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Notes on the National Scene

Trading: Balancing the Nation's Water Quality Checkbook

The U.S. Environmental Protection Agency's Water Quality Trading Policy, announced January 13, 2003, marks federal approval for using pollution reduction credit trading—a market-based approach for improving and preserving water quality. Trading may improve efficiency in achieving water quality goals by allowing one source to purchase pollutant reductions created by another source with lower pollution control costs. It may also be used in waters that already meet standards to preserve good water quality by offsetting new or increased discharges of pollutants. In impaired waters, trading may be used to achieve pollutant reductions and restore water quality standards ahead of total maximum daily load (TMDL) requirements. EPA believes that trading can be used to achieve greater efficiency and provide greater flexibility during TMDL implementation.

The EPA policy endorses trading as an economic incentive for voluntary pollutant reductions from point and nonpoint sources. (See www.epa.gov/owow/watershed/trading/finalpolicy2003.pdf.) Although trading is not mandatory under the Clean Water Act (CWA), the EPA policy serves as guidance to states and tribes to show how trading can complement existing program elements such as requirements to obtain permits, antibacksliding provisions, development of water quality standards (including antidegradation policy), National Pollutant Discharge Elimination System (NPDES) permit regulations, TMDLs, and water quality management plans. In fact, water quality standards established through CWA protocols form the baseline of the trading policy.

EPA's policy supports trading of nutrients (e.g., total phosphorus, total nitrogen) and sediment loads from both point and nonpoint sources. The policy recognizes the potential for environmental benefits from the trading of pollutants other than nutrients and sediments while also recognizing

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that such trades may warrant more scrutiny. The policy does not support any trading activity that would cause a toxic effect, exceed a human health criterion, or cause water quality impairment.

"We hope the policy will spawn more trading programs, especially to implement TMDLs," said David Batchelor, Senior Policy Advisor with EPA's Office of Water. "We believe that voluntary trading programs can be developed that will offset the potential negative impacts of growth and maintain high water quality, and, in pre-TMDL waters, achieve progress towards water quality standards attainment pending the development of a TMDL." Batchelor also noted that EPA does not support trading as a way to avoid developing and implementing TMDLs for impaired waters—as required by Section 303 of the CWA. "Where trading achieves water quality standards, either pre-TMDL or under a TMDL, then the waterbody could be delisted as provided under the Act. Trading is not a way to avoid or delay CWA requirements to restore impaired waters." He reiterated that it is a way to achieve cleaner water sooner at a lower cost.

The policy draws on lessons learned from pilot programs conducted under EPA's 1996 Draft Framework for Watershed-Based Trading (www.epa.gov/owow/watershed/framwork.html) by identifying common elements that EPA believes are necessary for trading programs to be credible and successful. These elements include clearly defined units of trade, use of standardized protocols to quantify pollutant loads and reductions, provisions to address the uncertainty of nonpoint source loads and reductions that are traded, accountability mechanisms for all trades, public participation and access to information, and monitoring and program evaluation.

The policy is also derived in large part from research by the World Resources Institute (WRI), particularly that which was described in *Fertile Ground: Nutrient Trading's Potential to Cost-Effectively Improve Water Quality*, a report released in 2000.

The Mechanics of Trading Between Point and Nonpoint Sources

Units of trade ("credits") are to be set by the regulatory authority or voluntary coalition overseeing the trading. Credits are to be expressed as concentrations or discharge quantities per unit time, and, as they usually involve point sources, are supposed to be consistent with NPDES permit units. The time duration of the credits is also required to meet the compliance time period specified in an NPDES permit or other regulatory requirement within a CWA program.

Estimating a credit of nonpoint source pollution for trading purposes with point source pollution can be difficult because nonpoint and point source pollution can differ in their types of impacts, timing, and predictability. EPA's water quality trading policy supports various ways to account for greater uncertainty in estimates of nonpoint source loads and reductions, including (1) monitoring to verify load reductions, (2) using a nonpoint source/point source trading ratio larger than 1:1, (3) using demonstrated performance values or conservative assumptions in estimates of nonpoint source management practice effectiveness, and (4) retiring a percentage of nonpoint source reductions for each transaction or a predetermined number of credits.

Will Point/Nonpoint Source Trading Really Reduce Pollution?

The question remains: will trading in water quality actually decrease levels of water pollution, or is it simply a more economically efficient mode of operation in pollution mitigation? Suzie Greenhalgh of WRI ventures, "It could mean greater reductions in pollutants than from simply requiring certain reduction levels to meet a standard such as a TMDL-recommended standard. A more conservative trading ratio between nonpoint sources and point sources would help to lower pollutant levels. For example, in a 3:1 ratio, for every 1 pound of nitrogen that a waste water treatment plant is supposed to remove, it would have to pay a farmer to implement a best management practice that removes 3 pounds of nonpoint source agricultural nitrogen."

Choices Yield Opportunities

Trading can provide real benefits for nonpoint source pollution generators. Landowners and developers can institute their most cost-effective solutions for improving the water quality of runoff from their properties. Some landowners, such as farmers, can actually create a source of income for themselves by implementing nonpoint source control practices and then selling the

Trading: Balancing the Nation's Water Quality Checkbook (continued)

corresponding pollution credits. Giving property owners the flexibility to choose the mitigation option best suited to their operations not only increases cost-effectiveness but may also increase the likelihood of acceptance and adoption of trading programs.

For more information about these resources check the Web site www.epa.gov/owow/watershed/trading/finalpolicy2003.pdf or refer to the article in *News-Notes* Issue #69, September 2002, "Nutrient Trading Tools for Cleaner Water." For a copy of the new trading policy, case studies, resources, and links to other trading-related sites, see the EPA's Trading Web site at www.epa.gov/owow/watershed/trading.htm.

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Watershed Initiative Projects Chosen

This spring, then-EPA Administrator Christie Whitman announced nearly $15 million in grants to 20 watershed organizations selected as part of the new Watershed Initiative program. The program supports community-driven efforts to protect habitat, improve water quality, and enhance outdoor recreation. Last fall, at the request of President George W. Bush, the nation's governors and tribal leaders nominated watershed proposals for the program. Regional and national experts selected the winners from 176 nominees, choosing 20 projects that best demonstrated an ability to achieve on-the-ground environmental results in a short time frame. Each winning project also exhibited strong partnerships with a wide variety of support, showed innovation, and demonstrated compatibility with existing governmental programs.

And the Winners Are...

The 20 winners represent countless committed individuals from diverse watersheds across the country. These watersheds cover more than 90,000 square miles, encompassing urban, suburban, and rural areas. Each watershed, from Rathbun Lake in Iowa to Hanalei Bay River in Hawaii, faces its own unique set of challenges. Funds will go toward restoration and protection projects, such as stream stabilization and habitat enhancement, the implementation of agricultural best management practices, and working with local governments and homeowners to promote sustainable practices and strategies. These one-time grant awards range from $300,000 to $1 million, and will need to be used within two to three years.

The 20 winning watersheds include Meduxnekeag River (ME); Narragansett Bay (RI, MA); Charles River (MA); Raritan River (NJ); Susquehanna Headwaters (NY, PA); Christina River (PA, DE); Dunkard Creek (PA, WV); Upper Tennessee River (VA, TN, NC); Cumberland River (TN, KY); Great Miami River (OH); Greater Blue Earth Watershed (MN, IA); Manistee River (MI); Rio Puerco Watershed (NM); Bayou Bartholomew (AR); Rathbun Lake (IA); Upper White Watershed (AR, MO); Clark Fork-Pend Oreille (MT, ID, WA); Upper South Platte (CO); Hanalei Bay (HI); Lower Columbia River (OR, WA).

The Future

EPA hopes to offer the grant program annually. To show his support, the President has included a 30 percent increase (from $15 million to $20 million) in next year's budget for the initiative. EPA plans to issue its 2004 Call for Nominations during summer 2003. For the next round of grant awards, EPA plans to continue its focus on quick, measurable results; partnerships; innovation; and program compatibility. More emphasis, however, will be placed on market-based approaches and other socioeconomic strategies. In addition, EPA hopes to devote one-quarter of the funds to address the serious and growing hypoxia problem facing the Gulf of Mexico. For more information see www.epa.gov/owow/watershed/initiative/.

Clearer Skies, Cleaner Water

New air quality legislation proposed by the Bush Administration will have the added benefit of reducing nonpoint source pollution to waterbodies. The "Clear Skies" legislation seeks to improve air quality by significantly reducing emissions from power plants by 2018. It would create a mandatory program that would dramatically reduce power plant emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x), and mercury by setting a national cap on each pollutant. Since air pollutants in emissions can be deposited on the ground and in waterbodies, any reduction in air pollutants should yield a corresponding reduction in water pollution.

Air pollution is transported to the ground surface by precipitation and settling dust particles, polluting waterbodies directly or through nonpoint source runoff. Atmospheric deposition can be a significant contributor to overall water pollution levels. For example, studies show that atmospheric deposition is responsible for 21 and 38 percent of the nitrogen entering the Chesapeake Bay and the Albemarle-Pamlico Sound, respectively. (Visit www.epa.gov/oar/oaqps/gr8water/3rdrpt/ for more information.) According to the National Atmospheric Deposition Program, atmospheric deposition of mercury accounts for 50 to 90 percent of the mercury load to many U.S. waters. (See http://nadp.sws.uiuc.edu/lib/brochures/mdn2002.pdf.) These atmospheric sources of mercury are partly to blame for the mercury-related fish consumption advisories issued in 44 states. Other pollutants that are often identified as having significant atmospheric contributions in waterbodies include sulfur compounds, mercury compounds, other heavy metals, and various pesticides and industrial byproducts. For more information see the EPA publication Air Pollution and Water Quality: Atmospheric Deposition Initiative at www.epa.gov/owow/oceans/airdep.

Power plants are significant sources of the most abundant of these air pollutants. According to EPA, the nation's power generation is responsible for 63 percent of sulfur dioxide (SO_2), 22 percent of nitrogen oxides (NO_x), and 37 percent of mercury released to the environment by human activity. (Visit www.epa.gov/owow/oceans/airdep/airdep_sept_final.pdf for more information.) The Clear Skies Initiative calls for roughly a 70 percent reduction in NO_x, SO_2, and mercury emissions from power plants by 2018.

Hallmarks of the Legislation

Clear Skies comprises four key legislative components, including:

- *Multi-pollutant Approach for Power Plants:* The legislation mandates reductions of NO_x, SO_2, and mercury from all fossil fuel-fired electric generators operating at greater than 25 mega watts (MW) levels. Mercury requirements affect only coal-fired electric generators greater than 25 MW.
- *Caps and Trades:* A cap, or limit, is established on total emissions, and will be reduced in a phased manner to meet environmental and public health goals. Emission "allowances" based on the prevailing cap and the allocation formula are distributed to power generators. To meet their compliance needs, the generators may trade the allowances within defined geographical zones based on their areas of influence. Clear Skies would expand the existing nationwide allowance market for SO_2, create a nationwide market for mercury allowances, and create eastern and western zones for NO_x allowances.

This approach, then, leaves it up to each source to decide how to comply with the emission reduction requirements of the program—each source may reduce emissions by any amount or buy allowances. The market, based on buying and selling allowances, will be created by sources' competitive efficiencies and cost differentials in installing pollution-control technologies.

Legislation Status

President Bush first announced the Clear Skies Act on February 14, 2002. Backed by EPA modeling and economic forecasts, Clear Skies legislation was first introduced in both houses of Congress in July 2002. The program was reintroduced in the U.S. House of Representatives (H.R. 999) and the U.S. Senate (S. 485) as the Clear Skies Act of 2003 on February 27, 2003. It is currently working its way through congressional review.

- *Incentives for Early Compliance:* Each power utility has the incentive to reduce emissions so it can "save" or "bank" allowances and then sell these unneeded allowances on the open market. The banking aspect of the trading program creates incentives for electricity generators to reduce their emissions further and more quickly than the law requires. Companies that cannot reduce emissions have the flexibility in this market framework to buy additional allowances without undermining air quality.
- *Accountability*: Clear Skies is expected to have higher levels of accountability and transparency than most other regulatory programs. Sources will be required to continuously monitor and report all emissions. If a power plant exceeds emission allowances, financial penalties will be automatically levied without the need for enforcement action. Further, if that power plant's emissions exceed limits, it will have to offset its emissions the following year to ensure that overall emissions do not exceed the cap.

Does Clear Skies Supersede the Clean Air Act?

Clear Skies is targeted at power generation and would not change Clean Air Act requirements for sources not covered by Clear Skies. Clear Skies will effectively replace and modify certain aspects of the Clean Air Act, including New Source Review (NSR), regional haze, the Acid Rain program, and the NOx State Implementation Plan.

Many people are confused about the role of NSR under Clear Skies. The NSR provision of the Clean Air Act applies to existing power plants and major manufacturing facilities only when they make modifications to their plants that result in increased emissions. They may then be required to install new emission control equipment to offset the new emissions. The NSR is not designed to reduce air pollution from power plants nationwide or maintain those reductions by regressively capping emissions amounts. Under Clear Skies, although new sources would not be subject to the NSR process, they would have to comply with Clear Skies' emission caps and the New Source Performance Standards outlined in the Clear Skies legislation.

