

St. Croix Basin Water Resources

Planning Status Report 2007

Prepared by Randy S. Ferrin

St. Croix Basin Water Resources Planning Team Coordinator

and the

St. Croix Basin Water Resources Planning Team

November 15, 2007



Lake St. Croix above Prescott, WI (photo by R. Ferrin)

Table of Contents

Executive Summary	2
Chapter 1: Introduction: A brief history of the St. Croix Basin Water Resources Planning Team and the 2007 Planning Status Report	4
Chapter 2: A summary of the significant accomplishments of the Basin Team in the years 2005-2006	5
Chapter 3: The redefined mission of the St. Croix Basin Water Resources Planning Team	7
Chapter 4: Basin Team subcommittee activities and accomplishments 2005-2006	9
Chapter 5: A synopsis of the activities and accomplishments of the Basin Team's partner agencies	19
Chapter 6: Looking ahead: a brief summary of 2007 events and issues to track for the 2009 Planning Status Report	34
Appendices	36
Acknowledgements	46

Executive Summary

The St. Croix Basin Water Resources Planning Team (Basin Team) has been addressing complex water resources issues since it was created in 1993. It has long had a focus on the issue of nutrient loading to the river, specifically phosphorus. In 2004, the Basin Team publicly announced its goal of reducing phosphorus and sediment loading to the river by 20-percent by the year 2020. If achieved, this goal will return Lake St. Croix to the ecological conditions found in the lake prior to 1950. In 2006, the lead environmental agencies of the states of Wisconsin and Minnesota endorsed this goal and signed a Nutrient Reduction Agreement.

This 2007 Planning Status Report chronicles the activities and accomplishments of the Basin Team, its subcommittees, and its partner agencies, for the time period January 2005 to December 2006. Since the Basin Team itself has no regulatory authority, these reports are intended to guide water resource decision making, serve as a source of information for funding opportunities, serve as a vehicle to create a unified plan between the two states, and serve as an internal agency document tracking the activities, achievements, and goals of the Team.

The *St. Croix Basin Water Resource Planning Status Report 2001* described the history of water resource management in the St. Croix Basin, examined the water resources of the Basin, and listed other plans developed for the Basin.

The *St. Croix Basin Water Resources Planning Status Report 2003* documented the efforts of the Basin Team in integrative interagency planning and management activities that protect and improve the quality of the surface and ground water resources of the St. Croix River Basin in Minnesota and Wisconsin. The report reviewed the work of the Basin Team since the completion of the Planning Status Report 2001.

The *St. Croix Basin Water Resources Planning Status Report 2005* focused on the development and implementation of water resource goals. One of the chapters detailed the studies and actions that have been completed to address water resource issues. This included a description of the process the Basin Team used to develop its phosphorus and sediment loading reduction goal for the St. Croix Basin. The focus of this report was to document the work of the Basin Team since the completion of the Planning Status Report 2003.

All three Planning Status Reports, and eventually the 2007 report, can be found at www.pca.state.mn.us/water/basins/stcroix/.

St. Croix Basin Water Resources Planning Team Current Membership

Signatory Agencies in Memorandum of Understanding

Minnesota Department of Natural Resources (MDNR)
Minnesota Pollution Control Agency (MPCA)
St. Croix National Scenic Riverway, National Park Service (NPS)
Wisconsin Department of Natural Resources (WDNR)
The former Minnesota-Wisconsin Boundary Area Commission

Cooperating Members

Chisago, Washington, St. Croix, Isanti Counties
Metropolitan Council Environmental Services (MCES)
St. Croix Watershed Research Station-Science Museum of Minnesota (SCWRS)
United States Army-Corps of Engineers (USACE)
United States Geological Survey (USGS)
University of Minnesota (UMN)
University of Wisconsin Extension (UW-Ex)

St. Croix Basin Water Resources Planning Team Staff

Randy S. Ferrin, St. Croix Basin Water Resources Planning Team Coordinator
James Harrison, St. Croix Basin Water Resources Planning Team Conference
Coordinator



St. Croix River near Marine, MN (Photo by R. Ferrin)

Chapter 1: Introduction

A brief history of the St. Croix Basin Water Resources Planning Team and The 2007 Planning Status Report

The Wild and Scenic Rivers Act of 1968, and as amended in 1972, included the St. Croix River in Minnesota and Wisconsin, and its tributary the Namekagon River, in the original list of eight designated riverways. Status as a Wild and Scenic River has been critical in protecting and preserving the scenic, recreational, geologic and biological values of the Riverway along a narrow corridor in and paralleling the river. However, this thin ribbon of protection is threatened by activities outside its boundaries including agriculture, aggregate mining, logging, construction, and tremendous population growth in the Twin Cities Metropolitan area of eastern Minnesota and western Wisconsin. The cooperative management of the Riverway involving Federal and State agencies provided a useful framework for the expansion of efforts to protect the main stem corridor. In 1993, with evidence that conditions in the St. Croix were likely to be degraded, agencies with management interests in the Riverway agreed that protection of the St. Croix required a broader, basin-wide approach to water resource management. Subsequently, a Memorandum of Understanding was signed that year between the Minnesota Pollution Control Agency, the National Park Service, the Wisconsin Department of Natural Resources, the Minnesota Department of Natural Resources and the former Minnesota-Wisconsin Boundary Area Commission. The MOU initiated a planning and collaboration process to better protect the water quality of the St. Croix and called for the formation of the St. Croix Basin Water Resources Planning Team (the Basin Team).

In the ensuing years, other state, federal, and local agencies with an interest in protecting the St. Croix have joined the planning effort. With over twelve agencies now represented, the Basin Team has been active since its inception. The Team's existence has leveraged hundreds of thousands of dollars in funding for water quality studies over the last decade. Several subcommittees, particularly the Nutrient Subcommittee, have provided guidance and direction for water quality protection initiatives. In 1999, six of the agencies participated in a season-long biweekly monitoring program at 27 main-stem and tributary sites. The monitoring, modeling, and trends analyses work of the subcommittee led to an interstate agreement being signed by officials of the Minnesota and Wisconsin water quality regulatory agencies in 2006. In the agreement, the States set a goal of returning Lake St. Croix to the ecological and water quality conditions that existed prior to 1950. The Team is currently working on an implementation plan to achieve that goal. A Monitoring and Assessment Subcommittee has developed a comprehensive monitoring plan for the Riverway and its tributaries. Other subcommittees include the Water Quality Standards Subcommittee and the Funding Subcommittee to help achieve the phosphorus reduction goal. To help meet its education and outreach objectives, the Basin Team has sponsored an annual St. Croix Basin Protection Conference since 2000, drawing well over a hundred participants each year.

Since 2001, the Basin Team has produced a planning status report every odd-numbered year that covers the activities and accomplishments of the Team, its subcommittees, and its member organizations over the previous two years. This is the 2007 Planning Status Report for the period 2005 through 2006.

Chapter 2: A summary of the significant accomplishments of the Basin Team in the years 2005-2006

After the Basin Team announced its goal in 2004 of reducing phosphorus loading in the St. Croix Basin by 20-percent by the year 2020, the Team spent much of 2005 and early 2006 developing a strategy for high-level buy-in by the regulatory agencies in both states. Those agencies with regulatory control over water quality issues were the Minnesota Pollution Control Agency (MPCA) and the Wisconsin Department of Natural Resources (WDNR). The Team decided the best approach was to develop a nutrient reduction agreement that would be signed at the highest level within each of those two agencies. Informational meetings were held so that managers understood the reduction goal and the science that went into formulating it. The goal was proven sound and defensible and the managers recommended to their respective agency heads to move forward on an agreement. In April 2006, the Commissioner of the MPCA and the Secretary of the WDNR agreed to sign the document in a public ceremony at the Sixth Annual Protecting the St. Croix: Reducing and Managing Nutrients and Sediment Conference at the University of Wisconsin-River Falls. The agreement established the groundwork for developing and implementing a nutrient reduction plan, setting site-specific standards for Lake St. Croix, implementing a monitoring and assessment program, and providing staff time and monetary support for the Team's efforts. A copy of the agreement can be found on the following page.

Another noteworthy accomplishment of the Team is the comprehensive Monitoring Plan for the St. Croix River, first completed in 2006 and updated annually. The monitoring plan was developed to track the progress in achieving the nutrient reduction goal. It outlines an optimum monitoring network complete with gaging stations and monitoring sites that identifies where there are gaps in monitoring and avoids overlap. The monitoring plan can be viewed at: <http://www.pca.state.mn.us/publications/wq-b6-03.pdf>

In addition to the Nutrient Reduction Agreement and the Monitoring Plan, the Team continued its success at organizing and sponsoring its annual conference in 2005 and 2006. Both conferences were held at the University of Wisconsin-River Falls and attracted well over a hundred attendees each.

In April 2006, Wisconsin Department of Natural Resources and Xcel Energy (Northern States Power Company) signed a Memorandum of Understanding that achieved a run-of-river operation for the hydroelectric facility dam at St. Croix Falls, Wisconsin. Prior to this agreement, the dam was operated as a peaking dam resulting in drastic daily fluctuations in water levels, especially below the dam which is a zone rich in freshwater mussels. Although not a direct achievement of the Basin Team, the Team had an early role in the process by endorsing a run-of-river operation for the dam and supporting WDNR in its negotiation efforts.

**Wisconsin Department of Natural Resources
Minnesota Pollution Control Agency**

Agreement on Nutrient and Sediment Reduction in the St. Croix River Basin

Preamble

The water resources of the St. Croix River Basin, including Lake St. Croix and the St. Croix National Scenic Riverway, provide scenic beauty, havens for a variety of wildlife, and a wide range of recreational opportunities to the millions of nearby residents of the states of Minnesota and Wisconsin. However, rapid population growth and accompanying land-use changes have adversely affected the water quality and biological diversity of Lake St. Croix and the water resources of the St. Croix River Basin. Given the projected increases in population growth in the St. Croix Basin, these water resources will continue to degrade unless the regulatory and voluntary actions that protect these resources, both inside and outside government, are strengthened.

In 1993, the Minnesota Pollution Control Agency, the Wisconsin Department of Natural Resources, the Minnesota Department of Natural Resources, and the St. Croix National Scenic Riverway (of the National Park Service) officially signed a Memorandum of Agreement establishing the St. Croix Basin Water Resources Planning Team and committing to formulating a joint water quality management plan and working together on river protection efforts.

Since that time, these partners and other state and federal agencies, as well as other interested groups, have worked cooperatively to coordinate planning and management efforts for the protection and improvement of the St. Croix River and the water resources in the St. Croix Basin. In 2004, these efforts culminated in a recommendation by the interagency St. Croix Basin Water Resources Planning Team to set a goal of a 20 percent reduction in phosphorus loading to Lake St. Croix, deemed necessary to reverse water quality and ecological changes which have occurred since 1950 and to prevent nutrient overload of the resource as the population continues to grow. If such a reduction can be achieved, average phosphorus levels in Lake St. Croix are projected to decrease from 50 ug/L currently, to 40 ug/L.

