

Vermont Clean and Clear Action Plan 2010 Annual Report



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**Vermont Agency of Natural Resources
Vermont Agency of Agriculture, Food, and Markets**

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in accordance with 10 V.S.A. §1386(d)**

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Executive Summary

The Vermont Clean and Clear Action Plan was initiated in 2003 with the goal of accelerating the reduction of phosphorus pollution in Lake Champlain and reducing related pollutants in waters statewide. Vermont, in conjunction with our federal, municipal, and non-government partners, has made an unprecedented commitment to Lake Champlain. Under the Clean and Clear program, the state has invested more than \$57 million in its efforts to improve water quality in the lake, and in turn has leveraged an additional \$68 million in federal funding. As a result, the Agencies of Natural Resources, Agriculture, and Transportation have been able to greatly expand their programs to implement the phosphorus loading reductions outlined in the Lake Champlain Phosphorus Total Maximum Daily Load (TMDL), and to address similar water quality needs statewide.

Each year since the initiation of Clean and Clear, these agencies have jointly prepared an annual report describing the broad scope of the Clean and Clear effort and the accomplishments to date. Act 130 of the 2008 legislative session established a requirement that the Agency of Natural Resources continue to submit to the Legislature an annual “*Clean and Clear program summary reporting on activities and measures of progress for each program supported by funding under the Clean and Clear Action Plan.*” This report is submitted in accordance with the requirements of 10 V.S.A. §1386(d).

Center for Clean and Clear

The Center for Clean and Clear was established in May 2007, to enhance Vermont’s commitment to improve water quality in Lake Champlain by placing the resources dedicated to improving water quality in Lake Champlain – resources that are currently spread through many state programs – under a single director.

In 2008, the Center restructured the Ecosystem Restoration Grant Program to guide the award of grants and contracts to support development and implementation of Clean and Clear projects. While budgets for projects vary widely, typical budgets fall between \$5,000 and \$50,000. Since the grant program was restructured, approximately 300 proposals have been received, and the program has awarded funding to over 150 projects.

A revised implementation plan for the Lake Champlain Phosphorus TMDL was sent to the General Assembly on January 15, 2010. As part of the revised implementation plan, a suite of ten programs or projects that should be expanded or initiated first if additional resources become available – the “next ten steps” – were identified. We are pleased to report progress, and often the significant progress that has been made on all ten of the next steps. These efforts, combined with the State’s core programs designed to improve water quality in the Lake Champlain Basin, have focused on the most essential phosphorus reduction needs. In order to build on this momentum, a set of priorities for implementing the Lake Champlain TMDL in 2011 has been established.

The Center also took a leading role in supporting the Lake Champlain Basin Program’s revision of their management plan entitled *Opportunities for Action* (OFA). The Center also worked to ensure a high degree of commonality between the priorities established in the revised TMDL implementation plan and the forthcoming version of OFA. Further, in leading by example, the

Center was able to encourage partners in New York, Quebec, and federal agencies to develop similar commitments.

Agencies of Natural Resources and Transportation Programs

The Agency of Natural Resources administers a broad variety of Clean and Clear programs within the Departments of Environmental Conservation, Forests, Parks, and Recreation, and Fish and Wildlife. The Agency of Transportation administers the Vermont Better Backroads Program in cooperation with the Agency of Natural Resources and other program partners. These programs are aimed primarily at reducing nonpoint source nutrient and sediment pollution, but most have other environmental and economic benefits as well.

Wastewater Discharges

Vermont's long-term commitment to upgrade wastewater treatment facilities for phosphorus removal has resulted in an 84% decrease in wastewater phosphorus loading to Lake Champlain from Vermont facilities since 1991. The total wastewater phosphorus load to Lake Champlain from Vermont's 60 treatment facilities was 20.3 metric tons per year during 2009, the lowest rate on record and well below the aggregate limit of 55.8 metric tons per year specified in the Lake Champlain Phosphorus TMDL. The last municipal facility (Waterbury) still needing an upgrade in order to meet its phosphorus wasteload allocation under the TMDL is nearing completion of the final design phase and is expected to go to construction in early 2011.

River Management

Analysis of stream geomorphic assessment data collected during the first six years of the Clean and Clear Program is providing important insights regarding the condition of Vermont's streams and rivers. Of the nearly 1,400 assessed river miles in Vermont, nearly three-quarters (74%) have become confined to deeper, straighter channels and no longer have access to historic floodplains. In response, the Vermont Agency of Natural Resources has adopted an avoidance strategy to restore and protect the natural stability of rivers and minimize flood damage. River corridor protection has become the primary tool in the Agency's avoidance tool box.

Multiple river corridor protection activities were underway or completed during 2010 in nearly all of the state's 17 major river basins. These activities included Phase 1 and 2 stream geomorphic assessment, river corridor planning, Fluvial Erosion Hazard mapping, project development, and project implementation.

Better Backroads

A total of \$443,379 in Better Backroads Program grant funds was awarded to Vermont towns and other organizations during 2010 for inventories, capital budget planning, and erosion correction projects, including the stabilization of ditches, culverts, and roadside banks. A total of 162 Vermont towns have participated in the Better Backroads Program since 1997 by conducting at least one grant-funded project, including 93 towns in the Lake Champlain Basin. In 2010, six new towns received grants through the program. Since the addition of significantly increased funding from Clean and Clear in 2004, participation by Vermont towns has increased from 26% to 65%, and participation by towns in the Lake Champlain Basin has increased to 74%.

Stormwater Management

The Stormwater Management Program issued 562 permits for new developments or redevelopment projects in 2010, of which 526 were operational general permits. In 2010, Stormwater Program staff conducted 81 operational site visits, of which 57% were generally compliant. The compliance rate is skewed because site visits are often focused on complaint follow-up and known non-compliant sites.

All twelve of the lowland (non-mountain) TMDLs for stormwater-impaired watersheds have been approved by EPA. The implementation of the new Municipal Separate Storm Sewer Systems (MS4) General Permit, currently under review by EPA, in conjunction with the Residual Designation Authority General Permit, will result in a complete regulatory requirement to implement the stormwater TMDLs in the affected watersheds.

With support from the Clean and Clear program, Stone Environmental, Inc. and the Vermont DEC have collaborated on drainage mapping and illicit discharge and detection elimination projects in the Missisquoi, St Albans Bay, Winooski, and Connecticut River basins. Currently studies are ongoing in the Lamoille and Otter Creek river basins. To date, 17 discharges of non-stormwater runoff have been located and have or will be eliminated. In Chittenden County, the twelve regulated entities subject to the Municipal Separate Storm Sewer System (MS4) federal permit have located and eliminated 42 illicit discharges since 2003.

Since the Clean and Clear program began, implementation of municipal stormwater infrastructure improvements statewide has been supported by \$2.39 million in federal matching funds to purchase equipment or construct facilities, \$1.32 million in state matching funds for stormwater impaired watershed improvement projects, and \$5.37 million in federal matching funds for projects that reduce water pollution generated by or directly associated with existing public roads and road maintenance activities.

Erosion Control at Construction Sites

Planned construction disturbance of 1,383 acres was permitted in 2010. This is the lowest value since 2007, and reflects the downturn in construction activity due to economic conditions. In 2010, more than 20% of project review staff resources were dedicated to compliance activities. The Stormwater Management Program conducted a total of 66 site visits during 2010, including 43 projects authorized under the Construction General Permit and 23 authorized under Individual Construction Permits. Fifteen sites were identified in 2010 that did not obtain the required permit before beginning construction, and some permittees did not take sufficient steps to address identified non-compliance issues. In response to instances of significant non-compliance, the Stormwater Program participated in the issuance of approximately seven Notices of Alleged Violation (NOAV) or 1272 Orders during 2010, and was involved in several formal enforcement actions.

Local Municipal Actions

Through the Clean and Clear Action Plan, funds have been provided to the Vermont League of Cities and Towns to support a Water Quality Coordinator to engage and work with towns primarily in the Lake Champlain Basin. This position provides technical assistance to planning commissions, conservation commissions, selectboards, development review boards, zoning boards and professional municipal staff to support water quality enhancements to their zoning

regulations and other municipal ordinances. Due to budget restraints, Clean and Clear grant funding provided to the Vermont League of Cities and Towns ended in June 2010.

During January-June 2010, this position assisted in reviewing existing flood hazard regulations, helped municipalities update their flood hazard regulations for compliance with the National Flood Insurance Program, published articles in the *VLCT News* on fluvial erosion hazard prevention and stormwater best management practices, participated in the Chittenden County Regional Stormwater Education Program, assisted communities in writing flood hazard regulations that exceed minimum national standards, and completed the project development plan for a Model Shoreland District Ordinance which includes standards and guidelines that prohibit unjustifiable un-buffered lakeshore development.

Wetland Protection and Restoration

The Clean and Clear program has dedicated \$1 million to wetland protection and restoration projects since 2005. In addition, changes enacted as part of the 2008 Farm Bill dramatically increased the amount of federal funding available for wetland protection and restoration through the Wetlands Reserve Program (WRP). The 2008 Farm Bill has made millions of dollars available for Vermont projects - representing a five-fold increase in available federal funds. As a result of the unprecedented levels of federal funding and interest in WRP, Clean and Clear has shifted its focus to the active support of NRCS in seeking new sign-ups for WRP. The rate at which wetland protection and restoration projects are being developed and completed has greatly accelerated with the availability of WRP funds. The program had approximately 315 acres of new sign-ups for wetland restoration projects during 2008, an additional 940 acres were enrolled in 2009, and 950 acres in 2010.

Forest Watershed Management

Since adoption of the Accepted Management Practices (AMPs), the Department of Forests, Parks and Recreation has worked with representatives from the Vermont forest industry to support the Agency of Natural Resources Enforcement Division in an effort to reduce the number and severity of water quality violations resulting from timber harvesting operations. In 2010, Department staff provided technical assistance on 60 cases. Department foresters have found that there continues to be a high level of cooperation and voluntary compliance among loggers and landowners to bring operations into compliance with Vermont's water quality statutes.

The Portable Skidder Bridge Initiative provides opportunities for loggers to borrow, rent or receive cost-share assistance to build or purchase portable bridges for temporary stream crossings on log jobs to protect water quality. Demand for bridges and logger participation has been steady. During 2010, loggers working in the Lake Champlain Basin entered into 11 free loan agreements for portable bridges. A total of 437 acres of woodland was accessed and 1,954 cords of wood were transported across portable bridges that were loaned out to loggers participating in the Portable Skidder Bridge Free Loan and Education Program. An additional 14 bridges were rented to loggers participating in the Portable Skidder Bridge Rental Program during 2010. Also, 28 loggers have applied and been approved for cost share assistance to build or purchase forty-one bridges in the Portable Skidder Bridge Cost Share and Education Program.

DEC Watershed Initiative

The goals of the DEC Watershed Initiative are to:

1. Educate people in each watershed or river basin about what they can do to help reduce pollution.
2. Coordinate the various pollution prevention and pollution reduction activities in the drainage.
3. Engage a broad, cross-section of the public in the river basin and its smaller watersheds in establishing priorities and making decisions about the best way to manage and protect waters in the watershed community.
4. Prepare a water quality management plan for each of Vermont's seventeen river basins reflecting those priorities.

In 2010, the five DEC Watershed Coordinators engaged many people across Vermont in forums and meetings designed to generate participation in projects, and developed or substantially assisted with dozens of water quality and aquatic habitat projects in watersheds throughout the state. A more complete enumeration of actions is presented in the Department's 2010 Annual Progress Report on River Basin Water Quality Management Planning, submitted to the Vermont General Assembly in January 2011.

Agency of Agriculture, Food, and Markets Programs

Agricultural Water Quality Regulatory Programs

The Agency of Agriculture manages three water quality regulatory programs, the Accepted Agricultural Practices (AAPs), Medium Farm Operation Rules (MFO), and the Large Farm Operation Rules (LFO). The authority for each of these programs is provided to the Agency through the Vermont Legislature and the programs are managed in conjunction with the Agency of Natural Resources (ANR) through a Memorandum of Understanding. The MOU outlines the responsibilities of each Agency, Agriculture manages non-point source pollution on farms, and the Agency of Natural Resources manages all point source discharges as well as oversees the agricultural non-point source programs.

In 2010, the Agency of Agriculture performed over 120 investigations on small farms to ensure compliance with the AAPs. Three of these investigations were potential point source discharges, and hence were referred to the Agency of Natural Resources per the MOU. The investigations on small farms are in response to a complaint either from the public or from within the Agency. On medium and large farms the Agency performs regularly scheduled inspections to ensure permit compliance. In 2010, 87 inspections were completed on MFO and LFOs which led to 11 enforcement actions. Another 235 technical assistance visits were done to install practices that protect water quality where farmers were interested in correcting the identified issues. In order to follow up on past enforcement actions, 50 visits were conducted by the Agency to ensure continued progress towards compliance.

ANR performed six inspections on medium farms which resulted in three enforcement actions, and they also followed up on the four previous enforcement actions from the 11 inspections performed in 2009. The Environmental Protection Agency (EPA) visits Vermont annually to perform their own farm inspections to make sure the ANR and VAAFPM programs are meeting

the Clean Water Act standards. In 2010 EPA visited 10 medium and large farms and no enforcement actions are pending as a result.

Looking Forward, Developing New Approaches to Implement Practices on Farms

During the 2010 legislative session the Agency of Agriculture was afforded more latitude in how the grant programs are administered. This resulted in eight grants with non-profit partnering organizations totaling approximately \$332,000 to install water quality practices on farms. Specifically the Agency is working with partners to provide more education and technical assistance resources to livestock farms of all types to increase the use of livestock exclusion from surface waters. Current estimates suggest that nearly 3,000 farms including beef, dairy and equine operations could benefit from this practice. The Agency is also working on new practices such as water and sediment control basins (wascobs) and vegetative filter strips along ditches in hopes of developing practices that have benefits for the farm and water quality. Lastly the Agency has worked with the Farmer's Watershed Alliance for several years in implementing on farm practices that are low-tech and low-cost. This approach has been very successful in reaching farms that are less willing to work with the government but have an interest in receiving assistance in installing water quality practices.

Financial Assistance Programs

The Agency manages one program, the Best Management Practices (BMP) program, to support the implementation of production area structures such as silage leachate, clean water diversion, manure management and other water quality related practices. In 2010 the Agency received \$1.6 million and was able to pay on \$1.3 million in installed practices in the same year. In combination to the funding that the Agency provides to farms, the USDA Natural Resource Conservation Service (NRCS) received \$8.8 million in their Environmental Quality Incentives Program (EQIP) of which \$6.4 million was allocated to the same types of production area practices that the Agency of Agriculture is supporting. Many times these two programs join resources to provide a complete cost-share package for the farmer; however the Agency's program can work independently with farmers.

The Agency redefined estimates for the major production area practices in addition to Nutrient Management Plans (NMPs) and livestock exclusion from surface waters as a means to project the need on farms of all sizes in Vermont. The estimated need amounts to approximately \$78 million, of which small farms needs are projected to be \$68 million. In order to address this need the Agency will continue to ensure the medium and large farms comply with permit requirements, inspect all complaints on small farms, and continue to provide resources to the Conservation Districts to provide education and outreach to small farms about the AAPs and connect them with assistance programs to install the necessary practices.

In addition to production area structures, the Agency provides several programs focused on field practices. The Conservation Reserve Enhancement Program (CREP) provides incentives for installing conservation buffers (trees and grass) along rivers and streams throughout the State. To date there are more than 2,400 acres in Vermont and in 2010 additional staff resources through partnering organizations have been hired through Great Lakes Fishery Commission funding. As a result, we expect an increase in enrollment as this program has historically been limited by staffing resources, not funding.

The Farm Agronomic Practices (FAP) program provides cost-share assistance to implement practices that are supported in nutrient management planning such as cover cropping, crop rotation from corn to hay, no-till planting, strip till planting, and several others. Cover cropping has been by far the most popular practice in the program with enrollment increasing each year. In 2010 the Agency did not have enough funding to support the requests of farmers for cover cropping in the fall, which meant there were also no resources available for spring planting practices. One resource this program was so successful in 2010 was the assistance provided by two partner organizations, the Friends of Northern Lake Champlain and the Conservation Districts, who helped to increase enrollment by connecting farmers with the program while providing them education about the practices. These types of relationships are incredibly helpful for a program like this as the Agency does not have a dedicated staff person to reach out to farmers.

The Nutrient Management Plan Incentive Grant Program (NMPIG) provides cost-share assistance to develop and update a NMP. The requests for NMPs has decreased in recent years compared to sign up in 2006 through 2008 when the majority of requests were from MFOs entering into a new realm of regulatory oversight as the MFO program was implemented. Since then there has been more interest in the FAP program to support the practices in NMPs. The funding for FAP and NMPIG are combined within the Agency and as mentioned above, the requests exceeded available funding in 2010. The Agency firmly believes offering financial assistance for farms to implement NMPs is crucial to ensuring farms continue to utilize the plans to improve water quality. The program demand could be increased if grant opportunities to partnering organizations were made available to help small farmers understand the value of a NMP and to work with all farms to ensure the plans are being implemented properly. If funding exists in 2012 the Agency hopes to move in this direction as there are still a lot of farms that could benefit from this program.

Technical Assistance for Water Quality Improvements

The majority of the Agency of Agriculture water quality staff are focused on implementing regulatory programs, however all of the staff are educated on the available technical and financial assistance programs and they offer this information to farmers. The Agency does have 3.5 staff who solely offer technical assistance for water quality improvements, these include a CREP position in northern Lake Champlain and 2.5 engineers, 2.0 of which work statewide and a half-time position who is jointly hired with NRCS and works in Franklin county. In order to provide additional technical assistance to the farming community, the Agency works with partners such as NRCS through contribution agreements to match funding to hire staff resources. Currently these agreements fund three Land Treatment Planners who help gather the necessary materials to develop a NMP and work to ensure contract implementation occurs on previously planned farm practices. The Agency also hires three Agricultural Resource Specialists through the Vermont Association of Conservation Districts who provide education and technical assistance to small farms to help them comply with water quality requirements. Funding for all six of these positions is possible through grants from the NMP/FAP programs.

Alternative Farming Equipment to Improve Water Quality

The Legislature created the Capital Equipment Assistance Program in 2008 to help farmers purchase field equipment that could benefit water quality. The program was allocated \$250,000

to enter into agreements with farmers, who would provide 50% of the equipment costs. Examples of the types of equipment eligible for this program include aerators, and toolbars for manure incorporation, low nozzle manure application and manure injection. Farmers were very interested in this program, however the 50% match limited many from participating. The Agency has not requested additional funding for this program in 2012 as it took two years to allocate the initial funding. However farmers are showing more and more interest in purchasing or retro-fitting equipment to minimize erosion and runoff from their fields. UVM Extension is working under a grant from the Agency of Natural Resources to help farmers retro-fit equipment, and if successful could really help more farmers gain access to equipment without increased financial burdens.

Groundwater Monitoring Program

The Agency of Agriculture has taken more than 6,000 samples from wells throughout the State as a means to monitor the quality of the groundwater around farms. Specifically the Agency tests for nitrates and herbicides which can travel deep into the soil profile and have the potential to contaminate drinking water wells. The Agency has seen a continued decrease in the number of wells where nitrate levels exceed drinking water standards (10 ppm or greater) and in the last decade there have been no wells that exceeded the herbicide drinking water standards (standards vary depending on herbicide detected). The use of nutrient management planning and an industry wide decrease in the amount of herbicides used due to enhanced seed products available are two suspected reasons for these results. The Agency plans to continue monitoring groundwater as long as the EPA funding remains available.

Measuring Progress

The January 2010 Revised Implementation Plan for the Lake Champlain Phosphorus TMDL indicated that the need to develop benchmarks and to account for phosphorus load reductions resulting from program actions will be addressed by the following combination of efforts.

1. Direct monitoring of lake phosphorus concentrations and tributary loading rates
2. Development and tracking of program-specific indicators
3. Watershed modeling
4. Scientific literature review and field studies on management practice effectiveness

The states of Vermont and New York continued during 2010 to jointly conduct the Long-Term Water Quality and Biological Monitoring Program on Lake Champlain with support from the Lake Champlain Basin Program. Using data generated by this monitoring program with new statistical methods, the U.S. Geological Survey presented findings during 2010 showing that while most Lake Champlain tributaries had increasing phosphorus trends during 1990-2000, the pattern reversed during 2000-2008 when 15 out of 18 rivers had decreasing trends in flow-normalized phosphorus concentrations. While these findings need to be confirmed with more years of data collection, it appears that watershed management efforts may be starting to have an effect in reducing phosphorus loading to the lake.

Clean and Clear funds also support the operation of the Vermont Lay Monitoring Program in which volunteers have obtained water quality samples from throughout Lake Champlain and many other lakes statewide every year since 1979. During 2010, these data were made available through a new, on-line Vermont Lake Score Card.

The Revised Implementation Plan for the Lake Champlain Phosphorus TMDL included a preliminary list of program-specific indicators. During the past year, ANR and AAFM staff have worked to refine these indicators in close coordination with concurrent efforts by the Lake Champlain Basin Program to develop an adaptive management process for the lake. Consistent with the adaptive management concept, it will be necessary to define in advance the acceptable levels for each indicator, and to report periodically on the status of the indicators with respect to their ultimate acceptable levels. Progress was made during 2010 in defining specific phosphorus reduction indicators and the data needed to support them. It is anticipated that the 2011 Annual Clean and Clear Report will include a focus on the status of these indicators.

Watershed modeling and management practice effectiveness studies currently underway include a Missisquoi Bay watershed critical source area study to identify critical sources of phosphorus, a stream modeling study to assess the magnitude of streambank erosion as a source of sediment and phosphorus loading in the Missisquoi River watershed, a study of urban best management practices in the Englesby Brook watershed, and a monitoring study of the Rock River Watershed Targeted Watershed Initiative to evaluate the effectiveness of agricultural best management practices.

Introduction

Vermont's Clean and Clear Action Plan was initiated in 2003 with the goal of accelerating the reduction of phosphorus pollution in Lake Champlain and reducing related pollutants in waters statewide. The Clean and Clear Action Plan involves implementation of a suite of programs, most based in either the Agency of Natural Resources or the Agency of Agriculture, Food, and Markets, that support the pollution reduction blueprint forged in the Lake Champlain Phosphorus TMDL, as approved by the U.S. Environmental Protection Agency. In general, these programs are designed to better manage the landscape in order to "turn off the spigot" and reduce the annual load of phosphorus pollution being delivered to Lake Champlain. The state has appropriated \$57 million for Clean and Clear over the first seven years of this effort, and Vermont's commitment to Clean and Clear has stimulated an additional \$68 million in federal funds for supporting programs.

In January 2010, the Agency of Natural Resources issued a Revised Implementation Plan for the Lake Champlain Phosphorus TMDL. This revised implementation plan is now guiding the efforts of the Agency of Natural Resources, the Agency of Agriculture, Food, and Markets, and their many partner organizations to reduce phosphorus levels in Lake Champlain and achieve the targets established in the TMDL.

Each year since the initiation of Clean and Clear, these agencies have jointly prepared an annual report describing the broad scope of the Clean and Clear effort and the accomplishments to date. State law (10 V.S.A. §1386(d)) now directs that *"Beginning February 1, 2009 and annually thereafter, the secretary shall submit ... a clean and clear program summary reporting on activities and measures of progress for each program supported by funding under the Clean and Clear Action Plan."*

To address this requirement, this report provides a program-by-program summary of Clean and Clear funded activities and measures of progress through 2010. Each program chapter includes a description of the phosphorus generating processes that the program is addressing, an overview of the program structure, and a summary of accomplishments during 2010 and previous years. The last chapter discusses how phosphorus reduction progress will be measured.

The new administration's commitment to water quality is strong. The Agency of Natural Resources will continue in its leadership role in managing Vermont's efforts to implement the Lake Champlain Phosphorus TMDL, and will coordinate and collaborate on programs and projects to improve water quality statewide. As evidence of this commitment, one needs only look as far as the proposed FY12 budget, which includes a 30% increase in the funding for the Ecosystem Restoration Grants program.

Center for Clean and Clear

The Center for Clean and Clear (“the Center”) was established in May 2007, to enhance Vermont’s commitment to improve water quality in Lake Champlain by placing the resources dedicated to improving water quality in Lake Champlain – resources that are currently spread through many state programs – under a single director. Over the past three and a half years, the Center has established a functional structure that has resulted in strong lines of communication across programs, departments, agencies, and organizations. Key efforts over the past year are described below.

Ecosystem Restoration Grant Program

In 2008, the Center restructured the framework used to guide the award of grants and contracts to support development and implementation of Clean and Clear projects. The Center established a project review committee (PRC) comprised of ten staff – the Center director, five representatives from DEC’s Water Quality Division, two from the Department of Fish & Wildlife, and one each from the Department of Forest, Parks & Recreation and Agency of Agriculture, Food & Markets (AAFM).

Twice per year, the PRC solicits proposals for ecosystem restoration projects. The PRC is specifically interested in proposals designed to improve water quality, including but not limited to projects that:

- Improve stream stability, incorporate the science of fluvial geomorphology in river corridor management decisions
- Protect against flood hazards, and improve in-stream and riparian habitat, mitigate the effects of hydrologic modification associated with either agricultural operations or urban development
- Protect and restore riparian wetlands, re-establish lake shoreline native vegetation and related shoreline erosion corrections
- Enhance the environmental and economic sustainability of agricultural lands

The first proposal round is generally limited to priority projects identified by state agency staff, or “internal” projects. Although the majority of internal projects are brought forward by ANR staff, proposals have also been received from AAFM, the Agency of Transportation (AOT), the Department of Buildings and General Services (BGS), and the Department of Economic, Housing & Community Development (DEHCD). For example, ANR is partnering with DEHCD to combine Ecosystem Restoration Grant funds with a Downtown Transportation Fund award to the Town of Poultney, for a single project that will both enhance the designated downtown area and address stormwater management considerations.

For the second round, project proposals are sought from Vermont municipalities, local or regional governmental agencies, non-profit organizations, and citizens groups. Individuals and federal agencies are not eligible to receive funds directly, but may partner with an eligible project sponsor. Proposed projects vary from watershed assessment and project identification to restoring and replanting riparian vegetation, to hiring machinery for more extensive construction projects.

In both instances, the proposals are reviewed, ranked, and prioritized by the PRC for funding. While budgets for projects vary widely, typical budgets fall between \$5,000 and \$50,000. Since the grant program was restructured, approximately 300 proposals have been received, and the PRC has awarded partial or full funding to over 150 projects.

Revised TMDL Implementation Plan Revisions

A revised implementation plan for the Lake Champlain Phosphorus TMDL was sent to the General Assembly on January 15, 2010¹. As part of the revised implementation plan, a suite of ten programs or projects that should be expanded or initiated first if additional resources become available – the “next ten steps” – were identified. Because of the cross-cutting nature of the effort necessary to fully implement the Lake Champlain TMDL, the next ten steps drew from and built on programs and projects within the Department of Environmental Conservation (DEC), and in particular the Water Quality Division, as well as the Agricultural Resource Management and Environmental Stewardship program at the Agency of Agriculture, Food & Markets (AAFAM).