In testimony to the Senate Environment and Public Works Committee on April 8, 2003, then-EPA Administrator Christie Whitman explained that the Clear Skies initiative provides many advantages over the Clean Air Act:

- *Guarantee of reductions:* Clear Skies requires mandatory caps guaranteeing that reductions in emissions will be achieved and maintained over time. Under the existing Clean Air Act, a host of time delays due to regulatory development, litigation, and implementation are possible.
- *Faster benefits:* Because Clear Skies has built-in incentives allowing sources to bank excess emissions reductions, a significant number of sources are likely to over-comply during the early years. Clear Skies' projected cumulative SO_2 and NO_x emissions reductions over the next decade exceed those that could be achieved under the existing Clean Air Act.
- *Less litigious delay:* The very nature of the Clear Skies initiative would minimize the chances of litigation by power plants. Congress would decide upon and pass the two most controversial items: how large a reduction and when. To institute similar reduction requirements under the existing Clean Air Act, EPA and states would have to complete numerous rule-making processes. Existing regulatory tools often take considerable time to achieve significant results, and can be subject to additional years of litigation before significant emissions reductions are achieved.
- *Lower cost to the government.* The economic impact analysis completed for Clear Skies suggests that reductions could happen at a considerably lower cost and with greater certainty than would occur under the current Clean Air Act.

According to EPA's analysis, Clear Skies would modify the emission reductions and timetables to cut power plant emissions of NO_x, SO_2, and mercury by 70 percent, eliminating 35 million more tons of these pollutants in the next decade than the Clean Air Act. Analytical data generated by

Clearer Skies, Cleaner Water (continued)

EPA computer modeling shows that nationwide reductions of these three harmful pollutants would have striking results. Every part of the country where power plants contribute significantly to air pollution, most notably, the Northeast, Southeast, and Midwest, would see vast improvements in air quality. Many cities and towns would meet air quality standards for the first time in years. For more information on Clear Skies, visit www.epa.gov/air/clearskies.

Slow Start to NPDES Phase II Compliance

A key deadline established in the National Pollutant Discharge Elimination System (NPDES) Phase II rule has passed—leaving many out of compliance. By March 10, 2003, operators of small municipal separate storm sewer systems (MS4s) in urbanized areas and small construction sites were expected to file a notice of intent (NOI) under their permitting authority's general permit. Although operators are now expected to comply with the intent of the rule, complicating factors, including delays in general permit development and litigation, have prevented some operators from officially meeting the deadline. EPA recently issued guidance to clarify to these operators what is required under the rule while the problems are being resolved.

NPDES Permitting Authority

To be granted NPDES permitting authority, states, tribes, and territories are required to submit documentation to EPA demonstrating that they have the necessary resources available to manage an NPDES program. Forty-five states plus the Virgin Islands have successfully applied for and been granted NPDES permitting authority. The remaining states, tribes, and territories still fall under EPA's NPDES permitting authority. The states and territory with NPDES permitting authority are responsible for developing and issuing the general permits for their Phase II programs.

Roadblocks to Scheduled Phased Implementation

Under the originally published schedule for Phase II implementation, the NPDES permitting authorities were required to issue general permits for Phase II-designated small MS4s and small construction activity by December 9, 2002. The operators of Phase II-designated regulated small MS4s and small construction activity were then required to obtain their permit coverage within 90 days of general permit issuance (March 10, 2003).

However, many permitting authorities, including EPA, experienced delays during permit development and were not able to issue their general permits by December 9, 2002. In places where no general permit was available from the permitting authority, operators have not been able to obtain coverage under a general permit and have had to consider applying for an individual permit. Approximately two-thirds of the 45 states with NPDES permitting authority have issued their Phase II construction general permits, and half have issued their MS4 general permits.

EPA reissued its construction general permit on July 1, 2003, which provides coverage for large (more than 5 acres disturbed) and small (1 to 5 acres disturbed) construction activities in federal lands and Indian country, and the states and territories where EPA maintains permitting authority. The EPA's general permits will be issued by the individual EPA regions as applicable. For more information about EPA's permit see http://cfpub.epa.gov/npdes/stormwater/cgp.cfm.

EPA's delays were largely caused by litigation and questions about the construction general permit. Concerns about the impact of the permit requirements on oil and gas construction activity (disturbing one to five acres) diverted EPA's attention away from permit development. Eventually, EPA postponed the Phase II permit deadline for this class of operators for two years (until March 10, 2005). Furthermore, in a lawsuit brought against EPA by the Environmental Defense Center, the Ninth Circuit Court in California ruled that EPA must reconsider certain NOI provisions of the Phase II rule. The affected provisions of the rule include agency and public review of NOIs and public meetings about NOIs. Many permitting authorities are now uncertain about what NOI process should be used when issuing Phase II MS4 general permits.

Slow Start to NPDES Phase II Compliance (continued)

Interim Guidance

In March 2003, EPA issued interim guidance for operators to follow while EPA appeals the court's ruling and while Phase II general permits are being finalized. The guidance states that despite the court's ruling and possible future repercussions, all elements of the Phase II rule remain in effect for applicants and potential applicants. The guidance clarifies the following aspects of the rule:

- The deadline for Phase II operators to submit NOIs or individual permit applications stood at March 10, 2003.
- In jurisdictions where the permitting authority has not issued a final MS4 or construction general permit for Phase II, an operator is expected to file an individual permit application or a notice to be covered under a future general permit. If the operator applies for a general permit at a later time, all of the information reported in the individual permit will convey.
- EPA recommends that permitting authorities grant permission for coverage at some point after MS4 NOI submission, specifically to allow time for the state or EPA region to review information included in the NOI. This may be to:

  (1) Authorize discharge after a waiting period specified in the general permit, or

  (2) Authorize discharge upon notification by the permitting authority.

  (These two options give the permitting authority additional time to review MS4 NOIs and conduct the public participation envisioned by the Ninth Circuit Court if the authority chooses to do so.)

In the Meantime . . .

As long as the permitting authority has not issued a construction general permit for which the small construction facilities can apply, contractors and developers fall in a gray area where their construction does not officially have coverage under an NPDES water permit. Between March 10, 2003, and the time their applicable construction general permit is finalized, EPA encourages small construction activities to use an existing NOI form (www.epa.gov/npdes/pubs/connoi.pdf), and follow the requirements of the general permit already in place for large construction (under Phase I).

Showcase: Pennsylvania's MS4 program

Pennsylvania is one of 45 states that have permitting authority and issued its MS4 general permit in time to meet the original December 9, 2002, Phase II deadline. Pennsylvania's Phase II MS4 Program covers approximately 900 small municipalities and 31 of the state's 67 counties in 22 urbanized areas. Pennsylvania also has 17 potential urbanized areas where the state must conduct a case-by-case review and make permitting determinations.

Nationwide, Pennsylvania is one of a few states with this many small MS4s in the Phase II program. The Pennsylvania Department of Environmental Protection (DEP) recognized that this posed a considerable burden for the state agency and also for the small MS4s affected by the new regulations. DEP's strategy for developing the Phase II MS4 Program involved identifying opportunities to draw on existing programs and regulations, as well as providing opportunities for stakeholders to participate in the development process. DEP developed its permit package after a series of brainstorming sessions and outreach meetings with MS4 Phase II representatives. DEP made its final general permit package available to the public on December 7, 2002. To help the MS4s prepare for the March 10, 2003, deadline, DEP conducted a series of technical assistance workshops in February 2003.

The general permitting package contained the standard elements, such as the notice of intent form, the permit, and permit fact sheet. Pennsylvania's permit package also contained a Phase II MS4 Storm Water Management Program Protocol (Protocol), a comprehensive compliance guidance document that contains BMPs, measurable goals, and implementation schedules for each of the six minimum control measures required under the NPDES Phase II Rule. DEP developed the Protocol through the stakeholder involvement process, and intends to make a CD-ROM of resources (e.g., checklists, outreach materials, forms) available to help MS4s. Small MS4s have the option of implementing the Protocol in its entirety to meet Phase II MS4 permit requirements, or developing its own stormwater management program that meets the Pennsylvania's Phase II requirements.

[For more information on Pennsylvania's program call Pennsylvania Department of Environmental Protection, Bureau of Wastewater Management at (717) 772-5661 or check its Web site: www.dep.state.pa.us.]

Slow Start to NPDES Phase II Compliance (continued)

On March 7, 2003, EPA's Office of Enforcement and Compliance Assurance issued an enforcement strategy guidance memo noting that violations for lack of permit coverage for small construction sites and some still unregulated new large construction sites are a "low priority" for enforcement activities as long as operators are seen to be making a good faith pollution prevention effort. However, this does not prevent third parties from filing civil suits on the basis of the Clean Water Act against construction sites and developers. Additionally, the EPA guidance on enforcement strategy cannot provide protection in the 14 states that are delegated stormwater permitting authorities, but that have not yet issued their Phase II general permits.

For more information on the NPDES Program, contact Jack Faulk, Office of Wastewater Management, Mail Code 4203M, 1200 Pennsylvania Ave., NW, Washington, DC 20460. Phone: (202) 564-0768; e-mail: faulk.jack@epa.gov.]

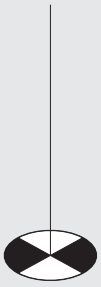
Lakes Awareness Month and 10th Annual Secchi Dip-In

As part of the EPA's Clean Water Act anniversary celebrations, July 2003 was designated Lakes Awareness Month. During the month of July, EPA is highlighted the protection of lakes for their various uses by the public. EPA conducted a nationwide outreach and education program, and coordinated with it partners, including the North American Lake Management Society and Kent State University, on events such as the annual Secchi Dip-In.

EPA's Office of Wetlands, Oceans, and Watersheds offers electronic versions of Clean Lakes Month outreach materials at www.epa.gov/owow/lakes/cleanlakes. The public is invited to order, download, or reprint and disseminate the materials. The materials include posters, fliers, and handbooks, and can benefit lake associations, marina operators, local governments, neighborhood associations, campsite operators, and others.

This summer marked the 10th annual Great North American Secchi Dip-In. From June 28 to July 13, individuals in volunteer monitoring programs took a "snapshot" of the clarity of lakes, reservoirs, estuaries, rivers, or streams throughout the United States and Canada. Coordinated through Kent State University, and spearheaded by Bob Carlson, David Waller, and Jay Lee, the Secchi Dip-In was co-sponsored by EPA's Clean Lakes program and Volunteer Monitoring program, in cooperation with the North American Lake Management Society.

Most volunteers used a Secchi disk to measure transparency, although other monitoring methods were also applied. A Secchi disk is an 8-inch disk with alternating black and white quadrants that is lowered into the water until it can no longer be seen by the observer. The depth at which the disk disappears is recorded, correlating greater transparency with greater depth. Transparency can be affected by the color of the water and presence of algae and suspended sediment, all of which are indicative of the quality of the waterbody. One goal of the Dip-In is to increase the number and interest of volunteer monitors, while providing a national perspective on water quality.



A Secchi disk.

This year Kent State University succeeded in consolidating data from annual Dip-Ins from 1994 to 2002. Using 1,361 (undifferentiated) waterbodies with five or more years of volunteer-monitored data, the Kent State team plotted trends in transparency, to find that the majority of waterbodies did not show any detectable significant trends. Only 4.7 percent of the waterbodies showed significant increases in transparency and only 3.9 percent showed significant decreases. Sampling site data were also mapped out spatially.

To find out more about the Secchi Dip-In event and to see state-by-state results for past Dip-Ins, go to http://dipin.kent.edu.

U-3 Conference Marks Growth of NEMO Network

The National Nonpoint Education for Municipal Officials (NEMO) Network is a confederation of programs that educate local land use decision makers about the links between land use and natural resource protection. NEMO programs focus on a three-tiered strategy of land use planning, site design, and best management practices to protect water resources. Network programs are coordinated by the original NEMO Program developed at the University of Connecticut. Each Network program is a unique entity involving a different suite of partners. NEMO programs are most often led by university-based Land Grant and/or Sea Grant programs, but lead agencies also include regional planning organizations, state agencies, and nonprofit groups.

Today, the Network rounds up 33 funded programs in 32 states and territories. The U.S. Department of Agriculture (USDA), National Oceanic and Atmospheric Administration (NOAA), and

U-3 Conference Marks Growth of NEMO Network (continued)

EPA are all invested, providing support for both the national hub office and individual state programs.

In 2002, exciting new partnerships were formed with the EPA "Smart Growth" Office (on open space planning education), and with a four-division NOAA consortium (providing "enhancement grants" to coastal NEMO programs). NEMO also works closely with the NOAA Coastal Services Center and the Center for Watershed Protection to provide additional technical tools and topical expertise for Network members. With these partnerships and the strength of the USDA Land Grant, NOAA Sea Grant, and NASA Space Grant university systems to tap into, the Network has a solid foundation of research and technical resources.