Agreement

This Nutrient and Sediment Reduction Agreement reaffirms the 1993 Memorandum of Agreement commitments to protect and enhance the quality of the St. Croix River. The Minnesota Pollution Control Agency and the Wisconsin Department of Natural Resources accept and endorse the 20% nutrient reduction goal established by the St. Croix Basin Water Resources Planning Team. Further, both states will work together to support this goal, providing staff time and financial resources to develop unified strategies and coordinate efforts to achieve it.

Strategy

The Minnesota Pollution Control Agency and the Wisconsin Department of Natural Resources will work together to accomplish the following objectives:

1. Jointly evaluate and establish water quality standards related to eutrophication which are applicable to Lake St. Croix by the end of 2009;
2. In partnership with the St. Croix Basin Water Resources Planning Team, perform a point and non-point source nutrient loading study and develop an implementation plan by June 30, 2009;
3. Coordinate and improve water quality monitoring and assessment capabilities to track progress on the achievement of the recommended 20% phosphorus loading reduction goal for Lake St. Croix; and
4. Provide continued staff and funding support to the St. Croix Basin Water Resources Planning Team.



Sheryl Corrigan, Commissioner
Minnesota Pollution Control Agency



Scott Hassett, Secretary
Wisconsin Department of Natural Resources

Date: 4/6/2006

Chapter 3: The redefined mission of the St. Croix Basin Water Resources Planning Team

In the original Memorandum of Understanding signed in 1993, the signatory agencies agreed that a Basin Team would be formed and this Team would have five distinct tasks. These tasks were to: 1. Formulate a protection plan; 2. Cooperate with the US Geologic Survey (USGS); 3. Develop a plan of study; 4. Coordinate monitoring; and 5. Act as a public forum. The Basin Team took on these tasks first by identifying priority issues facing the water resources of the basin and then forming subcommittees to address these issues. Early in its history, the Basin Team convinced the USGS to include the St. Croix Basin in its National Water Quality Assessment Program (NAQWA) and the USGS has been a partner agency on the Team on a continuing basis. A water resources management plan was developed through a NPS contract with the University of Minnesota and guided by the Team. Through its quarterly meetings and other communications, partner agencies were informed of on-going monitoring efforts and gaps. In 1999, a multi-agency monitoring program was implemented with mainstem and tributary monitoring every two weeks during the growing season. Finally, an annual conference has provided a public forum for informing the public of the activities of the Team and the issues on which it was working.

The Nutrient Reduction Agreement, signed in April of 2006, provided a new direction for the Basin Team. The four strategies of the agreement became the new strategies for the Team, and four subcommittees were formed or reformulated from existing subcommittees. Below are the four subcommittees and their mission statements. In the next chapter, the activities of these subcommittees and their predecessors over the calendar years 2005-2006 are summarized.

Standards Subcommittee:

- Evaluate and establish water quality goals for Lake St. Croix by the end of 2009.
- Translate water quality goals into definable water quality standards.

Implementation Subcommittee (formerly the Nutrient Subcommittee):

- Perform point and nonpoint loading studies, and develop an implementation plan by June 30, 2009.
- Identify and assess sources
- Prepare recommended load allocations
- Identify implementation strategies and evaluate their effectiveness.
- Emphasize partnerships with local units of government and nongovernmental organizations.

Monitoring and Assessment Subcommittee:

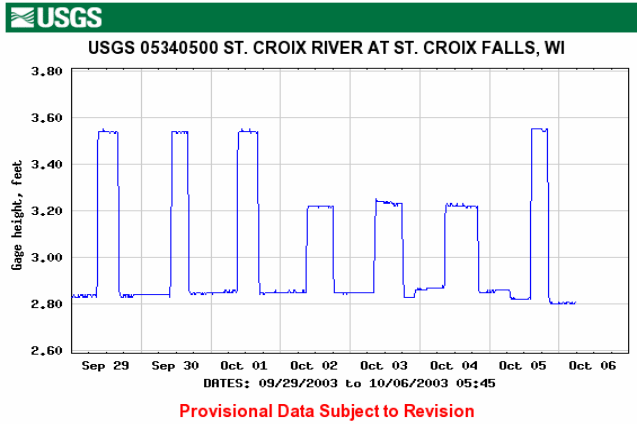
- Coordinate and improve monitoring and assessment capabilities to track progress on achieving water quality goals.
- Annually update and expand the inventory of monitoring activities.
- Prepare an analysis and summary of data (on an annual or biannual basis)

Funding subcommittee (formerly the Finance Subcommittee):

- Ensure continued staff participation and funding support for the Basin Team.
- Work to obtain in-kind and cash contributions from member agencies.
- Identify other sources of funding and assist member agencies and local units in preparing applications.
- Continue and if possible increase funding for the coordinator's position and annual conference.



St. Croix Falls Flowage (Photo by R. Ferrin)



Daily fluctuations below the flowage, prior (top), and after, Run-of-River MOU. Courtesy of the USGS website: <http://waterdata.usgs.gov/wi/nwis/uv?05340500>

Chapter 4: Basin Team subcommittee activities and accomplishments 2005-2006

Funding Subcommittee

2005

The committee submitted a grant proposal to the Environmental Protection Agency's (EPA) Targeted Watershed Program. The focus of the proposal was to provide implementation money for the 20-percent reduction in phosphorus and sediment loading goal. Despite the short time frame to complete the writing of the grant, a detailed proposal was submitted. Four inter-related projects were proposed. The first involved evaluating a phosphorus mass loading cap and establishment of a pollutant trading program, to be hosted by the St. Croix Watershed Research Station. The second project involved on-the-ground implementation of management practices primarily in the watershed of Wisconsin's Willow River, a Clean Water Act 303(d) listed water. Closely linked to this was the third project, which was the design and implementation of pre- and post-evaluation monitoring to refine pollutant reduction efficiencies of specific practices. The fourth project would have funded a watershed approach to educate communities basinwide in their role and to enhance participation in restoring the St. Croix River and its tributaries. The proposal was not selected for funding by EPA but the subcommittee continues to pursue funding from other sources using the basics of the original proposal.



St. Croix backwaters near Scandia, MN (Photo by R. Ferrin)

2006

In early spring, a subgroup was formed to begin developing a grant proposal to EPA. EPA did not issue a call until late in the year for proposals for the EPA Targeted Watershed and Capacity Development Grants. With the endorsement of the subcommittee, the Research Station submitted a proposal for the Capacity Development Grant program. The need to foster political support for the proposal was noted and legislative aides were contacted by the NPS. The Basin Team Coordinator wrote a letter of support for the proposal to EPA.

The subcommittee decided not to develop and submit a Targeted Watershed grant proposal, citing the need to complete modeling predictions first before deciding what practices to implement and where in the Willow, and possibly the Sunrise. A starting outline for a proposal was developed, to be expanded based on model results.

Year 1: Community-based Social Marketing effort to get participation in the project. Identify practices to be implemented and recruit landowners/cooperators through SWAT and SNAP. Monitor pre-implementation water quality and habitat, etc. Gather information for loadings on the targeted watersheds and their sub-watersheds.

Year 2: Begin installing BMPS and continue monitoring. Recruit additional cooperators. Fine tune SWAT or SNAP models if needed.

Year 3: Continue Year 2 activities, plus conduct qualitative and quantitative monitoring of practices installed the previous year.

Year 4: Install additional practices; do post-project monitoring for improvement; draw conclusions on success of project and close out financial obligations.

One additional source of funding was identified using Clean Water Act Section 604b funding through WDNR. <http://dnr.wi.gov/org/caer/cfa/Grants/localwater.html>

Topics were discussed for potential NPS funding including establishment of a gaging station at Prescott to follow the recommendation of the monitoring plan; storm-event monitoring, also recommended in the monitoring plan; monitoring on the Kinnickinnic, Snake, Apple, Willow, and Kettle; TMDL source load analysis; a spill response-time of travel study; and a study to link biological response to nutrients. After further discussion, the consensus was to submit the gaging station proposal and the tributary monitoring proposal.

Implementation Subcommittee

2005

At its January meeting, the Subcommittee discussed strategies for achieving the 20-percent reduction goal. These included: setting mass caps (limits) per media (for example, stormwater, wetland, agriculture), listing Lake St. Croix as impaired under a 303(d) listing, integrating the work on the St. Croix with the TMDL listing of Lake Pepin, waiting for site-specific standards, or building on the interim policy of "no-net increase" by establishing mass caps at the year 2000 actual flow for point sources. Non-point source reduction strategies discussed included: stormwater regulations and BMPs, lake protection through grants for small lakes, wetland restoration, and agricultural BMPs.

Staff from the MPCA and the WDNR began work within their respective agencies to draft an interstate nutrient agreement that would endorse the 20-percent reduction goal. At an August meeting of the Nutrient Subcommittee, the participants agreed on a strategy to include a point and non-point source nutrient load and allocation study in the interstate agreement, with site-specific standards and an implementation plan (the study report to be completed by June 30, 2008), write a stronger statement stating both states endorse the goal and will devote staff and resources to implementing it, and include a statement of support for continued modeling and monitoring to refine implementation steps and track progress on goal achievement.

The USGS started operation of a gaging station on the Willow River downstream of Little Falls Dam to calculate loads for suspended sediment and total phosphorus. It also did load computations for the Apple River at Somerset, and the Kinnikinnic River at River Falls, under a cost share program with the WDNR. The monitoring at these sites spanned two growing seasons. The USGS was also funded by WDNR to begin development of a monitoring plan for the basin.

Construction of a SWAT model was in full swing for the Willow River Watershed. The model program subdivided the watershed into 27 subbasins based on digital data sets of hydrography and topography. Digital land-use data derived from satellite imagery were available for 1992-93; this data set was updated to 1999 conditions to correspond to the year for which stream monitoring data were available for calibration. Between 1992 and 1999, there was a seven percent loss of farmland, so relative areas of hydrologic response units (HRUs, which are areas of uniform land use and soil type) were changed to reflect the conversion of cropland to rural residential developments and forest. Problems with the model began to surface: the model doesn't allow alfalfa to stop growing and reservoirs were not properly ameliorating flood peaks.



St. Croix Falls Flowage (Photo by R. Ferrin)

With the leadership of the USGS, a monitoring plan was under development. Measuring achievement of the 20-percent reduction of phosphorus was the priority monitoring goal.

A spreadsheet was developed which displayed the current monitoring sites, list of analytes, sampling frequency, and years when samples are collected. Stream gaging site needs were identified including one at Prescott at the mouth of the St. Croix and one at the Stillwater boom site to measure the input to Lake St. Croix. Monitoring sites for the National Park Service (NPS) Large River Monitoring Protocol were agreed upon. This subgroup became the Monitoring and Assessment Subcommittee in 2006.



St. Croix River near Scandia, MN (Photo by R.Ferrin)

2006

In January, a modified version of SWAT that allowed alfalfa to rotate properly with other crops was obtained from a colleague at the University of Wisconsin-Green Bay, thus allowing model calibration to proceed. Reservoirs had been improperly parameterized, and use of the “days to reach target storage” option greatly improved the simulated flood peaks, though the snowmelt curve was difficult to match. After gradual parameter adjustment into February, model hydrology was effectively calibrated and the modelers moved on to sediment and phosphorus calibration. Detailed soils data (from the SSURGO data set) were averaged for each hydrologic group within each subbasin and then entered into SWAT. Slopes for each hydrologic response unit (HRU) were determined directly from the digital elevation model, rather than relying on subbasin-average slopes as is the default in the model. The next step was to fine-tune the sediment loading within the tools in SWAT, such as trapping sediment in closed depressions, wetlands, and reservoirs. Phosphorus transport was difficult to reconcile in the program because the overland-transport module partitions phosphorus into different forms than the channel-transport module in SWAT.