We are pleased to report progress, and often the significant progress that has been made on all ten of the next steps. These efforts, combined with the State’s core programs designed to improve water quality in the Lake Champlain Basin, have focused on the most essential phosphorus reduction needs. In order to build on this momentum, a set of priorities for implementing the Lake Champlain TMDL in 2011 are presented first.

Lake Champlain TMDL Implementation Priorities for 2011

- Collaborate with EPA in order to maximize the federal and state resources available to put water quality programs on the ground in Vermont.
 - Cost neutral
- Put in place a mechanism to ensure a dedicated, long-term funding stream for river corridor, wetland, and lakeshore conservation. There are numerous possible strategies for achieving this outcome. In one recent example, Minnesota raised the state sales tax by 3/8 of a percent with the revenue dedicated to efforts to protect and restore water quality in lakes, rivers, streams, and groundwater. Another example can be drawn from the draft federal Water Protection and Reinvestment Act which would assess a number of small taxes on a broad base of those who use water and contribute to water pollution. Specifically, the law envisioned a 3% excise tax on items disposed of in wastewater, such as toothpaste, cosmetics, toilet paper and cooking oil.
 - Revenue generated would be dependent on the strategy employed. It would be important to ensure that any new revenue was used to supplement traditional funding sources and not be used as a substitute.
- Ensure that all state agencies have a consistent approach for managing, regulating and protecting river, stream, and shoreland riparian buffers. Currently different agencies, and

¹ Vermont Agency of Natural Resources. 2010. Revised Implementation Plan for the Lake Champlain Phosphorus TMDL. Submitted to the Vermont General Assembly in accordance Act 130 (2008), Section 2. Waterbury, VT. <http://www.anr.state.vt.us/cleanandclear/news/TMDL%20impl%20plan%20final%20-%20011510.pdf>

even programs within agencies, may have different management strategies, objectives, and/or regulatory thresholds which impact the state's ability to consider comprehensive riparian and shoreland buffer protection measures.

- Cost neutral; ANR would form work group, with AAFM, VTrans, VEM and other effected agencies, to develop specific recommendations for establishing a common framework for evaluating impacts from, as well as managing or regulating activities within riparian buffers and shorelands.
- Develop and implement expanded technical assistance to fully support the forthcoming General Permit for stream alteration activities proscribed in Act 110 (2010), including a training program for consulting engineers.
 - \$200,000 one-time to develop and make available (on an on-going basis) a web-based training program
- Establish a structure for and complete the planning necessary to ensure the significant interest and activity in low impact development (LID) and green infrastructure techniques results in strategic, integrated implementation that maximizes water quality benefits. One strategy could be to link the adoption of LID ordinances at the local level with a degree of relief from stormwater regulations, similar to benefits afforded by Act 250 to towns with appropriate zoning.
 - \$225,000 annually
- Expand technical assistance and regulatory oversight efforts directed at small farm operations. The Accepted Agricultural Practice (AAP) program was not originally envisioned as an inspection-based program, rather investigations were conducted in response to a complaint. It has become clear that a more proactive approach is needed in order to address the water quality needs on small farms and meet the Lake Champlain Phosphorus TMDL; this requires increased capacity at the Agency of Agriculture dedicated to implementing and enforcing the AAPs.
 - \$325,000 annually
- Replenish the Capital Equipment Assistance Program (CEAP) at the Agency of Agriculture, which funds 50% of the purchase cost, up to \$50,000, for innovative equipment that help reduce nutrient pollution associated with agricultural operations. The often significant upfront investment in innovative equipment is often cited as an obstacle to implementation. CEAP helps reduce the financial risk to the producer of making such a purchase, and results in more producers having access to equipment that will help improve water quality.
 - \$100,000 annually (capital funds)
- Establish CEAP-like program to support municipalities interested in the purchase of equipment that can help reduce sediment and nutrient pollution and/or improve stormwater quality. The program would target specific types of equipment – street sweepers, vactors, hydroseeders, sewer cameras – which tend to require a large upfront investment, and therefore limit availability and use of equipment. Program would be designed to encourage equipment sharing-arrangements between jurisdictions.

- \$150,000 annually (capital funds)
- Ensure that publicly-owned wastewater collection and treatment systems have the resources, tools, and technical support to continue to analyze, troubleshoot, inventory, and develop a capital improvement plan for wastewater and stormwater infrastructure assets in order to insure the long-term viability of these critical community assets.
 - \$50,000 annually
- Expand opportunities for residential stewardship. One possible approach would be increased education efforts and tree planting incentives to accelerate the reforestation of open land in Vermont cities and towns through active replanting and emphasizing protection of significant trees during development and redevelopment.
 - \$250,000 annually for technical assistance and incentives

Progress in implementing the “next ten steps” of 2010

- Increase the number of extension personnel (agronomists and nutritionists) available for on-farm technical assistance, education and support.
 - \$550,000 of funding from the Great Lakes Fisheries Commission (GLFC) is being used to hire three agronomists for a period of three years to work on farm nutrient management planning. The Lake Champlain Basin Program has granted these funds to ANR to administer; ANR has worked with UVM Extension and the Poultney-Mettawee Conservation District in developing a strategy for hiring and deploying the agronomists who will be stationed in St Albans, Middlebury, and Poultney. The three agronomists have been hired and will begin work in early-2011.
- Require additional post-construction stormwater management for impervious surfaces using existing stormwater management authorities, such as state operational stormwater permits, MS4 permits, and residual designation authority.
 - ANR is in the process of reissuing the MS4 Permit to replace the current version. A draft of the permit was released on 1/22/2010 for public comment. A revised draft was prepared and, as per EPA’s request, has been sent to EPA for their review and comment. EPA comments are due back to the Agency in January 2011.
- Develop and implement a set of water quality-based design standards and best management practices for road maintenance and drainage and link state transportation funding for municipalities to adherence to the standards.
 - The Lake Champlain Basin Program (LCBP) released a request for proposals seeking a contractor to determine the contribution of rural road networks to phosphorus and sediment loadings and to evaluate the effectiveness of BMPs. \$100,000 is available for this project, and a contract has been awarded to UVM. The work is planned to be completed by the end of 2011.
 - Act 110 (2010) requires: *The agency of transportation shall work with municipal representatives to revise the agency of transportation’s town road and bridge*

standards in order to incorporate a suite of practical and cost-effective best management practices, as approved by the agency of natural resources, for the construction, maintenance, and repair of all existing and future state and town highways. These best management practices shall address activities which have a potential for causing pollutants to enter the groundwater and waters of the state, including stormwater runoff and direct discharges to state waters. A work group has met regularly since May and released draft BMPs for public comment in October, and is on track to present a final version to the Legislature in mid-January 2011.

- Provide technical assistance and financial incentives to encourage municipalities to adopt stream corridor protection that prevents conflicts between streams and infrastructure and provides for stream equilibrium, floodplain function, and vegetated buffers on tributaries and lakeshores.
 - Act 110 (2010) requires: *Beginning February 1, 2011, the secretary of administration, after consultation with the state agencies of relevant jurisdiction, shall offer financial incentives to municipalities through existing grants and pass-through funding programs which encourage municipal adoption and implementation of zoning bylaws that protect shorelands and buffers.* ANR staff have begun outreach to the relevant state agencies, including Emergency Management and VTrans, about the development of financial incentives to municipalities through existing grants and pass-through programs which encourage municipal adoption and implementation of zoning by-laws that protect shorelands, river corridors and buffers.
 - In November 2010, the River Management Program combined its floodplain management and river corridor protection programs into a single entity that will be able to better deliver technical assistance to municipalities, as envisioned in Act 110.
- Expand the Farm Agronomic Practices and Nutrient Management Programs to support increased use of soil erosion reduction practices and alternative manure application techniques, such as soil aeration.
 - Act 110 (2010) makes explicit that funding for the FAP program can be used to support implementing alternative manure application techniques and additional soil erosion reduction practices.
 - Approximately \$450,000 of funding from the GLFC has been used to create two positions through the Vermont Association of Conservation Districts to increase sign-ups for the Conservation Reserve Enhancement Program (CREP) in the Lake Champlain Basin, which seeks to restore and revegetate riparian areas. These new staff resources are located in St Albans and Rutland.
- Increase capacity to provide landowners and municipalities with engineering assistance in the siting and design of infrastructure near or in stream and eliminate the 10 mi² drainage area threshold for issuing stream alteration permits.
 - Act 110 (2010) gives the Agency of Natural Resources the authority to create a general permit for stream alteration activities, and replaces the 10 mi² drainage

area threshold with a perennial stream jurisdictional threshold . The general permit authority will become active on February 15, 2011, and the change in jurisdictional authority will take effect on March 31, 2011. While the expanded jurisdiction creates a huge potential for improved water quality, it does not, by itself, increase the capacity to provide landowners and municipalities with engineering assistance in the siting and design of infrastructure near or in a stream. The Agency has prepared a report for the Legislature (under separate cover) that spells out the structure of a general permit and next steps for increasing technical assistance capacity over time.

- Existing Resources within the River Management Program have been reallocated to increase available engineering assistance and regulatory oversight within the program.
- Provide financial incentives to achieve a minimum width (10 feet) of buffer zone along intermittent streams and ditches that pass through annual cropland.
 - Act 110 (2010) expands the Vermont Agricultural Buffer Program to include providing incentives for conservation practices in ditch networks.
 - LCBP has approved \$95,000 to provide cost-share to farmers wishing to install water and sediment control basins (WASCoBs) at the downstream end of a ditch/tile network. This funding will compliment a recent RFP issued by AAFM also offering cost-share on these structures. WASCoBs have been used for several years in Quebec and have been well received by Quebec farmers.
 - AAFM has committed over \$50,000 for a pilot program which will install a minimum of six wascobs and to establish grassed buffers along four agricultural ditches in the northern Lake Champlain Basin.
- Provide incentives for the use of low-impact development (LID) practices in new and existing development.
 - The first meeting of a “green infrastructure round table” was held May 27th, involving staff from state and local agencies, as well as non-profits and the private sector. The group is focused on outreach, interagency communication, and coordination in the use of LID practices.
 - The Department of Forests, Parks, and Recreation has received a \$150,000 grant from the US Forest Service to support its “Main Streets to Green Streets” initiative. Discussions are on-going about how this effort can dovetail with the promotion of LID and “green infrastructure” through Clean & Clear.
- Provide financial and regulatory incentives to install fencing (temporary and permanent), watering systems, and stream crossings in order to improve management of animals in and around streams and rivers.
 - ANR and AAFM have committed up to \$150,000 to implement on-farm livestock exclusion from surface waters throughout Vermont. Two RFPs have been released soliciting projects involving fencing, alternative watering systems, and stream crossings. To date, more than \$100,000 in grants have been awarded to the Farmers Watershed Alliance, the Missisquoi River Basin Association and the

Winooski Natural Resources Conservation District for project implementation. Additional awards are anticipated shortly.

- Act 110 (2010) clarifies that the construction of temporary fencing intended to exclude livestock from entering surface waters of the state shall be an on-farm improvement eligible for assistance under this subchapter when subject to a maintenance agreement entered into with the agency of agriculture, food and markets.
- LCBP has approved \$200,000 to provide incentives for animal exclusion fencing; this funding was included as part of the FY11 allocation ANR receives from LCBP. ANR anticipates granting these funds to UVM Extension and one or more conservation districts for project implementation.
- Broaden the conservation purposes of and annually expend all funds made available through the Wetland Reserve Program (WRP) and Farmland Protection Program (FRPP) to permanently protect and restore wetlands and stream corridors.
 - A Clean & Clear grant to Ducks Unlimited resulted in the enrollment of more than 900 acres in WRP in the Lemon Fair and Otter Creek watershed in 2010. Additional Clean & Clear funds have been committed to continue DU's project development efforts through July 2011.
 - Act 110 (2010) requires that *in seeking federal farmland protection funds under this subsection, the [Vermont Housing & Conservation Board] shall seek to maximize state participation in the federal wetlands reserve program in order to allow for increased or additional implementation of conservation practices on farmland protected or preserved under this chapter.*
 - Approximately \$225,000 of funding from the GLFC has been provided to NRCS two half-time Wetland Reserve Program Coordinator positions to work on implementing WRP programs in the Lake Champlain basin. One of the positions has been filled and will be based out of the Middlebury NRCS office.
 - USDA-NRCS has recently expressed interest in incorporating river corridor easements on farms that were conserved using FRPP (farm and rangeland protection program) funds; previously NRCS had expressed concerns over issues related to easement subordination so such projects had not been pursued.

Lake Champlain Basin Program - Opportunities for Action

The Center also took a leading role in supporting the Lake Champlain Basin Program's revision of their management plan entitled *Opportunities for Action* (OFA). OFA is more comprehensive than the TMDL implementation plan in that it considers a broader range of issues, including not only the improvement of water quality, but also the protection of habitat and the preservation of the region's cultural heritage. The Center's involvement with OFA focused on the water quality portions of document.

Previous versions of OFA identified broad areas of programmatic need, but stopped short of assigning specific responsibilities and/or program specific indicators. The Center worked with staff in ANR and AAFM to identify specific actions, implementation timelines, and target implementation levels for each of the areas of programmatic need identified by LCBP. The

Center also worked to ensure a high degree of commonality between the priorities established in the revised TMDL implementation plan and the forthcoming version of OFA. Further, in leading by example, the Center was able to encourage partners in New York, Quebec, and federal agencies to develop similar commitments.

The newest version of OFA was released in November 2010, and can be viewed on-line at: <http://plan.lcbp.org/>

Agencies of Natural Resources and Transportation Programs

Wastewater Discharges

The Problem

Untreated wastewater contains high concentrations of phosphorus. Much of the phosphorus in wastewater can be removed through advanced treatment processes. There are 60 wastewater treatment plants discharging phosphorus in the Vermont portion of the Lake Champlain Basin. These facilities include municipal and private industrial plants, and other facilities such as fish hatcheries. Wastewater discharges represent a regulated and readily measurable source of phosphorus to Lake Champlain.

The Program

Vermont has been making capital investments to upgrade wastewater treatment facilities for phosphorus removal for many years. Between 1979 and 2001, before the Lake Champlain Phosphorus TMDL was adopted, 30 municipal facilities in the Lake Champlain Basin were upgraded for phosphorus removal at a capital cost of \$39 million.

State law limits the concentration of phosphorus in the effluent from larger facilities in the Lake Champlain and Lake Memphremagog basins to a monthly average of 0.8 milligrams per liter. In addition, the Lake Champlain Phosphorus TMDL established individual, annual mass loading limits (in metric tons per year) for phosphorus at each wastewater discharge in the basin. Compliance with the loading limits in the TMDL required the additional construction of phosphorus removal upgrades at five aerated lagoon type treatment plants. The state currently provides grants to municipalities for 100% of the capital cost of constructing needed phosphorus removal upgrades.



An advanced wastewater treatment facility.

Program Accomplishments

Richford

This facility upgrade has been completed and phosphorus removal became operational in September of 2006.

Troy/Jay

This project is under construction. To accommodate expansion of the Jay Peak Resort, as well as development in the Town of Jay, the treatment capacity will be increased from 200,000 gallons per day to 800,000 gallons per day. To comply with the current mass limit for the discharge of phosphorus, the enlarged facility will be required to achieve a phosphorus concentration of 0.2 milligrams per liter at full capacity. In order to comply with the facility's discharge permit, which required phosphorus removal implementation by September 30, 2006, the town installed interim phosphorus removal facilities which are allowing them to achieve their stricter permit limits while the facility enlargement project is being completed.

Hardwick

This project, which includes an anaerobic reactor zone in the first lagoon as a pilot project to determine performance and operational benefits that may result, is complete and in operation.

Waterbury

This project is nearing completion of the final design phase and is expected to go to construction in early 2011.

Proctor

This project is complete and became operational in the fall of 2009.

Aerated Lagoon Wastewater Phosphorus Removal Projects in the Lake Champlain Basin			
Facility	Estimated Capital Cost	Phosphorus Reduction (mt/yr)^a	State Fiscal Year of Funding^b
Richford	\$585,000	2.20	2005/2006
Troy/Jay	\$500,000	1.16	2005
Hardwick	\$745,000	2.15	2007/2008
Waterbury	\$4,800,000	2.96	2007-2010, 2012
Proctor	\$520,000	1.89	2009/2010
TOTAL	\$7,150,000	10.36	

^a Reduction in permitted load (metric tons per year).

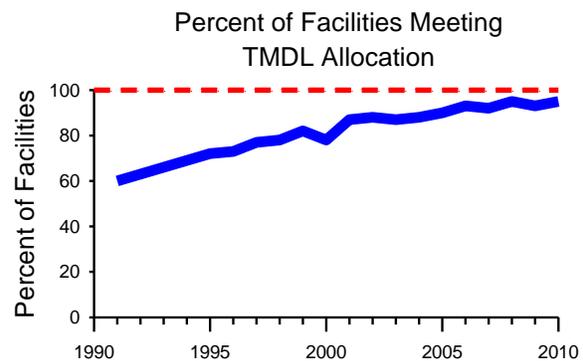
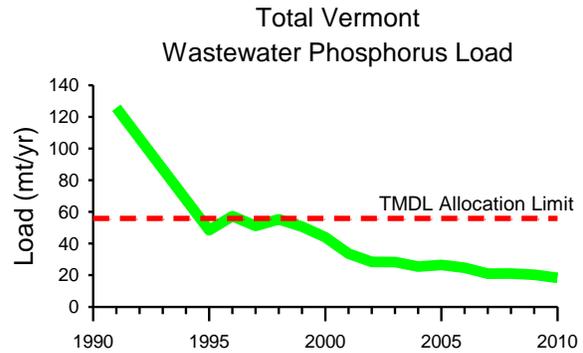
^b Year of actual or proposed appropriation.

Indicators of Progress

As a result of these past investments, phosphorus loading to Lake Champlain from Vermont treatment plants has declined by 85% since 1991. The total wastewater discharge of phosphorus from Vermont is well below the overall TMDL limit of 55.8 metric tons per year, largely because of the improved treatment, but also because most of these facilities are operating below their flow capacity. The total wastewater phosphorus load to Lake Champlain from Vermont wastewater treatment facilities was 18.4 mt/yr during 2010, the lowest amount for any year on record.

Vermont's long-term program to reduce wastewater discharges of phosphorus to Lake Champlain represents a major success story. All but three of Vermont's 60 facilities in the basin achieved their annual TMDL wasteload allocations during 2009. These three discharges included an aerated lagoon plant in Waterbury with an upgrade planned in 2011, a very small discharge in Newport Center, and a summer camp.

During the 1970s, wastewater discharges made up nearly half of the total phosphorus load to Lake Champlain. Recent river monitoring data indicate that Vermont wastewater discharges are now only about 3% of the total phosphorus load to the lake from Vermont.



River Management

The Problem

During the first six years of the Clean and Clear Program, the Vermont River Management Program (RMP) has collected and analyzed stream geomorphic data, which is used to define how and to what degree streams have become unstable. Of the nearly 1,500 assessed river miles in Vermont, nearly three-quarters (74%) have become confined to deeper, straighter channels and no longer have access to historic floodplains. The increased power of larger floods, contained within the channel, has led to higher rates of bed and bank erosion. Millions of dollars are spent annually in Vermont to protect property. These armaments attempt to keep rivers disconnected from their floodplains and static in the landscape. Erosion hazards and flood losses are increasing. One of the most significant new insights is that river management has become a vicious cycle. Flood recovery and structural constraints (i.e., channel straightening, berming and rip-rapping) give a sense of security and lead to developments along rivers where they formerly meandered and flooded. Inevitably, and often decades later, a large flood occurs, structures fail, and the cycle repeats itself. Economic, social, and environmental costs are increasing.



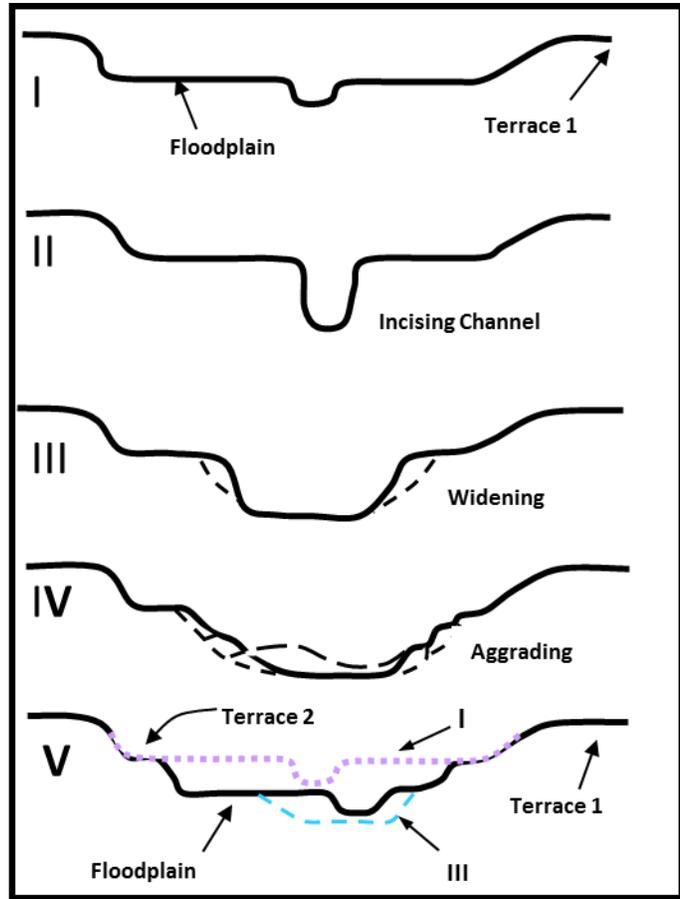
The Rivers Program has evolved with the premise that the cycle must be broken. Otherwise, land-based enterprises will continue to suffer economically because, in addition to erosion hazards, channelization leads to a loss of sediment storage and a net export of life-giving soil and nutrients from a watershed. Rivers that have down-cut and lost access to their floodplains will erode their banks until new floodplains are formed. During the early stages of this channel evolution process, floods remain within deepened channels, and have much more power to erode and carry away anything that enters them. Without floodplains and meanders, it is often the lakes

and reservoirs that are the first quiet waters in which rivers deposit the eroded soil and nutrients. Floodplains are essential to stable streams and sustainable water quality management.

The Program

The Vermont Agency of Natural Resources has adopted an avoidance strategy to restore and protect the natural stability of rivers and minimize flood damage. River corridor protection has become the primary tool in the Agency's avoidance tool box. River corridors consist of lands adjacent to and including the present channel of a river. Delineations are based primarily on floodplain function, the lateral extent of stable meanders, and a wooded riparian buffer to provide streambank stability. Meander widths are governed by valley landforms, surficial geology, and the length and slope requirements of the river in its most probable stable form.

A river is considered stable or in a state of "dynamic equilibrium," if it can adjust its channel geometry (width, depth, and slope) to efficiently discharge, transport, and store water, sediment, and debris without significant aggradation or degradation of its bed (i.e., changes in vertical channel bed position in relation to annually accessed floodplains)^{2,3}. A river requires a sufficient corridor to accommodate equilibrium conditions and the vertical and lateral channel adjustments that occur as the river adjusts to its equilibrium⁴. Failure to provide a sufficient corridor will constrain the river from achieving the equilibrium condition. Thus, managing corridors to accommodate equilibrium and associated channel adjustment processes serves to reduce damages to existing structures and property, avoid new damages, protect public safety, achieve the general health of the river system, and avoid the high



Channel evolution model – 75% of Vermont streams are in stages II – IV.

² Leopold, L.B. 1994. A View of the River. Harvard University Press, Cambridge, MA.

³ Rosgen, D. and L. Silvey, 1996. Applied River Morphology, Wildland Hydrology, Pagosa Springs, CO.

⁴ Brierley, G.J., and K.A. Fryirs. 2005. Geomorphology and River Management: Applications of the River Styles Framework. Blackwell Publishing.

cost to install and maintain channelization practices⁵. Precluding the use of channelization practices, in turn, avoids the unintended consequences of transferring bank erosion and other damaging effects from concentrated flow and vertical channel adjustments to other locations along the river^{6,7,4}.

The RMP is providing river corridor delineations as an important spatial context for restoring and maintaining the river processes and dynamic equilibrium associated with floodplain storage of nutrients and high quality aquatic habitats. River corridors are also intended to provide landowners and town, state, and federal agencies with a science-based river and riparian land use planning and management tool to avoid fluvial erosion hazards (FEH). Reducing current and future near-stream investment and achieving natural stream stability promotes a sustainable relationship with rivers over time, minimizing the costs associated with floods and maximizing the benefits of clean water and healthy ecosystems. Vermont ANR river corridor protection, supported by the Clean and Clear Program, consists of technical and financial assistance to a host of municipal, state, and federal river resource and floodplain management programs, Act 250 floodway protections, municipal fluvial erosion hazard zoning, and river corridor easements.

The restoration of floodplain function and stream equilibrium represents long-term insurance against future flood hazards, climate change, and increased nutrient loading to Lake Champlain. Restoration simply cannot occur if river corridors are developed. It is critical that future land use development patterns recognize the dynamic nature of rivers and floodplains. Since most land use decisions occur at the local level, offering incentives is the most effective way of raising public awareness about river corridor and floodplain values and motivating landowners and municipalities to take proactive steps to reduce property loss, protect water quality, and build greater resilience to future flood damages. Protecting natural processes that maintain water quality and aquatic habitat enables the State to avoid the cost of developing and maintaining artificial structures to capture and retain sediments and nutrients. These actions also represent an important step for the State to combat the ill effects of climate change, particularly in light of the hydrologic models that predict a greater frequency of flash flood events.⁸

Rivers Program components of the 2009 Lake Champlain TMDL Implementation Plan

Three of the ten programs or projects the ANR identified in 2009 as key to moving forward in the implementation of the Lake Champlain TMDL have encompassed primary components of the Rivers Program.

⁵ Piegay, H. et al. 2005. A Review of Techniques Available for Delimiting the Erodible River Corridor: A Sustainable Approach to Managing Bank Erosion. John Wiley and Sons, River Res. Applic. 21: 773-789.

⁶Brookes, A. 1988. Channelized Rivers; Perspectives for Environmental Management. John Wiley & Sons, Chichester.

⁷ Huggett, R.J., 2003. Fundamentals of Geomorphology. Routledge Fundamentals Physical Geography.

⁸ Frumhoff, P.C., et. al., Confronting Climate Change in the U.S. Northeast, July 2007; Groisman P. et., al., Trends in intense precipitation in the climate record. *Journal of Climate*, **18(9)**, 1326-1350.

- Increase capacity to provide landowners and municipalities with engineering assistance in the siting and design of infrastructure near-stream or in-stream and eliminate the 10 mi² drainage area threshold for issuing stream alteration permits.
- Provide technical assistance and financial incentives to encourage municipalities to adopt stream corridor protection that provides for stream equilibrium, floodplain function, and vegetated buffers.
- Broaden the conservation purposes and annually expend all funds made available through the Wetland Reserve Program (WRP) and Farmland Protection Program (FRPP) to protect and restore wetlands and stream corridors.

The 2010 General Assembly passed Act 110 which addressed each of these priority programs. The following Sections of this report provide an update of the Rivers Program progress in addressing these provisions of Act 110.

