

December 1997 Minnegram

Protection, mitigation and restoration: the future of Twin Cities urban streams

Urban growth is inevitable. Cities will expand. Suburban homes will colonize once-vacant fields. Sewer lines will be laid for new and prospering communities. Here in the Twin Cities, those concerned with maintaining the integrity of metro-area streams are faced with serious challenges brought about by a seemingly ever-expanding ring of suburban growth. While growth is touted as a necessary component of a healthy economy, this same growth is a formidable threat to the health of natural systems, such as streams. Now, researchers and managers say the real challenge is finding ecologically healthy avenues for growth, ones that lead to healthy stream systems.

Connectivity - an important paradigm shift

Single-site, in-stream restoration has been around since the early 1950s. At that time, techniques such as weirs and lunker structures were developed to massage stream hydraulics and morphology to be more amenable to certain species, often trout. In the early 1980s, an emerging body of stream ecosystem theory recognized a fundamental connectivity between a stream and its watershed. In addition, new stream ecosystem theories recognized profound upstream/downstream linkages in streams. Managers and researchers began to look to the surrounding landscape for broader, more lasting solutions to maintaining stream integrity in the wake of increasing urban influences.

Because of the overriding influence of watershed activity on stream conditions, in-stream restoration plays a smaller role in current efforts, says Bruce Vondracek, an adjunct assistant professor of fisheries and wildlife at the University of Minnesota. "In-stream restoration is useful because it provides instant gratification." Conversely, a watershed-scale effort, says Vondracek, is a more gradual process. Progress is harder to measure and requires a consistent source of not only funding, but of public and political will.

With the acceptance of stream ecology theory, a focus on watershed protection and mitigation is becoming the norm. Managers have realized that unless land-use activities in a watershed are structured to allow for healthy functioning stream systems, in-stream restoration activities are quick fixes at best. "Stream restoration is a myth," says University of Minnesota fisheries biologist Marty Melchior. "Unless land-use impacts are dealt with, in-stream restoration is almost useless."

Urbanization - a familiar progression

The deterioration of streams in urban watersheds is becoming an all too familiar progression. Time and again, trout have vanished from streams in the metro area within 5 years of major development. Likewise, warm water streams, such as Minnehaha Creek, suffer from reduced water clarity and species diversity, and rapidly eroding stream banks.

Currently, researchers have a good grasp of how urbanization affects streams. As urbanization proceeds, impervious surfaces impede infiltration of rain water. Instead of trickling slowly

through the soil en route to a stream, most of the water stays on the surface where it is warmed and rapidly transported to the stream. The result is an alteration of both the thermal and the hydrologic regime of the stream. Heavily impacted streams are generally more flashy (higher, quicker flood flows) and warmer than non-impacted streams of similar morphology and climate. In addition, urbanization leads to increased inputs of nutrients from lawn fertilizer and wastewater, and increased sediment inputs during construction.

Scaling up - moving into the watershed

Large-scale watershed protection and mitigation is a complex, multifaceted process involving numerous governmental units, nonprofit organizations, consultants and the private sector. Effective coordination of this complex landscape of interests and priorities, rather than the scientific aspect of minimizing land-use impacts, is becoming the central challenge to achieving ecologically healthy growth.

Watershed Coordinator for the DNR's Metro Trout Stream Watershed Protection Initiative, Annette Drews, takes a flexible approach to protecting streams. "Each community is different, the resources are different, and so our approach is different," says Drews.

In some cases, urbanization is so pervasive that any restoration, in-stream or watershed, short of removing a large portion of the existing development, cannot reverse degradation. "A few years ago the governor wanted to know if the DNR could restore a stream to support trout in downtown St. Paul. After considerable research, we told him - no way," said Drews. Melchior, like Drews, sees definite limits to restoration efforts. "Once it's gone, it's gone. We have to get in there before urbanization proceeds too far."