By mid-year, the modelers had found serious problems with the SWAT model coding. In addition to the alfalfa problem mentioned above, the model apparently adds an extraneous source of phosphorus to the channel from the uplands in the form of algae, and the model traps all water that infiltrates from topographic depressions rather than

adding it as groundwater recharge to the shallow aquifer. The latter problem was quite serious because closed depressions are a common feature in the Willow River watershed and likely trap a great deal of sediment and phosphorus. While the SWAT model can effectively simulate this trapping, it incorrectly traps the water as well. The best solution to these bugs would be to revise the model FORTRAN code, but that was beyond the scope of this project, at least on a short time frame. Consequently, because the problems couldn't be completely fixed, they had to be avoided. The extraneous phosphorus problem could be avoided by deactivating the channel water-quality routines in SWAT. The entrapment of infiltrated water was compensated for by adding virtual point sources in each subbasin to simulate the contribution to baseflow that should have resulted from this missing infiltration. The "cost" of avoiding these problems was that channel processes were simplified to the point that all channels became simple transport conduits, with bank erosion, sediment deposition, and in-channel nutrient cycling disallowed. In-channel reservoirs, however, still had a great influence on sediment and phosphorus trapping.

Upper Midwest SWAT modelers convened a meeting in Stevens Point, WI in June to discuss such problems with the model. It was confirmed that there were actual flaws in the model code, not just mistakes or problems related to Willow River modeling effort. Problems identified by the group were shared with the SWAT model developers at the USDA-ARS lab in Temple, TX, to see if the faulty routines can be fixed.

Despite its problems, it was felt that SWAT was still the best model for the Basin Team's nutrient reduction application, particularly since, for future projects, the model code can be corrected now that some of its bugs have been identified. Further, it was felt the model should be able to identify the subwatersheds of the Willow that contribute the most storm flow and non-point loads (i.e., those subbasins with the fewest closed drainage areas and riparian wetlands) as starting points for implementing phosphorus-reduction BMPs.

By August, the model was calibrated for hydrology and water quality. The calibration was based on average daily flows and monthly loads of sediment and phosphorus for water year 1999, as measured by the USGS. The primary version of the calibrated model was called the "passive channel" version because it treats the river channel as a passive conduit of sediment and nutrients from the landscape to the watershed outlet. A second version of the model that allows loss of sediment and nutrients to the channel and floodplain was also calibrated; this version was called the "active channel" version of the model. The fact that the model could be calibrated in two distinctively different ways demonstrates that model calibration is not unique. Consequently, caution is needed in interpreting model results, because different versions of a calibrated model may give different results in testing the effectiveness of proposed BMPs. The "passive channel" model was chosen as the primary version to be used, because its relative simplicity will make interpretation of results more straightforward. However, if time permits, other calibrated versions should be tested as well to show possible differences.

SWAT offers a buffer (or filter) strip tool; however preliminary runs indicated that the model results were not realistic, with exaggerated reductions of sediment and nutrient loads. Further, model runs simulating no-till scenarios were also apparently unrealistic, as runoff and sediment loads were not effectively reduced and phosphorus loads increased. The problems were traced to unrealistic residue decomposition and improper parameterization of infiltration. Once again, a colleague from the University of

Wisconsin-Green Bay (Paul Baumgart) provided a modified SWAT model code that calculated crop residue. Based on this new information, residue decomposition could finally be properly tuned, and infiltration and surface roughness could be adjusted to approximate no-till conditions. In December, the model was being once again recalibrated with this new parameterization. A SWAT website provides updated information at <http://www.smm.org/scwrs/tapwaters/>.



St. Croix River at William O'Brien State Park (Photo by R. Ferrin)

Other Activities of the Implementation Subcommittee in 2006

In March, a TMDL conference was held for Lake Pepin. The St. Croix 20-percent phosphorus reduction goal was incorporated into the Lake Pepin goals. A poster highlighting the goal setting process for the St. Croix was displayed at the conference.

In April, the group hosted a presentation on the Wisconsin Buffer Initiative and phosphorus indexing from the University of Wisconsin Soils Department. The Wisconsin Buffer Initiative identified selected areas where additional runoff practices could provide demonstrable benefits including the Willow, the South Fork of the Willow, the Rush, and the Kinnickinnic. The program then was to target fields in these watersheds that would be good candidates for alternative management practices. One early finding was that the phosphorus runoff didn't correlate well with the soil test phosphorus concentration. More information can be found at: <http://www.soils.wisc.edu/extension/nonpoint/wbi.php>

In July, upper level administrators from MPCA and WDNR were invited to the subcommittee's meeting to discuss implementation of the nutrient reduction goal. The science that went into setting the goal was discussed, along with the four objectives of the nutrient agreement, the four subcommittees and their missions, point and nonpoint source planning, SWAT modeling, the monitoring plan, and future activities. It was agreed that an annual meeting should be held with the managers to discuss progress and problems in meeting the nutrient reduction goal.

In October, the subcommittee started looking into the TMDL process and discussed how it fit well with the Nutrient Reduction Agreement's Objective 2 (perform a point and nonpoint source nutrient loading study and develop an implementation plan by June 30, 2009). Because TMDL relate the source of pollution to the desired water quality conditions and establish the allowable loading that Lake St. Croix can receive without exceeding the standards, it provides a foundation for future action. The components of

TMDL development were outlined for the subcommittee and the group began filling in the informational needs for each component.

1. Problem identification, key factors, and background information for a listed water to describe the impairment. a) designated uses and the nature of the impairment; b) available data; c) geographic setting; d) temporal consideration; e) nutrient sources and effects on water quality; f) uncertainties and margins of safety; g) potential control options and regulatory framework.

2. Identification of measurable water quality indicators and an achievable numeric target: a) Applicable water quality standards; b) Measures of water quality and ecological conditions; c) Target values and comparison to existing conditions.

3. Source assessment of all point and nonpoint sources, type, location, magnitude, and TP delivery: a) Identification of general source categories and the regulatory framework; b) Techniques for estimating source loads; c) Phosphorus delivery characteristics for each group; d) Specific sources, characteristics, and contribution by sector.

4. Analysis of linkage between water quality targets and sources, a cause-effect relation.

5. Allocations among point and nonpoint sources. (A point source is required to achieve allocation, but nonurban nonpoint is not.)

6. Effectiveness monitoring and evaluation. (Track progress on attaining water quality standards and support revisions to the TMDL.) Monitoring could branch out into programmatic monitoring such as acres treated.

7. The Implementation Plan. (Which includes the following actions: identify and evaluate all total phosphorus control options; integrate and update state and local water quality management plans, and local comprehensive plans and ordinances; issue water quality based permits which are consistent with TMDL allocations; implement nonpoint source controls; enhance state and local education and enforcement programs; and provide cost estimates and time frames.) An Implementation Plan can go beyond five years.

At its November meeting, the group heard a presentation on the Lake Pepin TMDL process and how the St. Croix work fits in. At its December meeting, after lengthy discussion, the group agreed to proceed with a TMDL-type process and to seek funding for a contractor to complete many of the items in the outline.



St. Croix River back channel near East Farmington, WI (Photo by R.Ferrin)

Monitoring and Assessment Subcommittee

2006

This subcommittee was formed in February and its first activity was to develop a spreadsheet which showed the monitoring being done throughout the basin by all of the agencies. This information was also converted into a GIS database complete with maps. The maps and spreadsheet were used to identify gaps where monitoring wasn't occurring.

The monitoring plan was under development through most of the year. The monitoring plan identified four objectives:

- Objective 1.** Monitor nutrients and other parameters to determine ambient water quality concentration trends and loadings for the mainstem of the St. Croix River and Lake St. Croix.
- Objective 2.** Determine nutrient loadings from selected tributaries, in order to develop and track progress on tributary nutrient management goals.
- Objective 3.** Monitor algal indicators in Lake St. Croix (algal composition, bloom frequency, intensity and chlorophyll a concentrations) and in strategically-selected mainstem and tributary locations (algal composition and chlorophyll a concentrations) to measure progress toward the nutrient reduction goal.
- Objective 4.** Develop and refine mainstem and tributary nutrient models to predict outcomes of various nutrient management scenarios. The first draft of the monitoring plan was issued in late February. Issues not yet resolved included storm event monitoring, and gaps in monitoring to track progress with the nutrient goal. Criteria for prioritizing gap locations were based on information needed to track progress with the goal.

By early spring, the Monitoring Subcommittee had identified the ideal network needed to accommodate the four plan objectives. They had also prioritized the sites for sampling and gaging and identified gaps between the priorities and the current program. The biggest gap remained to be storm event loadings. The group incorporated a periodic review step each year or two for revision and reprioritization. The final version of the plan was presented to the entire Basin Team at its June quarterly meeting. Of particular value, were Figure 3 and Table 1 that show what the priority sites are, and the gaps that need to be filled to achieve all of the monitoring goals. See Appendix 1. An annual update is planned. The monitoring plan can be viewed at the following MPCA website: <http://www.pca.state.mn.us/publications/wq-b6-03.pdf>

Standards Subcommittee

2006

In December, the Standards Subcommittee felt that standards would be in place by the summer of 2007, if not sooner. There will eventually be site-specific eutrophication standards for Lake St. Croix including total phosphorus, chlorophyll a, and secchi disc. The subcommittee drafted a mission statement that included:

The Subcommittee's Charge: Consider existing and proposed standards and rules to meet the water quality goals of the St. Croix Basin Team with primary emphasis on Lake St. Croix nutrient goal.

Establish a Lake St. Croix eutrophication water quality standard within the context of existing and proposed rules.

Consider implications of Lake St. Croix eutrophication water quality standard on TMDL listing, point source discharges and non point sources.

Inventory federal, state and local authorities that support protection of St. Croix water quality with primary emphasis on Lake St. Croix eutrophication water quality standard.

The expected outcome is a written report documenting inventory of existing and proposed rules as relates to the protection and management of the St. Croix River and Lake St. Croix.

Nutrient and Sediment Conference-Protecting the St. Croix

2005

The sixth annual conference was held at the University of Wisconsin-River Falls with 111 people in attendance. The theme of the conference was "One field and one lot at a time". The nutrient reduction goal setting process was highlighted in a plenary session. The keynote address was jointly given by the MPCA Commissioner and the Deputy Secretary of WDNR. Breakout sessions featured tools for reducing nutrient in urban stormwater, county and township areas, and agriculture. The closing presentation by the Conference Coordinator highlighted the work and passion that went into designating the St. Croix as a Wild and Scenic River.