Regulation and Technical Assistance for Stream Alterations

Act 110 (Sec.14) amended 10 V.S.A. § 1021 to eliminate the 10 square mile threshold for state regulation of stream alterations. Effective February 15, 2011, the ANR Secretary may issue a non-reporting general permit for certain specific stream alteration activities under 10 V.S.A. Chapter 41 (10 V.S.A. § 7501). Act 110 (Sec.16) requires the Agency to report on a general permit program for stream alteration. The report required under subsection (a) shall:

1. Define the thresholds, classes of activities, or other categories of activities that will be regulated under the general permit program.
2. Summarize the requirements or management practices to which stream alteration activities must comply under a general permit, including whether any activity or class of activities will qualify as a non-reporting general permit.
3. Summarize the scientific basis for the thresholds, classes of activities, or categories of activities regulated under the proposed general permit program.

On March 31, 2011, stream alterations will be regulated activities when they change, alter, or modify the course, current, or cross-section of any watercourse (now defined as a perennial stream) or of designated outstanding resource waters, within or along the boundaries of this state either by movement, fill, or by excavation of ten cubic yards or more in any year. All other definitions, thresholds, and exemptions, in 10 V.S.A. Chapter 41, remain in place.

Small streams are often manipulated to the detriment of downstream water quality. Small streams in Vermont that have been channelized often experience higher rates of erosion. In recognition of these impacts, and as part of its 2009 plan to implement the Lake Champlain TMDL, the Agency of Natural Resources sought jurisdiction over small stream alterations. In granting this request, the Legislature recognized the potential need for a general permit to address both the anticipated workload and the regulatory burden. This report was required to ensure that the Agency performed a careful analysis of how a general permit would work in stream alteration regulation.

The Agency has completed a detailed assessment of the Stream Alteration Program and the people it serves, how the change in jurisdiction will affect the Program, and how the program may be supported by the use of a Stream Alteration General Permit. The Agency's findings and

recommendations for a new general permit program are predicated on maintaining program standards for public service, environmental protection, and hazard avoidance.

10 V.S.A Chapter 41 and its amendments acknowledge that when stream alterations are not regulated, there are environmental impacts and a real danger to public safety and the property of others. In recognition of these dangers, and working with people who have little resources to deal with big problems, the program has made itself directly accessible to people. The program's primary objective is to be a presence in the field, where regular and informal interactions between members of the public and program field staff are fostered and maintained. These relations are critically important to maintaining Vermont's hazard-avoidance approach. It is the willingness of the public to seek out and follow the advice of the field engineer which reduces river-related conflicts and therefore the environmental, social, and economic costs associated with stream instability and erosion. When program technical assistance functions are integrally packaged with its regulatory activities, there is a much improved public attitude toward and acceptance of the regulatory function.

The program wants people to use their discretion and call, because if they do not, it means more calls and more non-discretionary enforcement and remediation work for the State in the long run. On average, the program gets between 1,000 and 1,500 calls during the field season, and while far more would benefit, as many as half or more of the calls involve a site visit. The number of actual stream alteration permits issued in a year is a small fraction of the calls, visits, and technical assistance provided to help project proponents understand the eventual river response and the risks they create to the environment, themselves, and their neighbors. Quite often, it is through these face-to-face encounters where stream dynamics are clearly understood, and projects, especially ill-advised or poorly designed projects, are avoided.

Working in streams creates a healthy fear and respect for the power of flood water, where most people want advice from experts, especially if it's provided as a public service; i.e., at minimal or no direct cost. Significant public safety and environmental gains have been accomplished through the relationships and informal networks the program has established; particularly in smaller watersheds (< 10 square miles). A stream alteration general permit program must preserve these gains.

Eliminating the 10 square mile regulatory threshold more than triples the stream miles under Chapter 41 jurisdiction. The Program is already involved, on an informal basis, with many small streams projects. The increased jurisdiction however, will result in more project reviews, permitting, compliance, and enforcement. To avoid turning field staff into desk-bound, permit writers, the Agency's goal is to have a stream alteration engineer in the five ANR regional offices. Decreasing average regional coverage (from 81 towns and 7,600 stream miles to 50 towns and 4,500 stream miles) and adopting a general permit, will allow the program to stay in the field, maintaining the current level of technical assistance.

A stream alteration general permit will be an important regulatory tool and should be developed to include both reporting and non-reporting categories based on project type and watershed size. To maintain the current environmental standards and hazard avoidance outcomes, the following best management practice (BMP) performance criteria will be applied to all stream alterations covered under the general permit:

Equilibrium Standard: The activity does not change the physical integrity of the stream in a manner which departs from, or impedes the attainment of, the channel width, depth, meander pattern, and slope associated with natural equilibrium conditions⁹.

Technical guidance is under development and trainings will be offered to increase the capacity and experience within the regulated and the professional consulting/engineering community to use and comply with the non-reporting General Permit. The ANR field engineers gain experience with river dynamics and conflict resolution each time they deal with a flood and see the environmental damage and human suffering that occur when projects fail. It is their day-to-day field exposure to Vermont river systems and the people and communities that live along them that creates accountability back and forth between the service provider and the communities they serve and supports sustainable relationships at larger natural and economic scales.

River Corridor Management Programs

Act 110 amended 10 V.S.A. § 1427 such that the Secretary of Natural Resources shall establish a river corridor management program and a shoreland management program, effective February 1, 2011, to provide municipalities with maps of designated river corridors and develop recommended best management practices for the management of river corridors, shorelands and buffers. Beginning January 15, 2011 and biennially thereafter, the Agency of Natural Resources shall report to the House Committee on Fish, Wildlife and Water Resources and the Senate Committee on Natural Resources and Energy regarding the status of river corridor, shoreland, and buffer zoning within Vermont. The report shall include:

1. The priority schedule for providing river corridor and buffer maps required by 10 V.S.A. § 1427 and a summary of the implementation of the priority schedule;
2. A summary of the status of best management practices required under 10 V.S.A. §§ 1425 and 1427 for management of river corridors, shorelands, and buffers;
3. A summary of the municipalities that have adopted river corridor, shoreland, or buffer zoning bylaws and a summary of the content of such bylaws;
4. A description of the financial incentives that have been established according to the requirements of 10 V.S.A. §§ 1425 and 1427 for municipal adoption and implementation of zoning bylaws that protect and preserve river corridors, shorelands, and buffers; and
5. The agency of natural resources' recommendations for statutory changes, regulatory changes, or additional practices that, based on information available to the agency of natural resources, will improve the efficacy of the river corridor management and shoreland management programs and improve the quality of the waters of the state.

Act 110 is structured around the offering of incentives to accomplish its objectives. Since most land use decisions occur on the local level, offering incentives is an effective way of raising public awareness about river corridor and floodplain values and motivating landowners and

⁹ Equilibrium conditions occur when water flow, sediment, and woody debris are transported by the stream channel in such a manner that the stream maintains its dimension, pattern and profile without unnaturally aggrading or degrading. The requirements of 10 V.S.A §1021, and Vermont's Anti-Degradation Policy (i.e., limiting bed and bank erosion and/or the loss of floodplain attenuation) are substantially met through the attainment and maintenance of equilibrium conditions.

municipalities to take proactive steps to reduce property loss, protect water quality, and build greater resilience to future flood damages.

In response to Act 110, the Rivers Management Program reorganized, effective November, 22, 2010, to create a River Corridor and Floodplain Management Program (RCFMP). This new program integrates floodplain management under the FEMA National Flood Insurance Program (NFIP), fluvial erosion hazard avoidance, river corridor and buffer protection, and river science. This reorganization enables the Rivers Program to more effectively and efficiently provide technical assistance to municipalities, landowners, and the regulated community to help minimize flood hazards, improve water quality, reduce risks to public safety, and promote ecological integrity of rivers statewide.

River corridor procedures, currently under development, will outline the process of delineating and mapping river corridors and present a priority schedule for providing municipalities with river corridor maps. The RCFMP anticipates working with approximately 30 municipalities in river corridor map development over the next two years. That number is based on the current budget and staff levels, local interest, and whether the municipality is in the process of updating its flood hazard ordinance to remain compliant with the National Flood Insurance Program.

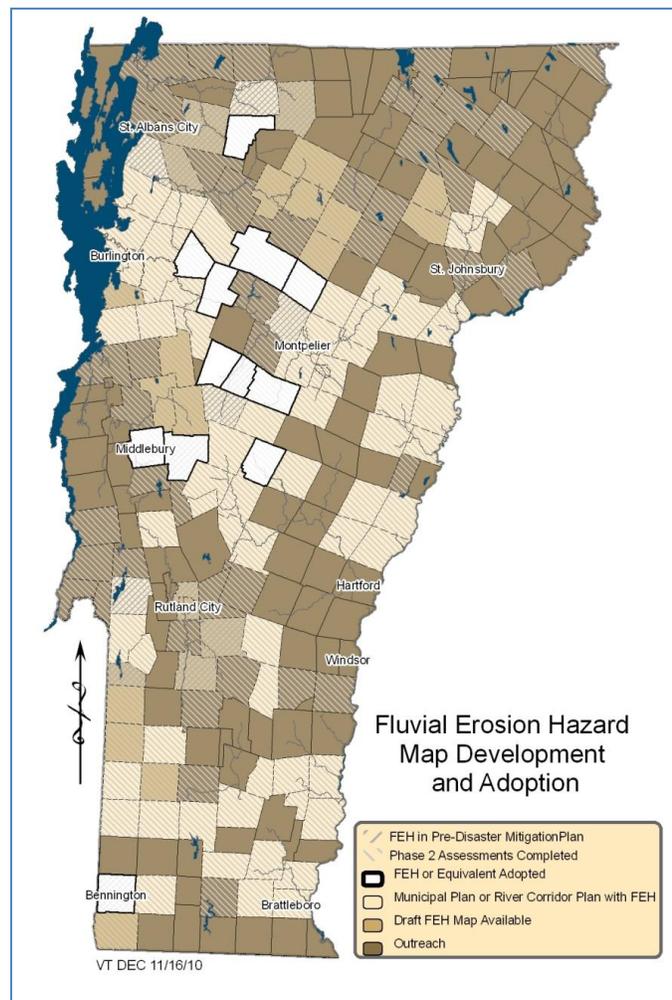
The Rivers Program identifies three Best Management Practices (BMPs) to restore and protect the equilibrium condition of rivers, minimize flood damages, and achieve water quality and habitat objectives: (a) minimizing or removing stream channel constraints; (b) restoring and maintaining riparian buffer vegetation; and (c) protecting river corridors and floodplains. Programs and guidance documents currently exist to help landowners and municipalities implement these BMPs.

The RCFMP is focused on efforts to provide technical assistance and incentives to municipalities to accomplish river corridor protection. Helping municipalities to be proactive in re-establishing and maintaining equilibrium stream conditions will reduce property loss, enhance public safety, protect water quality, and build greater resilience to future flood damages.

The Rivers Program has worked with other state and federal programs on a potential suite of financial and programmatic incentives that state agencies could offer municipalities to encourage adoption and implementation of zoning bylaws that protect shorelands, river corridors and buffers. Model municipal river corridor ordinances have been developed which should help municipalities qualify for the incentives. More work is needed to fully implement these incentives.

The following map and supporting table summarize river corridor protection at the municipal level using FEH mapping and FEH flood hazard bylaws. This map illustrates the State's continued commitment to provide towns across the state with technical assistance on how to best enhance their resilience to flood impacts. To date, there are 13 municipalities with river corridor protection bylaws in place.

Total number of communities involved in river corridor planning	170
Phase 1 geomorphic assessment underway or recently completed	42
Phase 2 geomorphic assessment underway or recently completed	148
FEH projects underway or completed as part of town and/or river corridor plans	60
Draft FEH maps completed	81
FEH maps adopted as an ordinance	13



River corridor protection using fluvial erosion hazard mapping.

The RMP continues to provide technical assistance to municipalities under the National Flood Insurance Program (NFIP). The Rivers Program is facilitating a FEMA-driven statewide process to update Flood Insurance Rate Maps (FIRMS), prepare digital format of the FIRMS, and update associated flood hazard bylaws for NFIP compliance. Communities in Chittenden and Washington Counties are currently updating their flood hazard area bylaws, and the new Digital Flood Insurance Rate Maps are expected to become effective in the summer of 2011. Additionally, many communities are working with their Regional Planning Commissions to update their Pre-Disaster Hazard Mitigation Plans as part of a FEMA grant cycle, and maintain eligibility for disaster relief.

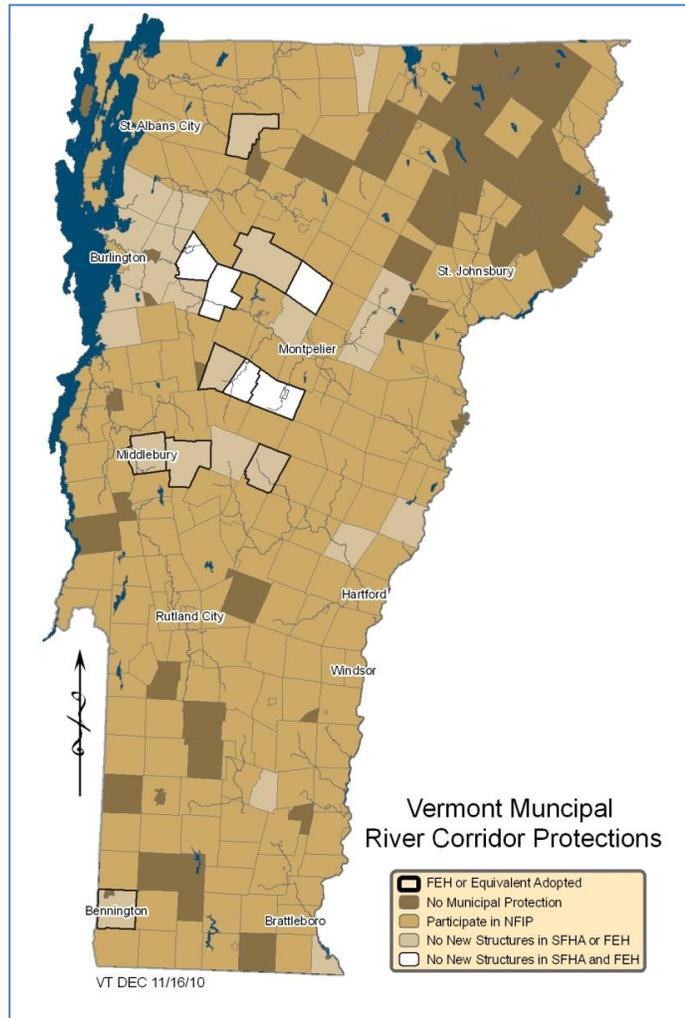
This process has put the consequences of flooding and river corridor issues on the agenda of local municipal boards. The RMP is using these opportunities to help educate municipalities about how to improve local resilience to flooding by avoiding development in known hazard areas delineated on both the FEMA and FEH maps.

In September 2008, Vermont DEC, with the assistance of planners from around the state, released model flood hazard bylaws to help municipalities meet or exceed the requirements of the NFIP, avoid development in known hazard areas, and accommodate river processes to achieve and maintain stream equilibrium conditions. There are 26 communities across the state with municipal land use regulations that strive to avoid further exposure to flood hazards.

River Corridor Conservation

A River Corridor Easement Program has been established in Vermont to conserve river reaches identified as high priority sediment and nutrient attenuation areas. The opportunity to purchase and sell river corridor easements was created to augment the state and municipal fluvial erosion hazard zoning which, if adopted, avoids future encroachment and flood damage, but does not restrict channelization practices. The socially-ingrained notion to stop all erosion, even where few investments are at risk, may limit the channel evolution process and slow the attainment of equilibrium conditions. The key provision of a river corridor easement is the purchase of channel management rights¹⁰.

The RMP works closely with state and federal farm service agencies, the Vermont Housing and Conservation Board, and land trust organizations to combine corridor easements with other land conservation programs. The purpose of the river corridor easement is to allow the river to re-establish a natural slope, meander pattern, and access to floodplains in order to provide flood inundation and fluvial erosion hazard mitigation benefits, improve water quality through hydrologic, sediment and nutrient attenuation, and protect riparian habitats and the natural processes which form them. The easement gives the holder or grantee the right and opportunity within the corridor to establish a naturally vegetated, floating buffer measured from the river banks as the banks move. The landowner may continue to conduct activities such as agriculture



Vermont communities with municipal land use regulations that strive to avoid further exposure to flood hazards.

¹⁰ Kline, M. 2008. A Guide to River Corridor Easements. Vermont Agency of Natural Resources, Waterbury, VT.

and timber harvesting within the river corridor, but is restricted from placing, repairing, or modifying structural elements such as bank armor, levees, or earthen fills. Within the corridor, the easement ensures that watercourses and wetlands are not manipulated so as to alter the natural water level or flow, or intervene in the natural physical adjustment of the water bodies. To date the program and land trusts have completed, or nearly completed, easements on 15.79 miles of river which, when in equilibrium, will have access to over 605 acres of floodplain.

River Name	Stream Length (ft)	Easement Area (acres)
Nulhegan River	2,000	19.0
White River	1,360	16.3
Meadow Brook	1,056	4.5
Little River	1,460	8.4
LaPlatte River	15,100	160.0
Beecher Hill Brook	1,431	6.3
North Branch Winooski	8,412	76.9
Ayers Brook	19,790	50.8
Browns River	2,800	23.7
Hungerford Brook	1,700	7.3
Tyler Branch	4,405	23.1
Middlebury River	1,340	11.7
Mad River	1,563	8.3
Green River (Arlington)	2,300	11.4
Batten Kill	900	8.9
Mettowee River	3,700	7.5
Wanzer Brook	2,050	4.0
New Haven River	4,318	9.1
Lewis Creek	7,700	147.3
Totals	83,385	604.5

During the 2010 project year, the Rivers Program and the DEC Clean and Clean Program formalized a very important funding partnership with the Vermont Agency of Agriculture, the USDA Natural Resource Conservation Service, the Vermont Housing and Conservation Board

(VHCB), and the Vermont Land Trust. Through the VHCB funding agreement with the USDA under the Farm and Rangeland Protection Program (FRPP), and with approval from the Office of General Counsel (OGC), the agencies agreed that agricultural soils conservation and river corridor conservation (including protection of dynamic equilibrium stream corridors) were compatible easement purposes. This agreement paved the way for VHCB approval of a farm conservation project in Vermont that included river corridor easement restrictions. This important milestone will allow Vermont to use Clean and Clear state funds to match federal FRPP funds and complete conservation projects with both agricultural and river conservation objectives.

Program Accomplishments During 2010

The River Management Program has been active in providing technical assistance to municipalities and individual landowners regarding river corridor protection and fluvial erosion hazard mitigation across Vermont. Below is a summary of river corridor protection-oriented activities completed or underway in 2010, organized by River Basin and watershed. These activities include Phase 1 and 2 stream geomorphic assessment (SGA), river corridor planning, Fluvial Erosion Hazard (FEH) mapping, project development, and project implementation.

Basin 1 – Batten Kill, Walloomsac, Hoosic

Batten Kill

The Rivers Program continues to provide technical assistance to the Batten Kill Corridor Planning Steering Committee and has been successful at moving projects toward implementation on the Batten Kill. The Program worked with the Vermont Land Trust on three permanent river corridor easements within the Batten Kill watershed. These high priority easement sites are located on historically modified sections of Batten Kill and Green River where the river remains mostly straightened and lacks access to the floodplain. The easements will provide the river an opportunity to restore the natural form and floodplain function that will reduce sedimentation and flooding hazards and improve in-stream habitat over time. One easement on the Green River, a major tributary to the Batten Kill, is completed and two more are underway. We continue to work closely with the Batten Kill Watershed Alliance, U.S. Fish and Wildlife Service, and the U.S. Forest Service on river corridor planning in the watershed.

During the river corridor planning process the Rivers Program staff met with all towns located within the Batten Kill watershed and presented the results of the assessment and corridor planning process. Staff outlined each town's options for improving their river corridor protection and reducing flood hazards. This outreach resulted in Arlington, Dorset, Sandgate, and Sunderland broadening their flood hazard language in their town plans to describe river corridor protection as a planning priority.

The Rivers Program has worked collaboratively with the Natural Resources Conservation Service to implement exclusion fencing and buffer planting on the Dry Creek, a tributary to the Batten Kill, in Sandgate, VT. Federal dollars were leveraged to complete the bulk of the contract and state funds were used as the match.

Roaring Branch

Using Clean & Clear funding, the VT DEC River Management Program (RMP), in partnership with the Town of Bennington, completed Phase I and Phase II of a large flood plain restoration project along the Roaring Branch. Bennington is situated in a particularly hazardous location on an alluvial fan at the foot of the Green Mountains. The Roaring Branch is a tremendously dynamic and powerful force at times of flood, delivering astounding volumes of boulders, rock and woody debris into the urbanized area. For 150 years or more, this municipality and its residents have struggled with the river, attempting to confine it and control it with a system of earthen berms and structural levees.

Unfortunately for village residents and town taxpayers, the river has won most of the contests, breaching and then catastrophically avulsing through the berms, inundating residential and industrial areas, and devastating public infrastructure including roads and bridges. Each flood would trigger a spasm of channel dredging and reconstruction of the temporary and inadequately confining structural elements along the channel margins. These channelization practices did not provide long-term protection of the property and infrastructure behind the berms. Rather, these structures remained extremely vulnerable to the next flood.

In 2008, Bennington formed a partnership with the DEC and initiated a public process to adopt Fluvial Erosion Hazard (FEH) bylaws in which additional development encroachments into currently undeveloped areas of the river corridor are prohibited. The ordinance model and FEH zone map were provided by the River Management Program. Support for the town selectboard and planning commission through the adoption process was also provided by RMP staff.

In response to the town adoption of the FEH bylaws, the RMP pursued C&C funds to design and construct a major flood plain restoration project. This project consisted of removing 3,500 linear feet of earthen berms, involving over 35,000 cubic yards of earth and rock excavation, construction of a new engineered, armored berm set well back from the river, and the restoration of approximately 12 acres of functioning floodplain within a critical area of the village. DEC also attempted to secure FEMA Pre-Disaster Mitigation Grant funding to assist in implementing this project, but was unsuccessful in securing Federal funds.

With the implementation of the first two phases, the project is approximately 40% complete. The project has dramatically reduced the potential for a channel avulsion through a capped industrial hazardous waste site (PCBs), protected the Park Street Bridge, a major thoroughfare, from being outflanked by the river, promoted fine sediment capture and nutrient attenuation in the restored flood plain, and resulted in a sedimentation pattern that reduces the hazardous accumulation of sediments under the Park Street Bridge. The DEC and Town of Bennington are hoping to continue with Phase 3 of this project in 2011 in anticipation of the availability of C&C funding.



Bennington Floodplain Restoration Project before construction: failing berm looking upstream from Park Street Bridge (left) and looking downstream toward Park Street Bridge (right)



Bennington Restoration Project after construction: restored floodplain looking upstream from Park Street Bridge (left) and looking downstream toward Park Street Bridge (right).

Basin 2 – Poultney, Mettowee

Mettowee River

River restoration work continues in the Poultney-Mettowee basin. The Rivers Program completed their first river corridor easement in Basin 2 on the Mettowee River mainstem. We worked with the Vermont Land Trust to permanently conserve the river corridor for a section of the Mettowee River that provides important floodplain attenuation and shade on a river that is lacking in these important functions.

Hubbardton River

The Nature Conservancy applied for and received Clean and Clear restoration funding to complete a project on their clay plain forest reserve in West Haven. The project consists of two small tributaries that are both highly incised and lack floodplain access. The first tributary was treated with woody debris jams to trap sediment and build up the bed of the stream, ultimately re-connecting it to its historic floodplain. The second tributary was treated by excavating a new floodplain at a lower elevation to improve storage of sediment and flood waters during high flows. This paired tributary approach will be monitored closely over time to see which treatment best improves the stream function and water quality.



Floodplain restoration site in West Haven. The left picture shows new floodplain that was excavated; the right picture is post-construction under flood flows with the new floodplain being inundated. Photos courtesy of Paul Marangelo of The Nature Conservancy.

Basin 3 – Otter Creek, Little Otter, Lewis Creek

Middlebury River – The Town of Middlebury

Work continues with corridor planning on the Middlebury River. The Rivers Program staff has provided technical assistance to both the Addison County Regional Planning Commission (ACRPC) and the Town of Middlebury toward implementation of zoning bylaw to protect the river corridor from future encroachment. The town has adopted language and is working with the program to implement river corridor protection in their municipal ordinances for the Middlebury River.

Middlebury River – The Town of Ripton

A devastating flood in the summer of 2009 caused extensive damage in the small mountain community of Ripton and closed the scenic state highway VT 125. The Middlebury River flows down through a steep, narrow valley and joins two major high elevation tributaries just above the village of Ripton. The resulting unstable condition of the riverbank in the village area resulted in the town facing the threat of a catastrophic channel avulsion down through the middle of the village along VT 125 during the next flood event. Previous attempts at stabilization of the stream bank by property owners and federal agencies had completely failed.

The Town of Ripton proactively took steps toward protecting the river corridor in town from future encroachments by adopting a fluvial erosion hazard zone (FEH) into their municipal zoning. Because of Ripton's commitment to reduce flood hazards through its local ordinance, the River Management Program (RMP) pursued FY 2010 C&C capital funding to assist the community in structurally addressing the channel erosion that directly threatened several residences, mass failure of 50 ft. high glacial deposit, and represented an incipient avulsion threat.

The RMP worked with the town, landowners, the Addison County Regional Planning Commission (ACRPC) and its consultant to design and construct a robust streambank and channel stabilization project and a flood relief chute. The channel stabilization involved over 700 linear feet of rock armoring and the construction of a channel bed grade control weir.

The C&C funding was used to provide the non-federal match for a FEMA Hazard Mitigation Grant through the VT Division of Emergency Management. The project was tested by a high water event in early October and performed as anticipated.

The ACRPC, town and Middlebury Area Land Trust are now working with landowners upstream of the village to permanently conserve the river corridors and 100-year floodplains.



Constructed floodchute, viewed from the right bank.



Project to prevent avulsion, looking downstream.

New Haven River

The Rivers Program is working with a consultant to develop a River Corridor Plan to outline strategies to improve water quality and reduce hazards on the New Haven River in Bristol and New Haven. The New Haven River has experienced many hazardous and damaging floods in recent years. Program staff continues to provide technical assistance to the Towns of Bristol and New Haven as well as landowners along the New Haven River.

Neshobe River

The Rivers Program has been involved in a river corridor planning project on the Neshobe River in Brandon. Staff is working with the town and Rutland County Natural Resource Conservation District and a private contractor to develop strategies to prevent encroachment-related conflicts and improve water quality. Brandon has incorporated supportive language for river corridor protection into their town plan and is interested in including the river corridor protection in their

zoning. RMP staff will continue to provide technical assistance to the Town of Brandon and its citizens throughout the planning process.

Lewis Creek

Work continues on the Lewis Creek watershed to implement the River Corridor Plan. This year, progress was made toward obtaining landowner willingness and funding for a high priority river corridor conservation project on the mainstem of the Lewis Creek. The Rivers Program worked with the Vermont Land Trust on an easement acquisition and this was the very first integrated agriculture/river corridor conservation project to be approved for funding by the Vermont Housing Conservation Board.

Furnace Brook

The Rivers Program continues to provide technical assistance to the Town of Pittsford to develop a plan and design for the removal of Kendrick Dam on the Sugar Hollow Brook. This dam was identified as being a hazard and in need of repair or removal. The removal of this dam would improve sediment transport and floodplain function downstream and remove a significant flood hazard.