But Vondracek takes a more optimistic view when dealing with now-defunct trout streams. "We can still have naturally functioning, healthy communities, just not ones that support trout." In Vondracek's view, an impacted stream may lose some of its natural characteristics, but can restabilize in a new, relatively healthy state through restoration efforts. Still, it seems that the longer urbanization has existed and the farther it has progressed, the more expensive and potentially ineffective restoration efforts become.

Valley Creek -opportunities for long-term approaches

In places where urban growth is still more threat than reality, stream managers and researchers are looking to long-term monitoring, conservative zoning and creative partnerships to avert the fate suffered by the many streams that have already been radically altered by urbanization.

Valley Creek is a high quality trout stream draining into the St. Croix River near the City of Afton, MN. Currently, all of the Valley Creek watershed lies west of the Metropolitan Urban Services Area (MUSA) boundary. Consequently, public sewer and water services are not available within the watershed. Recently, the Metropolitan Council designated the area a rural preserve, with strict zoning that dictates gross dwelling densities of less than one dwelling per 10 acres. But with the booming suburb of Woodbury, with its staunch commitment to aggressive

development, looming on the western edge of the watershed, development seems inevitable, if not imminent. At Valley Creek, protection, rather than restoration, is the focus.

Jim Almendinger, a research scientist for the Science Museum of Minnesota's St. Croix Watershed Research Station, is heading a long-term hydrologic study of Valley Creek. The study, which began in July 1997, will provide managers with a rare long-term data set detailing sediment loading, surface- and ground-water hydrology and nutrient chemistry of the creek and surrounding watershed. "Monitoring is one of the most effective ways to spend public funds for stream protection. Without base-line data, it becomes extremely difficult to detect impacts, due to year-to-year variability."

While the major impacts of urbanization on streams are well known, the timing and severity of impacts may vary widely from watershed to watershed. Almendinger thinks that predictive hydrological models can reduce this ambiguity and improve decision-making concerning urban growth. "With models and the right data, the relative impacts of different development scenarios can be explored before they are actually implemented."

Eagle Creek - challenges of mitigation

Eagle Creek is a natural treasure with its mystical artesian "boiling springs." The creek, located in Scott County just south of the Twin Cities, is home to a naturally reproducing trout population, rare oak savannah lands, the unique Savage Fen, and several threatened species.

Eagle Creek's situation differs from that of Valley Creek in that the decisions to develop the watershed at densities that could threaten existing natural resources have already been made. Long-term monitoring and modeling are not viable options. In 1989, the Twin Cities got a lot closer to the stream as the Metropolitan Council extended the MUSA boundary well into the Eagle Creek Watershed at the request of the nearby City of Savage. Lois Eberheart, also a watershed coordinator for the DNR's Metro Trout Stream Watershed Protection Initiative, laments the situation. "At Eagle Creek zoning has already been established. This leaves fewer options for intervention," said Eberheart. She sees a big problem with mitigation. "We should be considering natural resources as we plan for growth, not mitigating around resources after pro-growth strategies have been laid out."

But concern for the welfare of Eagle Creek has translated into action, despite the decision to develop. Most notable, perhaps, is the recent purchase of a 200-foot riparian corridor along the entire course of the stream by the State of Minnesota. The corridor is now being managed by the DNR as an Aquatic Management Area. According to Annette Drews, land acquisition, particularly in riparian areas, affords several benefits, including the ability to replant native species and the legal right to implement in-stream restoration measures.

Some are critical of whether riparian land purchase will live up to its billing. In a 1995 article on Eagle Creek in the Minneapolis Star Tribune, Dennis Anderson, staff writer, wrote that the buffer strip purchase was an easy way to appease environmentalists, while allowing the rest of the watershed to proceed with intensive development. Despite the expensive land purchase, the article contended that thermal and hydrologic impacts might still render the creek uninhabitable

for trout. Mark Ebbers, statewide fisheries coordinator for the DNR, remarked that even experts don't know how much of a buffer strip is necessary to fully mitigate upland land-use impacts. Some, including Minnesota State Senator Charlie Berg, say the \$5.4 million purchase price for land is too much for a solution that might not even work.