2006

There were 110 attendees including some student scholarships at the seventh annual conference held again at the University of Wisconsin-River Falls. The conference offered a wide range of presentations on current issues including a panel discussion on the Stillwater Bridge and a keynote presentation on achieving societal acceptance of scientific-based environmental initiatives. One of the most significant events of the conference was the previously mentioned formal signing of the Nutrient Reduction Agreement. Breakout sessions featured talks on protecting water quality amidst agricultural and rural land use changes, and economic and water quality benefits of open space protection.



St. Croix River near Governor Knowles State Forest, WI (NPS photo)

Chapter 5: A synopsis of the activities and accomplishments of the Basin Team's partner agencies for calendar years 2005-2006

Chisago County

2006

The county worked with MPCA to set up a stream monitoring program for continuous flow and monthly chemistry monitoring at the mouths of the Sunrise River and the North Branch of the Sunrise, as well as on Rush, Goose and Lawrence Creeks to help track progress with the reduction goal and do TMDL projects. County staff drafted a monitoring plan for the county and started sampling in the summer.

A TMDL study was initiated on the North Branch of the Sunrise and the Sunrise. The North Branch was the beneficiary of a Clean Water Legacy Act grant of \$90,000 and an AgBMP loan of \$25,000, the funds to be directed at fecal coliform control measures. County staff worked on securing funding from the Corps of Engineers for a study on the Sunrise.

The county issued a five-year water plan that went out for public comment and was sent to state agencies for review. The plan included an endorsement of the twenty-percent reduction goal, and had several tasks identified that correlate with each of the implementation steps in the signed Nutrient Reduction Agreement. A link to the county's website is <http://www.co.chisago.mn.us/> and search for water plan. Editor's note: it is a large file.

Great River Greening

2006

This non-profit group reported at the Basin Team's December quarterly meeting. Tapping several funding sources including a federal 319 grant through the MPCA, they developed a St. Croix Healthy Waters Initiative. The initiative's goals are to improve water quality in the St. Croix, help to achieve the twenty percent reduction in phosphorus goal, demonstrate BMPs for ravine, slope, and streambank stabilization and stormwater infiltration and treatment, and teach landowners and the public how to improve and protect the ecological condition of the land and river. They hope to have 20 BMP demonstration projects in their two-year window. They are able to do work in Wisconsin and the Willow River was suggested as a candidate for work. They needed local partners to feed projects into the system. Of the nearly half-million dollars secured by grants, landowners needed to contribute to match \$150,000.

Metropolitan Council-Environmental Services

2005

The two long-term MCES water quality monitoring sites at Stillwater and Prescott were sampled weekly for analysis of a core group of water quality variables, but nutrient-related variables were only analyzed biweekly. See Appendix 1 for the location of the sites.

Volunteer monitoring on Lake St. Croix was reactivated after a two-year hiatus. Four sampling locations were covered by the same volunteers as in the period 1999 – 2002 and a fifth site was added near Carpenter Nature Center. MCES initiated a new monitoring protocol that allowed the samples to be field filtered, stored in freezers, and picked up twice per season. The following variables were monitored: physical condition rating; recreational suitability rating; secchi depth; total phosphorus; total Kjeldahl nitrogen; and chlorophyll. Throughout the May-September 2005 period, volunteers conducted biweekly monitoring.

2006

The two long-term MCES monitoring sites at Stillwater and Prescott were sampled weekly for analysis of a core group of water quality variables, but nutrient-related variables were only analyzed biweekly. See the following website for more information: <http://www.metrocouncil.org/environment/RiversLakes/Rivers/index.htm>

Lake St. Croix volunteer monitoring was active for its sixth year. Samples were obtained at five sites on a biweekly basis, from mid-May through the end of September. The five sites were located near Bayport, Hudson, Troy Beach, south of Afton, and the Carpenter Nature Center. Eight to ten samples were obtained at each site, with analysis for total phosphorus, total Kjeldahl nitrogen, and chlorophyll. The MCES laboratory analyzed all samples. Field measurements at each site included physical condition rating, recreational suitability rating, and secchi depth. Although a dry, low-flow year, concentrations of phosphorus and chlorophyll were at or slightly above water quality goals. One volunteer obtained dissolved oxygen and temperature profiles at several locations in Lake St. Croix.

MCES staff computed pollutant loads (including nutrient loads) for all of the Metro Area tributaries it has been monitoring since 1988, including four St. Croix River tributaries that have been monitored since 1995. The loading data are being used to develop target pollutant loads for most Metropolitan Area watersheds. To avoid duplication of effort with the TMDL program at the MPCA, MCES and the MPCA signed an MOU to work together on TMDL development for Metro Area streams, with MCES providing monitoring and SWAT modeling expertise.

The 2006 St. Croix River monitoring plan identified a high priority need for flow gaging of the St. Croix River at Prescott and Stillwater. In 2007, MCES and the USGS will be implementing a three-year cost-share agreement that will allow the USGS to establish and operate a flow gaging station at Prescott. The gage is now active and providing daily-updated readings at:

http://waterdata.usgs.gov/mn/nwis/uv?cb_00045=on&cb_00065=on&cb_00055=on&cb_00011=on&format=gif_default&period=7&site_no=05344490

Since USACE river stage measurements are already available at Stillwater, MCES will be obtaining rating curve measurements at this site in 2007, so that the stage measurements can be translated to daily flow estimates. For daily river levels at Stillwater see the USACE website at:

<http://www2.mvr.usace.army.mil/WaterControl/stationinfo2.cfm?sid=STLM5&fid=STLM5&dt=S>

Minnesota Department of Agriculture

2005

The Minnesota Legislature passed legislation restricting the use of phosphorus in lawn fertilizer statewide. Restriction on phosphorus fertilizer use on lawns and turf started in 2004 in the seven county Twin Cities metro area and in Minnesota's other 80 counties in 2005. As of January 2007, Minnesota is the only state in the nation which regulates phosphorus fertilizer use on lawns and turf. For more information visit the following website:

<http://www.mda.state.mn.us/protecting/waterprotection/phoslaw.htm>

Minnesota Department of Natural Resources

2005

The MDNR printed a page-sized poster of the nutrient work of the Basin Team as an educational flyer. The poster was developed by the WDNR and the University of Wisconsin-Extension. MDNR also published a four-page educational brochure on "bluffs as a resource" that discussed the value of bluff lands along the St. Croix, along with bluff conservation and best management practices. Several thousand copies were produced.

A St. Paul Pioneer Press article covered the MDNR's annual inspection trip on the river looking for building violations and stressed the need for continued stewardship.

2006

References to the Nutrient Reduction Goal were common in reports and proposals coming into the MDNR office.

The Lower St. Croix Management Commission met in September after almost two years without meeting. A presentation on the nutrient reduction goal and basin team activities was made by the Basin Team Chair.

A new Commissioner, Mark Holsten was appointed by the Governor. He previously served as the Deputy Commissioner and prior to that as a state legislator.

Minnesota Pollution Control Agency

2005

MPCA was expecting to adopt numeric lake eutrophication standards (nutrient standards) by the end of 2005. Lake standards adoption was being undertaken as part of the agency's triennial review of state water quality standards. Lake standard adoption will be for four of the seven ecoregions in Minnesota (Northern Lakes and Forest, North Central Hardwood Forest, Western Corn Belt Plains and Northern Glaciated Plains Ecoregions). Numeric standards will be established for total phosphorus, chlorophyll a, and secchi disc transparency. Additionally it was anticipated that the rule will permit establishing site specific criteria for lakes, reservoirs and shallow lakes that lie on the border between two ecoregions, or are located in the Red River Valley, Northern Minnesota Wetlands or Driftless Area Ecoregions (remaining three of seven ecoregions in Minnesota). Site specific criteria establishment was anticipated for Lake St. Croix.

A TMDL study was started on the Groundhouse River in Kanabec County in Minnesota. It was assessed as having impaired fish and macroinvertebrate communities and high fecal coliform bacteria levels.

The MPCA reported on its biological assessment of the St. Croix Basin using the Index of Biological Integrity. It found 36 percent of the streams in the basin were impaired based on biota. The impairment was primarily due to land use and was most prevalent in the southern most portion of the basin.

Staff from the MPCA and SCWRS met with staff from the Science Museum of Minnesota to discuss methods of using the scientific parts of the nutrients reports for displays on the Mississippi Floor of the Science Museum. A display was constructed by the Museum.

The Minnesota Courts of Appeals ordered the MPCA to revoke an NPDES permit issued for a new regional wastewater treatment facility for the cities of Annandale and Maple Lake. The appeals court based its decision on the requirement that a new or expanding discharge could not increase its contribution of a pollutant or stressor that was the cause of impairment in a downstream water listed on the 303(d) list, until a TMDL was completed. The proposed facility would have added phosphorus above Lake Pepin, which is listed for impaired water quality due to excess nutrients. The Agency appealed the decision to the State Supreme Court and it agreed to hear the MPCA request. While the case was pending, the MPCA could permit new or expanded WWTF discharges in the watershed of Lake Pepin (including the St. Croix) only if they would not increase their phosphorus effluent load above their current permitted levels, or current effluent loading rates if the facility did not have a phosphorus limit.

The Agency made progress with phosphorus standards development. All new or expanding municipal treatment plants that discharge over 1800 pounds of phosphorus per year (based on design flow) were required to meet 1 mg/L as an effluent limit.

2006

The goal setting process and proposed nutrient agreement were presented to upper management at the Agency in early February. They approved of the agreement and recommended the Commissioner sign it.

Work progressed on setting up protocols for site-specific standards.

MPCA biological monitoring (fish and invertebrates) returned to the St. Croix Basin during 2006. This was the first return to a basin as part of a cyclical program started ten years ago. The biological monitoring program piloted a new approach to watershed monitoring on the Snake River watershed. During the first year, biological and outlet monitoring was conducted for 11 subwatersheds in the basin. This was to be followed by a second year of intensive, comprehensive sampling in impaired watersheds. The first-year data was used for 303(d) assessments. The second year data will be used for follow-up TMDL projects. The protocols were under development.

In July, the Agency issued a contract for the services of a part-time Basin Team Coordinator.

The Minnesota Legislature passed the Clean Water Legacy Act providing start-up funding for water quality restoration and protection programs, including impaired waters. The MPCA will receive \$5.03 million of an initial \$15 million appropriation for 2007 to do water quality assessment and to develop TMDLs and TMDL implementation plans.

A new poster on the St. Croix Basin and the Planning Team's water quality goals was completed and was ready for display at meetings and conferences.

Through funding from the Clean Water Legacy Act, the Agency was able to add staff, including a monitoring specialist who will assist with monitoring on the Snake and the St. Croix. Another benefit of the Clean Water Legacy Act was a grant for \$104,000 for an implementation and capacity building effort for a multi-county joint powers commission (IMPACK6). This included six of the nine Minnesota counties with drainage in the St. Croix Basin (Isanti, Mille Lacs, Pine, Aitkin, Chisago, Kanabec).

Brad Moore, a long-term MDNR employee and former Assistant Commissioner was named the new Commissioner of the Agency. Leo Raudys, the former lead of water programs, was named the new Deputy Commissioner.



St. Croix River historic swing bridge near Cedar Bend (Photo by R.Ferrin)

National Park Service

2005

The NPS Inventory and Monitoring Network provided funding to assist the USGS in continuing operation of the gaging stations at St. Croix Falls and Danbury.