In May 2003, the Network held its third conference in Avery Point, Connecticut. Dubbed "NEMO University 3" or NEMO U-3, the conference was attended by representatives of 23 state programs and 4 federal agencies. Of special interest to the nonpoint source community, the agenda included updates from NEMO projects around the country participating in the open space planning and coastal enhancement projects, sessions about the effects of stream buffering on water quality, stream restoration, and development of NPDES Phase II education programs. Perspectives from NEMO "investors" were presented, including EPA's Nonpoint Source Control Branch, EPA "Smart Growth" Office, NOAA Coastal Program Division, NOAA National Sea Grant Office, and the USDA Cooperative State Research, Education and Extension Service.

As affiliated programs have begun to develop their own topical expertise and educational innovation, the U-3 session helped to strengthen the evolving "distributed leadership" model within the Network. "Our original vision of the Network depended on the idea that programs other than Connecticut would begin to take leadership of their own," says NEMO co-founder Chet Arnold. "It is gratifying to see that vision taking hold. If we continue down this road, I think there's no limit to what we can accomplish in the field of land use education."

NEMO programs are making a difference in communities across the country, as their educational programs and technical assistance result in changes to local plans, regulations, policies, and development designs. Local impacts are the focus of the recently issued National NEMO Network 2002 Progress Report, the first of its kind. Single copies can be ordered for free on the NEMO Web site (http://nemo.uconn.edu/national).

[For more information, contact John Rozum, National NEMO Network Coordinator at (860) 345-4511 or visit http://nemo.uconn.edu/national.]

News from States, Tribes, and Localities

Town Water Quality Ordinance Requires Low Impact Development

The Town of Huntersville in Mecklenburg County, North Carolina, has turned to low impact development (LID) to address its growth-related water quality problems. In February 2003 the Huntersville Town Board passed an ordinance that requires the use of low impact development to control runoff volume and water quality. To help developers in Huntersville design successful low impact projects, the County's Water Quality Program (MCWQP) developed a design manual featuring information about low impact development practices. The county also funded the development of a Site Evaluation Tool (SET) that developers must use to assess the potential runoff volume and pollutant loading impacts of proposed site plans. The developers modify their proposed site plans until the model shows that the plans meet the water quality performance criteria outlined in the ordinance.

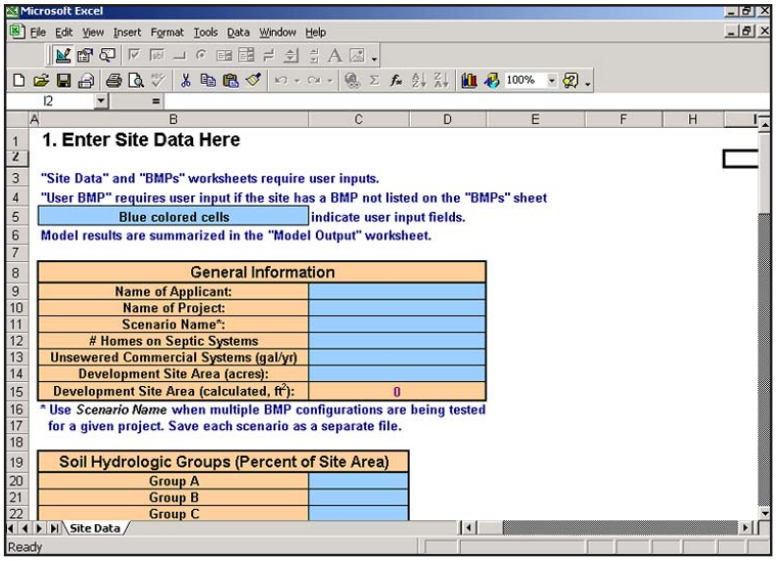
Water Quality Ordinance

The MCWQP and the Town developed the ordinance to protect the quality of the local drinking water supply. "Runoff from the rapidly growing town of Huntersville was negatively impacting the quality of the water in Mountain Island Lake, Charlotte-Mecklenburg's drinking water supply reservoir. The town agreed to implement the ordinance and take a proactive approach to prevent further degradation," explained Rusty Rozzelle, Water Quality Program Manager for Mecklenburg

Town Water Quality Ordinance Requires Low Impact Development (continued)

County. "Similar growth-related water quality problems are occurring throughout the county. We will be working with other jurisdictions in Mecklenburg County to develop and implement similar ordinances in the near future to fulfill Phase II Stormwater Permit requirements."

The ordinance requires that developers protect water quality by complying with a series of performance criteria. These include criteria related to removing total suspended solids, controlling and treating stormwater, and limiting the land area that can be served by a single BMP. The criteria specify that all sites must employ LID practices to control and treat runoff from the first half inch of rainfall. "About 90 percent of pollutants are washed off the land with the first half inch of rain," noted Rozzelle, "and our pollutants of greatest concern, such as nutrients, heavy metals, and temperature, are best addressed with LID practices." The ordinance permits developers to use either LID practices or a combination of LID and conventional stormwater management practices to control and treat additional runoff (defined as post-development runoff volume minus pre-development runoff volume) for either the one-year/24-hour storm event or the two-year/24-hour storm event, depending on the development zone.



Interface of the MS Excel spreadsheet-based Site Evaluation Tool (SET)

Resources for Developers

To help developers comply with the ordinance, the MCWQP developed the *Huntersville Water Quality Design Manual*. The manual explains and encourages the use of LID practices. It also outlines how developers can use site design strategies to infiltrate, store, and evaporate runoff on the site to replicate pre-development runoff characteristics and mimic the natural and unique hydrology of the site.

Developers are also required to submit Site Evaluation Tool (SET) output to the county for each proposed development site. The SET is a Microsoft Excel-based water quality model designed to help developers and MCWQP assess the potential water quality impacts of proposed site plans. The SET calculates the site runoff volume and pollutant quantities for a given study area. The user is required to define the soil types, septic use, land use distribution before and after development, and potential BMPs for the study site. The SET then compares the runoff volume and pollutant load between existing conditions, developed conditions without BMP implementation, and developed conditions with BMPs. The SET is applicable for the Piedmont region of the eastern United States. A programmer could adapt the SET to other ecoregions by modifying the model's assumptions and settings.

The SET allows the user to test how site designs that implement BMPs will perform with regard to mitigating changes in runoff volume and pollutant loading. A developer can modify plans and re-run the model until the water quality goals are met. "We've received many positive comments from developers about the SET," said Rozzelle. "They really like that they have a flexible tool available to help them design their plans to meet the ordinance. It takes much of the guesswork out of the process." MCWQP has held three SET training sessions, attended by more than 200 people, to make the transition easier. The SET, *Huntersville Water Quality Design Manual*, and the ordinance are all available for download at www.co.mecklenburg.nc.us/Departments/luesa. (Click on Water and Land Resources, water quality, then Huntersville Ordinance.)

What is LID?

Low impact development (LID) allows for the maximum reasonable utilization of a property while maintaining the pre-development hydrologic regime. The LID approach combines a site design with pollution prevention measures to reduce development impacts on hydrology and water quality. The goal is to maintain the pre-development stormwater runoff peak flows and volumes, and to mimic pre-development runoff conditions. Stormwater is managed in small landscape features controlling runoff at the source rather than in large, end-of-pipe pond structures located at the downstream extent of drainage areas. Through LID, hydrologic functions, such as infiltration, peak and volume of discharges, and groundwater recharge, can be maintained with the use of reduced impervious surfaces, functional grading, open channel sections, disconnection and utilization of runoff, and the use of bioretention/filtration landscape areas. For more information about LID planning techniques download the *Huntersville Water Quality Design Manual* or visit www.epa.gov/nps/lid or www.lid-stormwater.net.

Town Water Quality Ordinance Requires Low Impact Development (continued)

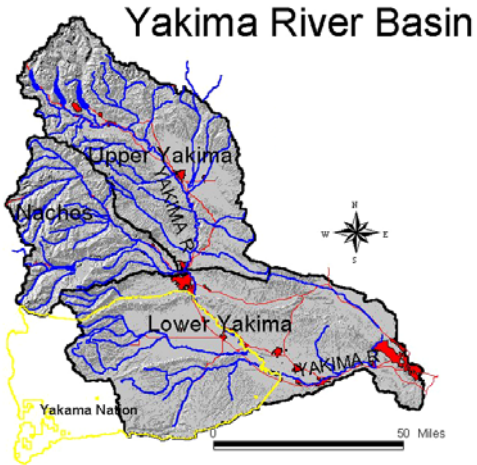
The localities and the developers recognize the need for the new requirements. "We have not received any measurable opposition to the ordinance," said Rozzelle. Since the ordinance is so new, no subdivisions have been built under the new requirements. However, the county has successfully used the SET in planning several pilot projects. Based on their experience, noted Rozelle, "we anticipate that the new requirements will cost developers more up front for the planning and design stage, but in the long run might actually save them money because of lower stormwater infrastructure costs."

[For more information contact Rusty Rozzelle, Water Quality Program Manager, Mecklenburg County, 700 N. Tryon Street, Charlotte, NC 28202. Phone: (704) 336-5449; e-mail: rozzers@co.mecklenburg.nc.us.]

Locally Driven Initiatives Jump-Start TMDL Activities

When a waterbody becomes impaired to the point that a total maximum daily load (TMDL) is required, many communities anticipate a government-driven, top-down approach to achieving water quality standards. The stories that follow, however, showcase alternate approaches used by two communities to restore their waterbodies. Both communities faced serious environmental problems, and had waters placed on their state's 303(d) list of impaired waters. But through their own initiatives, these communities took on the responsibility of removing water quality impairments head-on. In one case, the TMDL goals were met far in advance of projected target dates; in the other, through quick action the community was able to meet water quality standards and thus avoid the need for a TMDL altogether.

Yakima Valley Farmers Pull Together



The Yakima River Basin is divided into upper and lower reaches. The Yakama Indian Nation encompasses a portion of the lower reach.

Washington's Yakima River Valley is one of the richest, most intensively cultivated, and diverse agricultural areas in the country. Volcanic ash from Mount St. Helens has enriched the soil for eons, but it is also highly erodible. The Upper Yakima River and its tributaries are used by people in many ways, not only for agricultural and timber harvesting purposes, but also for recreational enjoyment.

Over the years, however, the sediment generated from all of these activities has led to serious impairments of the river's water quality. Long-term water quality monitoring and studies conducted by Washington's Department of Ecology (Ecology), U.S. Geological Survey, and the Yakama Indian Nation identified furrow-irrigated fields as the main source of pollutants. "It was amazing how much (soil) was washing down the river," says Chris Coffin with Ecology's Water Quality Program.

As a result, the Lower Yakima River was placed on the state's 303(d) list of impaired waterbodies. The listing signaled a need for Ecology to develop a TMDL to identify the limits required to meet water quality standards, which in turn triggers the production of a clean-up plan for the river.

While Ecology began developing a TMDL for the river, two of Washington's irrigation districts initiated their own strategies for addressing the erosion problem. In 1996 the Roza Irrigation District and Sunnyside Valley Irrigation District joined forces to create the Roza-Sunnyside Board of Joint Control (RSBOJC). This partnership grew out of a shared concern—they were both alarmed to discover that 300 tons of soil were being washed away every day on average, from four major irrigation drains discharging into Washington's Lower Yakima River Valley.

Rather than waiting for Ecology to complete the TMDL and determine how to meet the TMDL limits, the RSBOJC developed policies and guidelines to meet water quality goals, and "took the lead putting together a locally led

Locally Driven Initiatives Jump-Start TMDL Activities (continued)

enforcement policy," explained Marie Zuroske, resource technician with the South Yakima Conservation District (SYCD).

The RSBOJC formed multiple partnerships and leveraged various sources of funding to achieve their goals. Zuroske says, "The goal was to get grant funding and get as much conservation on the ground as possible." Because both the Upper and Lower Basins were designated as "geographic priority areas" by the Natural Resources Conservation Service (NRCS), several million dollars in cost-share funds were granted through NRCS's Environmental Quality Incentive Program (EQIP). The RSBOJC also secured a $10 million loan through Ecology's State Revolving Loan Program to help make practices more affordable for producers. Funding from the state conservation commission and Section 319 grants provided additional financial assistance.

On-the-Ground Action

The RSBOJC implemented a multi-faceted approach throughout the basin, providing educational opportunities, one-on-one technical assistance, financial assistance, and monitoring programs. Farmers and local stakeholders were invited to participate in advisory workgroups on irrigation and sediment control techniques. Because furrow irrigation is notorious for causing sediment flow into the water, one of the primary strategies for addressing the river's problems was to use outreach programs, financial incentives, and technical assistance to show Yakima Basin farmers the benefits of switching to more efficient irrigation methods such as drip or sprinklers. Using these methods, fertilizer could also be delivered directly through the irrigation system, reducing time in the field and equipment costs. In addition, these practices require little to no weed control and boast increased productivity.

Meanwhile, other organizations were also working to control polluted runoff. The North Yakima Conservation District continued its existing programs with hops farmers, ultimately convincing every landowner in a 7,500-acre area to convert from furrow to drip irrigation. The Yakima Indian Nation also implemented changes on its land and instituted monitoring programs.

Tailored Approaches

Implementing more efficient irrigation systems was the primary method used to reduce sediment loads, but other site-specific practices were also designed with individual landowners to meet their needs. Upon first hearing about the RSBOJC regulations, Jim Partch was concerned that the runoff from his farm would exceed the allowable amount of total suspended solids. At that time, Partch was furrow/rill irrigating corn and asparagus in the southern part of the Yakima Basin, an area with high turbidity levels.