Brown's Creek - finding innovative solutions

Brown's Creek, a trout stream just north of Stillwater, MN, is threatened by the decision of the City of Stillwater to annex much of the watershed for residential and commercial development. The trout fishery is exceptional in that it exists only in the lower portion of the stream, the reverse of what typically occurs. The City plans to add several roads, municipal sewer and water capability, municipal wells, and other infrastructure to support development in the annexation area.

In 1996, the City of Stillwater began an Alternative Urban Area-wide Review (AUAR), a rarely-used alternative to more traditional approaches to mitigation such as the Environmental Impact Statement (EIS), to develop protection strategies for natural resources in the annexation area. Unlike the EIS, which focuses on specific projects, the AUAR provides for review and mitigation strategies on an area-wide basis.

A 25-member technical advisory group, consisting of local and state government officials, activist groups such as Trout Unlimited and other organizations, was formed to head-up the AUAR process. Jim Perry, University of Minnesota professor of forest resources, a consultant on the AUAR, was surprised at the spirit of compromise and collaboration throughout the process. "I thought it was going to be rough. Instead, they worked together. It was wonderful."

One of the innovative solutions proposed by the AUAR is a proposed structure that would divert much the flow of Brown's Creek during moderate flood events to nearby McKusick Lake, thereby reducing impacts to the trout fishery in the lower stream. Other protection strategies presented in the AUAR include reducing street width and parking areas, clustering development in areas of high soil infiltration and using sand beds to cool runoff.

Perry says the Brown's Creek AUAR worked very well, and proves that cooperation and compromise can produce effective and thorough protection and mitigation strategies. But, according to Perry, none of that matters if the strategies outlined in the AUAR are not implemented. Part of the solution is a proposed monitoring program which would involve the Science of Museum of Minnesota, the Washington County Soil and Water Conservation District and students from Stillwater High School. In addition, Perry proposes an ongoing program whereby, as development proceeds, a collaborative review board is called together in each instance that AUAR strategies are not being followed or potential degradation to a resource is identified. The board has the authority to review construction practices and require corrective action if practices are not in strict compliance with the requirements of the AUAR. If the board's directives are not implemented, the Metropolitan Council could require a separate EIS for each new development project.

Are we there yet? The search for true ecosystem-based management

While advancements in stream ecosystem theory have led to larger-scale, more inclusive approaches to protecting and restoring streams, restoration efforts are often still concentrated on improving the status of a single species, with the assumption that the ecosystem will respond similarly. Stream ecosystem functions such as nutrient cycling, trophic stability and organic matter processing are often not direct targets of protection and mitigation efforts.

Part of the problem is the scientific, technical and financial difficulty of assessing impacts to ecosystem functions. Targeting single species makes assessment a great deal easier. Ebbers says that in many instances the response of trout biomass to in-stream restoration activity is used exclusively to gauge success. But the question remains, if a trout population is healthy, is the health of the ecosystem assured? Melchior says yes. "Trout is an indicator species, and the health of a trout population is a good indicator of a healthy system."

Perhaps the key aspect of single species vs. whole ecosystem approaches is the availability of funding. Ebbers says that he focuses on trout waters mainly because fees from fishing licenses provide the funds to work specifically on those systems. Other streams may get left out because of the lack of a flagship species such as trout. Marty Melchior agrees. "Trout is definitely a great resource for attracting attention and resources to a stream."

Many feel that healthy streams are a requisite for healthy communities. Increasingly, people like Lois Eberheart are searching for ways to allow growth while simultaneously protecting vital aquatic resources. For Eberheart, the future lies in collaboration, building community partnerships and working together.

Minnesota Water 98

Plans are taking shape for the 6th biennial conference on critical water issues in Minnesota, which will be held May 5-6, 1998 at the Holiday Inn Metrodome in Minneapolis. The planning committee has organized an exciting and timely technical program. Plenary and breakout sessions will focus on the broad area of drinking water supplies, including issues of safety, availability, technology, policy and management. Prominent state and national experts will address plenary sessions on such topics as privatization of drinking water supplies, state and federal programs to ensure safe drinking water, a status report on Minnesota's public water supplies and disinfection by-products and other organic contaminant issues.