Discussion continued about the Stillwater Bridge and the NPS continued to seek funding for SWAT modeling in the St. Croix Basin through the Stillwater Bridge mitigation

program. A draft Section 7(a) determination for the bridge project, (as required by the Wild and Scenic Rivers Act) was developed by the NPS, with a tentative finding of no direct and adverse impact.

Work began on a proposal to study nutrient cycling in backwater areas on the St. Croix.

A NPS funded groundwater modeling effort by the USGS was completed.

The Arrowhead to Weston Powerline Crossing of the Namekagon River was approved with a large mitigation package that included funding for an endowment fund.

There were extremely low water levels in the Riverway during August, 2005. Thousands of mussels were at risk of stranding and may have perished due to the conditions.

Water quality profiles were conducted in Lake St. Croix twice in August by the NPS Regional Aquatic Ecologist. Anoxic conditions were found below 11.5 meters.

A synthesis report on all the water resources work conducted in the past on the St. Croix and other Great Lakes National Park Units was authored by the NPS Regional Aquatic Ecologist and published by the NPS Water Resources Division. The report also identifies information gaps. A pdf version of the report can be found at:

http://www.nature.nps.gov/water/technicalReports/aq_synth_no_links.pdf

The NPS Great Lakes Network Inventory and Monitoring Program issued its draft protocols for monitoring large river systems. The protocols can be viewed at the following website page: <http://science.nature.nps.gov/im/units/glkn/reports.htm>

2006

Under a NPS grant, a Master's degree candidate from the University of Massachusetts began work on anoxic cores from Lake St. Croix. The nutrient cycling and retention in backwaters study was funded (for the St. Croix and Mississippi) with monitoring to start in 2007 for this three-year project. USGS staff from LaCrosse and Minnesota will be the investigators.

A USGS report on the groundwater study funded by the NPS was released (*Development and Application of a Screening Model for Simulating Regional Ground-Water Flow in the St. Croix River Basin, Minnesota and Wisconsin*: USGS-NPS Scientific Investigations Report 2005-5283). It can be downloaded at <http://pubs.usgs.gov/sir/2005/5283>.

Another NPS funded USGS study was also released. The title was "Spatial Variation in Fish-Tissue Mercury Concentrations in the St. Croix River Basin, Minnesota and Wisconsin, 2004" (Scientific Investigations Report 2006-5063). It can be downloaded at the following website: <http://pubs.usgs.gov/sir/2006/5063>

The Lac Courte Oreilles Band contacted the NPS for help evaluating potential impacts to the Pacwawong Flowage wild rice stands from local land use (on the Namekagon River in Sawyer County). NPS and WDNR staff planned to look into this issue. NPS will also look into further monitoring where a cranberry bog discharges to the Namekagon below the flowage.

The three-year backwaters nitrogen cycling study got underway covering both the Mississippi and St. Croix.

The St. Croix River Institute, a joint effort between the NPS and UW-River Falls was announced. The program intends to host guest speakers presenting topics related to the St. Croix to a general audience. The Institute will also try to provide training and tools for school teachers and set up internships for students.

A proposal for a flow gage at Prescott was submitted for potential funding. If the USGS and the Metropolitan Council establish a gage there, the proposal will shift to another gage site.

At a November meeting of the NPS Regional Director and regional park superintendents at Riverway Headquarters, the Basin Team Coordinator presented the Team's phosphorus goal setting process. There will be an Eastern Rivers Conference for the NPS at the end of February, 2007, at Shepherdstown, WV. The Coordinator will make a presentation about the Basin Team as part of a partnership session as well as a March, 2007 presentation at the Lake of the Woods International Water Quality Conference.

St. Croix County

2006

A Water Action Volunteer citizen-based monitoring program was established in the county. Volunteers made observations on wadable streams for macroinvertebrates, dissolved oxygen, streamflow, turbidity, and habitat assessments. A new Watershed Technician and Information and Education Specialist was hired. Three wetlands were constructed above Squaw Lake in the county as part of a BMP for the lake. The County again administered the grant contract for the Conference Coordinator.

St. Croix Watershed Research Station

2005

The Research Station hosts the SWAT modeling program which was discussed above in the Implementation Subcommittee section. For more information see the following: <http://www.smm.org/scwrs/tapwaters/>

Sediment cores were taken of Lake Mallalieu to monitor fine grain suspended load and the study of sediment cores in Lake St. Croix continued.

Protocols for monitoring programs for big river National Park units, such as the Upper Mississippi River and the St. Croix, was under development by the Research Station with funding from the NPS as discussed above. Random and targeted sites will be proposed for monitoring.

The Research Station began a two-year project aimed at understanding water-quality changes in back-water environs of the lower St. Croix River. Paleolimnological methods similar to those used on Lake St. Croix (diatoms in dated sediment cores) were used to reconstruct water quality trends since pre-settlement times to the present. Cores were collected from sites near Osceola and above the Apple River. The completed project was funded from a grant from the NPS.

The Research Station was coordinating a special issue of the *Journal of Paleolimnology*. The issue will discuss how the use of paleolimnology has contributed to decision making and will include the research used to determine the goal of a twenty-percent reduction in phosphorus and sediment loading recommended by the Basin Team. Paleolimnological research on Lake Pepin work will also be included.

The annual St. Croix Watershed Research Station-Research Rendezvous featured over a dozen presentations related to water resource issues of the St. Croix. Abstracts can be viewed at: <http://www.smm.org/scwrs/programs/rendezvous/>

2006

Staff gave a presentation on the Nutrient Reduction Agreement to the St. Croix River Association and issued a newsletter article summarizing how the Basin Team used science to formulate policy in developing the agreement. A copy of the article is included in the Appendix.

Sediment core work was done in backwaters from St. Croix Falls to the mouth of the Apple River. The cores were to be examined for diatoms, wild rice and other spores, etc. to see how the organisms have changed over time. The sample sites were sloughs and backwaters that are not in the main flow of the river.

The annual Research Rendezvous featured fifteen St. Croix water resource related presentations or posters. See their website for abstracts.

U.S. Army Corps of Engineers

2005

The St. Paul District received funds to perform a Reconnaissance-level watershed study for the St. Croix Basin. The reconnaissance phase identifies potential "problems and opportunities" for future consideration and reviews existing data to determine where potential actions might be cost effective within the St. Croix Watershed. During their scoping sessions, the need for watershed planning for urban development and sprawl came up frequently, especially in the lower part of the watershed.

2006

Work progressed on a reconnaissance study for the St. Croix Basin and the study was out for review by late summer. The agency requested potential cost-share projects across whole watersheds or subbasins through letters of intent from interested nonfederal agencies. Such letters were received for Sunrise and Upper St. Croix projects. The draft report recommended several subbasins for further work: the Kinnickinnic, Willow, Apple, Sunrise, Snake, Upper St. Croix above Gordon Dam, and one for the whole basin. The report is available on the USACOE St. Paul District website at:

<http://www.mvp.usace.army.mil/environment/default.asp?pageid=1008>

In a separate effort, a proposal for planning, baseline monitoring and modeling was submitted to the Corps District Office for additional funding. The proposal was one of two forwarded by the District to their headquarters, but the proposal did not get funded.



St. Croix River at Cedar Bend (Photo by R.Ferrin)

U.S. Geological Survey

2005

Monitoring site selection started in the St. Croix Basin as a forested and transitional zone for the National Water Quality Assessment Program. Sampling in the St. Croix Basin may begin the following year.

A three-dimensional groundwater model was developed for Pierce, Polk and St. Croix Counties. The model simulates ground-water flow through aquifers, water withdrawal from wells, and ground-water/surface-water interaction. The model is a tool for evaluating future change scenarios at regional to local scales.

Hydrogeologic characteristics of the St. Croix River basin were compiled to evaluate the susceptibility of ground water to potential contamination. The results were published in U.S. Geological Survey Scientific Investigations Report 2007-5112 (<http://pubs.usgs.gov/sir/2007/5112/>)

A streamflow gauging station on the Namekagon River at Leonards, Wis., was cooperatively funded by the NPS and USGS for the third consecutive year. Data is available at the following USGS website: http://waterdata.usgs.gov/wi/nwis/dv/?site_no=05331833&referred_module=sw

The second year of a two-year fish-tissue mercury study was funded by the NPS.

2006

The USGS announced all current stream flow gages on the St. Croix will be continued into the next year. There was also some match money available for additional gages on

a first-come first-served basis. The backwater nutrient cycling project was funded with the NPS. A similar nutrient cycling project on Valley Creek and associated springs was underway with assistance from the Research Station.

USGS cost-share funding allowed a continuation of Kinnickinnic River flow gaging, with matching funds provided by the City of River Falls, the Kiap-TU-Wish Chapter of Trout Unlimited, and the Kinnickinnic River Land Trust.



Upper Namekagon River near Telemark, WI (NPS photo by B.Karns)

University of Minnesota

2005

The stream classification project for the St. Croix and Namekagon entered the data analysis phase.

In October, the 20-percent nutrient reduction effort was featured at the University's Policy Analysis Conference.

2006

With funding from MPCA, the University conducted an impervious cover/land cover assessment for Pierce, Polk and St. Croix counties.

University of Wisconsin-Extension

2006

UW-Ex continued a project for manure, nutrient, and farm management planning for small farms along with UW-River Falls. Twelve farmers participated this year, the fourth year of implementing this program. With facilitation from UW-EX, the Friends of the St. Croix Headwaters and other watershed groups formed an alliance for St. Croix Headwaters monitoring and protection.

Washington Conservation District

2005

The Conservation District reported it had an extensive monitoring program in the county, including many long-term sites that would provide additional data for the St. Croix monitoring effort (including the mainstem, tributaries, and lakes). Most of these sites have water quality and flow data available.

2006

Water quality data from the WCD was made available to the nutrient and monitoring subcommittees. The District hired a Stormwater Coordinator for a three-year position. Washington County submitted a TMDL request for several lakes. Staff will assist the Metropolitan Council in producing a rating-curve for the Stillwater gage. Staff worked on grant applications for Clean Water Legacy grants and on implementing the Lower St. Croix Cooperative Management Plan.

Wisconsin Department of Natural Resources

2005

A draft MOU between Xcel Energy and the WDNR was submitted to partner agencies and organizations for review. The MOU called for “run of river” operation of the St. Croix Falls dam, and designated a flow rate to be maintained in low flow conditions to provide enough water for downstream aquatic species and habitat. A public review process was held later that year.

Two storm-damaged dams were proposed for removal in the basin including the Polk County Woodley Dam and the Osceola Creek Dam.

The WDNR collaborated with the Army Corps to monitor two sites in the basin: a wetland restoration project on Squaw Lake to help with nutrient reduction and the Horse Creek Lake project on Cedar Lake for nutrient control.

After two years of negotiation the West Wisconsin Land Trust negotiated purchase of all the property around Straight Lake, east of Luck. The property is slated to be given to the state for use as a wildlife area.

Discussions were underway about moving the St. Croix Falls wastewater treatment facility to the north end of town, upstream of the dam.

For the last two years quarterly sampling has been done at Danbury and St. Croix Falls by the WDNR.