Even though Partch has not changed from his furrow/rill irrigation method, he has greatly reduced runoff from his fields in three ways: (1) by implementing a *conservation tillage* system, (2) by constructing sediment basins that collect runoff from 160 acres and (3) by using polyacrylamide (known as PAM, a substance that bonds with soil to reduce erosion while allowing water infiltration). Partch is also working toward a zero discharge farming operation by recycling: pumping water collected in sediment basins back onto his farmland for irrigation.

Sulphur Creek draining through agricultural lands into the Yakima River. After agricultural best management practices were implemented to control sediment runoff, total suspended solids in the creek decreased from 152 tons/day to 4 tons/day.

Additional benefits of this system will be reaped in years of drought, when the irrigation district limits water deliveries. "I'll have more water to operate on in short water years," he explains. He estimates that he can eliminate one water delivery a year by storing water and recycling it. Partch has been able to implement this system for less than $30,000 for 160 acres, compared with a cost of $67,000 per 60 acres for sprinklers. Partch explains the benefits of implementing conservation tillage (no-till and low-till) methods on his farm: "Our production has actually improved because we've changed our tillage methods. Our environment is our livelihood. If we don't take care of it, we're going to be out of business before long."

Locally Driven Initiatives Jump-Start TMDL Activities (continued)

Efforts Pay Off

Due to the local efforts early on, the TMDL goal of reducing total suspended solids was already well on its way to being achieved by the time EPA approved the Yakima TMDL in 1998. According to Ecology, two years prior to the five-year target date of 2002, three out of four primary irrigation drains met the standard for turbidity. The table below quantifies the decrease in total suspended solids.

Water body	**1997**	**2001**
Granger Drain	100 tons/day (June-October)	5 tons/day (April-October)
Sulphur Creek	152 tons/day	4 tons/day
Spring Creek	13 tons/day	3 tons/day
Snipes Creek	4 tons/day	0.03 tons/day

"So far, the results are pretty amazing," said Coffin. "The reduction (of suspended solids loading) has been about 80 percent." Don Schramm, assistant manager for the Sunnyside Valley Irrigation District, credits the effectiveness of RSBOJC's water quality policies and guidelines to involvement of local stakeholders in advisory workgroups. "It was the landowners themselves helping develop the policy," he stated.

[Parts of this article were taken from CTIC's Partners, November/December 2002. (www.ctic.purdue.edu/CTIC/cticpartners/partners.htm) For more information, contact Jane Creech at (509) 454 7888 or e-mail jton461@ecy.wa.gov, or visit www.ecy.wa.gov/programs/wq/tmdl.]

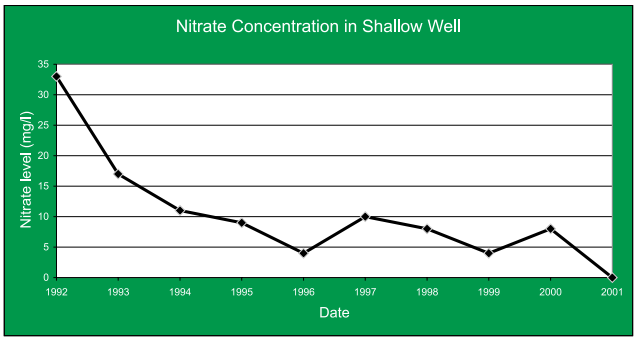
Cass County Dodges a TMDL

Hogs under cover: Technical assistance and cost-share money helped to promote confined operations and manure management in the Lake Donnell watershed.

Neighbors in the Donnell Lake watershed in Cass County, Michigan, knew they had a problem with their well water. To explore the problem, in the late 1980s to early 1990s, the community asked the Michigan State Institute of Water Research Ag Expo program to test the water. The Ag Expo program has a traveling van that takes water samples and delivers them to the university for testing, all for free.

The nitrate results were alarming—particularly since the wells provide drinking water for everyone in the community. Whereas the EPA standard for drinking water is 10 milligrams of nitrate per liter, the report found nitrate levels as high as 40 to 60 milligrams per liter in shallow wells.

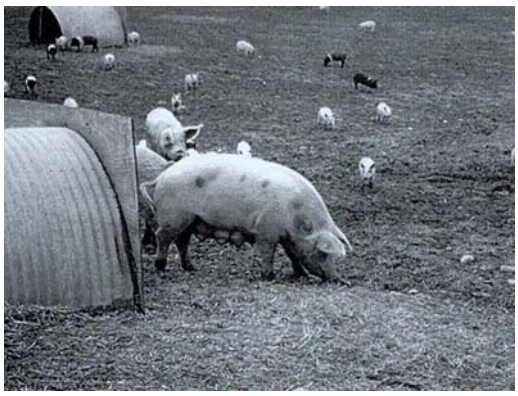
Owners of lakeside homes blamed the watershed's hog farmers for causing the water quality problems; they seemed an obvious target as the population of pigs was about six times the number of people (300,000 hogs versus 50,000 people). At the time, most hog farmers kept their pigs on open pastures with little or no provision for preventing runoff. However, the residences themselves, including a small town and homes around the lake, used septic systems. Problems associated with overuse and poor maintenance of septic tanks on people's properties came to light and were also brought up in reference to the nitrate problem. To compound the problem, because the water table was high most folks had shallow drinking water supply wells, some as shallow as 11 feet. It was clear that solving the water quality problems in this community required joint efforts by both the residents and the farmers.



Nitrate concentrations steadily decreased in a shallow well (approximately 20 feet deep) in the Lake Donnell watershed over a nine year period. Data provided by Joe Ervin, research manager for Michigan State University Institute of Water Research.

Nearby areas had worked together to build a sewer system a few years earlier, but the Lake Donnell watershed homeowners had vetoed the plan for themselves. According to John Gore, township

supervisor, when it became increasingly apparent that septic systems were contaminating their drinking water, a sewer area was defined for the township, and all residents had to be connected to it. 330 septic tanks were replaced by the sewer system, a 100 percent conversion. Even though the conversion was mandatory says Gore, it represented a new way of thinking about the common good: it would not solve the water quality problem to have only some residents convert from individual septic systems while others opted out. In another tactic to alleviate the drinking water contamination problem, deeper supply wells with casings were dug to get water supply from deeper aquifers protected by overlying impervious rock layers.



Hogs on pasture: There were many more hogs in the Donnell Lake watershed than there was land available to spread their manure at agronomic rates.

The Institute of Water Research (IWR) at Michigan State University took the lead in planning and implementing projects around Donnell Lake. IWR secured cost-share funding from the Section 319 program as well as the Water Quality Incentive Program. Alex Bozymowski, the Natural Resources Conservation Service (NRCS) district conservationist for Cass County, was contracted as a project planner and helped to organize local meetings and work with landowners. The Technical Service Providers (see box) were Michigan State University Department of Water Research and a local engineering firm, Whitman Associates.

Community Collaborates to Implement Practices

Joe Ervin, research manager for IWR, recalls that during one of the first public meetings a farmer said that while he didn't want the government in his community, he did want safe drinking water for his children. Recognizing this common goal, other farmers were motivated to consider their contributions as well.

Extensive education and technical assistance were directed toward agriculture. Thousands of pigs were either moved out of the watershed or into covered barns where the manure is collected in under-house pits and then pumped out, usually once a year but some every two or three years, for land application. Within two to three years, 150 to 250 of these hog buildings were constructed in Cass County. After learning about agronomic rates (the amount of manure that should be placed on a field), most hog farmers discovered they had more manure than they could use on their crop land. With the cost-share funding, they acquired tanks (often old milk tanks) into which they could pump the manure and deliver it to other farmers who could use it.

To reduce runoff from their fields, farmers are also using conservation tillage methods on their crops in an adapted three-year cropping cycle. Since manure cannot be injected through residue, it is generally applied one year, and the next two years a no-till cropping system is used. The manure application is then rotated from field to field on a three-year basis. Pesticide application has been reduced through the use of seeds resistant to the herbicide Roundup. In addition, farmers have excluded livestock from waterbodies.

Homeowners who had earlier blamed agriculture for all the water quality problems also started looking at the septic systems in their own backyards. Project activities directed at the residents included replacing old shallow wells with new deep wells. Even more importantly, Donnell Lake residents are now served by residential sanitary sewers.

Eliminating Contamination Obviates Need for TMDL

As project activities continued throughout the 1990s, studies revealed impairments to Christiana Creek, located downstream of Donnell Lake. Ervin, who was also studying Christiana Creek, said, "Nitrate levels in the Donnell Lake watershed's groundwater were a main contributor to the

What is a Technical Service Provider?

NRCS and conservation districts have traditionally provided technical services such as conservation planning and design, layout, installation, and checkout of approved conservation practices, and they will continue to do so. In an effort to make services more farmer-friendly, more widely available, more convenient, and provide greater choice, USDA will now reimburse producers and farmers for technical assistance provided by certified Technical Service Providers (TSPs). TSPs may be professionals from the private sector, nonprofit organizations, and public agencies who have gained a USDA certification for the expertise needed to deliver conservation activities. A nationwide registry of TSPs is available from the USDA's Web site at: http://techreg.usda.gov/.

Locally Driven Initiatives Jump-Start TMDL Activities (continued)

impairment of Christiana Creek." In 1998, the creek was listed on the state's list of impaired waters for poor macroinvertebrate communities and violations of general water quality standards due to bank erosion from animal access and agricultural runoff. This listing put the creek in line for a TMDL.

The success of the Donnell Lake watershed project activities helped remove downstream Christiana Creek from Michigan's list of impaired waters, averting the need for a TMDL. "Within 10 years," Ervin said, "the project activities substantially reduced groundwater nitrate numbers throughout the watershed."

When asked about the most significant finding of the study, Ervin replied, "It is possible to resolve a serious and contentious environmental problem using local, state, and federal resources and personnel. The serious contamination of the shallow groundwater was nearly completely eliminated in a relatively short period of time: concentrations of nitrate began to drop within a year or two and continued throughout an extended monitoring period. The local communities (agriculture, lakefront, village) and officials (townships, NRCS, Extension, Conservation District) all contributed and accrued benefits from this project."

"The most exciting things were," he added, "being able to help local people better understand the very vulnerable nature of the drinking water source and actually work to correct a very serious problem to witness the changes in the landscape from year to year and get to know many families and individuals who are still my friends."

[Parts of this article were taken from CTIC's Partners, January/February 2003. For more information, please contact Alex Bozymowski at alex,bozymowski@mi.usda.gov, or (269) 445-8643, or Joe Ervin, 50670 Garrett Road, Dowagiac, MI 49079.]

Experimenting with Rain Barrels in Michigan

Need to reduce runoff? Try using rain barrels! The Friends of the Rouge (FOTR), a nonprofit river restoration and stewardship organization, recently completed a rain barrel demonstration project in the City of Dearborn, located in the Rouge River watershed near Detroit, Michigan. Although not as successful as the project managers had hoped, the project did yield water quality and environmental education benefits for the local community. The knowledge gained through the project will also benefit any locality that is considering implementing rain barrel installation as part of an overall stormwater management effort.

Installing a rainbarrel at a roof downspout

In 2000, FOTR received a $95,000 Great Lakes Protection Fund grant to distribute rain barrels in a subwatershed of the Rouge River. The FOTR partnered with the City of Dearborn to implement the project, which sought to install rain barrels on some residential downspouts to capture a portion of the stormwater runoff on-site and educate residents about stormwater. The project team hoped to reduce runoff enough that it would impact the amount and number of combined sewer overflows (CSO), which occur when sewers that collect both stormwater and public sewages exceed their capacity and overflow into the Rouge River.

Project Implementation

The project team chose to install rain barrels in two adjoining "pilot neighborhoods" where the City was already monitoring the flow rates in the sewer system. The existing electronic monitoring system, installed as part of a different CSO-related project conducted by the City, provided the project team with pre-test data that could be compared with data collected during and after project implementation.

The project team targeted 400 homes, or a third of the pilot neighborhoods' homes, for voluntary rain barrel implementation. To boost participation, the City requested that the FOTR provide the rain barrels at no cost to interested residents. To educate the residents and invite them to participate, the City and FOTR mailed a project

Experimenting with Rain Barrels in Michigan (continued)

introduction letter from the mayor to all pilot neighborhood homeowners, issued a press release, and distributed fliers. Information about the project was posted on the FOTR Web site, included in the City of Dearborn's newsletter and in a Rouge River brochure (both of which were mailed to all residents), and presented to local groups and at watershed festival events. The project team decided to distribute the rain barrels at "Rouge Rescue/River Day," a local river celebration organized by the FOTR on June 3, 2000.

Project Outcome

Despite the team's best efforts, a low resident participation rate and an inadequate rain barrel capacity combined to make the project less successful than they had hoped. "The CSO monitors did not detect any significant reductions in the discharges in the target areas once the project was implemented," noted Kurt Giberson, Director of the City of Dearborn's Department of Public Works. "We just didn't have a high enough density of rain barrels in the study area to make a difference." Only 73 people from the pilot neighborhoods had initially expressed interest and picked up barrels in June 2000. By the end of August 2000 this number had grown to 183, not quite half the targeted number.