Sixteen breakout sessions are being planned in four thematic areas:

A. Managing Health Risks and Contaminants

1. Pathogens and microbial risks
2. Nitrate
3. Trace metals, arsenic, other inorganic contaminants
4. Endocrine disruptors and other organic toxicants

B. Technology

1. Disinfection by-products
2. Advances in drinking water treatment technology
3. Regional case studies: improved plant design/operation
4. Home treatment systems: bottled water issues

C. Issues Facing Public Water Supplies

1. New treatment and analysis standards; cost-benefits
2. Funding; privatization
3. Groundwater supplies in the metro region Twin Cities region
4. Rural water systems

D. Policy, Planning, and Management

1. Source protection (public wells, surface waters)
2. Private wells
3. Risk perception
4. Managing disasters (droughts, floods, spills)

A Festival of Water: The Great Minnesota Water Poster Session also will be a prominent feature of the conference. Topics for poster papers are not restricted to the themes of oral sessions, and the poster session will be a celebration of new findings and advances in research, education and outreach activities related to Minnesota's water resources. The deadline for submissions was

December 12; individuals who are interested in submitting an abstract but missed the deadline should contact the WRC as soon as possible.

Minnesota House considers floodplain management

On October 16, a joint hearing of the House Environment and Natural Resources Committee and the House Capital Investment Committee discussed potential avenues for better water and floodplain management. City officials, state experts, and others voiced concerns about the contamination of surface water, the availability of clean water, the control of flood hazards and other issues.

One of the top priorities at the meeting was to develop strategies to avoid a repeat performance of the devastating floods in 1997 (see June and September issues of Minnegram for other perspectives on the floods of '97).

"We really need to study how fast water rises, where it comes from and what it does to communities along the river," said Dave Smiglewski, mayor of Granite Falls, MN. "We need to think about the long term. If we don't, we're going to be sitting where we were last spring again."

Larry Lewis, an enforcement biologist for the U.S. Fish and Wildlife Service in Morris, MN, told lawmakers that restoring wetlands and taking other steps to slow water runoff is crucial to flood control.

"I'm firmly convinced that wetland restorations do make sense for flood control," said Lewis. He also added that wetland restoration should take a cooperative approach that considers fair compensation for landowners.

Finding sustainable sources of safe drinking water was another hot issue at the joint hearing. Although Minnesota is considered a water-rich state, finding sources of clean water, especially in west-central and southwestern Minnesota, is a growing problem. For example, the city of Granite Falls, MN, drew all of its drinking water from the Minnesota River until the late 1980s, when contamination made it impossible to use water from this source. As a result, the city was forced to turn to groundwater, and controversy between the city and rural residents over groundwater supplies ensued.

Dave Leuthe, a regional hydrologist for the MNDR, urged lawmakers to pay more attention to long-term planning for water supply. Rep. Willard Munger (DFL-Duluth) added that state and federal resources must be devoted to the full restoration of the Minnesota River.

"I think water quality is everyone's business, water quantity is everyone's business and restoring wetlands is everyone's business," said Munger.

Excerpted from 'Mini-Session Report' - October 1997.

MPCA study identifies contaminated sediments

The Minnesota Pollution Control Agency (MPCA) recently published the results of a survey of sediment contamination in the Duluth/Superior Harbor. The survey identified and characterized general areas of contamination in the harbor.

Sediment was analyzed for contaminants such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), pesticides, heavy metals, mercury and dioxins. Results showed that PAH and mercury contamination was widespread throughout the 40 harbor sites, although MPCA officials said that in some cases, the contamination appeared to be due to historical sources rather than activities of current land owners. PCBs, heavy metals, certain pesticides and dioxins were at elevated levels at several sites.

Of the 40 sediment sites sampled, the two most contaminated sites were located at the USX Superfund site in the St. Louis River estuary near Morgan Park.

In some cases, sediment toxicity was at critical levels. Toxicity experiments showed that some shallow harbor sediments could kill certain invertebrate organisms.