Lemon Fair

The Rivers Program worked with the Middlebury Area Land Trust to complete a wetland restoration plan for the Beaver Brook, a tributary to the Lemon Fair with nutrient loading issues. The goal of this project is to identify the properties and projects within the Beaver Brook watershed to allow MALT to target landowners who own lands which provide critical nutrient reduction functions for permanent conservation. These high priority functioning or restored wetlands will filter out nutrients and prevent them from making it downstream and ultimately into Lake Champlain. Momentum is gaining, as one landowner has agreed to donate a conservation easement within the watershed.

Basin 4 – Lower Lake Champlain

East Creek

Work continues on an assessment and development of a river corridor plan in the East Creek, a direct drainage to Lake Champlain. Once the plan is written, work will begin on outreach to landowners to get projects implemented.

Basin 5 – Upper Lake Champlain, LaPlatte, Malletts Bay, St. Albans Bay, Rock and Pike Rivers

LaPlatte River

River corridor planning and project development efforts in the LaPlatte watershed have resulted in six river corridor easements being ready for execution, one of which is a donation from the Town of Hinesburg on an extremely incised and highly sensitive reach that is expected to be executed next funding cycle. Several other river corridor easement projects are in the process of being developed with technical assistance provided by Rivers Program staff. Upon request, extensive educational outreach and technical assistance was provided to the Town of Hinesburg

Conservation Commission, Planning Commission, and Select Board regarding adoption of Fluvial Erosion Hazard provisions into town zoning regulations, but at this time the town has not adopted any language addressing this concern.

Mallets Creek

Phase 1 and Phase 2 geomorphic assessments of Mallets Creek and the Allen Brook tributary are underway, in partnership with the Chittenden Regional Planning Commission. Mapping and planning to mitigate fluvial erosion hazards will continue to be explored in 2011.

Basin 6 – Missisquoi

Missisquoi River

The project with the U.S. Department of Agriculture-Agriculture Research Service National Sedimentation Laboratory continues. The project involves evaluating the contribution of sediment and nutrient loading into Lake Champlain from unstable stream channels. This phase of the project involves assessing 10 sites in the Upper Missisquoi watershed from North Troy to Lowell along the mainstem of the Missisquoi, Jay Branch, and Mud Creek for soil types and erosion potential. The first phase of this project was conducted in 2009 in the Franklin County section of the Missisquoi, from the Canadian border to Lake Champlain.



Streambank soil testing in the Missisquoi watershed.

A Phase 2 geomorphic assessment was completed along 31 river-miles of the Upper Missisquoi River from North Troy to Lowell. Data will be used to map Fluvial Erosion Hazard areas and develop and implement river corridor projects.

A “Trees For Streams” program was initiated this year in the Missisquoi and St. Albans Bay watersheds in partnership with the Franklin Natural Resources Conservation District. This program supports volunteer buffer projects, particularly on lands that do not qualify for other state or federal programs. The program will complete one project in the summer of 2010. Several other projects are identified for implementation in 2011.

Two river corridor easement projects have been completed along the Tyler Branch and Hungerford Brook. Both projects are in key sediment attenuation areas and will reduce landowner conflicts with the dynamic nature of the river systems. These projects protect approximately 30 acres of river corridor and establish three stream-miles of vegetated buffers.

Missisquoi Tributary – Swanton

This project involved upgrading a woefully undersized culvert that was interfering with sediment transport and blocking aquatic organism passage. Project partners included the U.S. Fish and Wildlife Service and the Nature Conservancy.



Pre-construction culverts.



Post-construction bridge.

Tyler Branch

The Northwest Regional Planning Commission (NRPC) worked with Rivers Program staff to develop Fluvial Erosion maps for the communities of Bakersfield and Enosburg. Bakersfield adopted a 100 ft overlay district on all streams in their town to mitigate fluvial erosion hazards.

Rock River

The RMP worked with the Vermont Youth Conservation Corps (VYCC), the Vermont CREP Program, and the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program to restore a degraded, historically straightened section of a small tributary to the Rock River by planting a vegetated buffer and installing woody material in the channel. The Rock River is one of the most concentrated sources of sediment and nutrient loading to Missisquoi Bay. A project involved stabilizing actively eroding gully which was providing an estimated 600 tons of sediment to the Rock River.



VYCC crew installing wood in stream.

Trout River

The Missisquoi River Basin Association (MRBA) has continued to work with Rivers Program staff to develop projects in the Trout River watershed. Several projects were completed with the Town of Montgomery to reduce sediment loading to the Trout River from eroding roadside ditches and gullies. Additional projects in the watershed focused on individual landowners to install riparian vegetation, fence livestock out of the stream, reduce erosion on forestry road, and work towards conservation practices such as CREP and River Corridor Easements. The town and landowners, along with MRBA, provided volunteer time and energy to help fully implement the projects. Work will continue with the town to look at options, such as Fluvial Erosion Hazards mapping, to reduce flood-related impacts along the Trout River and its tributaries.

Basin 7 – Lamoille

Gihon, Wild Branch, Elmore Branch, Centerville Brook

The Lamoille Regional Planning Commission (LRPC), in partnership with the Rivers Program, is working with communities in Lamoille County to develop Fluvial Erosion Hazard (FEH) maps and develop implementation projects. Work in 2011 will focus on the communities of Elmore and Hyde Park.

Browns River

Additional Phase 2 geomorphic assessments are being completed to support the development of FEH maps in the Towns of Underhill, Jericho, and Westford. Rivers Program staff will continue to provide municipalities and the Chittenden County Regional Planning Commission with technical assistance for FEH adoption efforts.

The RMP worked with the Winooski Natural Resource Conservation District to design a project to remove four undersized old abutments and an undersized bridge that are contributing to erosion. These crossings will be replaced with an appropriately sized bridge. Implementation is scheduled for the summer of 2011.



Undersized structure to be replaced.

Gihon River

The Lamoille County Natural Resource Conservation District (LCNRCD) is working with the Town of Johnson to implement FEH mitigation strategies, river corridor protection projects, and stormwater mitigation projects.

Upper Lamoille River

In 2008, Hardwick experienced a flood that damaged several culverts and roads. The town has also experienced ice jam-related flooding along Route 15 in town over the past couple of years. The Caledonia County Natural Resource Conservation District (CCNRCD) completed fluvial geomorphic assessments, bridge and culvert assessments, and a River Corridor Plan in 2009. The (CCNRCD) will continue to work with the town to look for flood mitigation projects.

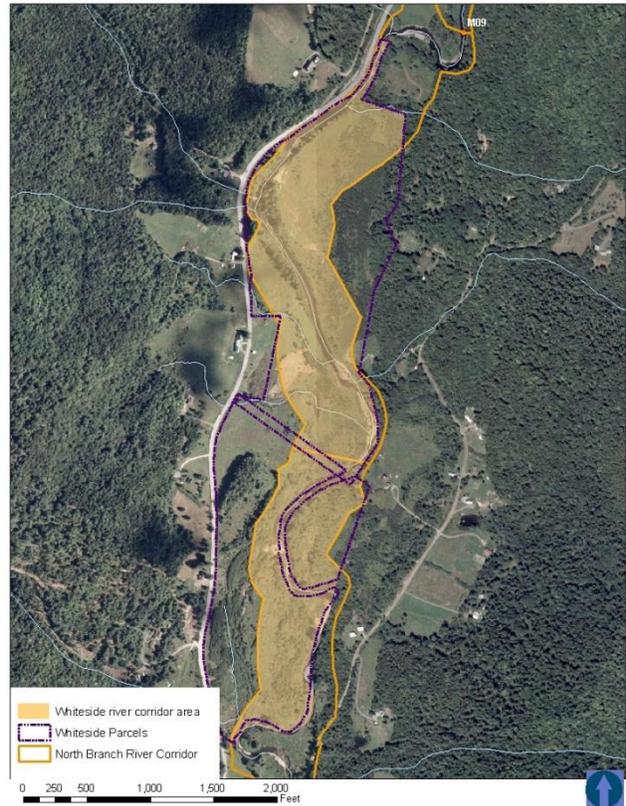
Basin 8 – Winooski River

Pekin and Thatcher Brooks

A Phase 2 stream geomorphic assessment was completed on Thatcher Brook in Waterbury and additional reaches on Pekin Brook in Calais. In addition to this Phase 2 assessment on Pekin Brook, project development efforts have continued in this sub-watershed and resulted in the execution of a riparian re-vegetation project and interest by one landowner in a river corridor easement.

Stevens Branch and North Branch

Project development has also continued in the Stevens Branch and North Branch sub-watersheds with great success. In the Stevens Branch sub-watershed, one river corridor easement project is ready for execution pending identification of a funding source, and many others are actively being pursued. In the North Branch sub-watershed, 73 acres of extremely sensitive river corridor were conserved on a large parcel straddling the Middlesex/Worcester town lines. This reach of the North Branch was in imminent threat of development, and had been identified as a high priority for conservation due to it being a critical location for attenuating flood waters and associated sediment, and providing critical habitat for a State threatened wildlife species. Several other landowners in the North Branch sub-watershed have expressed interest in river corridor easements, and these potential projects are in the process of being developed.



River Corridor Easement in Middlesex and Worcester

This reach of the North Branch Winooski River has been identified as critical wildlife habitat for a state threatened species and is extremely sensitive to channel adjustment. The easement will encompass approximately 73 acres within which the river will be allowed to redevelop meanders and a state of dynamic equilibrium.

Mad River

Project development has also continued in the Mad River sub-watershed, and thus far has resulted in a donated river corridor easement that will permanently protect 8.5 acres of very highly sensitive river corridor in Waitsfield (project to be fully executed in 2011). For all of the project development efforts mentioned above, significant technical assistance was provided to project partners in the development of river corridor maps for targeted parcels and corridor easement valuation estimates.

In 2010, the Town of Waitsfield adopted a Fluvial Erosion Hazard Bylaw for the Mad River. As a result, The Rivers Program is working extensively with the town and organizations, such as the Friends of the Mad River, to pursue FEMA and Clean and Clear funding to support streambank stabilization and stormwater management projects within the developed village area.

Little River

River Corridor Plans were completed on the Little River and headwaters of the West Branch Little River, and a project is currently underway to move a portion of the Stowe Quiet Path on an actively adjusting meander bend outside of the river corridor. The project's end result will be enhanced river stability, improvement of riparian and in-stream habitat conditions, and reduction of conflict between town infrastructure and the dynamic river processes.

Main Stem of the Winooski

An effort to remove the Marshfield-8 dam in Marshfield is underway with funding from the U.S. Fish and Wildlife Service. This dam is in disrepair and no longer serves a functional purpose. The project was initiated by the dam owner due to concerns over the dam's safety. Upon completion, the project will restore sediment continuity and fish passage to a damaged reach along the main stem of the Winooski River.

FEH Outreach and Technical Assistance

Educational outreach and technical assistance in the Winooski watershed has resulted in the adoption of Fluvial Erosion Hazard zones into zoning regulations in the three communities, including Worcester (North Branch), Northfield (Dog River), and Waitsfield (Mad River) in the past year. The Towns of Huntington (Huntington River) and Berlin (Dog River) also received educational outreach and technical assistance regarding FEH, but neither community has adopted FEH regulations at this time. In addition, significant technical assistance was provided to the Chittenden County Regional Planning Commission in development of fluvial erosion hazard maps for incorporation into hazard mitigation plans.

Basin 9 – White River

Upper White Main Stem and Tweed River

Project development continues on the Upper White and Tweed Rivers. These efforts have included discussions with landowners about corridor easements and riparian plantings, as well as identifying culverts that are geomorphically unstable and/or barriers to fish passage, and in need of retrofit or replacement. Technical assistance from Rivers Program staff have facilitated these efforts through landowner meetings, creation of parcel-specific river corridor maps, and estimating values of river corridor easements. Development of replacement/retrofit options for three culverts in the Town of Rochester to address aquatic organism passage barriers continue to be developed.

Lower Main Stem White River

The completion of a River Corridor Plan for the main stem of the White River in the Town of Sharon resulted in the town adopting interim flood hazard regulations that address fluvial erosion hazards. With much technical assistance from Rivers Program staff, the town is currently in the process of holding public hearings to transition from interim to official flood hazard regulations.

Basin 10 – Black River

Main Stem Black River

Work continues to finalize Phase 2 stream geomorphic assessments and corridor planning on the Black River between Lake Rescue and Echo Lake, as well as some of the major tributaries upstream of Lake Rescue. It is anticipated that results of this assessment will provide some insight into potential sources of sediment causing anecdotal changes in aggradational features in Round Pond in the northern end of Lake Rescue. Upon request by the Southern Windsor Regional Planning Commission and the Town of Cavendish Planning Commission, educational outreach and technical assistance were provided regarding adoption of Fluvial Erosion Hazards into town flood hazard regulations. At this time, the Cavendish Planning Commission has not taken any action on regulatory adoption of FEH.

Basin 11 – West, Williams, and Saxtons Rivers

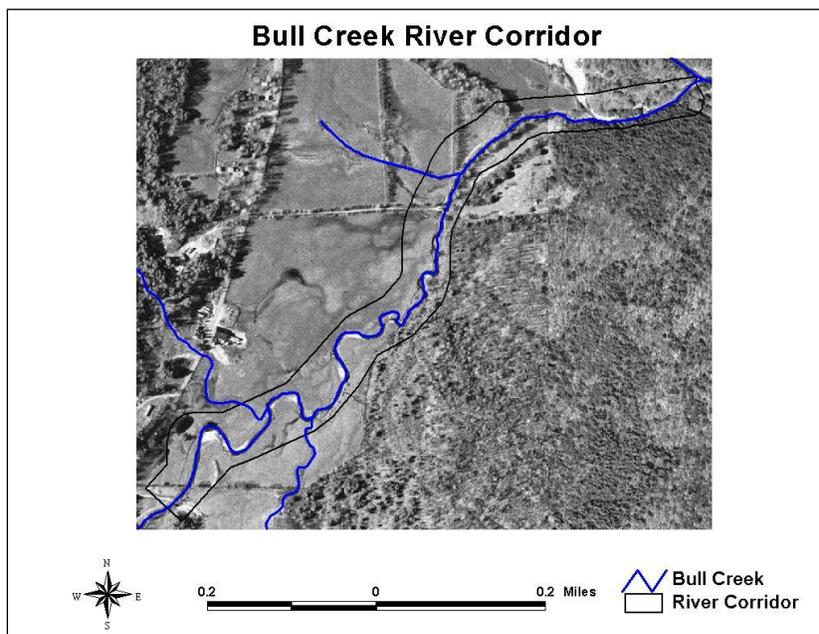
Saxtons River

The River Corridor Plan is complete for the Saxton River and project implementation is underway within the basin.

The Rivers Program worked with the Vermont Land Trust to acquire an easement on a very high priority river corridor on Bull Creek, a major tributary to the Saxtons River. This site has been historically straightened and remains incised or lacking floodplain access, and lacks an adequate riparian buffer.

The goal of the long term conservation is to improve the riparian buffer to both provide stream stability and improve filtration of nutrients running off adjacent farm fields. The conservation would also allow the stream to meander over time at will and improve floodplain access and storage of sediments within the channel and floodplain.

In addition, we are working with the Vermont River Conservancy to start a new river corridor conservation project just downstream in the very dynamic confluence of the Bull Creek and Saxtons River. The confluence site provides critical storage of sediment within this highly modified system. Other river corridor planning projects underway include a feasibility study of removing the Kidder Hill Dam to restore natural stream flow and sediment transport, ongoing landowner discussions about berm removal to improve floodplain function and riparian plantings to help stabilize streams and provide much needed shade on the main stem of the Saxtons.



River Corridor conservation project in Athens, VT on the Bull Creek.

Basin 13 – Lower Connecticut River, Mill Brook

Whetstone and Crosby Brook

The Town of Brattleboro has experienced numerous floods in recent years resulting in evacuation, property loss and degraded water quality. The town expressed interest in pursuing strategies to mitigate their flooding hazards and decrease the damages associated with flooding and erosion. At the town's request, the River Management Program worked with the Town of Brattleboro to complete the assessment necessary to create a Fluvial Erosion Hazard Area (FEH). The FEH zone outlines the area the stream needs to accommodate the watershed inputs and, if adopted as a zoning overlay, prevents development and filling within this hazardous area. A purpose of the FEH mapping program is to help towns move toward a more sustainable relationship with the river and over time avoid conflicts. After many meetings and much debate, the town decided not to adopt the FEH zone.

Basin 14 – Waits, Wells, Ompompanoosuc, and Stevens Rivers

Waits River

The recent completion of the Waits River Corridor Plan has transitioned into project development efforts. One river corridor easement project is ready for implementation on the tributary Meadow Brook (to be executed in the 2011 funding cycle), and many more potential projects are actively being pursued.

Ompompanoosuc River and Stevens River

A Phase 1 stream geomorphic assessment was completed on the entire Ompompanoosuc watershed, and a Phase 2 assessment is currently underway in the Towns of West Fairlee and Thetford. Phase 2 stream geomorphic assessment is also underway in the Stevens River watershed in the Towns of Barnet and Peacham. The resulting River Corridor Plans from both the Ompompanoosuc and Stevens River Phase 2 stream geomorphic assessments are expected to be complete in spring 2011. In the West Branch Ompompanoosuc watershed, significant educational outreach and technical assistance was provided to the Strafford Conservation commission upon request in developing potential river corridor easement and riparian planting projects, but with limited success due to very limited landowner interest and a lack of support from the community.

FEH Outreach and Technical Assistance

Educational outreach and technical assistance regarding fluvial erosion hazards was provided at the request of the Thetford (Ompompanoosuc River), Newbury (Wells River), and Bradford (Waits River) conservation and/or planning commissions. The Town of Bradford adopted language and an FEH map into its Town Plan to acknowledge erosion hazard concerns, but no regulatory zoning language regarding FEH has been adopted in any of these communities at this time.

Basin 15 – Passumpsic

East Branch Passumpsic

The Caledonia County Natural Resources Conservation District (CCNRCD) and Rivers Program staff are working with Lyndon and Burke to look to reduce flood damage from inundation and erosion hazards, including FEH flood bylaw adoption. Lyndon is the second highest “repetitive loss” community in Vermont for the NFIP claims.



10/1/2010 Flooding at LynBurke Motel, Rte 5.



East Branch Passumpsic high erosion hazard and ice jam area.

West Branch Passumpsic

A Phase 2 geomorphic assessment, corridor plan, and draft FEH maps are completed. The CCNRCD will use these materials to help Lyndon reduce its exposure to flood impacts.

Basin 16 – Mid-Connecticut River Drainages

Blood Brook

At the request of the Two Rivers Ottauquechee Planning Commission and the Town of Norwich, an FEH map was finalized on Blood Brook based on previously collected Phase 2 data. It is anticipated that further technical assistance will be provided to Norwich, as well as other communities with recently completed Phase 2 geomorphic assessment, to address fluvial erosion hazards through municipal planning.

Nulhegan River

The Rivers Program has been working with the Northwoods Stewardship Center and the Essex County Natural Resource Conservation District (ECNRCD) to complete a Phase 2 geomorphic assessment and river corridor plan. A river corridor easement that contains a vegetated buffer component was completed along a section of river that links other conserved land along the main stem and East Branch tributary.

Basin 17 – Lake Memphremagog, Black, Barton, Clyde, and Conticook

Black River

A Phase 2 geomorphic assessment on the Black River and several of its tributaries was completed this season. A river corridor plan and initial project identification will be completed by early 2011. Preliminary FEH maps will be developed with the data during 2011.

Better Backroads

The Problem

The backroads of Vermont are integral to the state's rural image and quiet, tranquil nature. Hidden from view is the fact that these rural roads, whether gravel or paved, can be a significant source of phosphorus if they are not properly maintained. The Better Backroads Program enables towns to fix chronic erosion problems in an optimal way so they can avoid annual repairs and reduce phosphorus and sediment pollution.

Roadside drainage ditches and culverts become part of the stream network during rainstorms or snowmelt events. Sediment eroding from road surfaces and ditches washes into the drainage network and delivers phosphorus that is transported downstream, eventually to Lake Champlain, Lake Memphremagog, the Connecticut River or the Hudson River. With an average of 46 miles of backroads per town, the impact can be significant.

The Program

Proper correction of these roadside erosion problems has the dual benefit of reducing long-term road maintenance costs while protecting water quality. Our goal is to provide sufficient administrative assistance, technical support, and grant funding to eventually involve all Vermont towns in the program. Financial and technical support demonstrates to towns that the proper fix pays for itself in a few years, increasing the likelihood that towns will implement such projects on their own. The long-term goal for the Better Backroads Program is to enable and encourage towns to practice best management practices in road maintenance and repairs so as to institutionalize these practices into town policy.

The Vermont Better Backroads Program started in 1997. It provides grants and technical assistance for towns to correct erosion problems and to adopt road maintenance practices that protect water quality while reducing long-term highway maintenance costs. It is a partnership formed with the Vermont Local Roads Program, the Vermont Agency of Transportation, the Vermont Agency of Natural Resources, and the Northern Vermont and the George D. Aiken Resource Conservation and Development Councils. The program is administered by the Northern Vermont Resource Conservation and Development Council. The Clean and Clear Action Plan significantly enhanced the capacity of the program beginning in 2004, by adding staff for grants management and technical assistance and by increasing the dollar amounts available for grants.

The road maintenance practices advocated by the Better Backroads Program are typically cost-effective in the long run. The one-time investment to fix a chronic erosion problem properly (e.g., rock-line a steep roadside ditch) generally pays for itself many times over in reduced long-term maintenance costs. The modest grants provided by the Better Backroads Program also demonstrate the benefits of recommended maintenance practices to local road commissioners and enable them to garner support for additional projects. It has been our experience that most towns adopt the recommended practices for all their road maintenance work, so that the grants we provide can leverage their cost in improved maintenance practices that will both reduce pollution and save towns money in the future.

The Better Backroads Program offers improved infrastructure and maintenance practices for eroding ditches, unstable culvert inlets or outlets, and eroding roadside banks which can also help prevent flash flood damage during heavy rain events. Grants are provided for two general categories of projects including (A) developing a town-wide inventory of erosion control needs and a capital budget plan to address these needs, and (B) correcting existing erosion control problems.

Program Accomplishments

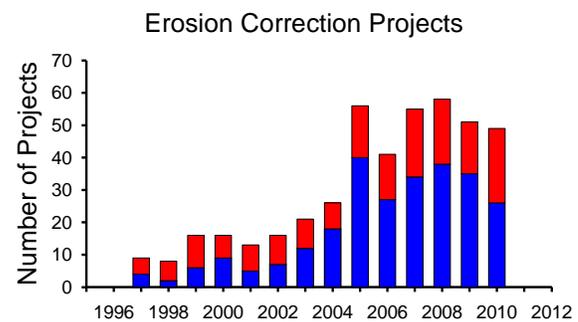
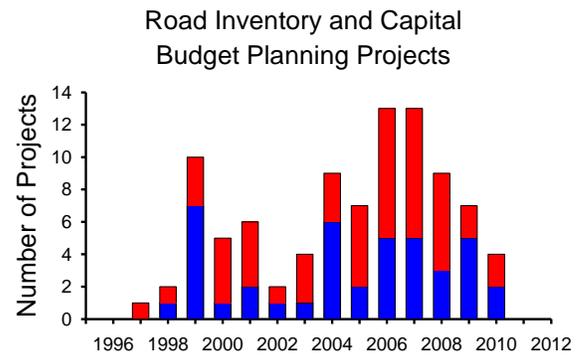
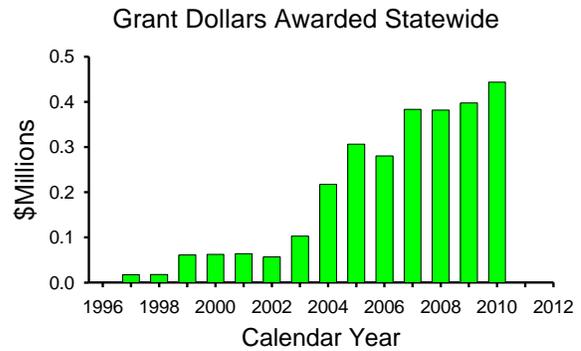
A total of 162 Vermont towns have participated in the Better Backroads Program since 1997 by conducting at least one grant-funded project, including 93 towns in the Lake Champlain Basin. In 2010, six new towns received grants through the program. Since the addition of significantly increased funding from Clean and Clear in 2004, participation by Vermont towns has increased from 26% to 65%, and participation by towns in the Lake Champlain Basin has increased to 74%. In addition, substantial efforts were made by the Backroads Technician to contact towns in the Lake Champlain Basin that have not participated so far to encourage them to apply for a grant.

In addition to municipal projects, 28 non-municipal organizations have received grants since 1997. The funding of non-municipalities has enabled such projects as private road erosion corrections (often along a lakeshore), road erosion inventories conducted by lake or river associations or a regional planning commission, and the purchase and promotion of a hydroseeder which is shared among towns in a region.

During 2010 the Better Backroads Program continued cooperation with the Vermont Youth Conservation Corps. Manual labor supplied by the VYCC was used to implement certain aspects of a project in Tunbridge. Using additional Clean and Clear funding, VYCC crews assisted with projects involving substantial manual labor.

The 2010 projects reported here were approved by the Better Backroads Steering Committee in the fall, will be reviewed at VTrans during the winter of 2011, and will be ready for implementation in the 2011 construction season.