"We don't really know why participation was so low," explained Sally Petrella, Public Involvement Coordinator with the Friends of the Rouge. "The pilot neighborhoods are older and more established, and many of the residents seemed to resist changes." Eventually the project team made the remaining rain barrels available for free to residents in other Rouge River watershed neighborhoods.

Rain Barrels All Around Us

Organizations and agencies around the country are recognizing the benefits of rain barrels in the landscape and are finding ways to help homeowners receive and install them. Some organizations, especially those in drought-prone areas, focus on the ability of rain barrels to capture and save rain water for landscape irrigation purposes. Other organizations focus on the corresponding reduction of rain water runoff into local streams. Regardless of the primary motivation behind the effort, these organizations are trying to make it as easy as possible for homeowners to learn about and install rain barrels.

Many municipalities are subsidizing the cost of rain barrels to make them more affordable to interested residents. For example, The City of Austin, Texas, is offering rain barrels for a reduced price as part of its effort to encourage water customers to conserve water. Customers may purchase two 75-gallon barrels at $45 each (retail price is normally $120 each) and two more for an additional $75 each.

Some organizations use their rain barrel distribution efforts as an opportunity to educate residents. County Cooperative Extension Service offices across Florida are hosting workshops promoting the use of rain barrels through the statewide Florida Yards and Neighborhoods Program (for more information on Florida Yards and Neighborhoods, see News-Notes Issue 71). This spring, for a nominal fee of $25 or less, homeowners in both Pasco and Hernando Counties learned about the benefits of rain barrels and were provided with a barrel to take home.

Some localities see the potential benefit of rain barrels, but would like to gather data to see if they make a real difference. The City of Seattle implemented a pilot project this spring to study the ability of rain barrels to contribute to natural yard care. Homeowners were offered rain barrels for $32 per barrel, as long as they agreed to use the barrel for one year and participate in a follow-up survey. The demand for barrels was overwhelming. For more information visit www.seattle.gov/util/rainbarrel/.

Nonprofit organizations are also finding ways to get rain barrels into the landscape. Maryland's South River Federation (SRF) recently completed a grant-funded rain barrel distribution project. The grant funds paid for the components needed to assemble rain barrels. With the help of 10th graders from a local school, the organization assembled 70 rain barrels, and distributed them for free to SRF members. Non-members had to pay a $30 membership fee to receive a barrel. "Recipients were very pleased with the barrels, particularly during the drought last summer," said Drew Koslow, SRF member. Later in the year SRF distributed another 100 rain barrels. "We hope to secure additional funding in the future to allow us to distribute more barrels," noted Koslow.

The recent drought conditions in many parts of the country, along with people's growing awareness of water quality problems, will inevitably make rain barrels more popular. If local organizations are not selling or giving away pre-made rain barrels, homeowners can purchase them from many retailers or can construct their own. As more and more homeowners install rain barrels, organizations and agencies are bound to begin seeing positive impacts on customer water use or local water quality, or both. For information on rain barrels see www.epa.gov/reg3p2p2/what-is-rainbarrel.pdf. For sample rain barrel construction instructions see the Low Impact Development (LID) Urban Design Tools Web site at www.lid-stormwater.net/raincist/raincist_construct.htm.

Experimenting with Rain Barrels in Michigan (continued)

"The calls came flooding in and the rest of the barrels were quickly given away," said Petrella. "Although we can't quantify any improvements made by these other rain barrels, at least we know they are helping to protect the Rouge River."

The size of the rain barrels provided by the project team compounded the problem. FOTR had initially planned to use rain barrels that held 148 gallons and had calculated stormwater reductions accordingly. However, the City feared that residents would find the barrels too large and unattractive and instead requested that the FOTR order 54-gallon barrels that were molded to resemble real wooden barrels. Although the residents did prefer the smaller barrels, the reduced storage capacity reduced the ability of the barrels to make a real difference in the stormwater runoff from the neighborhoods. "But every little bit counts," observed Petrella.

The project provided many lasting educational benefits for the community. City residents were exposed to information about rain barrels and stormwater management through the project's public outreach efforts. FOTR asked the pilot neighborhood residents that received rain barrels to complete a written, post-installation survey to help assess the project's success. The surveys indicated that "residents with rain barrels installed them without difficulty, liked using them to water flower beds, gardens, lawns, etc., and encouraged others to use them," noted Petrella. "Overall we feel that implementation of a rain barrel program in a community can help to increase citizens' awareness of stormwater-related issues."

What if other localities wish to undertake a similar project? "Project staff will have to make sure the rain barrels are distributed widely—and will probably have to heavily subsidize the rain barrels, perhaps installing them for the residents," said Giberson. "This project was a learning experience for us. Despite our difficulties, we still see the potential benefits and plan to reexamine rain barrels as a possible supplement to our CSO management program."

[For more information, contact Sally Petrella, Friends of the Rouge, 24401 Ann Arbor Trail, Dearborn Heights, Michigan 48127. Phone: (313) 792-9621; e-mail: picoordinator@therouge.org. Also contact Kurt Giberson, Director, City of Dearborn's Department of Public Works, 2951 Greenfield Road, Dearborn, MI 48120. Phone: (313) 943-2085; e-mail: kgiberso@ci.dearborn.mi.us.]

Notes on Watershed Management

Tubing a River to Plant Buffers

Minnesota's Big Birch Lake is much cleaner today, thanks to the efforts of its lake association. The Big Birch Lake Association (BBLA) has combined a relatively simple monitoring tool with a unique buffer program to achieve improvements in the lake's water quality. The BBLA participates in the Minnesota Pollution Control Agency's (MPCA) Citizen Stream Monitoring Program (CSMP). Volunteers use long, narrow transparency tubes to determine water clarity in streams once a week, as well as after significant rainfall events, from April through September. The BBLA recently developed a program to reimburse farmers to set aside stream buffers and uses its CSMP transparency data to help identify where buffers are needed.

The BBLA works with farmers to install grassed buffers like this one along Fish Creek.

In the early 1990s BBLA cooperated with MPCA on a study to try to understand the cause of steadily declining water quality in Big Birch Lake. That decline had been documented by volunteers with a "sister" MPCA program, the Citizen Lake Monitoring Program, who had seen average yearly Secchi disk depth drop from 13 feet in 1971 to 6 feet in 1994. The study pointed to Fish Creek, the largest tributary, as a major source of sediment and phosphorus.

Fish Creek flowed through farmland, so the BBLA decided to work with local farmers to address sources of pollution in the creek, using transparency data to identify problem areas along the creek. They

decided to follow the approach taken by a successful program sponsored by the U.S. Department of Agriculture, the Conservation Reserve Program (CRP) that paid farmers to retire land from production. BBLA identified a reimbursement level acceptable to the farmers with creek-side properties, to pay them to retire an approximately 30-foot buffer zone alongside the creek from production.

In a private contract drawn up between the BBLA and the farmers, BBLA pays the farmers $250 per acre for 33-foot-wide buffers, allows limited use of the buffers, and specifies a binding time period. "Our contracts run 5 years and are renewable, and so far no one has opted out," explained Gene Waldorf, a BBLA member and volunteer monitor. "We don't insist on planting trees in the buffer, only grasses recommended by the Soil and Water Conservation District. We do allow haying the buffers, but not all take advantage of it. They can drive their tractor equipment on it, but vegetation must be maintained on the entire surface. Overall, it's a good deal for the farmers, and we get a lot of problems solved for very little money."

Funding the Program

The money for the program comes strictly from BBLA dues and contributions. "Our association members are very pleased with the buffer program, so they frequently add donations to their membership to help fund it," Waldorf noted. "Our membership fee is $30 per year, but many send $100 and tell us to keep it for our programs. Since we started the buffer project, our association finances and membership levels have never been better."

Targeting the Buffers

Once the buffer reimbursement program was in place, the BBLA began using its transparency data to show farmers that certain areas needed buffers. Every other week, two monitors from the BBLA sample five sites on Big Birch Lake tributaries and record the data for future use. "Generally I consider anything less than 50 centimeters on the tube to be undesirable. However, we don't have a specific impairment level—instead we look at the relative differences between sampling locations," noted Waldorf.

As an example, Waldorf explained that he was monitoring two sites located one-half mile apart on Fish Creek and found that the downstream site was much less transparent. Investigating further he came upon an agricultural drainage ditch that emptied into the creek between his two monitoring sites. When he checked transparency in the ditch, it was very low. Based on this information, BBLA worked with the landowner to install buffers along the drainage ditch.

The BBLA issued its first buffer contract in 1999. Since then, BBLA has worked with three farmers to plant a combined total of nearly 16 acres of buffers. Their efforts appear to be paying off—Secchi disk depth in Big Birch Lake has increased to 9 feet. "The lake is considerably clearer," said Waldorf. "We are pleased that we have seen such great results in such a short period of time. We intend to continue our efforts to plant buffers, as well as to implement other projects such as

Transparency Tubes: BBLA's Monitoring Tool

Pioneered by Australia's Department of Conservation, the transparency tube is a clear, narrow plastic tube (2 feet long by 1 ½ inches wide) marked in units with a dark pattern painted on the bottom. Water is poured into the tube until the pattern disappears, or the tube is outfitted with a release valve that allows the user to release water from the tube until the pattern appears. The Minnesota Pollution Control Agency uses tubes marked in centimeters, and has found that tube readings relate fairly well to lab measurements of turbidity and total suspended solids (although they do not recommend the transparency tube for applications where precise and accurate measurement is required or in highly colored waters).

Secchi Disks

A Secchi (rhymes with "Becky") disk is an 8-inch diameter disk with a pattern of alternating black and white quadrants that is lowered by hand into the water to the depth at which the pattern vanishes from sight. The distance to vanishing is then recorded. The greater the Secchi depth, the clearer the water.

Watershed Guidebooks Available

Lake and Pond Management Guidebook

The Lake and Pond Management Guidebook by Steve McComas (Blue Water Science, St. Paul, MN, March 2003. $79.95) is the successor to the best-selling *Lake Smarts: The First Lake Maintenance Handbook*, the "bible" for small-scale lake and pond improvements, published by the Terrene Institute in 1993. Completely revised and updated, now published by Lewis Publishers (www.crcpress.com), this guidebook contains over 300 ideas and projects including step-by-step practical, low-cost solutions to a wide range of problems that lake management professionals face every day. The guidebook explores shoreland buffer installation, fisheries management, small scale dredging, lakeside wastewater treatment systems, small scale designing, nuisance algae and exotic aquatic plants reduction, and more.

Watershed Health Monitoring

Watershed Health Monitoring: Emerging Technologies by Chris Jones, Mark Palmer, Susan Motkaluk, and Michael Walters (Lewis, May 2002. $89.95), is a concise reference that defines the concept of watershed health and explains how monitoring the health of a watershed is a critical precursor to watershed-based adaptive resource management. The focus of the text is a clear description of an innovative "closed loop" model that specifies four key aspects of successful monitoring programs: political linkages and support, sound scientific assessment techniques, a community education and awareness component, and a sustainable cost-recovery framework achieved through partnership. To order copies contact Lewis Publishers at www.crcpress.com.

septic system and manure pit upgrades. Our ultimate goal is to get the lake clarity back to an average of 14 feet as it was in the early 1970s. We know this is achievable."

[For more information contact Gene Waldorf, Big Birch Lake Association, P.O. Box 342, Grey Eagle, MN 56336. Phone: (320) 285-8867; e-mail: gwaldorf@meltel.com.]

Innovative Program Funds Stormwater Management

Many localities are struggling with ways to comply with new stormwater requirements outlined in their National Pollutant Discharge Elimination System (NPDES) permits. Now, a company in California is helping to make compliance easier through a program called "Adopt-A-Waterway." The company, Environmental Communication (EC), works with businesses to raise funds to support local governments' stormwater management projects, and to provide public stormwater education resources. In exchange for the funds, the businesses receive recognition on Adopt-A-Waterway signs and other promotional material. EC retains a portion of the funds it raises to support program operation. The EC programs are offered to local governments at no cost—and do not require taxpayer dollars.

For more information about NPDES storm water permits see www.epa.gov/npdes/stormwater. Information is also provided in *News-Notes* Issue #69, September 2002.

How does the program work? Once a locality agrees to participate, EC contacts national corporations and local businesses in that area and requests sponsorship. Fifty percent of the sponsorship funds go directly to the local government to allow them to implement stormwater management practices. The other 50 percent is used by EC to support the program—including development of signs, development and distribution of educational materials (e.g., printed materials, television spots), solicitation of sponsors, and other program-related costs.

To sponsor the program, businesses "purchase" Adopt-A-Waterway signs that are placed in highly visible traffic areas. The signs integrate the logos of corporate sponsors with a general environmental message, such as "Cleaner storm drains, Cleaner waterways," which help people make the connection that storm drains lead directly to waterways. In addition, the signs have specific messages such as "Please don't litter," or "Pick up after your pets," which help people understand how their individual actions affect the problem.

EC uses part of its share of the sponsorship funds to develop and distribute public outreach and educational materials in each participating locality. This educational program, known as "The Clear Solution," is a community outreach program aimed at improving water quality by inspiring changes in human behavior. The program includes EC-produced printed stormwater education

materials (e.g., brochures, newsletters, children's activity books) and public service announcements for local radio, television, and newspapers. All major sponsors in a locality are recognized in "The Clear Solution" printed materials.