MPCA officials report that many of the worst sites are already being cleaned up or studied for cleanup under the state and federal Superfund programs and the St. Louis River Remedial Action Plan, a joint state, federal and community cleanup effort.

For more information on the sediment survey, contact Judy Crane at the MPCA's St. Paul office, at (612) 297-4068.

On the river for a good ol' zebra mussel hunt

by Pam Davis

Sinking twelve inches into the muck of the exposed shoreline, I wondered if the zebra mussel hunters would have to come and dig me out. How embarrassing to offer assistance to the zebra mussel drawdown effort only to become one of its victims!

Randy Ferrin, head of natural resource management for the St. Croix National and Scenic Riverway, told me that at many times during the past two weeks, Park Service employees were called to rescue animals stranded as the water level of the St. Croix River continued to drop. The idea was to lower the level of the river behind the dam at Taylor's Falls to expose large areas of river substrate for zebra mussel inspection. But there was a trade-off; the plan risked stranding hundreds of native mussels and other riverine creatures. Native mussels stranded on top of the mud, who could no longer escape into the river, would become easy prey for raccoons.

I and two other volunteers patrolled a two-mile stretch along the west bank of the St. Croix River from the Taylor's Falls dam northward. First, we carefully investigated the retaining wall just north of the dam. The DNR suspected that if zebra mussels were going to collect anywhere, it would be in the inlet anchored by the wall. Here, water collected to create a staging area for

debris. The rocky exposed substrate provided a perfect haven upon which zebra mussels could attach. We squatted among the rocks, peering into cracks and crevices, intently searching for the exotic mussel, but prayed we wouldn't find any.

Slipping over rock after rock, I wondered if I would be the one to miss the only zebra mussel colony in the river, and thus be responsible for the infestation of the mussel into the Upper St. Croix. Would it even be possible for me to spot one of the little critters? In my pocket was a small glass container with zebra mussel shells to use for identification. I worried that I would drop the bottle into the St. Croix and let loose a pestilence of zebra mussels!

At the retaining wall, we found about 120 native mussels that had become stranded above the receding water line. We dug them out of the sand and placed them a little further out in the river, hoping they wouldn't become exposed again as the water level continued to decline.

By the end of the day, within the two-mile zone to which we were assigned, we were able to rescue 320 native mussels and had not found a single zebra mussel. As we sprayed mud off of each other, we discussed whether the Park Service would continue the drawdown and risk further exposure of hundreds of native mussels. The ensuing debate would be an engaging one.

Pam Davis is a graduate student in the University of Minnesota Water Resources Science Graduate Program.

MPCA workshop explores land-use effects on groundwater

The Minnesota Pollution Control Agency, in cooperation with several other state and local groups, recently sponsored a workshop designed especially for citizens and decision makers to learn how land-use decisions can affect groundwater quality. The workshop was held at the St. Cloud Civic Center, on November 18.

Citizens, landowners, local governments, planners and developers learned about studies, services and programs to assist them in planning the future of their community. The presentations covered a wide range of topics, including effects of agriculture, septic systems and land use on groundwater; wellhead protection planning; resources for cleaning up "brownfields"; and prevention of environmental emergencies such as toxic spills.

One presentation reported on a MPCA Ground Water Monitoring and Assessment Program (GWMAP) study now underway in St. Cloud. Since 1996, the study has been monitoring wells in each of six different land-use areas within a 30-square-mile study area. Samples from these wells are collected and analyzed for chemicals that may be indicators of land use at and near the site. The results of the study will provide policy makers with better information on which to base decisions about land use and groundwater impacts.

Questions about the workshop or the GWMAP study can be directed to Tom Clark at (612) 296-8580 or (800) 657-3938.

Center for Water and the Environment lays ambitious research plans

The Center for Water and the Environment (CWE) is a busy place these days. In recent weeks, the Center has been awarded over \$4 million for new and continuing projects. The Center, which is part of the Natural Resources Research Institute (NRRI) on the Duluth Campus of the University of Minnesota, specializes in studying northern ecosystems, and a large component of the Center's research focuses on water resources. Here are descriptions of some of the water-related efforts currently funded at the CWE.

