violations of well rules. Nine counties and two municipalities administer the state well code through delegation agreements.

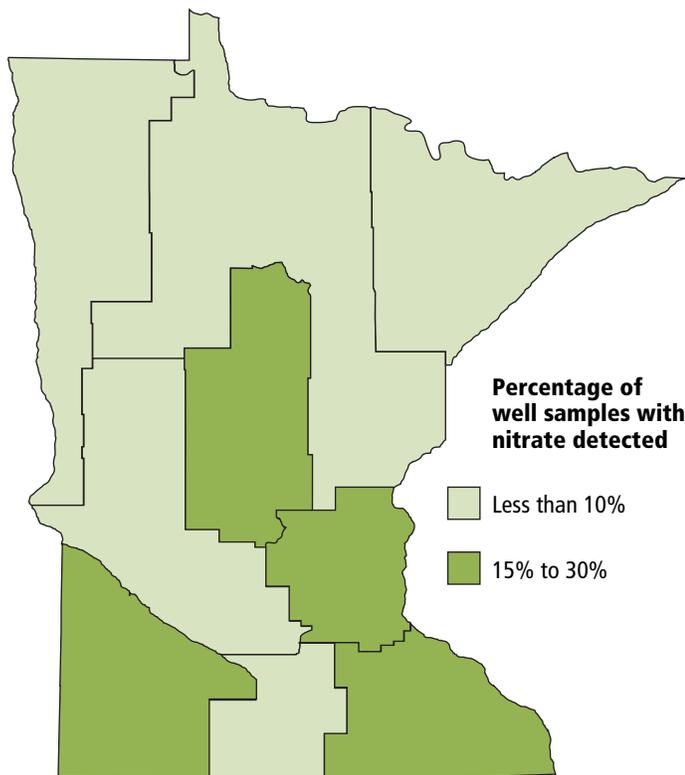
Water wells are a direct route into ground water and sealing unused wells has been a major state objective. Disclosure requirements, necessary when property is transferred, have resulted in sealing more than 100,000 wells since 1990. The Department of

Health simplified rules for well sealing in the mid-1990s and added rules to force sealing of high-risk wells; it offers a handbook on well rules. Funding is available to seal priority wells when the owner cannot be located. To keep track of unused wells, the department requires maintenance permits.

Cost share funding, available between 1991 and 1996, encouraged the sealing of more than 4,500 priority wells and indirectly many more when state funds were augmented with local funds. The DNR's effort to identify and seal unused wells on state land will result in sealing all wells that can be located by 2002. By June 1998, 465 of the 654 known wells have been sealed.

Several state agencies and local water plan coordinators provide private well testing clinics and educational seminars on the need and methods for water testing and interpreting results. The Department of Agriculture sponsors nitrate clinics around the state. To ensure that water testing results are correct, the Department of Health certifies water-testing laboratories; it has revised health risk limits for contaminants in drinking water. In the Twin Cities region, the department instituted long-term monitoring of private water supplies near dumps, since they present the greatest threat to human health.

NITRATE CONTAMINATION POSES A GREATER PROBLEM IN CENTRAL AND SOUTHERN AREAS



Note: Nitrate levels are detected if they exceed one part per million; Wells were sampled over a five-year period, 1992 to 1996. Most experts consider nitrate above this level a sign of human influence on water quality.

Source: Minnesota Pollution Control Agency

PLANS ARE REQUIRED FOR WELLHEAD PROTECTION AREAS. Under rules effective November 1997, the plans help build local understanding of ground water systems and the effects of land use, proposing local actions to protect ground water supplies. Water supply systems highly susceptible to ground water pollution or serving large populations are top priorities for planning. Thirty-six pilots were conducted to identify needs of local governments and test plan development.

A memorandum of agreement outlines state agency roles in implementing wellhead protection measures. In addition, the Pollution Control Agency prepared guidelines on how to manage contaminant sources in wellhead areas. Funding is available for wellhead delineation and program implementation through the state revolving fund. Wellhead protection was added in 1993 as a requirement of local comprehensive plans for Twin Cities communities.

Needs and directions

- Develop a framework to manage priority aquifers and to protect quality and availability of ground water.
- Phase 1,500 public water supply systems into the wellhead protection program.
- Help local staff interpret well water quality data and use well record information.
- Upgrade county well index software and load all well data.

Edgerton reduces nitrate contamination

The City of Edgerton worked with the Department of Health to define the area that contributes water to the city well. A wellhead protection planning team is working with local land owners to reduce nitrogen input from crop production, animal manure and septic systems. As a result, the nitrate levels in the city well are starting to decline and soon may comply with the drinking water standard.

10-YEAR OBJECTIVE: TO DEVELOP A COORDINATED LOCAL-STATE PROGRAM TO ENSURE THAT MINNESOTANS HAVE ENOUGH WATER TO MEET THEIR LONG-TERM NEEDS.

