

WATERSHED SCIENCE BULLETIN



Journal of the Association of Watershed & Stormwater Professionals
A program of the Center for Watershed Protection, Inc.

FALL 2010

Total Maximum Daily Loads (TMDLs)
Innovations and Implementation

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MISSION: The mission of the *Watershed Science Bulletin* (the *Bulletin*) is to synthesize research and experience from the numerous disciplines that inform watershed management and transmit this valuable information to researchers, regulators, practitioners, managers, and others working to protect and restore watersheds everywhere.

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Watershed Manager, Center for Watershed Protection

This photo was taken along Pocono Creek in Monroe County, PA, near Camelback Mountain. Like many streams in Pennsylvania, it is dominated by a forested watershed and provides critical habitat for trout populations. Some tributaries in the Pocono Creek watershed qualify for the highest level of water quality protection under Pennsylvania regulations. Population growth and the resulting urbanization and hydrologic changes are a threat to the health of the watershed.

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water conservation districts, to plant and maintain riparian areas on the enrolled land.

Since 2004, 63 urban and rural projects have planted over 1.6 million native trees and shrubs and have established 35 miles of riparian corridor; as of 2007, the riparian part of the trading option had cost \$4.3 million. At the end of the five-year NPDES permit cycle, CWS had developed all of its needed credits for permit compliance plus a small surplus for future needs.

Several factors have contributed to the success of the program, including a focus on the highest priorities in the watershed for restoration and water quality improvement, regulatory flexibility, the development of important third-party partnerships, and the capacity to implement and maintain restoration on a large scale.

In response to the strong interest expressed by other utilities in the United States and abroad, Clean Water Services established the Clean Water Institute, a nonprofit 501 c3 organization, to aid other utilities in the development of water quality trading strategies and innovative approaches to watershed management.

For more information contact Bruce Roll, Director of Watershed Management, bruce@cleanwaterinstitute.org

List of Sources

Abdalla, C. 2008. Land use policy: Lessons from water quality markets. *Choices* 23(4): 22–28.

Optimizing Resources To Achieve Pollutant Reductions in Wisconsin

The ultimate goal for many total maximum daily loads (TMDLs) is to implement the load reduction practices and strategies that will achieve the TMDL restoration goal in a cost-effective manner, while sharing the burden of implementation equitably. This is easier said than done. However, the Wisconsin Department of Natural Resources (WDNR), along with its project partners, is steadfastly moving forward to implement such an approach to address total suspended solids (TSS) and total phosphorus (TP) in the Lower Fox River basin (LFRB) and Green Bay.

The TMDL is led by WDNR, which is working in partnership with The Cadmus Group, Inc., US Geological Survey, University of Wisconsin–Green Bay, University of Wisconsin–Milwaukee WATER Institute, University of Wisconsin Sea Grant, Green Bay Metropolitan Sewerage District, Brown

Clean Water Services. 2005. *Healthy streams plan*. Hillsboro, OR: Clean Water Services.

Clean Water Services. 2007. *Tualatin River Flow Management Technical Committee: 2007 annual report*. Hillsboro, OR: Clean Water Services.

Clean Water Services. 2009. *Temperature management plan, credit trading activities, annual report*. Hillsboro, OR: Clean Water Services.

Roll, B., B. Cordon, P. Guillozet, K. Petersen-Morgan, B. Vaughn, and K. Smith. 2008. *Sustainable integrated watershed management in the Tualatin basin*. Presented at Sustainability 2008: Green Practices for the Water Environment Conference, Washington DC.

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Case Study Contributors

Contributors to this case study included Tracie Nadeau, US Environmental Protection Agency Region 10, Oregon Operations Office; Bobby Cochran, Willamette Partnership; and Bruce Roll, Clean Water Services.

County Land and Water Conservation Department, and the Oneida Tribe. As part of a pilot project sponsored by the US Environmental Protection Agency, The Cadmus Group, Inc., designed a watershed-based optimization modeling framework, shown in Figure 1. The modeling framework is intended to identify cost-effective combinations of best management practices (BMPs) to target both point and nonpoint source pollution and to achieve the load reduction goals set by the TMDL.