Development and evaluation of multi-scale mechanistic indicators of regional landscapes
Principal investigators: C. Richards, L. Johnson, G. Host.
EPA (3 years)

This project seeks to develop new ways to predict the influence of land use on water quality in the Midwest. Techniques developed in a previous study in Michigan will be used to conduct new surveys and analyses in Southeastern Minnesota. The project integrates satellite imagery, geographic information systems, field surveys and model development, in an effort to produce cost-effective methods for evaluating the health of aquatic and terrestrial ecosystems, and provide a means for modeling the impacts of different land management alternatives.

Environmental factors that influence amphibian community structure and health as indicators of ecosystem integrity
Principal Investigators: V. Beasley (University of Illinois), R. Cole (National Wildlife Health Center Laboratory), L. Johnson, C. Richards, and P. Schoff (NRRI).

Researchers plan to identify some of the factors that influence amphibian presence/absence and health (including the presence of deformed amphibians) across the Midwest. The project will take advantage of NRRI expertise in satellite imagery, amphibian biology and aquatic ecology to systematically evaluate the use of amphibians as indicators of environmental conditions over large regions. The project is a unique effort to combine ecological health assessment protocols with assessments of organism health.

Lake Superior Basin land-use decision support
Principal Investigators: G. Host, L. Johnson, and C. Richards.
MDNR, EPA (3 years)

This effort will combine available spatial data for the Lake Superior Basin from a wide variety of sources to make them available to local and regional decision makers. In addition, a geographic information systems model will be used to provide:

- Analysis, assessment and policy development at local and regional scales in the Lake Superior Basin;
- Simultaneous consideration of ecological and economic resources; and
- Predictive capabilities to evaluate future land use scenarios based on computer models.

Water on the Web: monitoring Minnesota's lakes on the internet

Principal Investigators: B. Munson (UMD), G. Host, R. Axler (NRRI), M. McDonald (MN Sea Grant).

NSF (3 years)

Water on the Web will contribute to a more scientifically and technologically competent work force through a comprehensive educational program for high school and community college students and teachers. The goal of the project is to develop curriculum modules that teach basic concepts through the use of real-time remote sensing technology, geographic information systems and the internet.

Assessing and communicating risk: A partnership to evaluate a Superfund site on Leech Lake tribal lands

Principal Investigators: M. McDonald (MN Sea Grant), R. Axler, C. Richards, (NRRI), J. Gunderson, C. Hagley (MN Sea Grant). EPA (2 years)

This study will establish an environmental justice community/University partnership between the Minnesota Sea Grant College, NRRI and the Tribal Council for the purpose of evaluating human health effects and environmental risks associated with a Superfund site on tribal lands at Cass Lake, MN, and communicating these risks to the tribe. In addition, training and instrumentation will be provided to the tribe improve technical capabilities.

Deformed frogs study meets severe criticism

The Minnesota Pollution Control Agency (MPCA) and the National Institute of Environmental and Health Sciences (NIEHS) recently announced findings from a new study suggesting that a waterborne contaminant may be causing deformities in frogs in northern Minnesota.

But other scientists familiar with the bioassay procedure used in the study were far from convinced, and disputed the results because the study used nonnative frogs, and because the NIEHS ignored several common rules for running bioassays.

The study used water from two wetland sites in Minnesota where high numbers of deformed frogs have been found in the last two years. The test involved growing embryos of the African clawed frog in water dilutions ranging from zero to 100 percent. At concentrations above 50 percent, a high percentage of the frog embryos developed in the water showed a wide range of abnormalities. Water from "normal" sites (no deformed frogs found) did not produce abnormalities in the frogs.

When EPA researchers in Duluth replicated the study, they concluded that an ion imbalance known to commonly interfere with bioassay may have caused the observed frog deformations. The EPA reran the assay with the addition of ordinary salts to correct the ion imbalance and the results were free of abnormalities. Although the ion imbalances may exacerbate the effects of contaminants, the EPA researchers felt it was improper for the NIEHS and MPCA to jump to conclusions about possible human health implications.