What Does It Cost?

Businesses have a large range of options for program participation. "Businesses typically agree to one- to three-year contracts. Large companies provide the money up front, while small businesses pay their first quarter up front and then pay monthly thereafter," explained Paul Polizzotto, founder and president of EC. Small businesses can participate by purchasing one or many signs—typically at a cost of $300 to $500 per month, depending on the local market. A minimum purchase provides the business with the sign, plus recognition in EC press releases. Because of the high cost of production and distribution, recognition in written educational materials and on cable and radio spots requires the businesses to agree to a larger sponsorship. To sponsor a network television spot the cost would be even higher. "We are developing a series of sponsorship options targeted at large businesses and corporations that would provide them with a comprehensive multi-media advertisement package—these packages might cost anywhere from $100,000 to $500,000 per year, depending on what the company wants," explained Polizzotto. EC has already sold a large package to Comcast (the cable carrier) and is in the process of selling packages to several other companies.

Benefits for Local Governments

The Adopt-A-Waterway program relieves some of the local government's financial burden by providing an incremental, non-tax revenue stream designated for stormwater projects. These funds allow local governments to implement a wide range of runoff mitigation and prevention efforts, such as catch basin inserts, high-technology clean-up solutions, dry flow diversion projects, and storm drain cleaning. Local governments also benefit from EC-produced outreach and education programs aimed at inspiring communities to take ownership of their piece of the problem. These benefits are provided at no cost to the locality or the taxpayers. "We provide localities with a revenue stream they can count on, which is important in light of current budget problems," noted Polizzotto. "The localities can make stormwater management plans and know that the funds are there to carry them out."

Benefits for Businesses

What do businesses receive in exchange for their sponsorship? Depending on sponsorship level, they receive a variety of high-impact advertising opportunities. Equally important, Adopt-A-Waterway provides companies with an opportunity to participate in stormwater management and to put their values into action. By aligning with a positive, non-controversial environmental message, businesses receive high visibility as good corporate citizens.

Taking Off

EC's pilot program, Adopt-A-Stormdrain, was launched in 2001 in the coastal areas of Southern California and is expanding throughout the nation. "The City of Miami and localities throughout California are currently signed on—with many more local governments across the country expressing interest. We hope to have the nation's big metropolitan areas on board in the next 12 to 36 months," commented Polizzotto.

EC recently changed the name to Adopt-A-Waterway to reflect its expanding focus. "Our initial signs, 'Adopt-A-Stormdrain—Cleaner Storm Drains, Cleaner Oceans,' helped people make the connection that storm drains lead directly to the ocean," explained Polizzotto. "As we move into many inland states where people are concerned with other bodies of water—rivers, lakes, deltas, bays, creeks, streams—the name, Adopt-A-Waterway, is all encompassing."

[For more information contact Paul Polizzotto, Environmental Communication, 919 Manhattan Ave., Suite 100, Manhattan Beach, CA 90266. Phone: (800) 890-1185 or (310) 374-8212; e-mail: paul@adoptawaterway.com; Internet: www.adoptawaterway.com.]

Technical Notes

Cat Parasite in Runoff Linked to Otter Deaths

Offering a partial explanation to a mysterious decline in the federally protected southern sea otter population, scientists funded by the NOAA National Sea Grant College Program have established a strong body of circumstantial evidence linking cats to a lethal otter disease. University of California at Davis professor Patricia Conrad and her doctoral student Melissa Miller, both in the School of Veterinary Medicine, have shown that otters near heavy freshwater flows are three times more likely to have been infected by *Toxoplasma gondii* than otters from areas where runoff is light.

Toxoplasma gondii is a protozoan that causes convulsions, severe depression, and death in otters. In people, toxoplasmosis is usually asymptomatic, though AIDS patients and others with compromised immune systems can develop hepatitis, pneumonia, blindness, or severe neurological disorders. Toxoplasmosis can also be transmitted across the placenta, causing spontaneous abortions, still births, or severe brain damage.

In a survey of 233 live and dead otters from Santa Barbara to Half Moon Bay, California, the scientists found that a staggering 76 percent of otters near heavy freshwater outflows—storm drains and river mouths—had antibodies to *Toxoplasma gondii*. There was also a surprisingly high rate of infection in the general otter population. Forty-two percent of live otters surveyed had antibodies to the parasite—an almost certain sign of infection.

How Are Otters Becoming Infected?

The scientists' best guess is that parasite eggs in cat droppings are being washed by sprinklers and rains into coastal-bound storm drains and creeks. Although many animals—such as birds and rodents—can serve as intermediate hosts for *Toxoplasma gondii*, cats are the only animals known to shed the parasite's eggs in their droppings. (This cat-parasite link is the reason pregnant women are advised against cleaning cat litter boxes.)

Otters may be acquiring parasites directly through water contact or from eating infected mussels or other bivalves. Parasite eggs have not yet been found in wild bivalves, but they are logically suspect since they filter huge amounts of water feeding on plankton and thus accumulate parasites. The only marine mammal without an insulating blubber layer, otters have galloping metabolisms and snack voraciously on seafood treats such as shellfish.

Otter Populations Past and Present

Once numbering more than 300,000, southern sea otters were hunted to near extinction in the 19th century for their luxurious pelts, which otters must constantly preen to keep filled with tiny insulating air bubbles. In 1977 otters were listed as threatened under the Endangered Species Act. Following restrictions on certain types of fishing gear, their numbers rose, hitting a peak in the spring of 1995, when there were an estimated 2,377 individuals. In the last seven years, however, their recovery has stagnated or slid backward. There were an estimated 2,100 otters off California in the spring of 2002—roughly a 10 percent drop from the 1995 high.

Though scientists still do not know what has caused their decline or how much of it can be attributed to *Toxoplasma gondii*, otters originally thought to have been killed by boat strikes or shark bites have since been diagnosed with protozoal encephalitis. Miller's recent NOAA research has shown that about 60 percent of dead otters surveyed had been exposed to the parasite. New research led by a graduate student at the University of California at Davis suggests that for many of these otters infection proved lethal.

Other Risks from "Pathogen Pollution" Associated with Urban and Agricultural Runoff

The intense interest in unraveling the causes of these otter deaths, to a large extent, reflects the species' endangered status and the federal mandate to develop recovery plans for listed species. Conrad and Miller's research, however, also addresses other important emerging issues—waterborne infections and "pathogen pollution" associated with urban and agricultural runoff. Coastal

Cat Parasite in Runoff Linked to Otter Deaths (continued)

waters are the interface between what transpires on land and on sea. Therefore, various forms of pathogen and chemical pollution may be contributing to declines in marine species and increasing the coast's vulnerability to exotic species invasions.

Potential Risk to Humans

People are also potentially at risk, since they eat many of the same shellfish as otters. One documented outbreak of human toxoplasmosis in British Columbia was linked to drinking water presumably contaminated by cat droppings. Though a potentially serious human health threat, *Toxoplasma gondii* is only one of many waterborne protozoans that may be entering beach waters via runoff.

A new study funded through the NOAA California Sea Grant program is looking at one of the more worrisome of these, *Cryptosporidium*, widely regarded as one of the most significant causes of diarrhea in humans. Leading the project are Rob Atwill, also at the School of Veterinary Medicine at Davis, and Conrad. Taking cues from sea otters, Atwill and Conrad are measuring pathogen levels in bivalves near outfalls of human and agricultural runoff, to track the upstream sources of pollution. They are also conducting genetic tests to identify which animal species are the main sources of pathogen pollution. To round out their study, the team is working with dairies along the coast to test the degree to which management practices, such as planting vegetative buffer strips, can reduce pathogen pollution.

[This article, developed by the National Oceanic and Atmospheric Administration (NOAA) National Sea Grant College Program, was featured in the January 2003 issue of NOAA Magazine (www.noaanews.noaa.gov). For more information contact Jana Goldman, NOAA Research, at (301) 713-2483 or Ben Sherman, Sea Grant, at (202) 662-7095.]

Digital Video: Not Just for Home Movies

Digital video technology is increasingly used in natural resources assessment and water quality problem solving. An important step in protecting and restoring water quality is identifying key areas in a watershed where water quality problems are most severe or where unknown pollution sources lurk. What may have taken a week or more for technical teams to survey on foot can now be done from the air in just one day. Illinois and Montana resource agencies are both using systems that require attaching digital video recorders to moveable mounts on the underside of helicopter cabins. Pilots and resource managers fly the length of targeted waters while the cameras capture the river or stream corridor features below. What make the images so useful is that the video scenes are tagged automatically to their ground coordinates using earth-orbiting, satellite-based Geographic Positioning Systems (GPS).

The resulting data files allow watershed scientists to draw detailed maps of stream features, such as eroding banks, high quality riparian habitats, dams, waters diversions, culverts, basic land use, and stream meanders. They also provide historical snapshots of conditions along waterbodies that can be used to measure the progress of stream restoration activities. A single pass can be used for most streams and smaller rivers over fairly homogeneous land. If a river is wide, land use highly variable, or the vegetation thick, videos may need to be taken twice at different angles or elevations. Anywhere from 20 to 60 miles can be covered in an hour depending on the purpose of the project. Depending on the software used, a water quality manager can use a computer back at his or her desk to click on a digital map and then see the aerial scene taken by the digital camera. Even though flying time for a helicopter and pilot can run $500 per hour, once the river corridor scene is put on digital video disk (DVD) it can be replayed as often as necessary to help interpret environmental conditions.

In Illinois the U.S. Geological Survey (USGS) uses these recordings as a part of "Rapid Stream Assessments" to help soil and water conservation districts and landowners prioritize the implementation of management measures. To get the "big picture," as well as more detailed information, the USGS generally takes waterway footage at two levels; once at about 1800 feet above streams flying at approximately 60 miles per hour and again at about 250 feet above ground flying about 20 miles per hour. The slower, closer pass would help identify more difficult-to-see problems missed in the higher elevation video, such as sloughing banks, fish obstructions, and discoloration of tributaries. Technical advisors use the video to identify both problem areas and existing management practices along the streams.

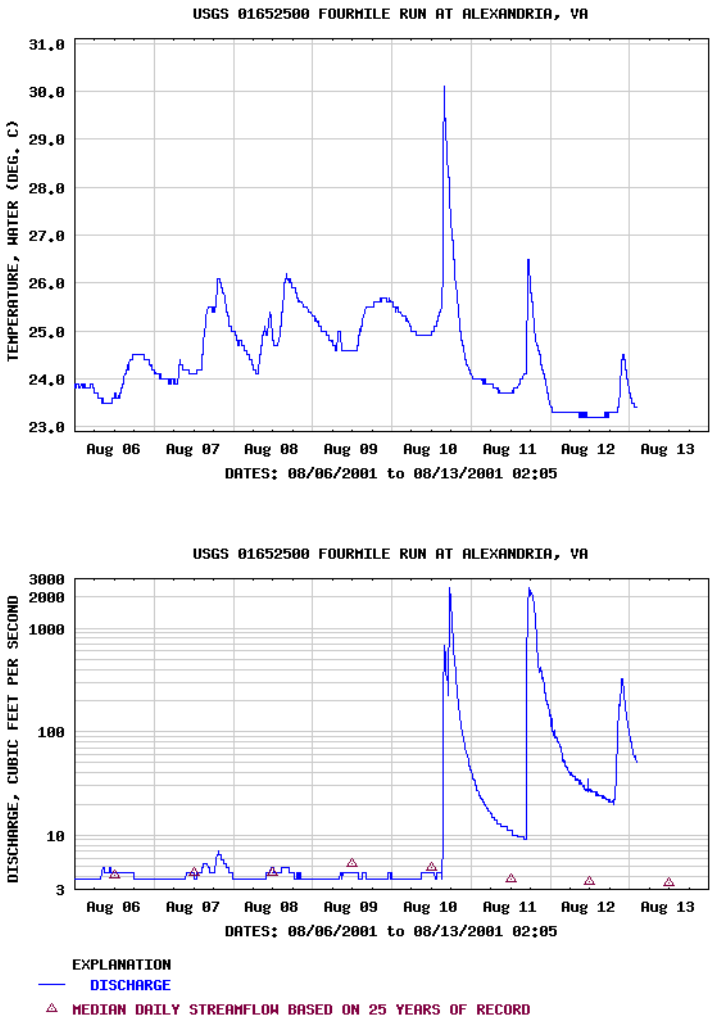
In Montana, Natural Resources Conservation Service (NRCS) scientists have taken ranchers aloft to view particular nonpoint source management problems while conducting river assessments. With the support of Montana Department of Environmental Quality's NPS Program and local watershed groups NRCS has surveyed entire river systems and also identified small problem areas. In one case, the birds-eye-view allowed a Montana landowner to see the full extent of a saline seep problem identified through vegetation differences and white deposits on his property. The digital mapping technology was used to create a map of baseline conditions for future reference and to help identify potential land use based pollution sources that can affect habitat.

For more information on the Illinois projects, contact Tim Straub (dstraub@usgs.gov). For more information on the Montana projects, contact Tom Pick (tom.pick@mt.usda.gov).