The 1991 *Minnesota Water Plan* recommended developing a water conservation strategy that examined the cost of water use and completing the metropolitan water supply plan.

EXAMINING WATER SUPPLY ISSUES PROMPTS CHANGES. A 1992 study of water availability issues by the EQB Water Resource Committee included recommendations to improve ground and surface water information and to enhance management of water use and water demand. In 1996, the committee examined water supply and wastewater treatment needs, and recommended gathering more information about aquifers and the amount of use that can be safely sustained as well as tying water funding to evidence of prevention measures and coordination.

The Metropolitan Council adopted a regional water supply plan in 1992, and published *Metropolitan Area Municipal Water Supply Planning Process: Metropolitan Council Report to the Legislature* in 1997. The council recommended that all entities work within the existing management framework — at a subregional level if necessary, rather than create a regional water supply system.

The council is currently collecting DNR water appropriation data on water use in the Twin Cities, and compiling a regional database for future water demand modeling. It also reviews local plans for consistency with regional and local plans. The council is revising its water supply plan to address two key issues: the impact of development and redevelopment on regional water resources and protection of resource water quality.

CONSERVATION BOOSTED BY LEGISLATION. Legislation was enacted in 1993 that required water emergency and conservation plans for municipal water suppliers in the Twin Cities region and for all water suppliers serving more than 1,000 people in the rest of the state. Water supply and availability studies by the Metropolitan Council and the Water Resources Committee pointed out the need. Water rates must be addressed in these plans. Of the 316 legisla-

tively required plans: 296 have been submitted, 199 reviewed and 133 approved effective July 1998.

To help communities complete plans, the DNR developed guidelines, options for public education programs and methods for reducing peak demands. The plans satisfy a wellhead protection contingency requirement to address water system disruptions caused by mechanical failure or contamination. Before the DNR can approve a public supply well or additional water volumes, the proposer must develop a conservation plan outlining demand reduction measures.

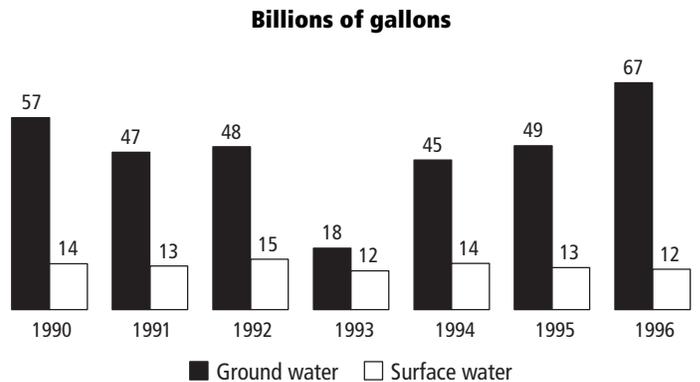
Conservation was boosted by a St. Paul Water Utility and Northern States Power program that distributed 51,565 showerheads during 1996-97. NSP paid for the showerheads and Niagra Conservation mailed the products to customers that returned cards expressing interest in the program. Conserving water can reduce the need for expansion of water and wastewater systems that safeguard water supplies and also reduce electricity needs.

About 50 new emergency interconnections have been identified since 1992 in water supply plans prepared by metropolitan area water suppliers, encouraging intercommunity sharing during water emergencies and joint development of water supplies. Sharing local water supplies is not common however, due to a perceived loss of control and community identity, and varying treatment costs and requirements for surface and ground water.

A 1993 law encouraged reuse of discharged gray water from sources such as bath and laundry, but little is occurring. Applicants for wastewater discharge permits must evaluate the potential reuses of discharged water. The Department of Health and Pollution Control Agency established criteria for use of gray water to irrigate golf courses.

A sixth water use priority for nonessential water uses such as lawn sprinkling, vehicle washing and golf course irrigation was added to

IRRIGATION USE CHANGES WITH WEATHER



Note: Water use fluctuates with rainfall and temperature. The reduction in water use in 1993 reflects a cool wet summer.

Source: Minnesota Department of Natural Resources

Minnesota law in 1993. This will help in drought or emergency situations to further clarify what uses of public supplies are considered nonessential; nonessential uses were not previously defined.