According to Andrew Blaustein, a zoologist at Oregon State University, the African frogs should not have been used because they have a very different physiology than native frogs. He also felt that the study was flawed because it did not allow the frogs to fully develop. Blaustein was quoted in the Washington Post as saying that the press conference was "alarmist and premature."

Jim Burkhart, the NIEHS's head scientist on the project, said that the data interpretation was not complete when the public announcement was made. He contended that the NIEHS did not want to make the announcement but the MPCA insisted on making the findings public sooner rather than later.

Judy Helgen, a scientist with the MPCA, defended the decision to go public, saying that MPCA felt they had to let the public know where they were with the frog research.

The frog malformation debate may get even more interesting. A new EPA study in Duluth now implicates UV radiation, not a water borne agent, as the principal cause of the malformations.

Minnesota environmental indicators initiative takes shape

Minnesotans want to know - is our environment healthy or ailing? Do our lakes and rivers support healthy fish communities and provide swimmable waters? Are Minnesota's forests productive and capable of sustaining ecological diversity in perpetuity? What is the status of our urban green spaces? How effective are Minnesota's environmental protection laws and programs? Overall, is Minnesota's present and future environmental health being assured?

While a wealth of environmental information is available, it exists largely in piecemeal form. But to protect Minnesota's natural resources wisely, policy-makers, resource managers and the public need a holistic appraisal of the health of our various ecosystems. Without this complete picture, we risk seriously damaging the environment upon which we depend.

The Environmental Indicators Initiative (EII) is an interagency effort sponsored by the Environmental Quality Board and funded by the Legislative Commission on Minnesota Resources. The EII will provide the first comprehensive framework to evaluate the overall condition of Minnesota's environment and monitor its change over time. The EII will enlist the aid of resource professionals, policy makers and stakeholders to develop an integrated set of environmental indicators that are scientifically valid and useful to the public. The EII will rely on these indicators to provide regular reports on the status and trends of Minnesota's ecosystems. To achieve these goals, the EII will:

- review, catalog and evaluate existing environmental monitoring data for use in a comprehensive set of indicators;
- develop a set of environmental indicators to assess health and document trends in Minnesota's ecosystems;
- prepare periodic reports on the state of the environment; and
- design an Environmental Indicators Network for consistent and coordinated monitoring of environmental indicators.

For more information about the progress of the EII in developing environmental indicators for Minnesota, contact Keith Wendt at (612) 297-7879.

Around the State - Water Resources Updates

Wetland banking woeful

The Minnesota Department of Natural Resources (MDNR) recently completed a study aiming to improve Minnesota's wetland banking system. The banking system allows restored wetlands to be purchased to meet mitigation requirements, and is administered by the Minnesota Board of Water and Soil Resources. A report will be published on the findings of the study, which include:

- the quality of wetland bank sites vary and are generally related to the construction method used;
- the location of banks sites is seldom based on ecological or hydrological needs;
- current wetland banking accounting and administrative services are insufficient;
- current monitoring and certification are inadequate; and
- comprehensive and easily accessible data are lacking.

A final wetland banking study report will be posted on the MDNR web site (<http://www.dnr.state.mn.us>). Contact Doug Norris, MDNR, at (612) 296-0779 to request a printed copy.

Excerpted from Minnesota Wetlands Conservation Planning - Work Team Report, October 1997.

Water 2000 funding announced for Madison, Minnesota project

The City of Madison, MN recently received a loan of \$2.29 million through the Clinton Administration's Water 2000 safe drinking water initiative. The funds will be used in conjunction with a \$600,000 grant from the Minnesota Department of Trade and Economic Development to make improvements to existing water treatment facilities.

Water 2000, a presidential initiative that began in August 1994, aims to provide clean, safe drinking water by the year 2000 to an estimated 1 million rural residents who have inadequate water supplies. For more information on Water 2000 programs, contact the USDA at (612) 602-7800.