"On a sunny summer afternoon, this black slate will melt the flip-flops right off your feet," the manager at a building stone store told Don Waye last year. After the manager pointed out the hottest flagstone on the lot, Waye, a watershed planner with the Northern Virginia Regional Commission (NVRC) at the time, asked to see which stone stays the coolest during hot days, and was led to a light-colored sandstone paver.

Many of us have experienced scalding our feet by stepping barefoot onto black asphalt roads or parking lots, or worse, on a metal manhole lid, on a summer day. Mornings, light-colored sidewalks, and (especially) cool grass are much easier on our bare feet. When dark pavement or rooftops heat up and then meet up with a sudden rainstorm, much of the heat stored in these materials is transferred to the streams by the storm runoff.

Be it clothing or roof shingles, dark colors of a given material absorb more heat that light colors of the same material. Heat impacts from urbanization go beyond surface color, however. As urbanization replaces and paves over forests and farmland, less rainwater is soaked into the ground, and more of it rushes into the streams during storms. In the absence of BMPs this runoff rushes into streams faster than would natural runoff because much of the urban runoff travels through smooth, straight storm drains. This increased volume and velocity leads to "blown out" extra-wide channels with very shallow stream flow between storm events. Additionally, as impervious cover increases, groundwater recharge is shunted off, often resulting in even lower baseflows. These wide, shallow streams heat up much more quickly than do more natural narrow, deep ones. Vegetated riparian zones that provide shade and some protection from channel erosion are often lost as a watershed is developed.

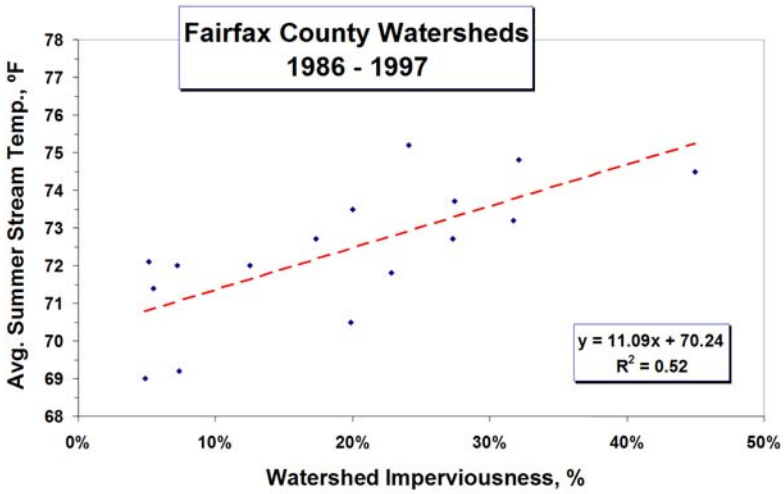


Temperature and flow graphs of urban runoff from convective cell storms, August 2001. Courtesy of NVRC and USGS.

While at NVRC, Waye teamed up with the U.S. Geological Survey to add an automated digital stream thermometer to a continuous flow monitoring site along Northern Virginia's ultra-urban Four Mile Run. Temperature, flow, and precipitation were recorded every five minutes for approximately two years. The paired graphs come from this data set and show spikes in stream temperatures during late afternoon convective cell thunderstorms typical of mid-Atlantic summers. The August 10, 2001 storm brought an increase of 4.5 degrees Celsius (8.1 degrees Fahrenheit) to the stream in 25 minutes. Waye notes that "Four Mile Run experiences profound, short-lived thermal shocks that would be missed if just daily or even hourly data were collected." He adds "these temperature spikes are less dramatic from non-summer events, and morning and nighttime storms."

In 1998, Waye isolated a summer effect by analyzing over 10 years of twice-monthly data for 75 stream stations across Virginia's Fairfax County. Now with just over a million people across 399 square miles, the county stretches from ultra-urban neighborhoods inside Washington, DC's beltway to a downzoned and protected drinking water supply watershed across its western third. Thus, a broad range of stream conditions, land uses, and imperviousness were included in the Fairfax study. Beyond agreement with earlier studies that correlated watershed imperviousness with higher stream temperatures, an increased summer effect was revealed. Specifically, while

stream temperatures were greater year-round for more impervious watersheds, the rate of increase in average summertime stream temperatures associated with imperviousness was nearly double the average year-round increases.



Average summer stream temperatures increase by 0.11 °F for every 1% increase in imperviousness. *Courtesy of NVPDC, 1998.*

The intensity of these thermal shocks on urban stream systems is a function of many characteristics, including air and rain temperature, cloud cover, surface albedo (reflectivity, dictated largely by color), solar radiation, shading, the thermal capacity and conductivity of various watershed surfaces, and even wind. Yi Li, a graduate student at the University of Guelph in Ontario, Canada, working with Dr. William James, an environmental engineering professor, has recently developed a pavement heat budget model to predict how impervious surface characteristics and solar factors affects stream temperatures. The model, called HEATRAN, has already been used to analyze thermal mitigation efforts for a large shopping mall in Portage, Michigan. Another new model, programmed into an Excel spreadsheet, has been developed by a team from the University of Wisconsin at Madison and the Dane County (Wisconsin) Land Conservation Department. The Thermal Urban Runoff Model, or TURM, allows users to enter parcel level information for a proposed development and predicts thermal runoff impacts. It has gained acceptance for use in Dane County, which has recently implemented a stormwater management ordinance with thermal runoff mitigation requirements. (See sidebar for more information on both of these efforts.)

Rapid water temperature fluctuations have a significant impact on all aspects of aquatic life, from metabolism to reproduction, but often get overlooked by monitoring programs that typically are not designed to capture continuous temperature data across short time intervals. Even more importantly, the temperature range of a waterbody determines which species can survive in it. For instance, trout can no longer survive year-round in many formerly natural trout streams as their watersheds have urbanized and contributed thermal shocks from stormwater runoff. While stream temperatures may be within an acceptable range for most of the time, rapid thermal spikes from urban runoff have become barriers to aquatic diversity in urban waterbodies. In a 1990 study, John Galli of the Metropolitan Washington Council of Governments noted that fish can experience thermal stress when stream temperatures change more than 2 to 3 degrees in 24 hours. These thermal stresses can occasionally turn lethal. For example, water temperature is the prime suspect in a spring 1997 fish kill in Four Mile Run. In that incident, over one thousand male American shad from a shad run were found dead in the

New Report Explores How Impervious Cover Impacts Aquatic Systems

Impacts of Impervious Cover on Aquatic Systems, a new 150-page report released by the Center for Watershed Protection (Center), provides a comprehensive examination of more than 225 multi-disciplinary research studies documenting the impacts of urbanization and the associated impervious cover on aquatic systems. Written in a clear, accessible style, *Impacts* is the Center's most extensive exploration of imperviousness to date, and reviews the available scientific data on the myriad of ways urbanization influences hydrologic, physical, water quality, and biological indicators of aquatic health.

The research distilled in this report was conducted in many different ecoregions, climatic zones, and stream types. *Impacts* includes more than 100 graphics and tables and is a must-read for watershed leaders, policy-makers and agency staff in watersheds across the country. *Impacts* is available in two ways: for $25 an electronic (pdf) version may be downloaded from www.cwp.org; for $30 a hardcopy report may be ordered from the same Web site.

Examples of Mitigating Thermal Impacts

1) In Dane County, Wisconsin, a new comprehensive stormwater management ordinance came into force on August 22, 2002 that included what may be the first thermal runoff mitigation requirements in the U.S. The ordinance requires that the temperature of runoff of sites that contribute 20,000 square feet or more of imperviousness to cold-water community watersheds be reduced. The spreadsheet model co-developed by the county and the University of Wisconsin, TURM, is used to evaluate impacts for lots under development using a special thermal design storm. Additional information on this ordinance is available online at http://www.co.dane.wi.us/commissions/lakes/stormwater.shtml. Information on TURM is available at www.co.dane.wi.us/landconservation/thmodelpg.htm.

2) In the 41,000 acre-foot Jennings-Randolph Reservoir along the Potomac River, the Army Corps of Engineers designed the reservoir outlet to mix water from different depths and release water of uniform temperature and pH. While this was done to mitigate acid mine drainage, the cooler temperatures yielded population booms for brook trout and brown trout. The reservoir releases also created a world-class whitewater venue.

3) In Portage, Michigan, the Water Environment Research Foundation (WERF) is supporting a study of BMP effectiveness for treating thermally-enriched urban runoff. Specifically, the project is examining the benefits of a large three-stage forebay/regional pond/wetland for mitigating thermal impacts from an ultra-urban 463-acre catchment in the heart of the city. The research has three objectives:

- To confirm the relationships between disrupted heat budgets found in urban areas and local hydrology;
- To quantify the impacts of thermally enriched stormwater discharges on coldwater temperature regimes as related to their influence on aquatic life and habitat; and
- To determine design criteria for stormwater BMPs and controls necessary to mitigate problems associated with stormwater thermal enrichment.

The project's lead researcher, Mark Kieser, of Kieser and Associates notes:

Preliminary results indicate that the three-stage treatment design, with the final stage being natural wetlands, appears to be one of the best means to treat thermally enriched stormwater. Mitigation of higher stormwater temperatures is not accomplished in the more traditional two-stage treatment process (i.e., the forebay and wet detention pond). By the time the flush of thermally enriched stormwater moves through the 11-acre natural wetland (5-10 day detention), a dense canopy coverage and contact with the shallow water table, allows the pulse of stormwater to at least return to ambient air temperatures before gradual release back into the drain. Large diurnal temperature fluctuations noted in the open water of the forebay and detention pond are also significantly dampened through the wetland cell.

This research has already yielded the development of the new HEATRAN model from the University of Guelph to assess thermal impacts associated with urbanization; and will likely deliver transferable BMP design criteria for mitigating these impacts. A final report on this research is expected later this summer. Additional information is available at www.kieser-associates.com/condrain.

lower section of the stream apparently caused by swimming upstream into urban runoff that was too hot for the anadromous fish to handle.

Temperature preferences among species vary widely, but all species can tolerate slow, seasonal changes better than rapid changes. Thermal stress and shock can occur in many desirable fish species (like brook trout) when temperatures change more than 2 to 4 degrees Fahrenheit in 24 hours.

Interestingly, BMP ponds often have detrimental thermal impacts. Wide, shallow ponds—especially if unshaded—will heat up much more than the streams that drain to these ponds. In 2002, Drs. David Blaha and Chris May at the University of Washington observed that moderately developed watersheds with BMP ponds and stormwater basins have less aquatic biodiversity than watersheds with similar levels of development and no BMPs. Some have speculated that heat generated by these ponds may be culpable for this diversity loss. However, it is also worth noting that longer residence times and slow release rates of BMP ponds help dissipate thermal shocks from storms on downstream waters.

Beyond the good news/bad news of BMP ponds, what will mitigate thermal impacts? While current research is thin, techniques that are likely to reduce these impacts include:

- Applying low impact development principles, such as minimizing impervious surfaces and maximizing infiltration opportunities, and even building green roofs;

- Planting native shade trees alongside stream banks and blacktop surfaces;
- Restoring pool and riffle structures in degraded/degrading streams;
- Using lighter-colored paving materials for rooftops, parking lots, and certain roads.

[For more information, contact Don Waye, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, 4503T, Washington, DC 20460. Phone: (202) 566-1170; e-mail: waye.don@epa.gov.]

Notes on Education

New Outreach Tools for Municipalities

Need nonpoint source pollution education materials fast? Be on the lookout for Midwest Research Institute—Florida's (MRI-FL) upcoming Florida Stormwater Education Toolkit. MRI-FL is currently compiling a toolkit of pre-produced outreach materials through a 5-year, $517,000 Clean Water Act Section 319 grant administered by the Florida Department of Environmental Protection (DEP). MRI-FL will produce 200 copies of the toolkit, half of which will be given to Florida municipalities that must comply with National Pollutant Discharge Elimination System (NPDES) Phase II permit requirements. The remaining half of the toolkits will be distributed to Phase I municipalities as requested.

Stormwater education for municipalities in Florida

The Goods

The Toolkit's purpose is to provide proven program ideas and materials to municipalities and agencies that want to implement education campaigns without spending a lot of time and money. To compile materials, MRI-FL reviewed existing model programs within Florida and around the nation. They collected nearly 1,300 different educational materials that focus on nonpoint source pollution and water conservation. Before deciding which to include in the toolkit, MRI-FL evaluated each for effectiveness, statewide applicability, and the ease with which it could be reproduced. The toolkit will be contained in three binders: one for the general public; one for business, industry, and government; and one for schoolchildren and teachers.

Each toolkit will contain printed and electronic versions of the brochures, fliers, manuals, posters, and public service announcements most appropriate for each target audience. Some of the electronic versions will be able to be modified to input local information and others will be generic. Examples of guidance materials include *How to Implement a Nonpoint Source Pollution Education Program*, *Coordinating a Volunteer Water Monitoring Program*, and *8 Months to Your Children's Water Festival*.