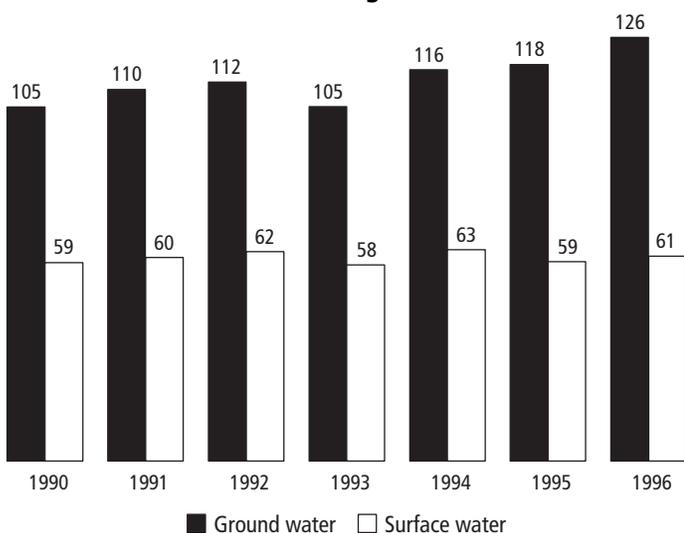
Inefficient and low-priority uses have been reduced. Over half of the once-through systems that use a continuous ground water flow to heat or cool buildings have been converted to other systems, and permits were terminated when ground water was used to augment surface water basins.

Drinking water revolving fund applicants must submit a DNR approved conservation plan. Requests for additional water from communities with high unaccounted volumes are issued on a temporary basis to allow time to correct the problem. Agricultural irrigation applicants are required to contact the soil and water conservation district regarding the need for a conservation plan and implementation of best management practices.

Needs and directions

- Strengthen water conservation and cooperative water supply efforts.
- Explore using different fees for the sustainability of different water sources, with higher fees used to safeguard more scarce or pristine resources such as the Mount Simon-Hinckley aquifer.
- Provide additional support and incentives for local conservation efforts.
- Support multi-community or sub-regional water supply systems in the Twin Cities area.
- Encourage reuse of gray water.

GROUND WATER USE FOR PUBLIC SUPPLY INCREASING
Billions of gallons



Source: Minnesota Department of Natural Resources

Managing water's interconnections

The final objective looks at integrating water and land use programs for a sustainable environment.

10-YEAR OBJECTIVE: TO HELP SUSTAIN THE QUALITY OF MINNESOTA'S ENVIRONMENT BY RECOGNIZING WATER'S INTERCONNECTIONS.

The 1991 *Minnesota Water Plan* recommended identifying and removing barriers to managing water's interconnections for a sustainable environment, linking water quality protection and restoration projects to measures such as ordinances and regulations, and building consideration of water protection needs into land use decisions.

Wetland restored to strengthen neighborhood's community, environment and economy

Ames Lake wetland in St. Paul is emerging from an obsolete, largely vacant asphalt wasteland. The wetland will restore the site's ability to clean stormwater, attract diverse wildlife, link to Phalen Park and provide an environmental education resource. Spurred by community support, the transformation of the blighted area will enhance surrounding property values and help attract quality commercial and residential development.

COMMUNITY-BASED PLANNING PROVIDES A NEW LEGISLATIVE FRAMEWORK. Minnesota Planning, working with the Environmental Quality Board, studied the impact of growth and change on water resources in the early 1990s. They reported that unplanned and poorly managed development in Minnesota results in significant environmental and fiscal costs and that the state and local framework for planning and managing land use change is fragmented and uncoordinated. The Minnesota Sustainable Development Initiative and a 1994 legislatively mandated task force offered goals and new approaches for managing Minnesota's land and community resources.

The Minnesota Round Table on Sustainable Development appointed by Governor Arne H. Carlson in 1996 continued the discussion, developing principles and strategies to help communities shape a sustainable future. Supported by various citizen groups, community-based planning was authorized in 1997. Pioneering communities are starting to plan for their future using common goals and help from the state. Water issues are linked to these goals. Four pilot projects are underway and will provide experience and information useful for other communities developing plans.

The Environmental Quality Board and Minnesota Planning are developing a guidebook to help communities consider sustainable development in their planning efforts.

Development affects water quality in Crow River

Growth in the Crow River basin with expanding, and new wastewater treatment plans threatens to exceed the river's ability to assimilate runoff and discharges. This has negative effects on aesthetic quality and the biological community. Future construction of treatment plants will be more costly, because facilities will need to remove more pollutants and will demand more consideration to other pollutant sources in the watershed, such as feedlots and urban runoff. The state and Metropolitan Council are encouraging local communities and schools to work together to protect water quality while allowing for sustainable economic development. The City of Greenfield agreed to remove phosphorus from effluent at its new wastewater facility.

WATER ISSUES INTEGRATED INTO COMPREHENSIVE PLANS. The Metropolitan Land Use Planning Act now requires that local comprehensive plans in the Twin Cities contain a water supply plan, a sewer system plan, on-site ordinance requirements and a local surface water management plan. The Metropolitan Council implements growth and development policies in the Regional Blueprint and the Water Resources Management Policy Plan. The council also reviews local conservation and watershed plans for consistency with state and regional plans.