Excerpted from "Rural Water," a publication of the Minnesota Rural Water Association, Fall 1997.

Second University of Minnesota drainage forum in works

In an effort to increase understanding and focus research priorities relating to the floods of '97 and other major hydrologic events, a second forum on drainage hydrology will occur at the University of Minnesota on December 16. The first drainage forum occurred on June 4, 1997 (see the June 1997 issue of Minnogram - "Farmers and the Flood").

The forum will bring together University researchers in a variety of disciplines with agency personnel involved with drainage issues. Topics will include geomorphic impacts of increased flows, impacts of drainage on peak discharge, social dynamics of drainage, as well as topics devoted to formulating future research agendas and establishing common goals.

Forum presenters will include Bruce Wilson (UM), Tim Larson (MPCA), Dave Ford (MDNR), Joe Magner (MPCA), Luther Aadland (MDNR), Calvin Alexander (UM), Randal Barnes (UM), Steven Taff (UM) and Gyles Randall (UM).

Look for an in-depth discussion of the forum in the spring issue of 'Minnegram.'

Water conference a success

The 30th Annual Water Resources Conference was a great success, with over 250 people attending. The conference was held at the Earle Brown Center at the University of Minnesota on October 27. Concurrent sessions focused on phosphorus, groundwater, bioengineering and erosion control. In addition, the conference featured a number of talks on various aspects of last spring's flooding, including remote sensing of snowpack and advances in hydrologic forecasting. The lunch session featured MDNR Watershed Coordinator, Annette Drews, addressing the fate of metro area trout streams (see our lead story on pg. 1.) Participants got a chance to unwind at a reception following the hard-hitting talks.

Minnesota Water Community News

Appointments

Jim Perry (Dept. of For. Res.) was appointed to the board of directors for the Minnesota Center for Environmental Advocacy.

Awards

Patrick Brezonik received a plaque and desk clock at an awards ceremony at the WEFTEC meeting in Chicago in mid-October in recognition of his two terms of service on the Research Council of the Water Environment Research Foundation.

New Grants

Efi Foufoula-Georgiou (Dept. of Civ. Eng.) received a \$332,000 grant from NOAA-NASA to study "Subgrid-scale precipitation variability over the Mississippi: statistical-thermodynamic analysis, downscaling and effects on water and energy partitioning." Foufoula-Georgiou also received a grant for \$334,169 from NSF for "A probabilistic framework for assessment and interpretation of quantitative precipitation forecasts from storm-scale events."

Personnel

Jim Perry (Dept. of For. Res.) was elected chair of the executive committee of the Water Resources Science Graduate Program. Perry also began a 12-month position as a resource teacher for the Bush Excellence and Diversity in Teaching Program.

Jim Cotner will join the Department of Ecology, Evolution, and Behavior faculty winter quarter from Texas A&M University. His research interests are in aquatic microbial ecology.

Drew Johnson, David Hibbs, Jasim Imran, and Morten Kjeldsen have been named new research associates at the St. Anthony Falls Hydraulic Laboratory.

John Gulliver has been named acting head of the Department of Civil Engineering.

Publications

George Spangler (Dept. of Fish. and Wild.) reports that the Dept. of Fish. and Wild. web page on treaty rights has been updated to provide information on the most recent rulings concerning the Mille Lacs fishing controversy. The URL is: <http://fw.umn.edu/indigenous>.

Travel

Howard Mooers (Dept. of Geol. - Dul.) attended the meeting of the Peri-Baltic group of the International Quaternary Union Commission on Glaciation in Kiel, Germany, in September. Mooers presented a paper on the origin of glacier boulder concentrations and boulder pavements. Mooers also attended the annual meeting of the International Association of Mathematical Geologists in Barcelona, Spain, where he presented results of ongoing research on multivariate analysis of Minnesota River baseflow characteristics.

Carol Johnston (NRRI) was an invited speaker at BIOGEOMON, the Third International Symposium on Ecosystem Behavior. Her talk was entitled "Geographic information systems for wetlands and watersheds, a US-Russian collaboration."