Wisconsin’s governor announced a “Conserve Wisconsin” initiative to be worked on over the next legislative session. The initiative included working on legislation to designate the Totogatic River and Headwaters of the St. Croix River as “Wild Rivers” under Wisconsin Law. Public listening sessions were held by the Department and by Senator Bob Jauch in November and December. There was good support for the proposal, as well as for further protection for these reaches.

The list of Outstanding and Exceptional Resource Waters in Wisconsin Administrative Code NR 102 was proposed to be revised. The Natural Resources Board authorized watershed staff to take the proposal out for public hearings in January. This would add a few more streams in the St. Croix Basin to these more protective classifications, including the Totogatic and the St. Croix Headwaters segment (above Gordon, Wisconsin).

2006

By mid-March WDNR administrators committed to signing the nutrient agreement, with the provision for setting standards extended until the end of 2009 (instead of 2007).

EPA released another draft of the NPDES permit for the St. Croix Tribal fisheries facility near Danbury, Wisconsin. WDNR staff continued to assert that effluent limits for the St. Croix as an Outstanding Resource Water need to meet background at the end of pipe, not at the mix point in the St. Croix.

In April, WDNR and Xcel Energy signed a Memorandum of Understanding for maintaining run of river flows below the St. Croix Falls hydroelectric facility. The signing was at Interstate Park at St. Croix Falls, Wisconsin.

WDNR staff worked on an implementation plan for the \$400,000 mitigation package related to the Stillwater Bridge. The plan was to use the money for monitoring and modeling work. For the point source funding portion of the mitigation plan, WDNR expressed the need for communities to plan for facilities that will meet the reduction goal (not just the status quo). This will probably mean removing more than twenty percent from the controllable sources.

Several examples of new technology being used in the basin were reported. The village of Roberts worked on alternative strategies for wastewater treatment and a dairy farm was working on harvesting phosphorus from dairy farm manure to make inorganic fertilizer.

WDNR found many violations on shoreline activities such as grading, filling, dredging, illegal dams, aquatic plant removal, etc. The agency convened a team of staff from waters and enforcement to find ways of addressing the growing number of violations on shorefront property. The team will identify several approaches through education, enforcement, and publicity to try and stem the trend documented in the spring.

The Wild River project was still moving forward (to name the Totogatic and Headwaters segment of the St. Croix as State Wild Rivers). There was a public informational meeting on the proposal in September.

New water quality sampling locations were initiated on a randomized set of locations starting in October. The sites were to be monitored monthly for a year. The sites didn't factor into the monitoring plan, as they were short duration and usually on smaller tributaries.

In December, nearly forty-four new stream segments were classified as Outstanding or Exceptional Resource Waters under Wisconsin Administrative Code NR 102. For the St. Croix Basin, these included:

Outstanding:

Clam River in Polk and Burnett Counties (middle reaches)
North Fork of the Clam in Burnett County
Moose River in Douglas County
St. Croix Headwaters segment in Douglas County
Spruce River in Douglas County
Stuntz Brook in Washburn County
Totogatic River - entire length excepting impoundments

Exceptional:

The Clam River (downstream reaches to the confluence)



Namekagon River at Pacwawong Flowage outlet (Photo by R.Ferrin)

Woodley Dam removal on the Apple River was still underway. The Department was receiving input from tribal entities concerning wild rice behind the dam, before completing the Environmental Assessment Record of Decision.

There was a public hearing on setting the Wisconsin ordinary high water mark(s) on Lake St. Croix. This was a public input opportunity on setting the level (and corresponding point on the shore) from which WDNR and county zoning will measure building setbacks and other zoning criteria. Two elevations were proposed: one above the Hudson railroad swing bridge and one below the bridge.

Stillwater Bridge

2005

Basin Team issues involved with the proposed bridge project included storm water runoff (during and after construction), impacts on wetlands, and off-site development issues. For the proposed alternative, the final bridge elevation would be lower in Minnesota than Wisconsin, so stormwater ponds were being planned in Minnesota to capture runoff from the structure.

MnDOT was aware of the Basin Team's goal for a twenty-percent reduction in phosphorus in the basin, and would like to do a demonstration project to plan for no net increase as a result of the bridge. MnDOT staff realize there will be vast amounts of impervious surface that can result in additional phosphorus runoff from this project after the bridge is built. They would like to look at phosphorus reduction in the watershed to compensate for additions from this project. They don't consider this a mitigation effort; they consider it a separate demonstration project.

Concerns with pollutant trading included the need to remove a similar type of phosphorus (non-point soluble) in the vicinity of the project, instead of removing agricultural or urban (organic/sediment bound) phosphorus elsewhere in the watershed. Removing phosphorus elsewhere in the watershed was considered difficult on a long-term basis.

The team supported a demonstration project that would try to infiltrate short duration and small rainfall events instead of building ponds to store and eventually discharge both large and small events. The project goal would be to capture small rainfall events and the first flush from large events.



The proposed Stillwater Crossing (Courtesy Minnesota Department of Transportation)

2006

Early in the year, a strong mitigation package from the bridge construction project was negotiated with funding earmarked for the Basin Team for specific activities. When available, there will be a five-year time-line for spending the money. The package included \$400,000 for soil and water modeling and monitoring of Lake St. Croix to help implement the twenty-percent phosphorus reduction and \$1.2 million for water resources planning and protection.

MnDOT announced its proposal to do a "water quality" MOU to set up an ad hoc committee to help coordinate the development of water quality permits for the project and consider other related water quality issues (such as a demonstration phosphorus trading project to lessen the stormwater costs associated with the long-term load from the proposed Stillwater Bridge). The intent of the demonstration project was to have no net increase from the total project, and they would like to do this by creating a double phosphorus load reduction off-site. The Nutrient Subcommittee suggested that three to four times the load would be better. This topic was discussed with MnDOT at the August 2005 meeting, and a stormwater infiltration project for the highway corridor leading up to the bridge was suggested. MNDOT was informed of the Team's interest in participating in the ad hoc committee.

By mid-year, the Basin Team found the money agreed to under the MOUs wouldn't be available until 2007 in the best case situation. The Basin Team Chair has a seat on the committee overseeing how the money is spent.

At its December quarterly meeting, the Basin Team was updated on the bridge project by a representative from MnDOT. The representative went over the history of the project that has been in the planning stages for over 35 years. The new crossing will be approximately one mile south of the existing lift bridge, which will remain open for bicycles and pedestrians only. The new bridge will have a unique design; a type never built in the US. The design is called extradosed, with shorter towers, and fewer piers in the water. The Record of Decision for the project was published in the Federal Register in December 2006, which began a 180-day window for any legal action against the project. In 2010 dollars, the bridge will cost \$484 million. Final design will take three years and construction three to six years. There is no funding as yet, but they do have \$25 million to start moving forward. The next federal transportation bill is not scheduled until 2009 or 2010.

The representative discussed potential phosphorus reduction related to the project. On the Minnesota side, there will be a projected nineteen-percent reduction in phosphorus over existing conditions, with a greater percentage reduction in total suspended sediment. On the Wisconsin side, there will be a projected seventeen-percent reduction in phosphorus, and a sixty-percent reduction in total suspended solids. Twenty-six wetlands have been delineated in the project area. Wetland impacts will be mitigated off-site, including work at William O'Brien State Park.

The mitigation package is priced at \$16.5 million, which includes \$400,000 for Basin Team support, and is the largest mitigation package MnDOT has ever done. It was agreed that land use planning would be a good priority mitigation item to happen early rather than after the bridge is built.

The website for this project can be found at:

<http://www.dot.state.mn.us/metro/projects/stcroix/index.html>**006**

Chapter 6: Looking ahead: a brief summary of 2007 events and issues to track for the 2009 Planning Status Report

Although this Status Report covers the period 2005 through 2006, significant events in 2007 are worthy of briefly noting because the events are direct or indirect results of the Basin Team's work during the 2005-2006 period. The eighth annual conference was held in April with 115 attendees. The Monitoring Plan was updated for 2007. A flow gaging station was installed at Prescott by the USGS through a cooperative agreement with MCES. MCES obtained rating curve measurements at Stillwater, to translate USACE stage measurements to flow estimates. A gaging and monitoring station at Norway Point was reinstated by the USGS in cooperation with the NPS. A wastewater pharmaceuticals/personal care by-products study was initiated on the St. Croix by the USGS in conjunction with the NPS. A USGS/NPS backwaters nutrient cycling study conducted monitoring on select backwaters. The NPS Large-Rivers monitoring program targeted the St. Croix for sampling at thirteen sites along the Namekagon and St. Croix. Citizen monitoring and MCES monitoring continued on Lake St. Croix. Algae blooms were noted through the summer. SWAT modeling for the Willow River neared completion. Work continued on the Sunrise on a watershed plan and TMDL process. A spill response strategy was developed for the Taylors Falls to Apple River stretch of the St. Croix.

Perhaps the most significant event of 2007 was the placing of Lake St. Croix on MPCA's draft 303(d) list of impaired waters due to phosphorus and chlorophyll levels that exceed ecoregion-based water quality standards. The Basin Team endorsed this listing as a means of achieving the nutrient reduction agreement. WDNR is also considering listing Lake St. Croix as an impaired water. A nutrient reduction study and implementation plan was underway through a TMDL-type process. The reader is encouraged to stay involved with the process as a stakeholder, as the Basin Team works its way towards meeting the nutrient reduction goal.



Lake St. Croix sailboat race (Photo by R.Ferrin)

Looking ahead, the 2009 Planning Status Report will track the progress of the Basin Team and its subcommittees as they move forward towards the full implementation of the 2006 Nutrient Reduction Agreement. This will include the activities and accomplishments of the subcommittees, including successful funding efforts, implementation of the monitoring plan complete with data assessment, setting site-specific standards for Lake St. Croix, and completion of a phosphorus loading study and evaluation of implementation strategies for the St. Croix Basin.