Additional funding for on-site waste treatment systems and feedlots require development or existence of a local ordinance. Priorities for the Clean Water Partnership and the Board of Water and Soil Resources challenge grants include adopting and enforcing official controls and long-term water quality protection; whether these grants increase official controls is unclear.

As wellhead protection areas are identified in local water plans, they become a priority for other programs. Land set-aside programs have contributed to managing wellhead protection areas. Pilot projects by state agencies are actively addressing wellhead protection in various parts of the state.

EFFORTS LINK LAND, AIR AND WATER. The Environmental Quality Board's Water Resources Committee study of water and wastewater needs emphasized that land use is directly connected to present and future costs. *Saving Resources: Meeting Minnesota's Water and Wastewater Needs* recommended that local planning should address water supply and wastewater treatment along with land use and population changes. In turn, the state should tie water and wastewater treatment assistance to needs identified and strategies proposed in local plans. The 1998 Legislature added requirements for new wastewater treatment systems mandating counties to

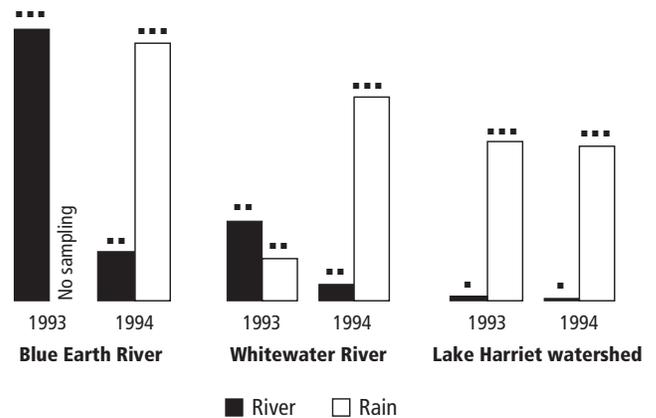
certify that projects located outside city limits are consistent with the county's comprehensive plan, zoning and subdivision regulations.

Some agricultural chemicals applied to land transfer to both air and water according to a study by the U.S. Geological Survey and the Minnesota Department of Agriculture. Agricultural pesticides not registered for home and garden use were found in urban rain and storm runoff confirming atmospheric transport. At least one pesticide was detected in most rain samples during the growing season, with alachlor, atrazine, cyanazine and metolachlor found most frequently. About 1 percent of the atrazine used on a field ends up in storm water, while about 2 percent is airborne, detected in rain.

Basin and ecosystem planning require a more holistic approach. State permitting and funding programs are more aware of surface and ground water interconnections and review projects accordingly. The Department of Agriculture is working toward monitoring small watersheds, intended to be representative of larger basins. Agricultural chemical management programs are implemented on a watershed approach. The Department of Health has a new initiative to work with local health entities in addressing cumulative effects of various land uses and practices.

The environmental review process developed into a better growth management tool during the 1990s, with improved guidance and an increasing use of the Alternative Urban Areawide Review. AUAR is a special process to review cumulative impacts resulting from a series of sequential projects, development typical of the rapidly growing areas which otherwise would be reviewed separately. The subject is a development scenario or several scenarios for an entire geographical area rather than a specific project. The review process

ATRAZINE DETECTED IN RAIN AND STORM RUNOFF
Micrograms per square meter per year



Note: The graph shows the link between atrazine in rain and storm runoff. In general, more atrazine was deposited into the watersheds from rainfall than in storm runoff. Yearly atrazine amounts in both runoff and rainfall depend on climate and use.

Source: U.S. Geological Survey and Minnesota Department of Agriculture

uses a standard list of questions adapted from the Environmental Assessment Worksheet, providing a level of analysis for typical urban area impacts comparable to an Environmental Impact Statement.

Comprehensive planning and zoning legislation proposed repeatedly by the Advisory Council on State and Local Relations never had the support to pass. The legislation aimed to coordinate and modernize the planning law governing cities, counties and towns. With 87 counties, more than 700 cities and 1,750 townships, authorities and relationships among them are critical.

Needs and directions

- Continue to strengthen the community-based planning effort.
- Incorporate water plans into community-based comprehensive plans and adequately make the land use connection.
- Address water demand and impacts in land use planning and official controls.

- Strengthen efforts to link assistance to prevention measures, such as ordinances.
- Develop strategies, including modifying regulations, that recognize interconnections and cumulative effects of human activity.

Next steps

Soundings reports progress on all 14 objectives of the 1991 plan and highlights some key needs to further them. The EQB Water Resources Committee will use the report as a tool to start shaping the next water plan due in September 2000. Soundings should be helpful to legislators, businesses, environmental groups, agencies, local entities and citizens in understanding current water issues, working with the committee to better design future goals and strategies.