An initial pilot application of the optimization model (prior to TMDL development) compared agricultural BMPs, along with their implementation costs, and identified the optimal scenario—that is, the most cost-effective combination of BMPs that would achieve the TP load reduction. In addition, the pilot application estimated potential TP load reductions

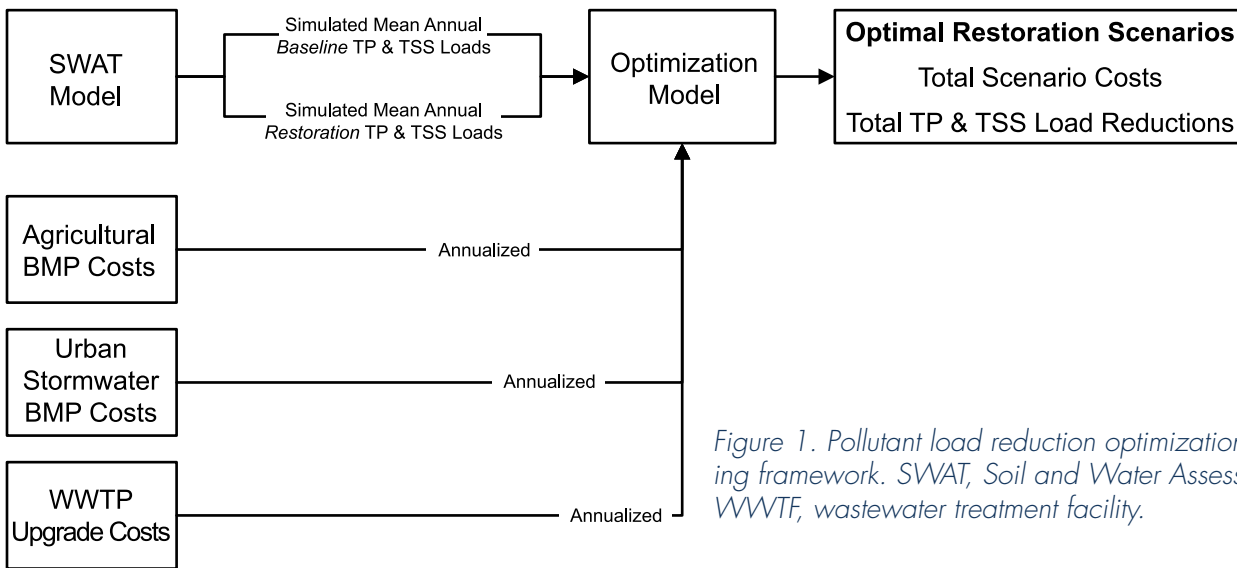


Figure 1. Pollutant load reduction optimization modeling framework. SWAT, Soil and Water Assessment Tool; WWTF, wastewater treatment facility.

and the costs associated with permitted point source facility upgrades.

The overall TP load reduction target was initially set at 50% for the pilot project. This target, which was not the final

TMDL goal, was based on the targets defined as part of the 1993 Lower Green Bay Remedial Action Plan, a Great Lakes clean-up program. Modeling showed that implementation of the optimal scenario of agricultural BMPs in the LFRB would result in an estimated phosphorus load reduction of about 50,000 kg/year (21%). Point source facility upgrades in the LFRB would result in an estimated phosphorus load reduction of 45,045 kg/year (19%). Combined, these actions would result in an estimated 40% decrease in phosphorus loading to Lower Green Bay (from 238,912 to 143,700 kg/year). The cost estimates for the agricultural and point source facility upgrades were \$138/kg TP and \$240/kg TP, respectively. This approach fell short of the preliminary TMDL goal for TP by 10%, did not address urban areas, and did not accurately capture the true costs of point source upgrades.