St. Croix River below Cedar Bend (Photo by R.Ferrin)

Appendices

Map of ideal monitoring network from the Basin Team monitoring plan	37
Table of ideal monitoring network from the monitoring plan	38
Map of 2005-2006 monitoring sites	39
Article: St. Croix Water Quality-Where Science Drives Policy	40
References and websites of interest	43

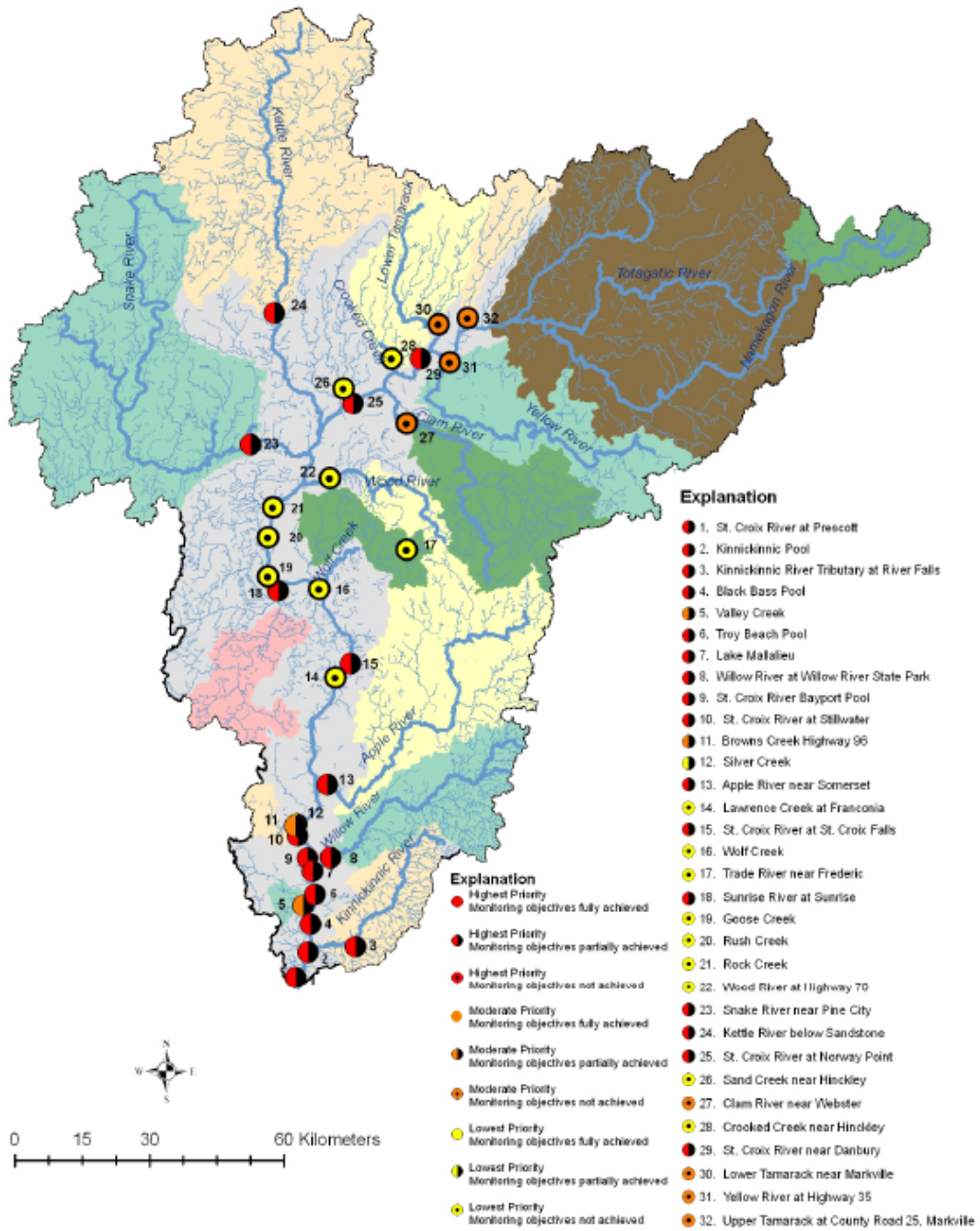


Figure 3. Ideal Monitoring Network St. Croix River Basin, Wisconsin and Minnesota

Table 1. The ideal monitoring network, site locations, water quality constituents, and sampling frequency

Site ID	Modified Water body	Site Loc.	Ditch	Flow ^a	TP ^b	DP ^b	TN ^b	NO ₃ ^b	NH ₄ ^b	TSS ^b	VSS ^b	urb ^c	data ^d	phyto ^e	secchi ^f	Turb ^g	DOC ^h	Total ⁱ	periphy ^j	surfo ^k
28	U St. Croix Falls	Derbury	2.5																	
31	U Yarmouk R.		2.5																	
32	U Yarmouk R.		2.5																	
30	U Yarmouk R.		2.5																	
28	Onondaga Cr.		2.5																	
27	Clam R.		2.5																	
27	Clam Cr.		2.5																	
26	St. Croix R.	Norway Point	1																	
29	Kidde R.	Sardisville	2.5																	
24	Snake R.	Pico City	2.5																	
23	Wood R.		2.5																	
22	Rock Cr.		2.5																	
21	Rush Cr.		2.5																	
20	Goose Cr.		2.5																	
19	Saratoga R.		2.5																	
18	Tripp R.		2.5																	
17	Wolf Cr.		2.5																	
16	St. Croix R.	St. Croix Falls	1																	
15	Lewisville Cr.		2.5																	
14	Apple R.		2.5																	
13	Silver Cr.		2.5																	
12	Boons Cr.		2.5																	
11	Willow R.	Willow R. S.P.	2.5																	
8	Valley Cr.		2.5																	
6	Koyukchick R.	River Falls	2.5																	
3	L. Malheur	Willow R. S.P.	2a																	
7	Lake St. Croix	Sturgeon	2a																	
10	Lake St. Croix	Support Pool	2a																	
9	Lake St. Croix	Tray Beach Pool	2a																	
6	Lake St. Croix	Bank Bass Pool	2a																	
4	Lake St. Croix	Acres Pool	2a																	
2	Lake St. Croix	Prescott	2a																	
1																				

NY

MUTES

Flow measured continuously

Surveys and indicators monitored for turbidity, both baseline (monthly) and stormflow (post-storm) sampling frequency

Surveys in surface waters, sampled once every 3 years

Biological indicators sampled from water column semi-monthly (once per month). May to September

Biological indicators sampled from littoral substrate, collected annually

highest priority

moderate priority

lower priority

not achieved by current monitoring

fully achieved by current monitoring

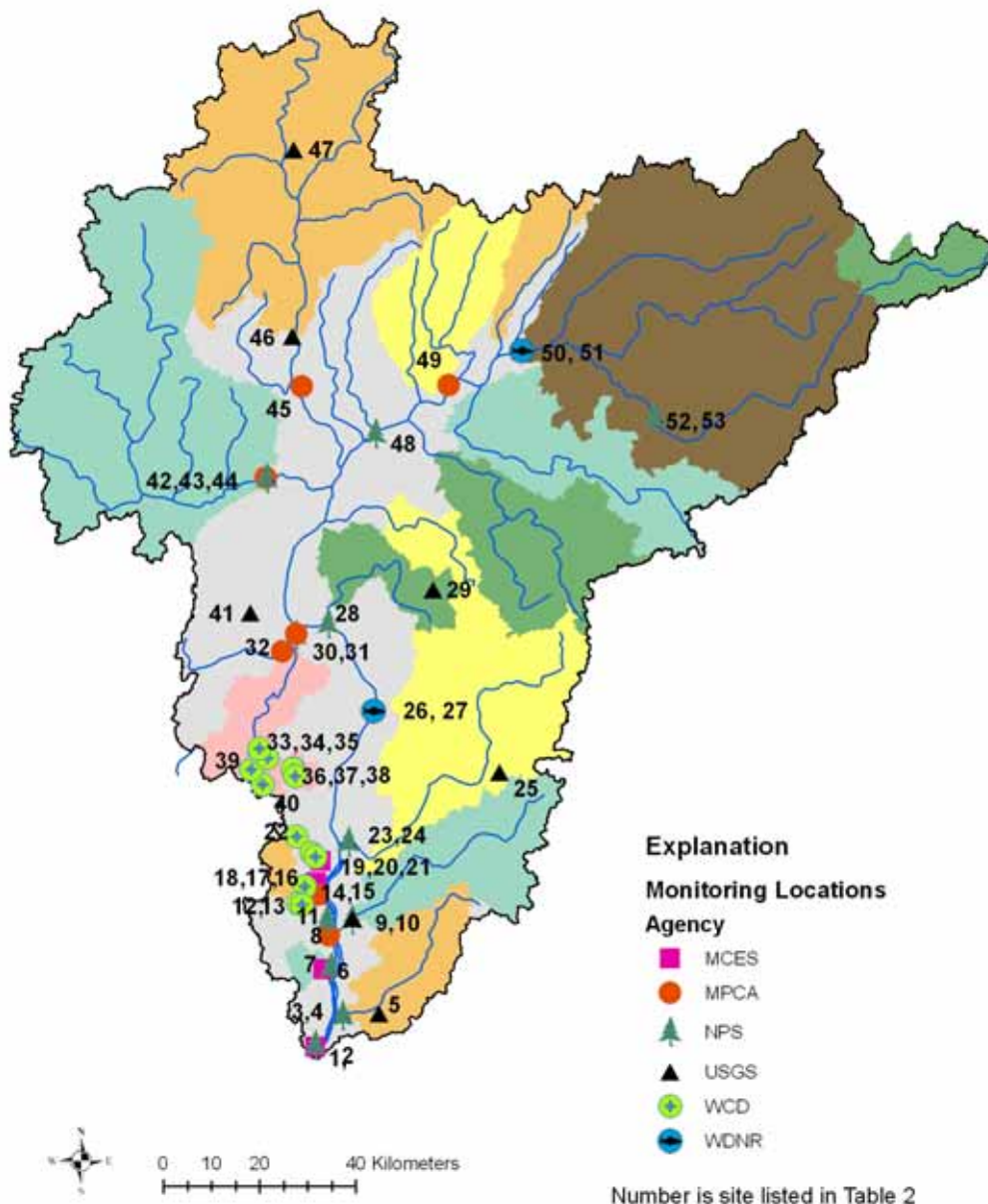


Figure 4. 2005-2006 monitoring site locations, St. Croix River Basin, Wisconsin and Minnesota



St. Croix Watershed Research Station / Spring 2006

St. Croix Water Quality—Where Science Drives Policy

by Daniel Engstrom, Director

Who would have thought it possible? Science—real environmental science—driving a major policy shift for the St. Croix River. Certainly not this skeptical geologist when he joined the staff of the St. Croix Watershed Research Station ten years ago. Seems more common these days to see science suborned to political and ideological ends. But here we are with the States of Minnesota and Wisconsin poised to sign a formal and far-reaching agreement to ratchet back nutrient and sediment inputs to the St. Croix River by something like 20% by the year 2020. Although 20% may not sound like a big deal, it is, as I'll explain in a few moments. But suffice it to say, achieving this target would return the River to conditions that existed prior to WWII when the St. Croix was far cleaner than anything we see today.

So how did we arrive at this turning point, and where does the science come in? Well, to begin with, and as most readers know, the St. Croix was among the first US rivers to be authorized for federal protection under the 1968 National Wild and Scenic Rivers Act. Of course, the protection



The confluence of the St. Croix and Mississippi rivers at Prescott, Wisconsin. Although the St. Croix's water quality looks good in comparison with that of the Mississippi, it too is threatened by excess nutrients and sediment. Photo by David Morrison, MPCA.

afforded by that designation applies only to a narrow corridor along the main-stem of the river—a boundary that water-borne pollutants readily cross. Fortunately, both Minnesota and Wisconsin subsequently declared the St. Croix to have "outstanding" to "exceptional" resource value and in 1993 formally established the St. Croix Basin Water Resources Planning Team (Basin Team), a federal/state interagency

cooperative charged with identifying the major threats to water quality for the entire watershed. The Basin Team quickly recognized that excess nutrients (especially phosphorus) posed a great danger to the ecology of the St. Croix and in 1997 established an interim recommendation of "no net increase of nutrients in permitted discharges." In conjunction with this relatively conservative management goal,

[continued on page 8](#)

continued from page 1

the Basin Team initiated a series of studies to determine baseline (pre-European) water quality, present-day nutrient sources, and the likely outcomes of future management actions.