Through on-site technical assistance, publications, and participation in workshops, the Better Backroads Program is able to provide information on a wide variety of techniques that towns can use to reduce sediment and phosphorus loading to waters, while at the same time protecting the

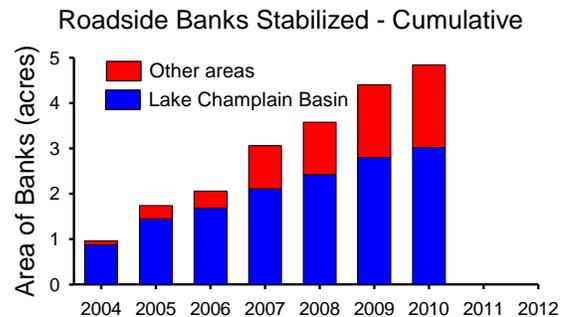
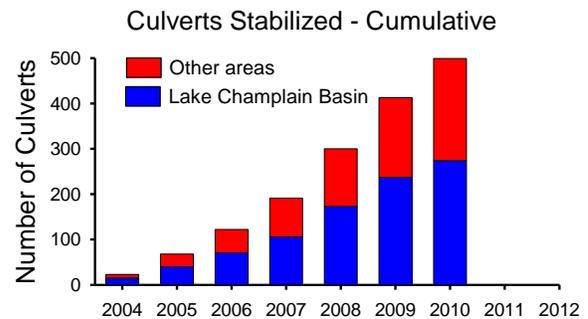
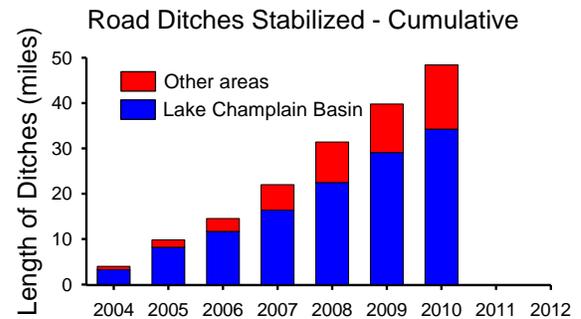


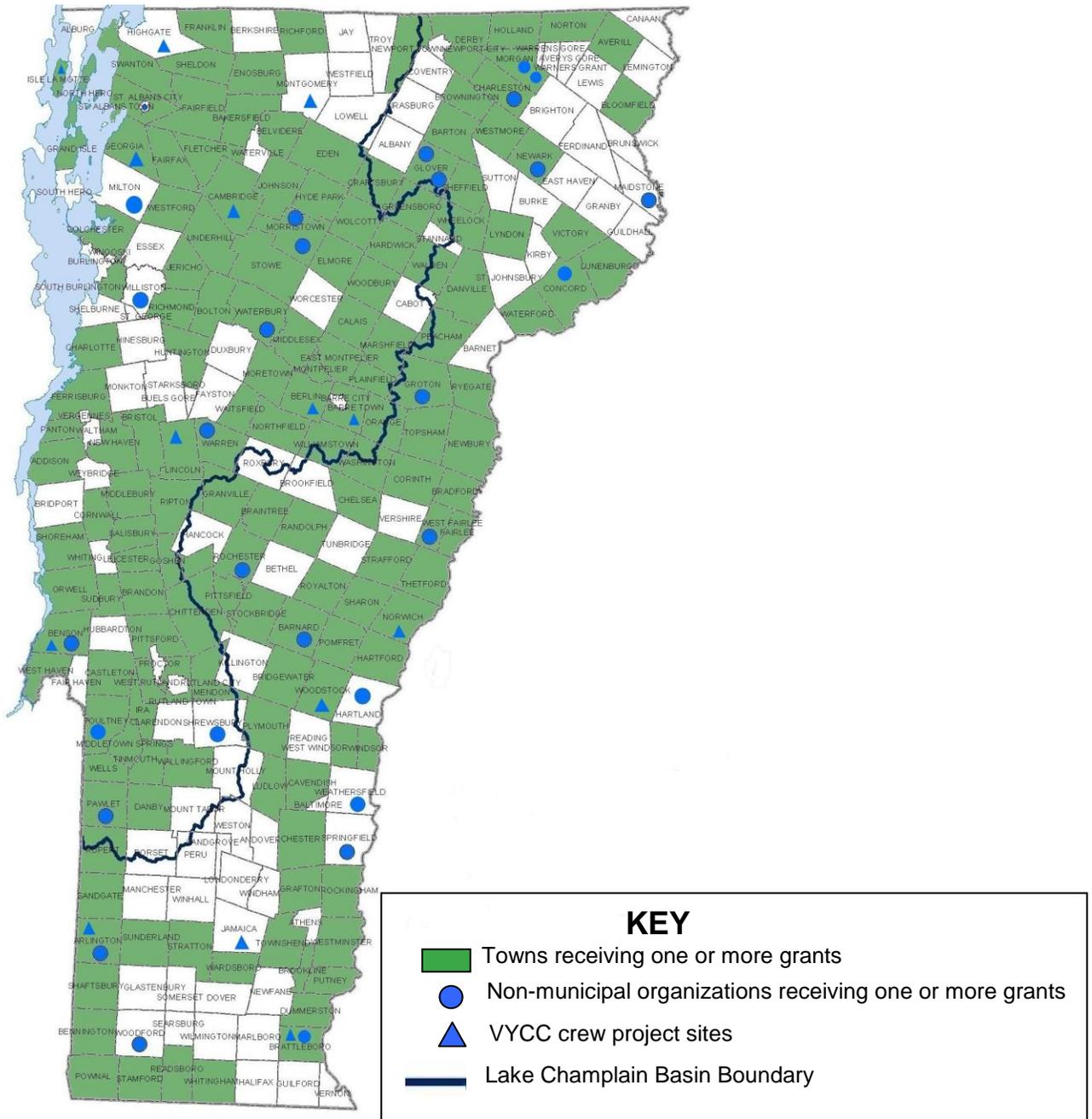
investment a town has in its roads. In 2010, Backroads program staff led five workshops and presentations, including a Road Inventory and Capital Budget Planning training workshop for inventory volunteers in Bakersfield.

Indicators of Progress

The Vermont Better Backroads Program continues to grow annually, with 71 new towns participating with Clean and Clear funding between FY 2005 and FY 2010. Statewide, however, only 65% of Vermont towns have applied for and received a grant. A Better Backroads Program goal is to achieve 100% participation of Lake Champlain Basin towns.

In 2004, the program began annual tracking (by calendar year) of phosphorus reduction indicators such as the total length of road ditches, number of culverts, and area of eroding road bank stabilized by Better Backroads projects. The number of projects correcting road erosion has been increasing, but the total number of roadside ditches, culverts, and banks that have been stabilized so far represents only a small fraction of what needs to be done statewide. By hiring a Backroads Technician in 2005, the Better Backroads Program has been able to tackle this challenge by visiting nonparticipating towns, encouraging their involvement, and offering on-site technical assistance in project development. In addition, the Technician is able to more thoroughly monitor implemented projects, evaluate their effectiveness, and offer follow-up suggestions. The Better Backroads Program has found that on-site assistance is a critical factor in gaining participation. In addition, the program has found that by offering a town a grant for an erosion control project, town staff learn how to accomplish erosion control and are more likely to implement such procedures in the future even without grant funding.





Vermont towns participating in the Better Backroads Program, 2005-2009.

Stormwater Management

The Problem

Urbanization of the landscape creates surfaces that are impervious to water such as roads and driveways, parking lots, and roof tops. When rainwater and snowmelt run off impervious surfaces without infiltrating into the soil, sediment, phosphorus and other pollutants are washed directly into streams. Stream flows rise more rapidly during storms as the volume of runoff increases. These hydrologic changes destabilize and erode the stream banks and channels, resulting in further sediment and phosphorus pollution.

The Program

The Vermont DEC's Stormwater Management Program is a regulatory program charged with issuing permits for stormwater discharges statewide, and restoring acceptable water quality in stormwater-impaired watersheds. State-of-the-art standards for stormwater treatment systems are required for all newly permitted discharges. TMDLs and watershed remediation strategies are being developed for the 17 stormwater impaired watersheds in Vermont, including 14 within the Lake Champlain Basin. These 14 stormwater impaired watersheds represent about 1% of the total area of the Lake Champlain Basin in Vermont.



Stormwater Impaired Watersheds in Vermont

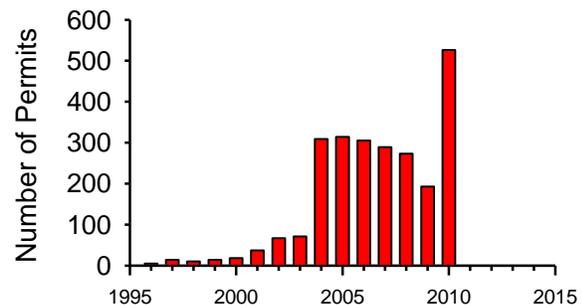
Program Accomplishments

Operational Permits

The Stormwater Program issues post-construction, or operational stormwater permits under both a state law based program for discharges from impervious surfaces, and a federal NPDES based program for discharges from industrial activities (i.e., Multi-Sector General Permit). Operational stormwater permits stay in place for the life of the regulated discharge. The Department has been issuing stormwater discharge permits since the late 1970s, and currently administers 2,883 active stormwater permits under these two programs. All permits require regular inspection, maintenance, and renewal.

The Stormwater Management Program issued 562 permits for new developments or redevelopment projects in 2010, of which 526 were operational general permits. The increase in permit authorizations is a result, in part, of the renewal of several hundred previous authorizations. In 2010, Stormwater Program staff conducted 81 operational site visits, of which 57% were generally

Number of Stormwater Operational Permits Issued



compliant. The compliance rate is skewed because site visits are often focused on complaint follow-up and known non-compliant sites.

TMDL Development

All twelve of the lowland (non-mountain) watershed TMDLs have been approved by EPA. In October 2010, the Department issued a proposed Municipal Separate Storm Sewer Systems (MS4) General Permit for EPA review. This proposed general permit will require affected municipalities to develop and implement Flow Restoration Plans to achieve the TMDL targets. The implementation of the new MS4 General Permit, in conjunction with the Residual Designation Authority General Permit (described below) will result in a complete regulatory requirement to implement the stormwater TMDLs in the affected watersheds.

Additionally, the Department is pursuing alternative approaches to the five mountainous stormwater-impaired watersheds. These alternative approaches include developing water quality remediation plans. Remediation plans for three of the mountain watersheds have been received, and the plans for the remaining two watersheds are expected early in 2011. The Stormwater Program expects to formalize the implementation of the mountain water quality remediation plans via watershed-specific general permits.

To develop the basis for the implementation plans, the Department has undertaken a multi-year effort to fully characterize the subject watersheds, and to establish a process for developing the most cost-effective remediation strategies. These efforts include contracting for stream geomorphic assessments, sub-watershed mapping, stream flow and precipitation monitoring, and high-resolution impervious surface mapping for each of the stormwater impaired waters. In addition, computer modeling projects were undertaken for both flow duration curve development, and to create a best management practice decision support system (BMP DSS). The BMP DSS is a robust computer modeling tool the Department is using to estimate the most cost-effective array of BMPs needed to meet TMDL targets. To date, more than \$1million has been dedicated to the implementation plan effort. Throughout the summer of 2008, the Department met with the Stormwater Advisory Group to develop an implementation plan framework. The Agency's plan for implementation titled, "*Final Report - A Framework for Remediation of Vermont's Stormwater-Impaired Waters,*" can be accessed at: http://www.vtwaterquality.org/stormwater/html/sw_swag.htm

Residual Designation Authority (RDA) Permit

In November 2009, the Stormwater Management Program issued General Permit 3-9030 for Designated Discharges to the Bartlett, Centennial, Englesby, Morehouse and Potash Brook watersheds. This general permit was issued pursuant to the Department's federally delegated National Pollutant Discharge and Elimination System (NPDES) program. Coverage under General Permit 3-9030 is required for designated discharges to Bartlett, Centennial, Englesby, Morehouse, and Potash Brook watersheds. The program has designated discharges to these receiving waters if the discharge is not covered under the NPDES municipal separate storm sewer system (MS4), another NPDES permit covering stormwater discharges, or has been issued a state stormwater discharge permit resulting in no net contribution to the receiving water. The General Permit requires different application requirements for three specified categories of discharges: (1) property with a previously issued state stormwater permit, (2) property with equal

to or greater than one acre existing impervious surfaces, or (3) property with existing impervious surfaces less than one acre.

Illicit Discharge Detection and Elimination

Many Vermont communities have aging sanitary sewer systems. Cross-connections and leakage from sanitary sewers to stormwater collection systems can be common, even in relatively new sewer lines. As a consequence, pollutants such as phosphorus, toxic substances, and pathogenic organisms can bypass the wastewater treatment facility and be discharged at stormwater outfalls.

With support from the Clean and Clear program, Stone Environmental, Inc. and the Vermont DEC have collaborated on drainage mapping and illicit discharge and detection elimination projects in the Missisquoi, St Albans Bay, Winooski, and Connecticut River basins. Currently studies are ongoing in the Lamoille and Otter Creek river basins. To date, 17 discharges of non-stormwater runoff have been located and have or will be eliminated. These discharges ranged in size from a very large municipal trunk sewer line that was leaking, to single-family homes. The collaboration has provided sixteen urbanized communities with a comprehensive stormwater drainage map identifying sites where installation of additional stormwater treatment measures may be feasible. The maps will also be used to assist with infrastructure maintenance and spill prevention emergencies. Funds are being sought to extend this work to other watersheds in the Lake Champlain Basin.

In Chittenden County, the twelve regulated entities subject to the Municipal Separate Storm Sewer System (MS4) federal permit have located and eliminated 42 illicit discharges since 2003. The majority of these discharges were from single-family homes.

Phosphorus samples, flow measurements, and other information were used to develop estimates of the phosphorus loading rate from these discharges. In total, the illicit discharges discovered to date by the Vermont DEC and municipal programs were contributing about 330 kg/yr of phosphorus loading to the receiving waters. For perspective, 330 kg/yr is larger than the phosphorus load discharged by most wastewater treatment facilities in Vermont, and is about 1.6% of the total phosphorus load from all wastewater treatment plants in the Vermont portion of the Lake Champlain Basin during 2009. In the Connecticut River Basin one corrected illicit discharge was estimated to have discharged 224 kg of nitrogen to the river over its duration before discovery.

Municipal Stormwater Infrastructure Improvements

Starting in 2003, nine municipalities in Chittenden County have been able to access \$2.39 million in federal matching funds to purchase equipment or construct facilities that would result in improved water quality for Lake Champlain and its tributaries. These funds were jointly administered by the Champlain Water District and the Facilities Engineering Division and Stormwater Management Program of VTDEC. In 2004, the Vermont Legislature provided an additional \$1.32 million in state matching funds for stormwater impaired watershed improvement projects. The state funds have allowed ten municipalities to construct stormwater improvement projects in nine stormwater impaired watersheds statewide. As a result of these projects, approximately 15-20% of the target stormwater volume for six watersheds has been achieved and 100% of the high flow target has been achieved in the Sunderland Brook watershed of Colchester. Five additional watershed projects are in planning and development. The purchase

of new high efficiency (vacuum) street sweepers, the construction of stormwater treatment retrofits to existing large municipal discharge pipes, and the stabilization of significant erosion areas are examples of projects completed with these funding sources. Most of the participating municipalities have created new municipal stormwater management programs resulting in increased maintenance of their stormwater infrastructure, education and involvement of the public, the elimination of municipal wastewater or industrial wastewater connections from drainage systems, and greater oversight of new development during both the design and construction phases. A summary of the projects completed as of 2007 can be found at: http://www.smartwaterways.org/files/vt_congr.ppt and in Appendix J of the 2010 legislative report: “*A Framework for Remediation of Vermont’s Stormwater-Impaired Waters.*”

Starting in 2005 an additional \$5.37 million in federal matching funds became available in Vermont for projects that “reduce water pollution generated by or directly associated with existing public roads and road maintenance activities.” These funds, administered by the Vermont Agency of Transportation with input from the Stormwater Management Section and Clean and Clear program have resulted in almost 70 projects being completed statewide. The construction or purchase of new public works garages, new salt sheds, stormwater treatment retrofits to existing large municipal discharges, roadside swale erosion stabilization, street sweepers, and catch basin cleaners are examples of projects made possible thru this grant program. Both the federal and state grant programs are now reaching an end, and new funding sources are needed to continue the momentum to improve municipal stormwater infrastructure.

Erosion Control at Construction Sites

The Problem

Construction activities that involve earth disturbance expose soil to rainfall and runoff, making it much more vulnerable to erosion. As a result, improperly managed stormwater runoff from construction sites can be a significant source of phosphorus-laden sediment reaching receiving waters. To minimize erosion and associated sediment transport by stormwater runoff from construction activities, construction site operators must implement and maintain a suitable suite of Best Management Practices (BMPs).

The Program

The Stormwater Section of the Water Quality Division issues federally mandated construction stormwater discharge permits for projects involving one or more acres of earth disturbance. The goal of the construction stormwater permitting program is to protect Vermont's waters by preventing the pollution of construction site stormwater runoff with sediment and phosphorus.

Accomplishing this aim requires equipping contractors with well-developed Erosion Prevention and Sediment Control Plans, training them in the proper installation and maintenance of BMPs, and providing clear direction on their obligations as well as the motivation to fulfill them. In short, the program strives for meaningful water quality protection by thorough and efficient permitting, effective education and outreach, and fair and equitable compliance and enforcement.

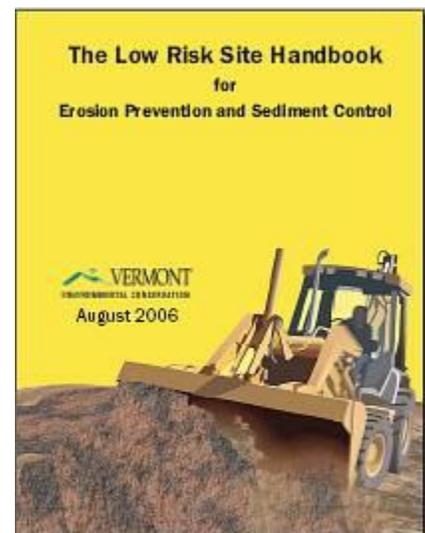
In September, 2006, the Construction General Permit was reissued with a drop in the regulatory threshold from five acres to one acre of earth disturbance. In conjunction with this new permit, the program has made important strides in the three core areas: permitting, outreach and education, and compliance.

Permitting

The Construction General Permit employs a novel, risk-based permitting system. Projects that qualify as Low Risk, based on the project location, site conditions, and volunteered limits on earth disturbance, are obliged to implement the practices in a BMP manual designed for use by the layperson. Because these projects do not pose a significant risk to water quality, permitting for Low Risk projects is expedited, allowing technical staff to devote more of their resources to the review of more complex projects that pose a higher risk of discharging sediment to waters of the state. These types of projects, which either qualify as Moderate Risk or require a customized Individual Permit, must submit a professional quality, site-specific Erosion Prevention and Sediment Control Plan for review by technical staff.

Outreach and Education

Historically, site visits were focused in areas of the state with the largest number and size of projects, mostly in Chittenden County and ski area developments. In late 2006, the construction and post-construction stormwater technical staff

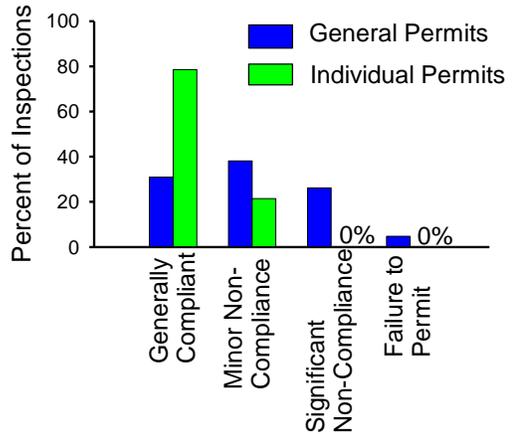


were cross-trained and assigned responsibility for permitting and compliance in regional districts. In their district roles, technical staff members have become familiar to the local regulated and consulting communities, thereby improving knowledge of the construction stormwater program and its requirements.

Compliance

The Stormwater Management Program conducted a total of 66 site visits during 2010, including 43 projects authorized under the Construction General Permit and 23 authorized under Individual Construction Permits.

2010 Compliance Inspection Findings



Indicators of Progress

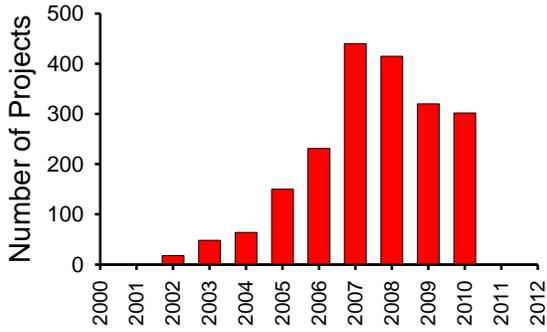
Permitting

Planned construction disturbance of 1,383 acres was permitted in 2010. This is the lowest value since 2007, and reflects the downturn in construction activity due to economic conditions. The acreage permitted does not equal the actual extent of regulated construction activity in a given year as authorizations are valid from 2-5 years.

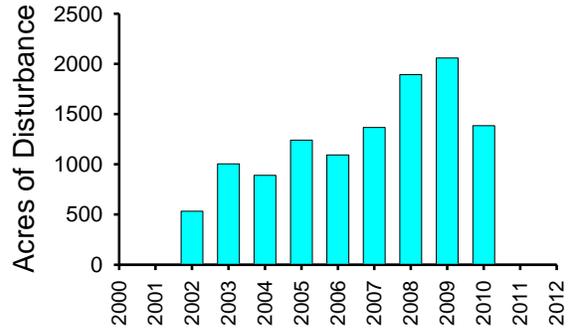
Compliance –All Stormwater Programs

Compliance remains a priority for the Stormwater Program. In 2010, more than 20% of project review staff resources were dedicated to compliance activities. Fifteen sites were identified in 2010 that did not obtain the required permit before beginning construction, and some permittees did not take sufficient steps to address identified non-compliance issues. In response to instances of significant non-compliance, the Stormwater Program participated in the issuance of approximately seven Notices of Alleged Violation (NOAV) or 1272 Orders during 2010, and was involved in several formal enforcement actions. Increased compliance assurance, including additional enforcement penalties and a sustained program of site inspections, are needed to help improve overall awareness of the permit program and deter intentional noncompliance. Additionally, site inspections are typically not random, but rather are focused on responding to complaints or other areas of anticipated non-compliance. Consequently, compliance rates of sites inspected may not be representative of the level of compliance on all sites. A program of site inspections on randomly selected sites (planned for 2011) may provide better information on compliance rates and trends.

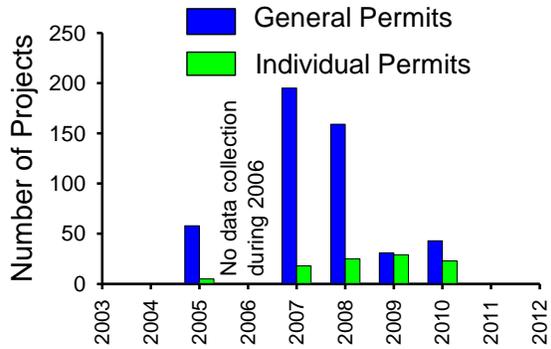
Number of Projects Authorized



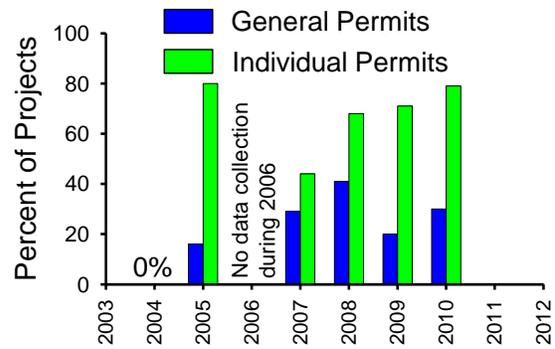
Area of Disturbance Authorized



Number of Projects Inspected



Percent of Inspected Projects in Substantial Compliance



Local Municipal Actions

The Problem

State programs do not cover all activities that may cause phosphorus and other discharges to Vermont waterways. Municipalities that want to incorporate good water quality protective language into their land use plans and regulations often lack the time and technical expertise to do so entirely on their own.

The Program

Regulations requiring measures such as vegetated riparian buffers, building setbacks from water, and appropriate erosion control provisions can be implemented at the local level to ensure that all projects meet minimum water quality protection standards. Some of the specific measures that can be implemented at the town level to control phosphorus and generally protect water quality include the following:

- Streambank and lakeshore setback requirements
- Floodplain management / flood hazard avoidance
- Vegetated buffer protection
- Low impact development standards that minimize the creation of new impervious surfaces
- Small construction site erosion control standards to minimize site disturbance and erosion
- Non-regulatory options such as the purchase of conservation easements, the re-planting of streambanks and shoreline, and educational events.

Through the Clean and Clear Action Plan, funds have been provided to the Vermont League of Cities and Towns (VLCT) to support a Water Quality Coordinator to engage and work with towns primarily in the Lake Champlain Basin. This position provides technical assistance to planning commissions, conservation commissions, selectboards, development review boards, zoning boards and professional municipal staff to support water quality enhancements to their zoning regulations and other municipal ordinances. Due to budget restraints in FY2009, this funding was reduced and the VLCT Water Quality Coordinator's hours were cut back from the original full-time status to 25 hours per week. The Clean and Clear grant funding provided to the Vermont League of Cities and Towns was eliminated at the end of FY2010. This report covers activities from January 2010 through June 2010.

Program Accomplishments - January through June 2010

Floodplain Management and Flood Hazard Assistance

Efforts were underway in 2010 in Chittenden and Washington Counties to update flood hazard maps. By the fall of 2010, all communities in these two counties that participate in the National Flood Insurance Program need to update their flood hazard regulations.

During the first half of 2010, VLCT continued its participation as a partner in a Hazard Mitigation Grant Program (HMGP) grant awarded to the Chittenden County Regional Planning and Central Vermont Regional Planning Commissions (CCRPC and CVRPC). The VLCT Water

Quality Coordinator provided ongoing assistance as the non-federal in-kind match for the project, reviewing existing flood hazard regulations and helping municipalities update their flood hazard regulations for compliance with the National Flood Insurance Program (NFIP). The Coordinator encouraged communities to adopt language from the ANR Floodplain Management Section's enhanced model flood hazard bylaws and promoted the implementation of Fluvial Erosion Hazard (FEH) zoning.

The Coordinator joined the State Hazard Mitigation Committee and participated in discussions on planning and outreach strategies to towns in flood prone areas on how they can utilize funding from the Federal Emergency Management Agency (FEMA) through their Flood Mitigation Assistance (FMA) grant program. The State Hazard Mitigation Committee engages in assisting towns and local agencies in applying for FMA grant funds to mitigate flood-impacted properties and structures. The Coordinator also attended a day-long "Local Mitigation Planning Workshop" presented by FEMA Region I.

Outreach, Presentations and Workshops

In March of 2010, the Coordinator published a comprehensive article pertaining to floodplain management in the *VLCT News*. The article, *Fluvial Erosion Hazard Prevention - Practicing the Gospel of Avoidance*, covered the National Flood Insurance Program (NFIP) and the Fluvial Erosion Hazard (FEH) program interface, case studies in Stowe, Bennington and Ripton, and the concept of "no adverse impact." The Coordinator also wrote an article titled *Municipal Stormwater Pollution Prevention - Everyday Best Management Practices* that was published in the August/September, 2010 *VLCT News*, which outlined eight stormwater pollution prevention BMPs that municipal employees should practice to help minimize stormwater pollution. The Coordinator facilitated the VLCT sponsored VIT workshop titled "The Data Your Town Needs for Comprehensive Planning" and helped with the initial coordination of the "Water Issues" workshop presented at the VLCT Annual Town Fair in October, 2010.

During the first half of 2010, the Coordinator attended and participated in workshops on a myriad of water quality topics. The Coordinator helped plan a workshop titled "Roads and Water Quality" to be held in September, 2010. This program will focus on improving town practices with regard to road runoff, the use of deicing salts, and stream crossings. To help prepare the workshop, the Coordinator attended a water quality and salt reduction seminar in New Hampshire titled "The Road Less Salted." The Coordinator helped plan and organize the Association of Vermont Conservation Commission annual meeting, much of which focused on water quality issues. The Coordinator participated in "Septic Systems and Our Lakes, Ponds and Rivers," the Federation of Vermont Lakes and Ponds (FOVLP) annual seminar, Vermont Invasive Patrollers workshop at the Missisquoi National Wildlife Refuge, the Rutland Natural Resource District annual meeting focusing on low impact development, the Vermont Planners Association Spring meeting, and the VLCT Local Government Day at the Legislature.