Moving Target Audience

MRI-FL's project was originally designed to provide community colleges with curricula and materials to train continuing education and associate degree students about stormwater education. "However, we identified an emerging need in our community—municipalities needed education resources to help them meet the requirements of their NPDES permits. Instead of going through the community colleges, we decided to target the municipalities directly, " explained MRI-FL's Leesa Souto. MRI-FL worked with the DEP to modify the contract to create the toolkits and target municipalities.

MRI-FL is currently collecting the toolkit contents and is also conducting a survey of local Phase I and Phase II governments. "The survey has two goals: (1) to assess the education needs and demographics of the various Phase II governments; and (2) to identify resources that may be missing in the toolkit," explained Souto. "This process is allowing us to fine-tune the toolkit to best meet the needs of the local governments." MRI-FL has already completed a similar survey to assess the need for educating businesses about nonpoint source pollution.

New Outreach Tools for Municipalities (continued)

Before MRI-FL distributes the toolkits, local and statewide teams will evaluate the program materials and processes. MRI-FL has organized a task force of members from local government and nongovernmental organizations, teachers, and members of the public that is evaluating the materials and developing the method for creating and sharing the toolkits. A statewide team of government agency personnel is reviewing toolkit prototypes and providing input before final distribution.

And Onward

MRI-FL is designing the toolkits to evolve with changes in programs. All toolkit recipients will be entered into a database so that MRI-FL can conduct an ongoing evaluation/feedback process between MRI-FL, recipients, and the statewide review team. The response will allow MRI-FL to distribute program implementation plans, lessons learned, and appropriate new material in additional binders, single mail-outs, or as inserts to MRI-FL's newsletter. Ideally, the toolkit will help people communicate and cooperate statewide to achieve their nonpoint source pollution education program goals.

Beginning this summer, MRI-FL will distribute the toolkits during Train-the-Trainer workshops throughout Florida. MRI-FL will coordinate the workshops to train people on how to implement nonpoint source pollution education programs using the toolkits. In time, all materials in the toolkit may become available on the Florida DEP Web site at www.dep.state.fl.us.

[For more information, contact Leesa Souto, Midwest Research Institute, 1470 Treeland Blvd., SE, Palm Bay, FL 32909-2211. Phone: (321) 723-4547 Ext. 200; e-mail: Lsouto@mriresearch.org.]

Note: Mark your calendars for an exciting educational opportunity!

The 3rd National Conference: Nonpoint Source Pollution—Information and Education Programs will be held October 20–23, 2003 in Chicago, Illinois. In response to a need for better public appreciation and understanding of nonpoint source pollution, this conference aims to provide a unique opportunity—at a national scale—to learn and share ideas on nonpoint source information and education strategies. The conference will explore practical, state-of-the-art examples of successful outreach programs through multimedia sessions. The conference's target audiences include nonpoint source, watershed, and TMDL program staff at the local, state, and federal levels, as well as environmental service groups that may work closely with local adult and youth education programs. The conference is an opportunity to meet people with similar objectives and challenges who are concerned about building social capacity to address nonpoint source pollution, and who are working to develop creative information/education programs.

The conference is co-sponsored by EPA and the Chicago Botanic Garden. To submit an abstract for consideration, contact Bob Kirschner, Chicago Botanic Garden, 1000 Lake Cook Road, Glencoe, IL 60022; e-mail: bkirschn@chicagobotanic.org.

Reviews and Announcements

New Guidebook Addresses Management of NPS Pollution in Aquatic Ecosystems

Parthenon Publishing Group, Inc., has recently released *Assessment and Control of Nonpoint Pollution of Aquatic Ecosystems: A Practical Approach*. Written in a style that would be understandable to both scientific personnel and policy makers this guidebook provides practical tools to design site-specific solutions for nonpoint source pollution problems. The examples contained in the guidebook highlight past and present nonpoint source management successes and failures and give guidance to help policy makers develop better management strategies.

The guidebook looks at the assessment and control of nonpoint source pollutants, including eroded sediments, nutrients, heavy metals, organic and inorganic chemicals, chlorides, and microorganisms from agricultural, urban, construction, and forested areas. This approach goes beyond traditional nonpoint source approaches by presenting atmospheric deposition as a mode of transport for nonpoint and point source pollutants. It also looks at the role groundwater plays as a

receiver and contributor to nonpoint source pollution, especially in light of contaminants originating in garbage dumps.

The book can be purchased for $154 at www.arsmedica.com/pa/pa-3883.html.

New EPA Report Explores Community, Culture, and the Environment

EPA's *Community Culture and the Environment: A Guide to Understanding a Sense of Place* is now available. The *Guide* explores the concepts of community and culture and provides tools for identifying, assessing, and working cooperatively within the social dynamics and local values connected with environmental protection. These tools will help define the organization's community, identify stakeholders, enhance education and outreach, build partnerships and consensus, identify resources, plan and set goals, and integrate local realities with ecological issues.

The *Guide* is designed for people involved in community-based initiatives, including those affiliated with community and watershed-based organizations, universities, and federal, state, tribal, and local agencies. Learn more about how this valuable resource can help organizations achieve their environmental protection goals by visiting www.epa.gov/ecocommunity/tools/community.pdf.

To request a free copy of the *Guide*, call the National Service Center for Environmental Publications (NSCEP) at (800) 490-9198, and ask for publication number EPA 842-B-01-003.

New Stakeholder Involvement Guide Available

EPA recently published *Getting In Step: Engaging and Involving Stakeholders in Your Watershed*. The guide, second in the *Getting In Step* series, features information on how to generate interest and participation in watershed assessment, planning, and management. A Web-based version of the new guide (along with the popular, previously published *Guide to Effective Outreach in Your Watershed*) is posted on the EPA Web site at www.epa.gov/owow/watershed/outreach/documents.

Updated Federal Funding Catalog Now Online!

In spring 2003, EPA updated its Catalog of Federal Funding Sources for Watershed Protection. This catalog is now online as an easy to use, searchable Web site. The site provides information for watershed practitioners and others on 84 federal funding sources that may be available to help fund various watershed-related projects. The site updates EPA's Catalog of Federal Funding Sources for Watershed Protection (EPA 841-B-99-003), which was published in 1999.

The Web site enables quick interactive searches to finds relevant federal funding programs, the level of funding available, the average amount of grant or loan, contact information, and other useful background data on the fund. EPA plans to update the site on an ongoing basis. The catalog is online at www.epa.gov/watershedfunding.

Web Sites Worth a Bookmark

Eyes on the Bay: www.eyesonthebay.net

The *Eyes on the Bay* Web site, developed by the Maryland Department of Natural Resources, explores how emerging new monitoring technologies, coupled with traditional monitoring programs, are allowing natural resource managers and the public to better understand, evaluate, preserve and restore Maryland's water and living resources. The Department collects water and habitat quality monitoring data and uses them to help characterize existing conditions and long-term trends, detect water quality changes in response to management actions, protect living resources, and develop the most cost-effective solution to restore Maryland's bays and tributaries. The site explains how new monitoring technologies provide agencies with near real-time data to assess fish kills,

harmful algal blooms, and the effects of storms and other short-term episodic events. These technologies also provide citizens, students, and researchers with an opportunity to explore the dynamic nature of the bays and tributaries, and the problems these ecosystems face.

Greenworks TV: www.GreenWorks.tv

This site features information about Environmental Fund for Pennsylvania/GreenWorks, a company that in 1997 began featuring a half-hour television series spotlighting the positive things people have done to help the environment. Over the years, GreenWorks' innovative television series has told the stories of hundreds of everyday environmental heroes—from fencing instructor Mark Masters to lifelong farmer Bill Gunser. The majority of the stories featured on GreenWorks feature people, programs, and locations in Pennsylvania; however, their productions are not limited to the state. To view the archived TV segments that are freely available on the site, a (free) downloadable plug-in is required, accessible via the Web site itself. GreenWorks' award-winning, interactive Web site, www.GreenWorks.tv, is home to the world's largest collection of on-line environmental videos. With funding support from the Pennsylvania Department of Environmental Protection, GreenWorks also recently partnered with National Public Radio to bring daily environmental news stories to listeners of Morning Edition, All Things Considered, and Weekend Edition on WHYY Philadelphia.

Brake Pad Library: www.tdcenvironmental.com/brake

The Brake Pad Partnership (a multi-stakeholder coalition formed to examine the environmental impacts of brake pad wear debris generated in the use of passenger vehicles) has assembled a technical reference library. The library is a collection of literature relevant to the fate, transport, and environmental significance of copper in vehicle brake pads. The collection is available on-line with bibliographic citations, abstracts, and information about publication availability.

Regulations.gov

Regulations.gov is a U.S. government Web site that makes it easier for the public to participate in federal rulemaking—an essential part of the American democratic process.

On this site, users can find, review, and submit comments on federal documents that are open for comment and published in the *Federal Register*, the government's legal newspaper. Features include a "Go" button that can be used to find *Federal Register* documents currently open for comment, and a "Submit a Comment on this Regulation" link that can be used to express an opinion on a specific document.

Spatial Wetland Assessment Available for Management and Planning Model: www.csc.noaa.gov/lcr/swamp/text/p661.htm

The National Oceanic and Atmospheric Administration (NOAA) Coastal Services has developed a conceptual Geographic Information System (GIS) model to evaluate the relative significance of tidal and riverine wetlands within watersheds. Called Spatial Wetland Assessment for Management and Planning (SWAMP), the model evaluates a wetland's contribution to water quality, hydrology, and habitat and can help managers to prioritize wetland habitats within a watershed. SWAMP requires ArcView Spatial Analyst. The model was originally developed for the Ashepoo-Combahee-Edisto River Basin of South Carolina, but the authors state that the approach should be transferable to other geographies provided care is taken to include knowledge of local wetland ecology. The Web site offers technical information on the model, as well as an order form. The model itself is free of charge.

Datebook

Meetings and Events

September 2003

8-11	*11th National Nonpoint Source Monitoring Workshop*, Dearborn, MI. For more information, contact Tammy Taylor at taylor@ctic.purdue.edu or (765) 494-1814.
8-12	*Applied Fluvial Geomorphology Course*, Lubrecht Forest, MT. For more information, contact Wildland Hydrology, 1481 Stevens Lake Road, Pagosa Springs, CO 81147. Phone: (970) 731-6100; e-mail: wildlandhydrology@wildlandhydrology.com. To register, visit www.wildlandhydrology.com/html/register.htm.
15-19	*River Morphology and Applications Course*, Lubrecht Forest, MT. For more information, contact Wildland Hydrology, 1481 Stevens Lake Road, Pagosa Springs, CO 81147. Phone: (970) 731-6100; e-mail: wildlandhydrology@wildlandhydrology.com. To register, visit www.wildlandhydrology.com/html/register.htm.
29-Oct 9	*River Assessment and Monitoring Course*, Pagosa Springs, CO. For more information, contact Wildland Hydrology, 1481 Stevens Lake Road, Pagosa Springs, CO 81147. Phone: (970) 731-6100; e-mail: wildlandhydrology@wildlandhydrology.com. To register, visit www.wildlandhydrology.com/html/register.htm. (Pre-requisite: Applied Fluvial Geomorphology, River Morphology, and good basic survey skills).

October 2003

6-7	*The STREAMS Channel Protection and Restoration Conference*, University Plaza Hotel, Columbus, OH. Further information is found on the Web at: http://www.ag.ohio-state.edu/~streams/conference/index.html.
20-23	*3rd National Conference, Nonpoint Source Pollution Information and Education Programs,* Congress Plaza Hotel, Chicago, Illinois. The full Conference program, including registration information and a printable registration form, is available at http://www.chicagobotanic.org/research/conference/nonpoint.
20-24	*National Symposium: Wetlands 2003 Landscape Scale Wetland Assessment and Management*, Nashua, NH. For more information, contact the Association of State Wetland Managers at (518) 872-1804 or by e-mail at aswm@aswm.org.
21-30	*Natural Channel Design & River Restoration Course,* Steamboat Springs, CO. For more information, contact Wildland Hydrology, 1481 Stevens Lake Road, Pagosa Springs, CO 81147. Phone: (970) 731-6100; e-mail: wildlandhydrology@wildlandhydrology.com. To register, visit www.wildlandhydrology.com/html/register.htm.
29-30	*"Getting It Done: The Role of TMDL Implementation In Watershed Restoration" Conference*, Stevenson, WA. This regional conference will bring together regulators, researchers, educators, technical assistance providers, and others to focus on improving the efficiency and effectiveness of TMDL implementation strategies in the Pacific Northwest. Phone: (509) 335-5531; Fax: (509) 335-1590; E-mail: watercenter@wsu.edu; Web site: http://www.swwrc.wsu.edu/conference2003/index.html.

November 2003

3-6	*American Water Resources Association Annual Conference*, San Diego, CA. The American Water Resources Association's Annual Conference is a forum for all water resources practitioners; it helps foster discussion of the multidisciplinary aspects of water resources. See the Web site: http://www.awra.org/meetings/California2003/.
5-8	*NALMS 2003: Protecting Our Lakes' Legacy*, Mashantucket, CT. For more information, visit the North American Lake Management Society's Web page at www.nalms.org/symposia/newengland/index.htm.
16-18	*TMDL 2003*, Chicago, IL. For more information, call the Water Environment Federation at (703) 684-2400, extension 7010 or visit www.wef.org/Conferences.

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