Probably the single most influential finding from these studies was the discovery that the St. Croix was far less pristine than anyone had imagined—that water quality had been severely degraded by excess phosphorus and that the biology of the river was changing as a result. Up until this time, most people (water-quality professionals and the public alike) considered the St. Croix to be near-pristine, at least in comparison to other major Midwestern rivers such as the Mississippi and Minnesota (see Figure). But these findings—based on the analysis of dated sediment cores from Lake St. Croix by SCWRS scientists Laura Triplett and Mark Edlund—showed that phosphorus levels had risen almost three-fold and that most of this change was relatively recent—coming in the later half of the 20th century (see Field Notes, Summer-2002). And not only were today's nutrient levels higher, but the kinds of microscopic algae that form the base of the aquatic food chain were changed as well; floating and bloom-forming types of algae had become far more abundant, a tell-tale sign that the River's health was heading in the wrong direction.

So what produced this change; where was all this phosphorus coming from and why had it increased so recently (since 1940)? Two different possibilities presented themselves: (1) the intensification of agriculture and widespread adoption of chemical fertilizers after WWII, or (2) the great expansion of municipal wastewater treatment facilities beginning around that same time. To answer this question, the National Park Service funded a follow-up study by Mark Edlund to examine the historical changes in phosphorus inputs from point-source (end of pipe) discharges to the St. Croix. Many readers may be

surprised to learn that there are over 80 permitted waste-water discharges to the St. Croix River and its tributaries, equally distributed between Minnesota and Wisconsin. Using contemporary discharge measurements (only good for the last decade or so), plant operational histories, and estimates of per capita phosphorus



Bill Smith, Deputy Secretary of the Wisconsin Department of Natural Resources and Sheryl Corrigan, Commissioner of the Minnesota Pollution Control Agency, shake hands after signing the historic Agreement on Nutrient and Sediment Reduction in the St. Croix River Basin.

loads, Mark was able to calculate the proportion of the phosphorus entering Lake St. Croix that came from these point sources—as well as that from the non-point runoff—on a decade by decade basis back to around 1900. What he found was quite remarkable; that phosphorus from waste-water discharge became a significant portion of the total load to the river only after 1940, but that even at its peak these end-of-pipe contributions never exceed 25% of the total (and are about 12% today). Phosphorus inputs from diffuse sources—runoff from agricultural and urban landscapes—have been, and continue to be, the dominant source of “cultural” phosphorus to the river. Equally important is the observation that about 40% of the total nutrient load is natural background and is thus not controllable. From this perspective, the 20% reduction goal is indeed ambitious, as it represents a full one-third of the controllable cultural contribution.

Around this same time, scientists with the US Geological Survey were identifying which of the St. Croix's major tributaries were the biggest contributors to phosphorus in run-off. And it should come as no surprise that this list of bad actors includes many of the agriculturally-dominated tributaries in the southern part of the basin—the Willow, Snake, and Sunrise. Although additional years of tributary monitoring are needed to determine how these phosphorus loads are affected by year-to-year climate (rainfall) variations, the results give us a good indication of where management efforts to reduce inputs might deliver the greatest return.

The final component in this scientific tour de force is the ongoing effort to construct detailed watershed-scale models that will predict how future management scenarios might play out for water-quality in Lake St. Croix and throughout the basin. The modeling work, currently headed by SCWRS hydrogeologists Jim Almendinger and Marylee Murphy—under the acronym TAPwaters (Technical Assistance Program for Watersheds)—uses detailed information on land-use, agricultural practices, climate, and underlying geology to simulate tributary flows and outputs of phosphorus and sediment. The models are “tuned” to present-day monitoring data, and then projected into the future by applying different land management scenarios. Again, the purpose of this complicated exercise is to better predict where and how to target management efforts to gain the greatest improvement in the health of the St. Croix.

To bring this story full-circle, in 2004-05 the Basin Team undertook a concerted review and synthesis of these results and came up with a series of recommended goals for protecting water quality in the St. Croix. One of their most important findings was that projected population growth and urbanization in the southern

continued on page 9

8



continued from page 8

part of the basin meant that doing nothing—the status quo—would result in continued deterioration of the river. Other scenarios were considered, such as returning the river to pre-settlement (pre-1850) conditions, or simply holding the line on any further nutrient increases. But in the end the Basin Team recommended a target that envisions a river such as existed around 1940 – just prior to the big changes that Laura Triplett and Mark Edlund discovered in the sediment cores from Lake St. Croix.

These recommendations were eventually forwarded to the two agencies with regulatory authority over St. Croix water quality, the Wisconsin DNR and the Minnesota Pollution Control Agency. Because the implications of the proposed goals are far reaching for things like urban development, agricultural policy, and waste-water permitting, their adoption was not a

....there are very few management plans for large rivers anywhere in the country that begin from such a solid basis of scientific understanding.

foregone conclusion. But, and here is the punch line, because the science behind the recommended goals was so comprehensive and its story so compelling, there was little or no opposition to their approval. In point of fact, there are very few management plans for large rivers anywhere in the country that begin from such a solid basis of scientific understanding.

So on Thursday, April 6th of this year, the heads of the MPCA and WDNR formally

signed a joint Agreement on Nutrient and Sediment Reduction in the St. Croix River Basin. The signing took place at the 7th Annual Conference on Protecting the St. Croix River, on the campus of the University of Wisconsin at River Falls. More than 10 years in the making, this agreement is a tribute to the dedicated efforts of dozens of water-quality professionals on the Basin Team, and a small victory for the power of science to influence public policy. Of course, it is also just a start, and the hard work of putting policy into practice now begins. It will take several more years of monitoring and modeling to figure out where and how our best efforts should be spent and even longer to develop cooperative management strategies that inspire land-owners, citizens, and local units of government to work toward a common goal of preserving the St. Croix River. Solid science is just a beginning...but a good beginning.

Field Season, 2006

This summer of 2006, station scientists will conduct field work in a wide range of locations. Scientific investigations will take our researchers to:

In Minnesota:

- Marcell Experimental Forest,
- Chippewa National Forest
- St. Croix National Scenic Riverway
- Mississippi National River and Recreation Area
- Voyageurs National Park
- Valley Creek, Washington County
- Grand Portage Indian Reservation
- Austin, Mower County
- Minnesota River Basin

In other states:

- Indiana Dunes National Lakeshore, Indiana
- Isle Royale National Park, Michigan
- Sleeping Bear Dunes National Lakeshore, Michigan
- Trego, Wisconsin
- Somerset, Wisconsin

Around the world:

- Northern Ireland

References and websites of interest (links active as of December 2007)

Water plans, monitoring, and summaries:

2004 St. Croix Basin Phosphorus-Based Water-Quality Goals (at MPCA's website):
<http://www.pca.state.mn.us/publications/reports/stcroixbasin-phosreport04.pdf>

Chisago County five-year water plan: <http://www.co.chisago.mn.us/> (search for water plan)

Metropolitan Council-Environmental Services long-term monitoring sites at Stillwater and Prescott: <http://www.metrocouncil.org/environment/RiversLakes/Rivers/index.htm>

St. Croix Basin Water Resources Planning Team's Monitoring Plan at MPCA website:
<http://www.pca.state.mn.us/publications/wq-b6-03.pdf>

St. Croix Basin Water Resources Planning Team's Planning Status Reports for 2001, 2003, 2005, and 2007 at the MPCA website:
www.pca.state.mn.us/water/basins/stcroix/ .

The NPS Great Lakes Network Inventory and Monitoring Program draft protocols for monitoring large river systems: <http://science.nature.nps.gov/im/units/glkn/reports.htm>

Modeling:

Science Museum of Minnesota-St. Croix Watershed Research Station SWAT website
<http://www.smm.org/scwrs/tapwaters/>.

Wisconsin Buffer Initiative and phosphorus indexing from the University of Wisconsin Soils Department. <http://www.soils.wisc.edu/extension/nonpoint/wbi.php>

Data and information sources:

Synthesis of water resource information for the St. Croix National Scenic Riverway at the National Park Service website:
http://www.nature.nps.gov/water/technicalReports/aq_synth_no_links.pdf

The annual St. Croix Watershed Research Station-Research Rendezvous abstracts:
<http://www.smm.org/scwrs/programs/rendezvous/>

The US Army Corps of Engineers St. Croix Basin Reconnaissance Study:
<http://www.mvp.usace.army.mil/environment/default.asp?pageid=1008>

Mercury in fish:

US Geological Survey study "Spatial Variation in Fish-Tissue Mercury Concentrations in the St. Croix River Basin, Minnesota and Wisconsin, 2004" (Scientific Investigations Report 2006-5063): <http://pubs.usgs.gov/sir/2006/5063>

Groundwater:

US Geological Survey groundwater report (*Development and Application of a Screening Model for Simulating Regional Ground-Water Flow in the St. Croix River Basin, Minnesota and Wisconsin*: USGS-NPS Scientific Investigations Report 2005-5283): <http://pubs.usgs.gov/sir/2005/5283>.

US Geological Survey study of hydrogeologic characteristics of the St. Croix River basin and susceptibility of ground water to potential contamination (USGS Scientific Investigations Report 2007-5112: <http://pubs.usgs.gov/sir/2007/5112/>

Flow and river stage information:

US Geological Survey flow data for the St. Croix River at St. Croix Falls, WI: <http://waterdata.usgs.gov/wi/nwis/uv?05340500>

US Geological Survey flow data for the St. Croix River at Prescott in conjunction with Metropolitan Council at the USGS website: http://waterdata.usgs.gov/mn/nwis/uv?cb_00045=on&cb_00065=on&cb_00055=on&cb_00011=on&format=gif_default&period=7&site_no=05344490

Namekagon River flow data from the USGS website: http://waterdata.usgs.gov/wi/nwis/dv/?site_no=05331833&referred_module=sw

Lake St. Croix stage data from Stillwater, from the US Army Corps of Engineers website: <http://www2.mvr.usace.army.mil/WaterControl/stationinfo2.cfm?sid=STLM5&fid=STLM5&dt=S>

Legislation:

Minnesota legislation on phosphorus in lawn fertilizer statewide at the Minnesota Department of Agriculture website: <http://www.mda.state.mn.us/protecting/waterprotection/phoslaw.htm>

Funding opportunities:

WDNR water quality funding source: <http://dnr.wi.gov/orq/caer/cfa/Grants/localwater.html>

Stillwater Bridge:

Stillwater Bridge replacement project at Minnesota Department of Transportation's website: <http://www.dot.state.mn.us/metro/projects/stcroix/index.html>

Acknowledgements

The author thanks the past and present members of the St. Croix Basin Water Resources Planning Team and its subcommittees for their diligence and professionalism in working on the water resource issues of the St. Croix Basin. The Basin Team has been a model of interagency cooperation and collaboration, due in large part to the dedication of its members. This status report is a sampling of the work being done to help protect the St. Croix and its watershed through that cooperation. Special thanks to Craig Affeldt, Basin Team Chair, for his vision of what the Basin Team and its subcommittees should accomplish and for helping to make this status report possible.



Common whitetail dragonfly, St. Croix River backwater (Photo by R.Ferrin)