In the first half of 2010, VLCT hosted several water quality gatherings including: Upper Winooski Basin Planning meetings, Upper Winooski monitoring group meetings, Low Impact Development workgroup roundtables, Friends of the Winooski River board meetings, and Association of Vermont Conservation Commissions board meetings. The Coordinator participated in the Water Quality Division's anti-degradation rule development stakeholder's meetings and stormwater manual work group on high elevation wind project requirements.

Municipal Assistance

During the first half of 2010 the Coordinator was an active participant in the Chittenden County Regional Stormwater Education Program (RSEP), where discussions focused primarily on the Draft National Pollutant Discharge Elimination System (NPDES) General Permit 3-9014 for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4 stormwater permit). The draft MS4 stormwater permit will apply to the following regulated MS4s: Burlington, Colchester, Essex, Essex Junction, Milton, Shelburne, South Burlington, Williston and Winooski. The draft MS4 stormwater permit will soon also apply to Rutland City, Rutland Town, St. Albans City and St. Albans Town. The Coordinator participated in the draft permit public hearing held in February, 2010.

During the first half of 2010, the Coordinator assisted communities in Chittenden and Washington Counties in writing flood hazard regulations that exceed minimum NFIP standards. The Coordinator helped prepare flood hazard regulations for Montpelier, Waterbury and Woodbury and began working with the Huntington Planning Commission on updating their flood hazard regulations. In addition to decreasing exposure to inundation and flood erosion hazards, these enhanced flood hazard regulations help protect the sediment and nutrient attenuation capacity of floodplains in the Lake Champlain Basin.

The Coordinator found out early in 2010 that Clean and Clear funding would not continue after the end of June. For that reason, the Coordinator stopped promoting new one-on-one technical assistance projects other than flood hazard regulation preparation under the HMGP (noted above) to allow time to finish the projects already begun. The Coordinator completed the project development plan for a Model Shoreland District Ordinance, which includes standards and guidelines that prohibit unjustifiable un-buffered lakeshore development. The model also provides clear pre-construction re-development standards that address the increased impervious surface areas created when existing small camps are replaced by large year-round homes. This model ordinance will be completed in FY11 under a 319 Federal Nonpoint Source Pollution Reduction grant.

During the first half of 2010, the VLCT Coordinator did not re-evaluate any town zoning or other applicable regulations for the existence of water quality protective language. The indicators of progress used to determine the success of the Clean and Clear Local Municipal Actions Program are based on whether towns include wetland, stream, and lake protections in their zoning. In order to be considered to have "good" water quality protections, all three must be present. If any of these parameters are lacking or deemed not protective enough, the rating is lowered to a fair or poor. VLCT is currently working on the 2010 bi-yearly municipal census which includes questions about land use regulation practices. The Coordinator added questions covering the following: bylaws adopted to protect wetlands, riparian zones, floodplains and steep slopes, local stormwater management and erosion protection/sediment control, shoreland or lake shore districts, and performance standards for water quality protection. The most recent municipal census, which was sent to all member municipalities in the spring of 2008, received 208 responses, or 76% from 274 municipalities. The 2010 Municipal Census Survey will be available at the end of 2010.

Indicators of Progress

Activity	2006	2007	2008	2009	2010	Comments/Information
Number of town contacts made	31	67	31	58	10	Any contact where information or technical assistance was provided on water quality topics. (Of these 58 towns, 26 were offered flood hazard related assistance in 2009.)
Number of town board/ commission or watershed council meetings attended	21	35	41	37	11	
Articles written	4	3	3	3	2	
Information materials produced	38	33	76	24	5	
Number of meetings with partners	81	43	42	36	20	
Workshops*					6	One of these included a Vermont Interactive Television workshop facilitated by the Coordinator with 33 municipal attendees, two speakers, and the regional planning commissions.
Zoning regulations with new or enhanced water quality protection components**	25	6	7	8		Towns where there were some water quality protection language added and the town went from red to yellow or green or yellow to green on the map or perhaps didn't change color but there were enhancements in the zoning as indicated in the database.
Number of towns with good water quality protections in their zoning**	24	25	26	29		Determined based on a review of the zoning regulations for setbacks from water, vegetated buffer strips, erosion control standards, stormwater standards, flood hazard regulations, limited permitted or conditional uses in shoreland areas, protective conditional use or site plan review standards. The final determination takes into account all these factors and more but is of necessity subjective to degree.

*Recorded for the first time in 2010.

** These numbers are likely an underestimate because it is not possible to review every zoning regulation and there are likely water quality standard improvements that are missed in any given year.

See the narrative for a full description of the Water Quality Coordinator's work which does not lend itself to these numeric indicators.

Wetland Protection and Restoration

The Problem

Many wetland areas in Vermont have been altered or destroyed to support land development or agriculture. This is a concern because wetlands serve an array of critical environmental functions; the protection of water quality foremost among them. Surface runoff often flows through wetlands prior to discharging into streams, rivers, or lakes. This runoff can contain a variety of contaminants, including excess sediments and nutrients such as phosphorus, which is the main focus of the Clean and Clear Action Plan. Riparian wetlands can reduce phosphorus loading through sediment deposition, the binding of phosphorus to soil particles, and plant uptake. Protecting existing wetlands and restoring the functions of altered wetlands will expand the natural barriers to phosphorus loading in Lake Champlain and other state waterways.

The Program

The State of Vermont has jurisdiction over wetlands through a variety of regulatory programs including the Vermont Wetland Rules, Act 250, and Section 401 Water Quality Certifications. There are also some federal restrictions on wetlands that are administered by the U.S. Army Corps of Engineers. These regulatory programs help maintain the water quality benefits and other functions of existing wetlands. To date, however, the state has already lost more than a third of its pre-colonial wetland acreage.

In 2006 the Agency of Natural Resources contracted for a study to identify and prioritize wetland restoration opportunities in the basin, and this plan was finalized on December 31, 2007. Since that time, data from the plan have been widely distributed to federal, state, local government agencies, and non-profit organizations with an expressed interest in wetland restoration and protection.

In an effort to increase the total wetland acreage within the Lake Champlain basin, capital funds have been provided through Clean and Clear for a number of projects and initiatives designed to protect and restore critical riparian wetlands.

Program Accomplishments

Wetland Restoration and Protection Projects

The Clean and Clear program has dedicated \$1 million to wetland protection and restoration projects since 2005. In addition, the changes enacted as part of the 2008 Farm Bill dramatically increased the amount of federal funding available through the Wetlands Reserve Program (WRP) for wetland protection and restoration. WRP is a voluntary program that provides technical and financial assistance to private landowners to restore, protect, and enhance wetlands in exchange for retiring marginal land from agriculture. The 2008 Farm Bill has made literally millions of dollars available for Vermont projects, each of the past three years. Further, this increase in available funding occurred at the same time that the U.S. Natural Resources Conservation Service (NRCS) significantly increased the amount it pays, per acre, for WRP easements, making the program much more attractive to landowners.

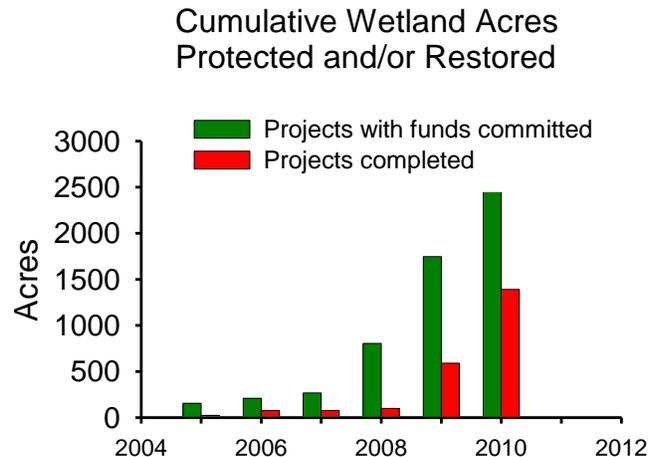
As a result of the unprecedented levels of federal funding and interest in WRP, Clean and Clear has shifted its focus to the active support of NRCS in seeking new sign-ups for WRP. Clean and Clear

has assisted with WRP project development through a combination of direct staff support and a grant to Ducks Unlimited. WRP had approximately 315 acres of new sign-ups for wetland restoration projects in the towns in 2008, 940 additional acres were enrolled in 2009, and 2010 brought applications for more than 950 additional acres of enrollment into WRP. All of these lands will be permanently conserved via an easement that is held by NRCS. NRCS pays for the easements to conserve these lands, and for the restoration expenses.

The reach of the Clean and Clear partnership with federal agencies was further extended by the U.S. Fish and Wildlife Service (USFWS) Partners for Wildlife Program, which has a staff scientist dedicated to assisting with wetland restoration plan implementation efforts and will shortly hire an additional staff position to expand the availability of Partners Program staff for WRP projects.. These positions are important to expediting restoration efforts since the NRCS has a significant engineering backlog for the survey and design work needed for its restoration projects. Restoration plans continue to be developed, designed, and implemented significantly quicker than they were just three years ago.

Indicators of Progress

The process of bringing a wetland restoration project to completion can take several years since such projects usually involve complex negotiations and agreements among landowners, state, local, and federal government agencies, and non-profit organizations. The success of wetland protection and restoration efforts under the Clean and Clear Action Plan is therefore tracked by documenting the acreage of wetlands protected and restored, as well as the acreage committed to be protected and restored.



Forest Watershed Management

The Problem

Sediment is the most common pollutant associated with timber harvesting. Soil can be carried by rainwater after timber harvesting equipment and trees dragged or carried over the ground loosen and expose the soil. Bare ground exposed during harvesting operations can be eroded by rainwater and enter nearby streams causing sedimentation. The presence of an intact forest floor on the soil surface protects soil from being eroded. The forest floor is composed of the litter layer, underlying organic layer (humus), and fibrous roots.

A 2007 report for the Lake Champlain Basin Program estimated that 8-15% of the total nonpoint source phosphorus load delivered to Lake Champlain comes from forest land. Work continues to accelerate the implementation of practices to protect water quality during timber harvesting operations. Stream crossings used during harvesting have been a particular area of concern in eliminating discharges of sediment. With forests covering more than 4.6 million acres and representing 78% of Vermont's total land base¹¹, forestry continues to be an area worthy of efforts to reduce sedimentation and phosphorus loading to state waters.

The Program

The Department of Forest, Parks, and Recreation's Watershed Forestry Program is focused on efforts to reduce nonpoint source pollution associated with forest management activities. This is being accomplished through the development and delivery of programs, education and technical assistance to loggers, landowners and natural resources professionals. The program also administers the "Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont" and Vermont's "Heavy Cutting Law" (Act 15).

Program Accomplishments

AMP Program

The AMPs were developed and adopted as rules to implement Vermont's water quality statutes, and became effective on August 15, 1987. The AMPs are designed to prevent sediment, petroleum products, and logging slash from entering waters of the state. They are also meant to reduce the potential for soil erosion and minimize stream temperature fluctuations. Loggers, foresters and scientists from Vermont and other states have developed these techniques and practices through experience and research. When implemented correctly, they have proven to be effective in maintaining water quality and preventing soil erosion on timber harvesting operations.

Since adoption of the AMPs, the Department of Forests, Parks and Recreation (FP&R) has worked with representatives from the Vermont forest industry to support the Agency of Natural Resources (ANR) Enforcement Division in an effort to reduce the number and severity of water quality violations resulting from timber harvesting operations. In 2010, FP&R staff provided technical assistance on 60 cases. There continues to be a high level of cooperation and voluntary

¹¹1997 Forest Statistics for Vermont; USDA Forest Service; Northeastern Research Station; Resource Bulletin NE-145.

compliance among loggers and landowners to bring operations into compliance with Vermont's water quality statutes.

Portable Skidder Bridge Initiative

The goals of this initiative are threefold:

1. Inform loggers, landowners and foresters about the benefits of using portable skidder bridges through workshops and presentations, field demonstrations, informational brochures, static displays, video and web production, and news articles.
2. Provide portable skidder bridges to loggers for purchase, loan and rental using a variety of means and partners.
3. Provide assistance and support for existing and start-up businesses that would fabricate and sell portable skidder bridges.

Portable skidder bridges are designed and intended for use as temporary structures for crossing streams during logging. Portable skidder bridges are becoming widely viewed as a Best Management Practice for controlling nonpoint source pollution associated with timber harvesting operations. When properly installed, used, and removed, they create less stream bank and stream bed disturbance as compared to other alternatives such as culverts or poled fords. They are also economical since they are reusable, easy to install and can be transported from job to job. Portable skidder bridges will reduce the potential for sedimentation, channeling, and degradation of aquatic habitat to occur while allowing loggers to harvest timber in compliance with Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont.



Loggers have the opportunity to learn about and use portable skidder bridges by participating in the ***Portable Skidder Bridge Rental Program***, the ***Portable Skidder Bridge Loan and Education Program*** and the new ***Portable Skidder Bridge Cost Share and Education Program***. The use of portable skidder bridges as a method for crossing streams during logging operations is gaining popularity as loggers, landowners, and foresters realize their environmental and economic advantages.

Portable Skidder Bridge Rental Program

This is a statewide program for loggers and landowners. The program is administered by the Natural Resources Conservation Districts (NRCD). This program was established as part of a joint effort between the Department of Environmental Conservation (DEC) Basin Planning Program, the FP&R Forest Watershed Program, and the NRCDs. It was started in 2007 with two pilot projects getting underway in Lamoille and Rutland counties. During 2009, three more rental programs were launched by the Windham, Winooski, and Caledonia County Conservation Districts. Caledonia partnered with the Essex County Conservation District to serve the greater

Northeast Kingdom area. Plans are underway to start up three additional programs for Bennington, Orleans and Orange/Windsor Counties in 2011.

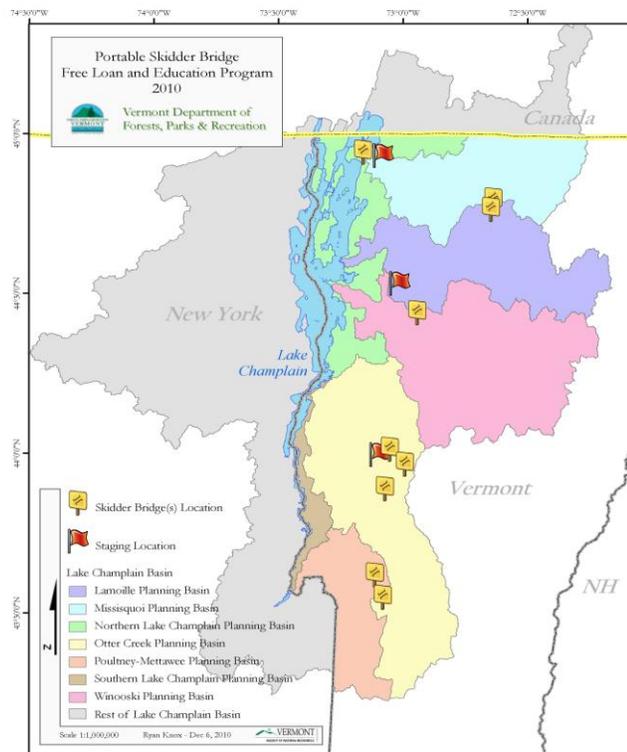
Loggers who do not own portable skidder bridges can rent them from Conservation Districts offering this program for \$100 a month. The bridges are located at six different participating sawmills and log yards around Vermont for loggers to conveniently pick up and return. Loggers who rent bridges are provided an educational packet illustrating guidelines to follow for installation, use, and removal of the bridges while following the “Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont.” Fourteen bridges were rented to loggers during 2010.

Portable Skidder Bridge Free Loan and Education Program

This program has completed its second full year of operation and has been successful in meeting its goals of reducing sedimentation associated with temporary stream crossings on logging jobs and providing exposure and guidance to loggers in the use of portable skidder bridges. The program has eleven bridges available for free loan to loggers working in the Lake Champlain Basin.

The program is administered by the Northern Vermont Resource Conservation and Development (RC&D) Council. It was launched in 2008 with an initial geographic focus area of the northern Lake Champlain Basin. In 2009, the program expanded to cover the entire Vermont Lake Champlain Basin. Loggers participating in this program are entitled to one free loan event. They are provided an educational packet that illustrates guidelines to follow for installation, use, and removal of the bridges while following the “Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont.”

Eleven bridges are being staged in various quantities for loggers to pick up and return at the Burlington Electric Department chip yard facility in Swanton, Lamell Lumber in Essex, and Canopy Timber Alternatives wood yard in East Middlebury. A project coordinator provides technical assistance and instruction to loggers using the bridges to ensure proper use to prevent sedimentation, monitor AMP compliance, and collect information on acreage accessed and volume harvested using portable bridges. The project coordinator is also responsible for tracking the bridges, geo-referencing installation sites, and performing bridge safety inspections.



One of the issues identified during the first year of the program was that the original standard design bridge will not safely support the weight of some of the larger logging equipment in use, such as mechanical harvesters and some of the largest skidders. In response, the FP&R Watershed Forestry Program applied for and received funding through the ANR Clean and Clear competitive grants program to design and build eleven bridges to accommodate heavier loads. The Free Loan and Education Program has received and put in service three of those bridges, and is scheduled to receive two more as they are built. The remainder of the bridges are being allocated to the rental programs administered by the Natural Resources Conservation Districts.

The response and feedback from loggers continues to be positive and has included suggestions for improvements to the program. The program is leading to increased use of portable bridges, as loggers experience and realize the environmental and economic benefits of using a portable design. As a result of having had an opportunity to use a bridge and see first-hand their advantages, three loggers who participated in the loan program have applied to the new ***Portable Skidder Bridge Cost Share and Education Program*** to receive financial assistance to build bridges of their own.

During 2010, loggers working in the Lake Champlain Basin entered into eleven free loan agreements for portable bridges. A total of 437 acres of woodland was accessed and 1,954 cords¹² of wood were transported across the bridges.

Portable Skidder Bridge Cost Share and Education Program

The next step in promoting the use of portable skidder bridges was started this year with the new ***Portable Skidder Bridge Cost Share and Education Program***. Funding for this program was obtained by Northern Vermont RC&D through a competitive grants program administered by the U.S. Forest Service State & Private Forestry. This is a three-year grant which allows loggers working in Vermont to apply for cost share assistance to build up two portable skidder bridges that meet specifications provided by the FP&R Watershed Forestry Program. Matching funds are provided to loggers up to 50% of the total cost to build a bridge, with a maximum award of \$1,400 for a standard design bridge and \$1,500 for a heavy duty design bridge. Federal funds in the amount of \$84,100 are available for this match.

There are three options available for loggers participating in this program. They can (1) build the bridge(s) on their own within a given timeframe, (2) build the bridge(s) at a workshop organized by Northern Vermont RC&D and FP&R or (3) purchase the bridge(s) from a vendor. In early September, a mailing was sent to 1,100 loggers working in Vermont, announcing the program and explaining the application process. The response has been excellent. To date, 28 loggers have applied for cost share assistance to build 41 bridges. Upon acceptance of their applications, loggers have up to nine months to build or purchase a bridge.

A project coordinator provides technical assistance to loggers participating in the program, inspects the bridges once they are built to ensure that they meet required specifications, and provides oversight to make certain that loggers participating in this program are compliant with the terms of the cost-share agreement. Participants are required to document bridge use and

¹² Total volume of timber harvested was converted into cords. This figure represents sawlogs, pulpwood, firewood and wood biomass.

compliance with Acceptable Management Practices (AMPs) for the first year of bridge use and report acres accessed and timber volume harvested using the bridges.

Expansion of the Portable Skidder Bridge Initiative

The Vermont Watershed Forestry Program was able to secure EPA grant funding through the Lake Champlain Basin Program to further reduce sedimentation from logging operations in the Lake Champlain Basin. This grant will establish a ***Portable Skidder Bridge Free Loan and Education Program*** for the New York State portion of the Lake Champlain Basin, modeled after Vermont's successful program. The program will be administered by the Greater Adirondack Resource Conservation and Development Council with assistance provided by the New York Department of Environmental Conservation. Eight portable skidder bridges will be built and made available to loggers for free loan. A program coordinator will be hired to provide on-the-ground technical assistance to loggers using the bridges to ensure that they are installed and used properly to protect water quality.



A Technical Assistance Program will be established for loggers participating in the Vermont ***Portable Skidder Bridge Rental Programs*** that serve the Lake Champlain Basin. There are currently three Natural Resources Conservation Districts that provide this service to loggers and forest landowners in the basin. A program coordinator will be hired to provide on-the-ground technical assistance to loggers using the bridges to ensure that they are installed and used properly to protect water quality.

A program coordinator will continue to provide technical assistance to loggers participating in Vermont's ***Portable Skidder Bridge Free Loan and Education Program*** through 2011, at which time the program will sunset. This program was designed and intended to be an 'incubator program' to expose loggers to this new technology and provide incentive for loggers to make the transition of incorporating portable skidder bridges into their operations.

Education and Outreach

The Vermont Department of Forests, Parks and Recreation hosts workshops and provides support to Vermont logger education and training programs. The Watershed Forestry Program has extended this effort to also include opportunities for landowners, natural resources professionals and high school vocational forestry students.

During 2010, the FP&R Watershed Forestry Program and Vermont NRCS organized and hosted a field training event for Vermont NRCS, FP&R and Vermont Fish and Wildlife staff in administering the NRCS ***Forest Trails and Landings Cost Share Practice***. This practice is offered to qualifying landowners through the Environmental Quality Incentives Program (EQIP) and the Wildlife Habitat Incentives Program (WHIP). The objective of the practice is to address active soil erosion and water quality impairment associated with existing skid trails and log landings. Twenty-eight natural resources professionals attended this day-long workshop.

Indicators of Progress

AMP Program Technical Assistance

There is no apparent upward or downward trend in the number of AMP technical assists as indicated by statistics for the last several years. However, FP&R staff has observed that the water quality violations are becoming less severe. AMP records from 1999 to present indicate that the number of technical assists on timber harvesting operations ranged from a low of 26 during 2005 to a high of 65 during 2006. The numbers vary due to many variables such as amount and distribution of annual rainfall, number and timing of timber harvesting operations, market conditions, etc.

AMP Program Enforcement Actions

Since adoption of the AMP's, the Department of Forests, Parks and Recreation has worked with Vermont's forest industry to support the Agency of Natural Resources Enforcement Division in an effort to eliminate discharges resulting from logging operations. In 1990, a Memorandum of Understanding (MOU) was developed and updated in 2010 between the Agency of Natural Resources Enforcement Division and the Department of Forests, Parks and Recreation. The MOU establishes a protocol that the Department of Forests, Parks and Recreation and Vermont forest industry representatives may use to assist loggers or landowners when there is a discharge while maintaining the legal enforcement responsibilities assigned the ANR Enforcement Division. According to the agreement, AMP Technical Advisory Teams have been created to directly assist any logger or landowner when there is a discharge or a request for technical assistance. Enforcement is pursued in instances where:

Year	Number of AMP Technical Assists	Number of Enforcement Actions ¹³
1999	62	3
2000	57	4
2001	43	0
2002	48	4
2003	36	2
2004	56	5
2005	26	2
2006	65	9
2007	41	9
2008	61	2
2009	60	8
2010	60	8

- There is substantial failure to comply with the AMPs which has resulted or is likely to result in substantial environmental degradation;
- Efforts to obtain voluntary compliance have been unsuccessful; and
- There is a history of noncompliance with the AMPs coupled with discharges to state waters.

The number of AMP cases referred to the ANR Enforcement Division remains low in comparison to the total number of cases investigated.

Forest Water Quality Education and Training

This indicator of success illustrates the sustained effort on the part of FP&R and the Watershed Forestry Program to provide education and training on the topic of forest water quality to

¹³ At a minimum, a "Notice of Alleged Violation" was served by an ANR Environmental Enforcement Officer.

loggers, landowners, natural resources professionals and high school vocational forestry students. Number of workshops and attendance will vary annually.

Indicator	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of training events	3	3	2	4	4	2	5	4	2	3	8	1
Number of participants	195	52	34	174	202	150	172	121	42	39	144	28

Portable Skidder Bridge Free Loan and Education Program

Indicators of progress for this program include (1) number of bridges available for free loan, (2) number of loans with loggers, (3) acres accessed using portable skidder bridges, and (4) volume of timber transported across portable skidder bridges. 2010 was the second full year that portable bridges through this program have been available to loggers and landowners in the Lake Champlain Basin. Demand for bridges and logger participation in this program has been steady.

Indicator	2009	2010
Number of portable skidder bridges available for free loan	8	11
Number of free loan agreements	10	11
Acres accessed using portable skidder bridges	470	437
Volume of timber transported across portable skidder bridges (cords)	4,008	1,954

Portable Skidder Bridge Rental Program

Indicators of progress for this program include (1) number of Conservation Districts administering the program, (2) number of bridges in the rental pool and (3) number of bridges rented. 2010 marks the third full year of operation for this program. Demand for bridges and logger participation has been steady.

Indicator	2008	2009	2010
Number of Conservation Districts offering a rental option	2	5	5
Number of portable skidder bridges in the rental pool	6	14	15
Number of bridges rented	7	11	14

Portable Skidder Bridge Cost Share Program

Indicators of progress for this program include (1) number of loggers approved for cost-share assistance, (2) number of bridges approved for cost share assistance, (3) number of bridges built, (4) number of bridge installations during the first year of use, (5) acres accessed by the bridges during the first year of use and (6) timber volume harvested using the bridges during the first year of use. (Since this program is new, not all indicator information is available).

Indicator	Year			Cumulative Totals
	2010	2011	2012	
Number of loggers approved for cost share assistance	28			
Number of bridges approved for cost share assistance	41			
Number of bridges built	2			
Number of bridge installations during first year of use				
Acres accessed with bridge(s) during first year of use				
Timber volume harvested with bridge(s) during first year of use				

DEC Watershed Initiative

The Problem

About 90% of the phosphorus pollution affecting state waters comes from a variety of nonpoint sources, including runoff from lawns, farms, streambanks, roadways, parking lots, construction sites. Unlike the piped, point source wastewater discharges that have been so successfully managed in Vermont over the last 35+ years, nonpoint sources of pollution create challenges concerning source isolation and source treatment. Those challenges are captured in the pages of text preceding this program description. It is the collective impact of all our activities on the land surface that results in lowered water quality arising from nonpoint source pollution. Because we are all part of the problem, we all need to be part of the solution, a solution involving a variety of structural and non-structural practices and behavioral changes.

The goals of the DEC Watershed Initiative are to:

1. Educate people in each watershed or river basin about what they can do to help reduce pollution.
2. Coordinate the various pollution prevention and pollution reduction activities in the drainage.
3. Engage a broad, cross-section of the public in the river basin and its smaller watersheds in establishing priorities and making decisions about the best way to manage and protect waters in the watershed community.
4. Prepare a water quality management plan for each of Vermont's seventeen river basins reflecting those priorities.

The Program

The Lake Champlain Phosphorus TMDL established phosphorus load allocations for each major lake watershed and included a general implementation plan containing major basin-wide program efforts that will be needed to achieve those allocations. Translating TMDL load allocations and river basin plans into real, "on-the-ground" actions requires a locally coordinated action process. The five DEC Watershed Coordinators play a critical role in making these plans into reality. Three of the five Watershed Coordinators are engaged in water quality management planning and project implementation in the seven river basins that empty into Lake Champlain.