The final TMDL-targeted load reductions for TP and TSS are 60% and 56%, respectively. During TMDL development, project partners ran the model a second time to identify a more cost-effective and equitable strategy by (a) identifying a more robust set of agricultural BMPs, (b) exploring a variety of treatment options for point source dischargers, and (c) determining costs for municipal separate storm sewer systems or regulated urban areas. The project partners will need to refine the model during TMDL implementation planning, possibly on a subwatershed scale, since the suite of agricultural BMPs could not meet the load allocations for the TMDL. Future model runs will incorporate programmatic costs and tailor treatment technologies to individual point source dischargers.

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Optimization modeling has provided important information regarding the feasibility and costs of meeting the TMDL goals to guide local decisions about how to effectively target implementation funds. Getting the right combination of practices and costs, however, is only one part of the implementation equation. Achieving the restoration goals also requires a commitment by individuals and organizations to implement practices and change behaviors. The TMDL Outreach Team for the LFRB and Green Bay engages in extensive efforts to keep the community informed about the TMDL and to provide opportunities for input. Two mail-in surveys have helped focus outreach efforts by generating a greater understanding of pollutant sources and by developing messaging as part of implementation. The TMDL Outreach Team developed the two surveys and mailed them to 600 dairy farmers throughout the basin and 640 urban residents in the East River subwatershed. The response rate was 58% and 49% for the farming and urban surveys, respectively. The results informed the TMDL Outreach Team that, in general, extensive education and outreach is needed to better inform

the public about the pollutants of concern, their contributing sources, and practices that could be implemented to improve water quality in the LFRB and Green Bay.

For More Information

For more information, visit <http://dnr.wi.gov/org/water/wm/wqs/303d/FoxRiverTMDL/> or http://basineducation.uwex.edu/lowerfox/tmdl_outreach.html or contact Nicole Clayton, Water Quality Specialist, Wisconsin Department of Natural Resources, at nicole.clayton@wisconsin.gov, or Laura Blake, Senior Associate, The Cadmus Group, Inc. at lblake@cadmusgroup.com.

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Lake Clarity Crediting Program for Lake Tahoe: An Adaptive Management Approach for Water Quality Crediting

Lake Tahoe is prized by both residents and visitors for its remarkably clear blue water. This famed lake clarity, however, has been in decline for decades. The Lake Tahoe total maximum daily load (TMDL), currently being adopted, identifies urban stormwater as the source of 72% of fine sediment (the primary pollutant of concern), 38% of phosphorus, and 16% of nitrogen pollutant loading (California Water Boards and Nevada Division of Environmental Protection, 2010). However, after investing some \$500 million in water quality restoration, stormwater managers and regulators do not have an understanding of the benefits from the pollutant controls implemented. The Tahoe basin is experiencing what a National Research Council (2008, 2) report, *Urban Stormwater in the United States*, had found across the nation: “the stormwater program has suffered from poor accountability and uncertain effectiveness at improving the quality of the nation’s waters.”

With this knowledge—and funding from a US Environmental Protection Agency Targeted Watershed Initiative Grant—the California Water Quality Control Board, Nevada Division of Environmental Protection, and Tahoe Regional Planning Agency focused on the development of a flexible stormwater program that rewards prioritization, innovation, and

multijurisdictional cooperation. The Lake Clarity Crediting Program (Crediting Program) establishes the framework that connects on-the-ground actions to the goal of restoring Lake Tahoe clarity. It defines a comprehensive TMDL accounting system to track and report pollutant load reductions using Lake Clarity Credits that are a function of the impact of fine sediment, phosphorus, and nitrogen on clarity. Annually increasing credit targets in National Pollutant Discharge Elimination System stormwater permits and memoranda of agreement are used to define achievable goals and drive accountability.

Stormwater managers and maintenance personnel make the frontline decisions that prevent pollutants from entering the lake. Therefore, the Crediting Program puts an integrated set of modeling and condition assessment tools in the hands of engineers and field staff. The program awards credits to jurisdictions that implement and maintain structural and nonstructural pollutant controls where they are most effective. It also allows jurisdictions to distribute credits awarded for load reductions in specific urban catchments to any other jurisdiction in the Lake Tahoe basin, enabling cooperation and water quality trading.