The Watershed Coordinators lead the development of individual basin water quality management plans based on a public involvement process. They serve as a vital communication link between all the various state and federal agencies and local organizations that are contributing to water quality improvement efforts. They help educate individual landowners and business owners to prevent or abate nonpoint source pollution from their property. They facilitate the completion of projects, large and small, that correct locally identified problems and restore water quality. Watershed Coordinators in each major basin will help ensure successful follow-through and implementation of the Lake Champlain Phosphorus TMDL and other water quality management plans throughout the state. Involving the public in the development of action-oriented strategies for protecting and improving water quality at the watershed, community level is both a recommendation in the Lake Champlain Phosphorus TMDL and a requirement of state law. The

Agency of Natural Resources (ANR) is committed to a river basin planning process that is action-oriented and inclusive of a broad cross-section of the public in each watershed.

The DEC Watershed Coordinators develop partnerships with other organizations on projects designed to improve water quality such as buffer plantings, rain garden projects, and stream assessments and clean-up projects. The coordinators meet with municipal and regional authorities, conduct presentations and talk with the news media about the projects they are involved with. A considerable amount of each coordinator's efforts is devoted to preparing a water quality management plan that meets state and federal requirements.

The river basin water quality management plans required by statute involve in-the-field actions to restore waters. The public helps in developing strategies for water quality improvement and protection at the community and sub-watershed level in watersheds throughout Vermont. Watershed councils are established in each basin to ensure a broad cross-section of public involvement. The Agency prepares a full report on watershed action planning for the Vermont General Assembly each year. The legislative report provides detailed information about activities in these watersheds. The full report will be available online at the DEC Water Quality Division home page: www.vtwaterquality.org

Program Accomplishments

Starting with the two Watershed Coordinator positions first approved by the General Assembly in 2005, DEC has varying levels of watershed action planning underway across Vermont in each of the four major regional drainages: Lake Champlain, Lake Memphremagog, Connecticut River, and Hudson River.

The White River Basin Plan (Basin 9) and the Poultney-Mettowee Basin Plan (Basin 2) were completed and adopted by the ANR Secretary in 2002 and 2005, respectively. Consistent with legislation enacted by the General Assembly in 2007, water quality management plans for the West-Williams-Saxtons River (Basin 11) and the Waits-Wells-Ompompanoosuc-Stevens River (Basin 14) were finalized and adopted by the ANR Secretary in June 2008.

In 2009, draft water quality management plans for the drainages emptying into northern Lake Champlain (Basin 5) and the Lamoille River (Basin 7) were finalized and approved by the ANR Secretary in October 2009. The plans are labeled as draft and approved (versus final and adopted), as neither document contains recommendations for water management typing.

Basin planning continued in the Otter Creek drainage (Basin 3), Southern Lake Champlain Direct (Basin 4), Winooski (Basin 8), Ottauquechee/Black (Basin 10), Lake Memphremagog (Basin 17).

An overview of the basin planning process and the major steps leading towards the development of a river basin water quality management plan is outlined in the following table. The progress or status of each planning step is presented for each river basin.

One required aspect of the river basin planning process is to develop recommendations for surface water classification and water management typing. Once a river basin plan is finalized and adopted, a petition, consistent with the classification and typing recommendations contained in the adopted plan, is prepared and submitted to the Water Resources Panel to be adopted as a rule. Only one such petition affecting surface waters in the White River basin has been submitted (2003). That petition was subsequently withdrawn. No water management type concerning any

Class B water in Vermont has been adopted. The four basin plans that were signed by the ANR Secretary in 2008 and 2009 (Basins 11, 14, 5, 7) do not contain any recommendations concerning water management typing. Uncertainties and issues with water management typing have slowed considerably the process of attaining fully completed plans and rulemaking actions for Vermont's seventeen river basins. ANR is working to find an alternative method to ensure that the goals of water management typing can be carried out in a practical manner. Further discussion on this issue with interested parties and the Legislature is expected in 2011.

Importantly, difficulties with water management typing have not slowed the action-oriented aspect of the watershed initiative in which the DEC Watershed Coordinators are facilitating projects and actions to fix water quality problems and threats. In addition to conducting the statutorily-required basin planning activities, DEC Watershed Coordinators are actively working with watershed councils, stream teams, watershed groups, other state and federal agencies, landowners, and other stakeholders to address water quality problems and threats throughout the state.

In 2010, the five DEC Watershed Coordinators engaged a great many people across Vermont in forums and meetings designed to generate participation in projects, and developed or substantially assisted with dozens of watershed projects. Many water quality and aquatic habitat projects were initiated or completed during the reporting period. A more complete enumeration of actions leading to or involving water quality remediation is presented on a river-basin-by-river-basin fashion in the Department's 2010 Annual Progress Report on River Basin Water Quality Management Planning, which was submitted to the Vermont General Assembly in January 2011.

Statewide Surface Water Management Strategy

During 2010, the Water Quality Division coordinated the development of a Statewide Surface Water Management Strategy to guide the Division's many programs and actions in support of holistic surface water protection and improvement. The Director for Clean and Clear was heavily involved in this effort. In developing this Strategy, the Division engaged in an intensive strategic planning process aimed at identifying areas of program duplication and program gaps, and designed to maximize the Division's effectiveness and efficiency in protecting Vermont's surface waters.

What's in the Strategy?

The Strategy describes pollutants and stressors that affect uses and values of Vermont's surface waters, approaches to address stressors, and applicable regulations, funding, and technical assistance programs. Specifically, this strategy:

1. Sets forth goals and objectives for managing Vermont's surface waters in light of the goals of the federal Clean Water Act and Vermont's state surface water quality policy;
2. Describes the Division's approach to protecting and improving surface waters by managing stressors rather than individual pollutants;
3. Evaluates program effectiveness in managing stressors, including an identification of regulatory "gaps" that impede effective stressor management;
4. Describes the updated Division Ambient Surface Water Monitoring and Assessment Strategy that will work hand-in-hand with watershed management planning at the

statewide and basin-specific level to identify and prioritize waters in need of protection, restoration or management; and

5. Recommends a new more focused approach to watershed management planning that would result in the development of explicit tactical basin plans that provide the geographic specificity necessary to effectively implement this Strategy.

The Strategy presents the Water Quality Division's approaches for protection and management of Vermont's surface waters, and will help to guide the Department's future decision-making to ensure efficient, predictable, consistent and coordinated management actions. The Strategy clearly articulates the Clean and Clear Program as a core partner in implementation of these management interventions.

To effectively translate this strategy into on-the-ground actions, the Strategy also describes a coordinated statewide planning process and presents recommendations for a focused, basin-specific planning approach designed to enhance the protection, maintenance, and restoration of surface waters. The Strategy reflects experience gained and lessons learned by the Water Quality Division in working with partner programs and watershed stakeholders. The Division has initiated a stakeholder process to both present the overall Strategy and to encourage a dialogue regarding proposals for an improved basin planning process.

Watershed Initiative Status (as of November 2010)

Current Status of Major Planning Process Components by River Basin Identification Number

Components of the basin planning process	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Public forums held	IO	C	C	I	C	C	C	IO	C	C	C		O	C			C
Watershed council formed	C	C	C	I	C	C	C	IO	C	O	C			C			C
Local WQ concerns identified	IO	C	C	I	C	OC	C	IO	C	O	C		IO	C			C
Panel discussions on WQ issues held	C	C	C	O	C	IO	C	I	C	O	C		IO	C			I
Strategies for WQ issue formulated	IO	C	C		C	IO	C	I	C	I	C		IO	C			I
Review of town plans & zoning regulations	I	C	C	C	C	I	C	I	C	IO	C		I	C			I
Develop water management type classification		C					C		CP		CP						
Meetings with towns on classification proposal		C					C		C		C						
Watershed plan draft	I	C	O		C	I	C		C	I	C			C			
Public hearings on draft plan		C	I		C		C		C		C			C			
Final basin plan		A			*		*		A		A			A			
Outreach to schools & local groups	IO	O	O	O	O	O	O	O	O	O	O		IO	O			O
Basin assessment report	C	C	C	I	C	C	C	C	C	CO	C	C	OC	C	C		C
Phase I SGA	IOC	OC	OC	C	IC	OC	OC	OC	OC		OC	OC	O	OC			IC
Phase II SGA	IOC	OC	OC	C	IC	O	OC	OC	OC		OC	OC	O	OC			IC
Bride & culvert inventory	IOC	OC	OC	C	O	OC	C	C		O	OC	IO	O	OC			IC
Dam inventory		O	O	O	C		C	IO	C		I						
Biological monitoring	OC	O	O	O	OC	O	OC	OC	OC	O	O	O		O			
Restoration projects	O	OC	IOC	OC	I	OC	OC	OC	OC	IO	IOC		I	O			OC

Table notes:

I = initiated; O = ongoing; C = completed; P = recommendations pending by respective RPCs

WQ = water quality; SGA = stream geomorphic assessments

A = Final plan signed and “adopted” plan by ANR.

(*) Draft plan signed and “approved” by ANR. Document lacks state mandated water management typing recommendations.

Basin 1 = BattenKill/Walloomsac/Hoosic; Basin 2 = Poultney-Mettowee Rivers; Basin 3 = Otter Creek; Basin 4 = Southern Lake Champlain direct;

Basin 5 = Northern Lake Champlain; Basin 6 = Missisquoi River; Basin 7 = Lamoille River; Basin 8 = Winooski River; Basin 9 = White River;

Basin 10 = Ottauquechee/Black; Basin 11 = West/Williams/Saxtons; Basin 12 = Deerfield; Basin 13 = lower CT River direct;

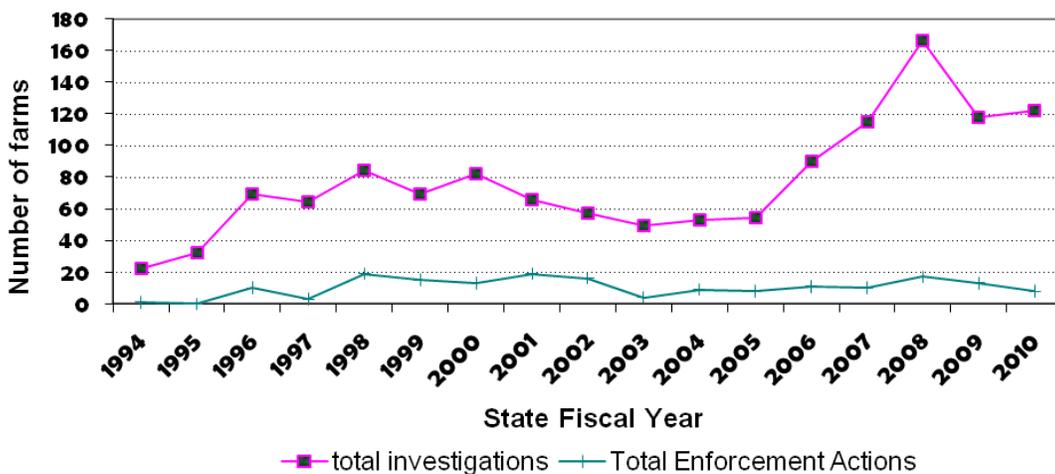
Basin 14 = Waits/Wells/Ompompanoosuc/Stevens; Basin 15 = Passumpsic; Basin 16 = upper CT River direct; Basin 17 = Lake Memphremagog

Agency of Agriculture, Food, and Markets Programs

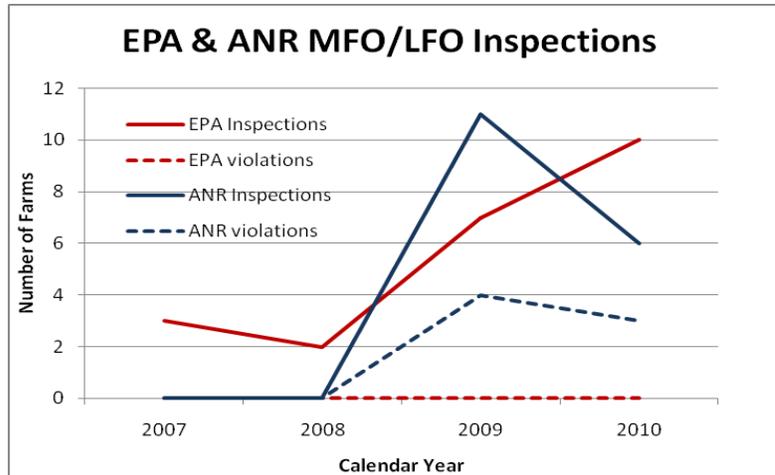
Agricultural Water Quality Regulatory Programs

The Vermont Agency of Agriculture Food & Markets (VAAFAM) is responsible for regulating nonpoint source pollution on farms. The current approach the Agency has taken to manage this task is to focus on the majority of the manure and cropland being managed by the fewest number of farms in the State, predominantly the Medium and Large Farm Operations (MFO and LFOs). This allows the limited staff to ensure compliance on a manageable amount of farms. Currently there are 152 MFOs and 20 LFOs in the state. The Agency has three MFO Coordinators and one LFO coordinator who work on regulating water quality on these farms, and also providing technical assistance to implement water quality improvement practices. The remaining 800+ dairy farms that are considered to be small farm operations are managed by the Agency through two approaches, technical assistance through the Conservation Districts and regulatory oversight via a complaint driven process. The complaint driven process includes internal staff recommendations and also concerns raised by the public. In 2010, 41% of the complaints were generated from the public, while 59% were from Agency staff. In the future the Agency hopes to reach a point where an inspection based program can be in place for small farms rather than a complaint driven process, however additional resources are required to systematically perform inspections of these operations. Any complaint or recommendation for inspection provided to the Agency receives a formal investigation by one of the five field agents throughout the state usually within 24 hours of the initial complaint, unless the nature of the complaint is not urgent. In recent years the number of investigations on farms has increased significantly, which has resulted in more identified violations. The rate at which identified violations are being found is not at the same pace as the increasing investigations, which demonstrates a positive sign that farmers are becoming increasingly aware of water quality regulations and are utilizing the available resources such as USDA or VAAFAM to help address any concerns they may have had on their farms.

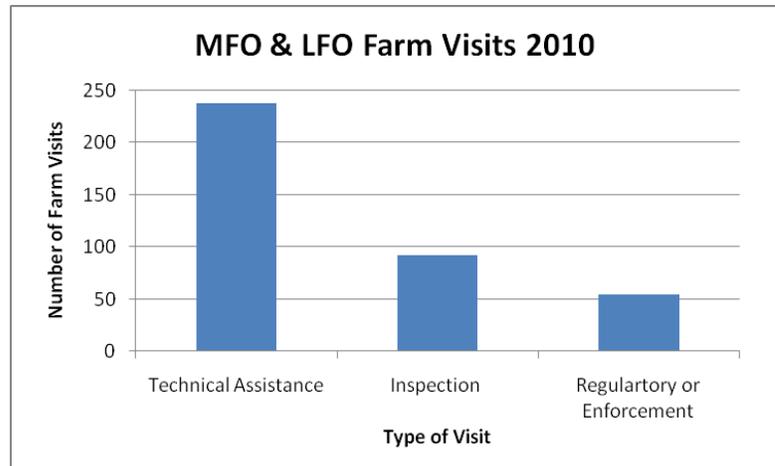
AAP Investigations vs Total Enforcement Actions



A Memorandum of Understanding (MOU) exists between the Agency of Natural Resources Department of Environmental Conservation and the Agency of Agriculture, giving Agriculture the lead on nonpoint source pollution on farms, and requires that all point source discharges on farms be referred to DEC by VAAFM in a timely manner. The MOU also lays out a process where DEC and VAAFM perform joint inspections on medium and large farms to ensure the programs are being managed by VAAFM in compliance with the Clean Water Act. In addition to these joint inspections between State agencies, the US Environmental Protection Agency (EPA) also performs joint inspections with VAAFM annually. EPA and ANR farm inspections focus predominantly on medium and large farms.



Moving forward the Agency will remain committed to ensuring the 152 MFO and 20 LFOs comply with the regulatory requirements, which were developed to be more stringent than or equal to Concentrated Animal Feeding Operation (CAFO) requirements of the EPA. In 2007-2008 the Agency performed the first round of inspections on MFOs. At that time, 53% of the farms had no violations of the MFO General Permit. Since then the Agency has worked with farms to correct identified permit deficiencies and to date has corrected 40% of identified concerns. In 2010 the Agency pursued 11 formal enforcement actions on MFO and LFO farms, more than 33 identified violations were corrected on these farms through technical assistance visits, and more than 50 visits were performed to follow up on the progress farms were making towards implementing corrective practices on previous enforcement actions. Where farms show interest and motivation to correct a potential violation identified through an inspection, the Agency will perform multiple technical assistance visits to ensure the project development and implementation continually move forward. When a farmer is not showing a commitment to correct a potential violation, the Agency will pursue an enforcement action.



Since then the Agency has worked with farms to correct identified permit deficiencies and to date has corrected 40% of identified concerns. In 2010 the Agency pursued 11 formal enforcement actions on MFO and LFO farms, more than 33 identified violations were corrected on these farms through technical assistance visits, and more than 50 visits were performed to follow up on the progress farms were making towards implementing corrective practices on previous enforcement actions. Where farms show interest and motivation to correct a potential violation identified through an inspection, the Agency will perform multiple technical assistance visits to ensure the project development and implementation continually move forward. When a farmer is not showing a commitment to correct a potential violation, the Agency will pursue an enforcement action.

Looking Forward, Developing New Approaches to Implement Practices on Farms

In an effort to expand the types of water quality management practices used on farms, the Agency is in the process of working on several low-cost, low-tech practices to see if they can be developed enough to eventually be widely available to farmers. Examples include several grants funded by the Best Management Practice Program that are currently in progress to minimize the cost of excluding livestock out of streams and developing an efficient mechanism to provide technical and financial assistance to the estimated 3,000 farms that could benefit from this practice. A committee developed in 2010 estimated the cost to implement livestock exclusion on these 3,000 dairy, beef, and equine operations throughout the state is over \$33 million.

In the field, the Agency is working on technologies that keep sediment and water from leaving the landscape so quickly, in hopes that with some retention a reasonable level of treatment can be obtained. These technologies are called water and sediment control basins (wascobs) and are currently in the design phase in northern Lake Champlain through a grant funded by the Conservation Reserve Enhancement Program. The ability to fund these wascob practices was made available to the Agency by the 2010 legislature through Act 110.

Another effort the Agency is currently engaged in is developing an incentive program to buffer agricultural ditches. Prior to 2010, there were no programs that solely provided financial assistance to farms if they wanted to create vegetative buffers along ditches. The Agency believes these ditches are an important part of the agricultural landscape for crop productivity; however they also have the potential to transport nutrients and sediments. Our hope is to develop an approach through the use of implementation grants from Conservation Reserve Enhancement Program funding that works for the farm and for water quality. Again, through the Act 110 legislation, the Agency obtained the authority to provide financial assistance for this type of practice and is currently working with partners in the northern Lake Champlain to identify the drivers needed to install more buffers along ditches.

Implementation Grants in 2010/2011

Organization	Purpose	Funding Source	Amount
Farmers Watershed Alliance	Best Management Practices	BMP Program	\$ 75,000
Farmers Watershed Alliance	Livestock Exclusion from Water	BMP Program	\$ 53,000
Friends of Northern Lake Champlain	WASCOBs & Ditch Buffers	CREP Program	\$ 51,510
Lamoille County Conservation District	Livestock Exclusion from Water	BMP Program	\$ 36,250
Missisquoi River Basin Association	Livestock Exclusion from Water	BMP Program	\$ 18,000
Ottawaquechee Natural Resource Conservation District	Livestock Exclusion from Water	BMP Program	\$ 3,843
Vermont Association of Conservation Districts	Livestock Exclusion from Water	BMP Program	\$ 54,000
Winooski Natural Resource Conservation District*	Livestock Exclusion from Water	C&C Program-ANR	\$ 40,908
<i>*Grant issued by ANR Center for Clean and Clear</i>			
<i>Total</i>			<i>\$ 332,511</i>

Financial Assistance Programs

The Agency of Agriculture has four financial assistance programs focused on implementing farmstead production area structures and cropland practices to reduce erosion and nutrient losses.

Best Management Practices Program

The Best Management Practices Program is the production area practice program and is often used in partnership with the USDA Environmental Quality Incentives Program (EQIP). In 2010 VAAFMM received \$1.6 million for the BMP program, while EQIP received \$8.8 million of which approximately \$4.8 million was used to implement production area structures. Since the inception of these programs in 1995-1996, they have been very successful in helping all farms, conventional and organic dairies, vegetable operations, and other livestock operations to implement water quality improvement practices.

In a 2008 Act 78 report the Agency provided estimates on what the remaining need for the major production area structures were on farms. This year we decided to update those numbers using improved methods and cost estimates, while at the same time accounting for the progress that the BMP program in conjunction with the EQIP program have accomplished. Note that the EQIP program provides assistance to farms in addition to those receiving funding from the Agency of Agriculture.



Silage Leachate Collection and Treatment Systems have been a focus of the Agency of Agriculture's for the past two years due to the high biological oxygen demand (BOD), phosphorus and other nutrients that can pollute surface waters. Historically most farms did not have these systems in place as the technology was limiting, however with engineered systems we are now able to offer assistance. Silage leachate is collected in a reception tank (two upper photos) which separates the high and low flows. Low flows are the most concentrated and are sent to a manure pit, while high flows are sent either to a filter area (bottom left) or a holding pond (bottom right) and eventually land applied.

At right are some new estimates for small, medium and large farm operations for the major production area practices. These estimates do not include new projects that may be needed as new technology is available, when a farm operation changes management systems, or the long term costs to update projects when the practice lifespan runs out. The combined total estimate to install the necessary water quality practices on farms of all sizes is \$78,061,622, the majority of which are costs associated with small farm operations. With the combined \$6.4 million from BMP and EQIP being utilized in production areas, we are still many years from addressing all the concerns that may exist on farms. Please note, all of these costs are not solely born by the government, to date farmers have contributed \$14.8 million of their own funding to support these types of practices.

Land management financial assistance programs range from providing incentives to install riparian buffers along streams to using alternative methods of tillage that reduce soil erosion and developing a nutrient management plan. There are three main programs that offer these services, the Conservation Reserve Enhancement Program, the Farm Agronomic Practices Program, and the Nutrient Management Planning Incentive Grant Program. Below is a summary of each of the programs' progress since their inception.

SFO Best Management Practices - Cost and Needs Estimate			
Best Management Practice	Number of Farms	Cost of Implementation (per farm)	Total Cost for SFO
Liquid Manure Storage	193	\$ 66,500	\$ 12,838,500
Silage Leachate	257	\$ 30,000	\$ 7,710,000
Access to Surface Water	2,900	\$ 11,079	\$ 32,129,100
Clean Water			
Diversion/Barnyard Runoff	400	\$ 19,950	\$ 7,980,000
Nutrient Management Plan	536	\$ 6,500	\$ 3,484,000
Milkhouse Waste	261	\$ 16,625	\$ 4,346,875
Total Cost SFO BMP			\$ 68,488,475

MFO Best Management Practices - Cost and Needs Estimate			
Best Management Practice	Number of Farms	Cost of Implementation (per farm)	Total Cost for MFO
Manure Storage Upgrade	48	\$ 140,000	\$ 6,720,000
Silage Leachate	49	\$ 45,000	\$ 2,205,000
Access to Surface Water	8	\$ 11,079	\$ 88,632
Clean Water			
Diversion/Barnyard Runoff	19	\$ 15,000	\$ 285,000
Nutrient Management Plan	2	\$ 17,258	\$ 34,515
Milkhouse Waste	0	\$ 16,625	\$ -
Total Cost MFO BMP			\$ 9,333,147

LFO Best Management Practices - Cost and Needs Estimate			
Best Management Practice	Number of Farms	Cost of Implementation (per farm)	Total Cost for MFO
Manure Storage	0	\$ 140,000	\$ -
Silage Leachate	4	\$ 45,000	\$ 180,000
Access to Surface Water	0	\$ 11,079	\$ -
Clean Water			
Diversion/Barnyard Runoff	4	\$ 15,000	\$ 60,000
Nutrient Management Plan	0	\$ 17,258	\$ -
Milkhouse Waste	0	\$ 16,625	\$ -
Total Cost LFO BMP			\$ 240,000

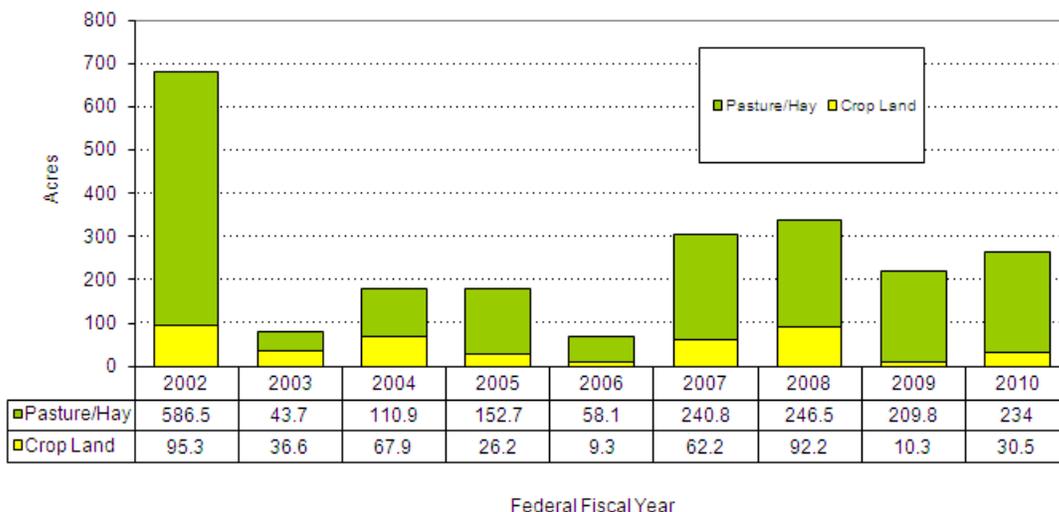
Conservation Reserve Enhancement Program

The Conservation Reserve Enhancement Program (CREP) helps to install riparian forested and/or grassed buffers along rivers and streams statewide. To date more than 2,400 acres have been enrolled, mostly riparian forested buffers (2,077 acres) and predominately in the Lake Champlain Basin (82% of contracts). The success of this program can be credited to the 4:1 federal match in financial assistance that pays 90% of the practice costs and rental payments for the land during the length of the contract, typically 15 years. There are four partner agencies cooperating on this program, the Agency of Agriculture, USDA Natural Resource Conservation Service, USDA Farm Service Agency, and the US Fish & Wildlife Service. In 2010 there has been additional assistance for the program provided by the Great Lakes Fishery Commission funding which supports one full-time three-year position to work on CREP in southern Lake Champlain, plus three Agronomists/Conservation Advisors who will help educate farmers about the programs opportunities.

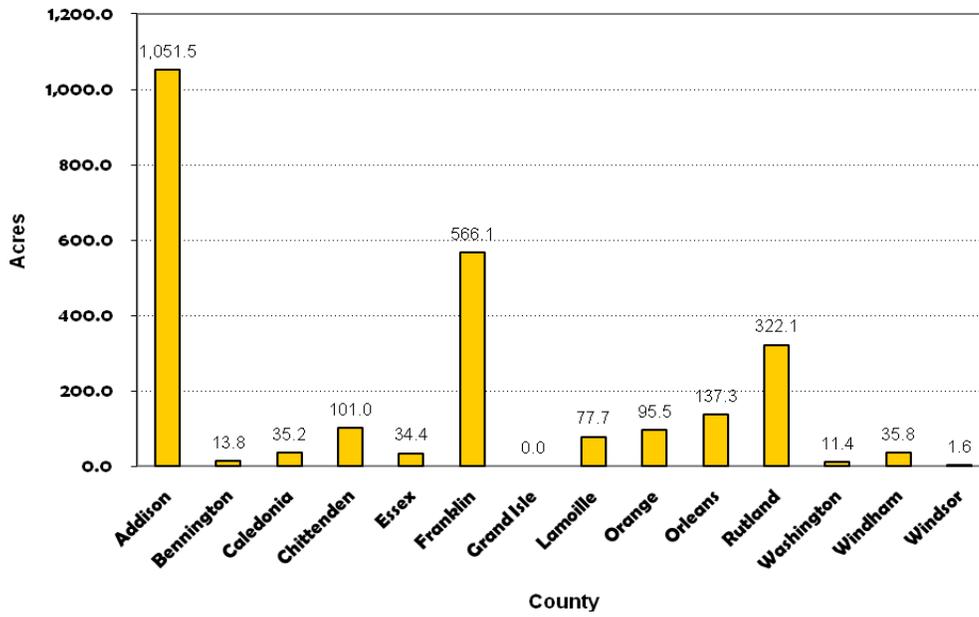


A before and after view of a forested riparian buffer CREP project in the Rock River Watershed in Northern Lake Champlain. Livestock were excluded from 22.5 acres, immediately critical erosion areas were seeded down with grasses, and the following spring trees were planted.

Acres of CREP Contracts Enrolled by LandUse Type



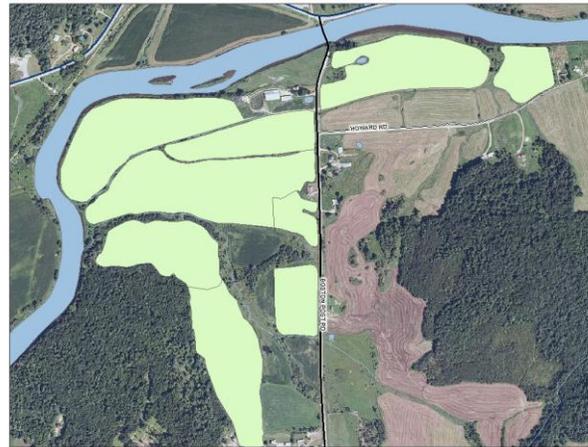
CREP Acres by County



CREP projects in Northern Lake Champlain. Riparian forested and grassed filter strip buffers in the Upper Missisquoi Bay Watershed (left); A forested riparian buffer in St. Albans Bay Watershed (center); A forested riparian buffer including livestock exclusion in the Rock River which flows into Missisquoi Bay (right).

Farm Agronomic Practices Program

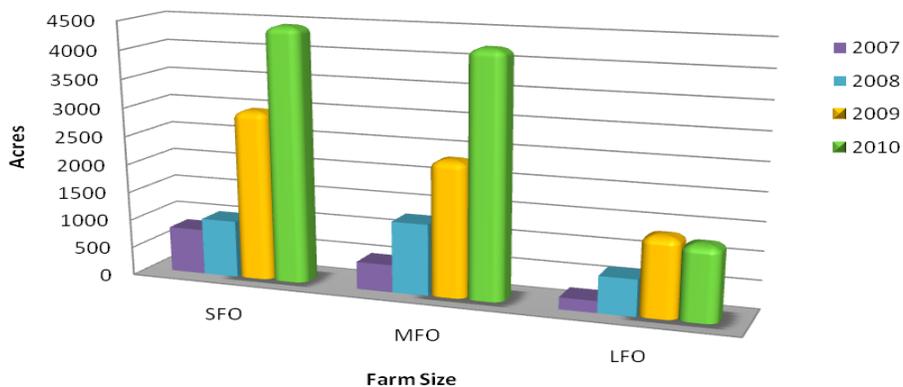
The Farm Agronomic Practices Program has by far been the most popular and fastest growing program at the Agency. This program helps by providing cost share to support the implementation of field practices such as cover cropping, crop rotation, strip cropping, no-till planting, soil aeration, alternative manure application methods and more. The most widely used practice offered in the program is cover cropping. Though it appears that small farm operations utilize more cover cropping, a \$5,000 cap per farm limits the enrollment for many medium and large size farm operations (max. eligibility per farm is 167 acres for cover cropping). From the information provided by these farms, it is clear that many are implementing sometimes twice as much cover cropping on their own without programmatic assistance.



Example of FAP mapping along the Missisquoi River. The shaded fields were cover cropped in 2010.

The funding for the FAP program is also joined with the Nutrient Management Planning (NMP) Incentive Grants program, and in 2010 the Agency received a total of \$540,952. The majority of these funds support the practices in the FAP program. For example, in 2010 \$458,658 was provided to farmers either through direct payments from the Agency or through one of our partnering organizations for FAP practices. In 2010, the Friends of Northern Lake Champlain and the Winooski Natural Resource Conservation District (NRCD) each promoted the cover crop program, while the Poultney-Mettawee NRCD and the Farmer's Watershed Alliance promoted soil aeration. The remainder of the funds supported Nutrient Management Planning grants to farmers (\$90,686) and Land Treatment Planning positions (LTPs) through the Vermont Association of Conservation Districts (\$33,000). These LTPs help assimilate the necessary information for a farmer to develop a nutrient management plan such as maps, erosion and slope calculations and are 50% funded by the USDA Natural Resource Conservation Service. Overall we allocated more funding than was available in both programs, however we were able to review older NMP agreements and cancel contracts that were not progressing which allowed us to free up previously obligated funding in order to meet the budgetary needs for 2010.

FAP Enrollment Trends



2010-Watershed Data-Implemented Practices

	<i>Acreage in Major Basins</i>				
	Totals	Lake Champlain	Memphremagog	Hudson	Connecticut
<i>Cover Crop</i>	8,455.4	5,899.9	231.0	235.0	2,089.5
<i>Rotation</i>	128.0	128.0	0.0	0.0	0.0
<i>Cross-Slope Tillage</i>	0.0	0.0	0.0	0.0	0.0
<i>Nurse Crop</i>	68.0	68.0	0.0	0.0	0.0
<i>Alt Manure</i>	485.6	485.6	0.0	0.0	0.0
<i>Strip Cropping</i>	0.0	0.0	0.0	0.0	0.0
<i>Conservation Tillage</i>	786.7	544.7	0.0	242.0	0.0

A success story which the FAP program helped to support is the aerator promotion done by the Farmer's Watershed Alliance in the northern Lake Champlain region. The 2009 Legislature directed funding to the Agency of Agriculture for the purchase of six soil aerators which would be utilized in the northern portion of the state. These six aerators were quickly mobilized into action by six custom operators through the Farmer's Watershed Alliance and were able to implement soil aeration on more than 13,000 acres in one growing season! The FAP program provided \$132,000 in payments at \$12 per acre for soil aeration to farmers who utilized these six pieces of equipment.



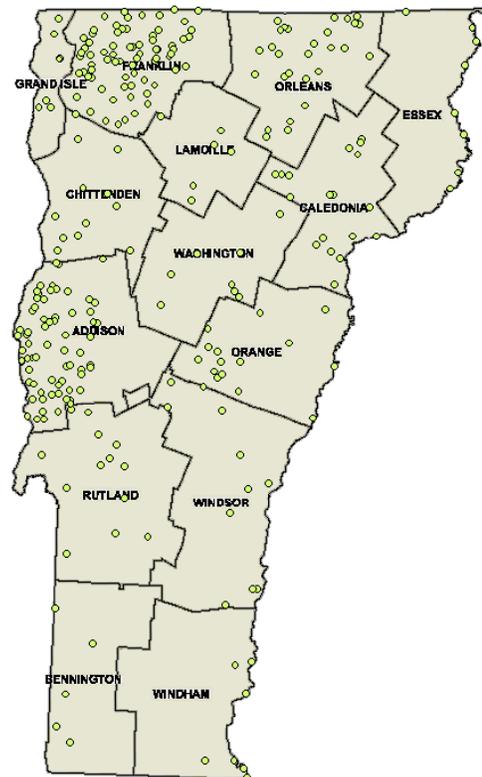
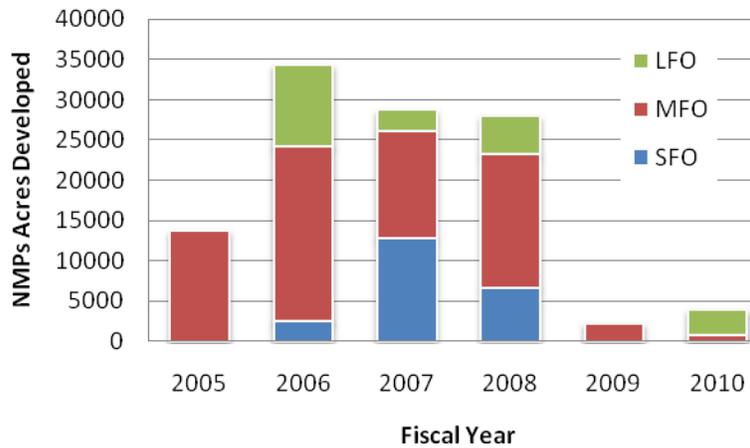
Winter Cover Cropping in Addison County.

The Nutrient Management Planning Incentive Grant Program

The Nutrient Management Planning Incentive Grant Program (NMPIG) is the dominant source of financial assistance for farmers to develop a nutrient management plan (NMP) in Vermont. A farm can receive up to \$14,000 in assistance to develop and update a plan over a four year period. After four years, the farmer can sign up with the FAP program to receive \$1,000 for a NMP update. MFO and LFO farms are required to have and implement a certified nutrient management plan. Small farms are required to perform their management similar to a NMP but do not have to have a certified NMP on site. For instance, a small farm must soil sample every 5 years, use the information from the soil samples to determine agronomic rates for nutrient applications for the crops being grown, and make any fertilizer or manure applications according to those rates.

This program was developed in 2005 in response to the regulatory need to ensure medium and large farms had NMPs that met the USDA Natural Resource Conservation Service standard. Large farms had NMPs in place prior to 2005; however changes in the rules for LFOs required many of these farms to develop the plan in a new format to meet enhanced standards. The majority of medium farms had never had a certified NMP prior to the regulatory requirement even though they may have practiced management strategies that incorporated many of the practices recommended in a NMP. The high enrollment from 2006-2008 is mostly attributed to medium and large farms utilizing this program to help offset the costs of developing a NMP. Many small farms were also enrolled during this period, perhaps because they either planned on growing into a medium farm and took the opportunity to develop a certified plan while funding was available, or they may have heard about the program through partnering organizations or nutrient management planners and pursued it as a means to enhance the farm's environmental and economical viability.

Nutrient Management Program



Statewide distribution of NMPs developed through the NMPIG program.

Moving forward the Agency would like to see more small farms develop nutrient management plans, especially those farms with 100 or more dairy cows and farms that grow crops for the sole purpose of resale. The Agency feels these types of farms could benefit from a NMP since they manage enough nutrients and land base to make a certified plan worthwhile. The smaller the farm is the less likely the cost of developing a certified NMP will pay off. The Agency would also like to focus on ensuring the plans that have been developed are being implemented and updated regularly. Through medium and large farm inspections the Agency has predominately focused on ensuring the production area structures are in place to maintain permit compliance. The shift towards focusing on field practices and NMP compliance is currently occurring for large farm operations as these permits have been in place for 10+ years. It will likely be another year or two before the medium farm program has the capacity to begin focusing their time on field practices to adequately ensure compliance with an NMP. Currently during a medium farm inspection the farm's NMP is viewed to ensure all the components have been completed and several fields are spot checked, however a thorough review is not performed for a larger set of fields during the inspection process. All plans that are developed or updated using the NMPIG program are sent to the Agency for a cursory review, and a subset of those plans are given a thorough review to ensure the handful of NMP planners offering the service to Vermont farms are developing plans that meet USDA certification.

Technical Assistance for Water Quality Improvements

The Agency of Agriculture provides direct technical assistance to farmers through the 2.5 full time engineers, a full time CREP position in northern Lake Champlain, and through the regulatory staff. The capacity to provide more technical assistance is limited by staffing levels and in some cases by program funding. For example, the Best Management Practice program received \$1.6M in 2010 which was fully obligated to 80 practices and already more than \$900,000 has been paid on 37 implemented practices. The engineering staff operates at full capacity which means that even if there were additional financial resources, new projects would not be able to be designed and implemented without additional staff. Conversely, the Farm Agronomic Practices program does not have anyone dedicated to providing technical assistance to farmers. Instead, our many partnering organizations educate farmers about the program's availability. In 2010, the FAP program did not have sufficient funds to support the demand for cover cropping which was requested in a matter of days. This created a major disruption within the farming community and a concern that by not servicing this demand we are not encouraging farmers to try new practices which are needed in order to make water quality progress.

As a means to provide additional technical assistance resources without increasing staffing level at the Agency, the grant programs have been utilized to enter into contribution agreements with federal partners for some of these services. For example, a 50/50 contribution agreement between USDA Natural Resource Conservation Service and VAAFMM has been in place for five years to provide nutrient management planning and practice implementation assistance to farmers currently enrolled in the State and Federal programs. This has been crucial for both agencies as it allows staff to continue planning new projects while ensuring implementation schedules are followed on previously planned projects. Another example of how these grant programs have been maximized are by conservation organizations who have applied for other funding to support their education, outreach and administrative efforts to work one-on-one with farmers to implement practices such as cover cropping. By giving these conservation groups the funding that normally would be paid out by the Agency for the same practices, they are able to work one-on-one with farmers to encourage them to try new practices. We have been fortunate to date that these organizations have had other funding to secure their administrative costs, however we know this will not always be the case. Since these financial assistance programs are managed by staff at the Agency that already have full time positions, they cannot offer the same one-on-one relationship that is provided by these conservation organizations which has helped to make these programs successful.

Alternative Farming Equipment to Improve Water Quality

The Capital Equipment Assistance Program was developed and funded up to \$250,000 in 2008 by the Vermont Legislature. This program offered 50% cost-share for farming equipment that would improve water quality. It took two years to allocate all of the funding as many farmers were unable to come up with their 50% contribution during poor economic times. In addition to the CEAP program the Legislature has also made several direct allocations to purchase equipment at 100% cost-share as a means to improve water quality. Below are examples of the types of equipment currently available in Vermont, either funded through the aforementioned programs or privately by farmers or custom operators.



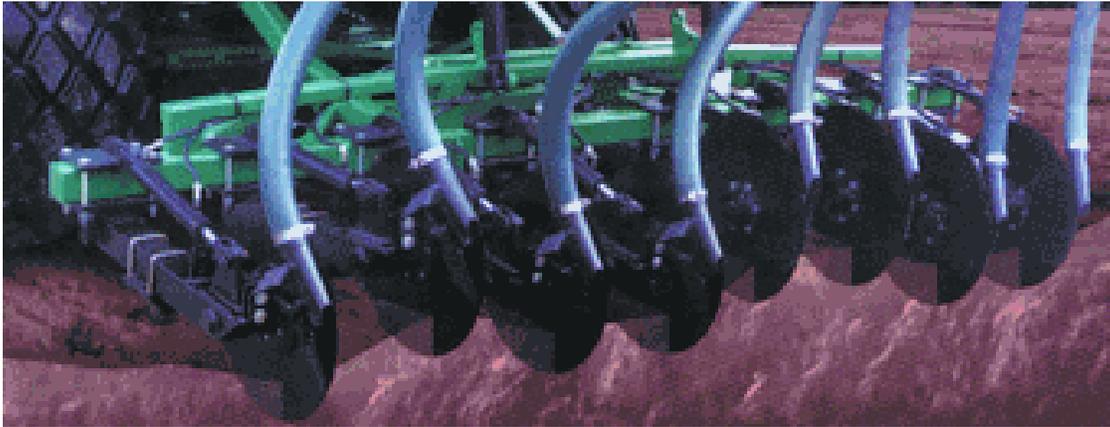
Aerway uses star-shaped spikes to punch holes in pasture/hay ground. The stars can be pivoted left/right for reduced tillage methods on annual crop lands. Currently there are 7 Aerways dispersed amongst Franklin/Grand Isle, Orange, Washington, Caledonia, Addison and Rutland counties, and 2 in Chittenden County. One aerator in Chittenden County has a manure drag line hose which helps reduce soil compaction by not driving a loaded spreader on the field, this helps water infiltrate better.



The Aerway has a mounting pad for a boom that allows manure to either be transported through drag lines from a far away storage location, or from a tanker pulling the equipment in the field. The manure is then spread closer to the ground which helps eliminate odors.



Gen-Till has longer star-shaped spikes compared to Aerway, however both types of equipment provide similar services of soil aeration and the ability to attach manure spreading equipment. There are two Gen-Tills with a drag line hose systems in Addison County and another Gen-Till attached to a manure spreader in Franklin County. Both of these systems have the manure spreading near the ground surface for immediate incorporation while aeration is being performed.



Houle offers a hydraulic disk injector unit that places manure right next to a disk plow for immediate incorporation. There is one of these in Franklin County. When manure is spread using this equipment, it is hardly visible on the soil surface.

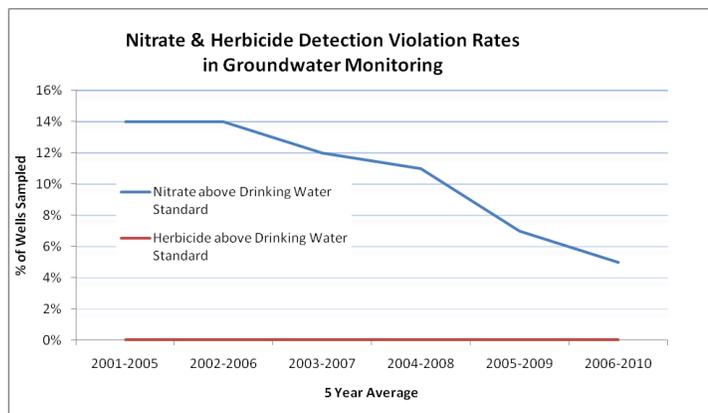


Houle has a drop flex hose system to apply manure directly to the ground surface which minimizes odor, nitrogen losses and the risk of manure being spread in a buffer zone. One of the two Houle drop flex hose systems in Orleans County has a shredder kit to evenly distribute the manure to each flex hose to assure a consistent application rate.

Groundwater Monitoring Program

Vermont developed a groundwater monitoring program in 1986 which is primarily funded through pesticide product registration fees collected by the Agency. This program provides a long term history on the quality of groundwater as it pertains to nitrates and herbicides on and around farm operations. Where results consistently exceed drinking water standards the Agency performs investigations into individual cases. The goal with these investigations is to identify the sources of contamination which can sometimes take several years to identify, especially where bedrock influences change the directional flow and travel time of water. During the process of identifying the source, the Agency works with the farm to identify resource concerns that if addressed may lead to a decrease in contamination. Addressing these concerns does not always correct the groundwater issue, and in those cases we continue to monitor and assess where additional implementation measures are needed.

Since the program's inception 2,062 wells have been sampled, and 6,144 total samples have been analyzed throughout the state, which provides a good indication on the overall quality of the groundwater as it pertains to nitrates and herbicides. In the last decade there have been no violations of the herbicide drinking water standards, and violations of nitrates in drinking water have significantly decreased.



The Agency keeps track of general detections of nitrates and herbicides, and where values come close to exceeding the drinking water standard, there is an attempt made to resample these wells to ensure the sample remains below the standard. Below are the results from 2010 showing the well detections which surpass the drinking water standard for nitrates and herbicides. Note that a specific standard is not offered for herbicides as the various herbicides that are tested for have varying standards based on the individual chemical characteristics. The ranges for nitrates <5, 5-10, and >10 represent the categorical groupings which trigger a reactive response. Those in the 5-10 range are on the watch list, while those over 10 ppm require further investigation to identify source contaminants and attempt to reduce the detection level.

Groundwater Detections for Nitrate & Herbicides Sampled in 2010					
2010	# Wells Sampled	# Wells w/ No Detections	# Wells w/ Detections		# Wells Above Standard
Herbicide Results	143	132	11		0
		92%	8%		(NA)
2010	# Wells Sampled	# Wells Not Detected	# Wells Below 5 ppm	# Wells 5-10 ppm	# Wells Above 10 ppm
Nitrate Results	143	68	47	14	14
		47%	33%	10%	10%

Measuring Progress

The January 2010 Revised Implementation Plan for the Lake Champlain Phosphorus TMDL¹⁴ included a chapter on measuring progress in phosphorus reduction. The plan indicated that the need to develop benchmarks and to account for phosphorus load reductions resulting from program actions will be addressed by the following combination of efforts.

1. Direct monitoring of lake phosphorus concentrations and tributary loading rates
2. Development and tracking of program-specific indicators
3. Watershed modeling
4. Scientific literature review and field studies on management practice effectiveness

The Vermont Water Quality Standards and the Lake Champlain Phosphorus TMDL define specific, in-lake phosphorus concentration criteria and maximum allowable phosphorus loading rates for each lake segment and its associated watershed. Direct monitoring of lake phosphorus concentrations and tributary loading rates will provide the ultimate measure of success in meeting the phosphorus reduction goals. However, these ambient water quality measures are slow to change following improved watershed management. This is because of the long time it takes for soils, vegetation, farm fields, and river channels to fully respond to restoration and nutrient control efforts. There is also a statistical time lag of several years or more between the time a water quality change actually occurs and the time when the monitoring data are sufficient to document the change with statistical confidence.

Documenting management activities with program-specific indicators provides a measure of progress that is more responsive in the short term. These program indicators track progress in implementing necessary management actions, but they usually cannot be translated directly into phosphorus load reduction quantities. Watershed modeling and research on the phosphorus reduction effectiveness of specific management practices are needed to make the link between program indicators and actual phosphorus reduction. This is why progress in reducing phosphorus in Lake Champlain must be evaluated by consideration of all four elements listed above. Activities during 2010 relating to these elements are described below.

Monitoring of the Lake and its Tributaries

Lake Champlain Long-Term Monitoring Program

The states of Vermont and New York jointly conducted the Long-Term Water Quality and Biological Monitoring Program on Lake Champlain since 1992 with support from the Lake Champlain Basin Program. The monitoring program measures phosphorus and many other parameters in the lake and its tributary rivers. The tributary monitoring results are analyzed with data from the network of stream flow gages in the basin operated by the U.S. Geological Survey. All chemical analyses are conducted by the Vermont



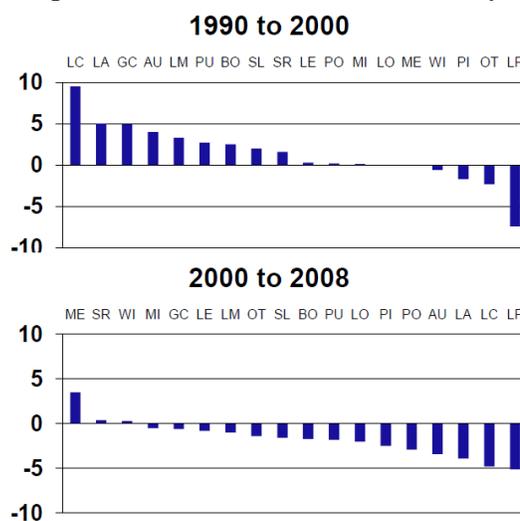
¹⁴ Vermont Agency of Natural Resources. 2010. Revised Implementation Plan. Lake Champlain Phosphorus TMDL. Submitted to the Vermont General Assembly in accordance with Act 130 (2008) Section 2. Waterbury, VT. <http://www.anr.state.vt.us/cleanandclear/news/TMDL%20impl%20plan%20final%20-%2020011510.pdf>

Department of Environmental Conservation's Environmental Laboratory. The data are made freely available on the Lake Champlain Long-Term Monitoring Program website¹⁵ and are used by researchers, resource managers, students, consultants, and the general public.

The Lake Champlain Basin Program presents monitoring results in State of the Lake Reports¹⁶ to show the current status and long-term trends in phosphorus levels in Lake Champlain and its tributary rivers. The Lake Champlain phosphorus concentration and tributary loading data from 1990-2008 were also analyzed in a jointly authored report by Vermont, New York, and Quebec staff, published by the Lake Champlain Basin Program in December 2009¹⁷. That report found that four lake segments had significant increasing trends in phosphorus concentrations over the 1990-2008 time period, while no significant decreasing phosphorus trends were observed in any lake segment. There were a few positive signs in the results, however. Phosphorus loads and flow-weighted mean phosphorus concentrations in the inflows to most regions of the lake were stable or decreasing during 1991-2008 in spite of ongoing land use conversion and development in the watershed.

The monitoring report discussed above did not attempt to statistically adjust the data for year-to-year changes in river flow rates, which can have a substantial impact on measured phosphorus loadings from the lake's watershed. To statistically control for such hydrologic variations and better discern the effects of watershed management activities, the U.S. Geological Survey applied newly developed analytical methods to the Lake Champlain tributary phosphorus data and reported their findings at a June 2010 Lake Champlain research conference in Burlington, VT¹⁸.

The USGS study found that while most Lake Champlain tributaries had increasing phosphorus trends during 1990-2000, the pattern reversed during 2000-2008 when 15 out of 18 rivers had decreasing trends in flow-normalized phosphorus concentrations. While these



Trends in flow-normalized phosphorus concentrations in Lake Champlain tributary rivers (percent per year) during 1990-2000 and 2000-2008 (from Hirsch and Medalie, 2010). Tributary codes are: Little Chazy (LC), Little Ausable (LA), Great Chazy (GC), Ausable (AU), Lamoille (LM), Putnam (PU), Bouquet (BO), Salmon (SL), Saranac (SR), Lewis (LE), Poultney (PO), Missisquoi (MI), Little Otter (LO), Mettawee (ME), Winooski (WI), Pike (PI), Otter (OT), LaPlatte (LP).

¹⁵ Lake Champlain Long-Term Monitoring Program website. http://www.anr.state.vt.us/dec/waterq/lakes/html/lp_longterm.htm

¹⁶ Lake Champlain Basin Program. 2008. State of the Lake and Ecosystem Indicators Report. Grand Isle, VT. <http://www.lcbp.org/lcstate.htm>

¹⁷ Smeltzer, E. F. Dunlap, and M. Simoneau. 2009. Lake Champlain phosphorus concentrations and tributary loading rates, 1990-2008. Lake Champlain Basin Program Technical Report No. 57. Grand Isle, VT. http://www.lcbp.org/techreportPDF/57_Phosphorus>Loading_1990-2008.pdf

¹⁸ Hirsch, R.M. and L. Medalie. 2010. Phosphorus inputs to Lake Champlain, 1990-2008 preliminary results. Presented at a research conference - Lake Champlain 2010, Our Lake, Our Future. June 7, 2010, Burlington, VT. U.S. Geological Survey. http://vt.water.usgs.gov/products/USGS_Ptrends.pdf

findings need to be confirmed with more years of data collection, it appears that watershed management efforts may be starting to have an effect in reducing phosphorus loading to the lake. A paper about these findings is currently under review at the Journal of Great Lakes Research.

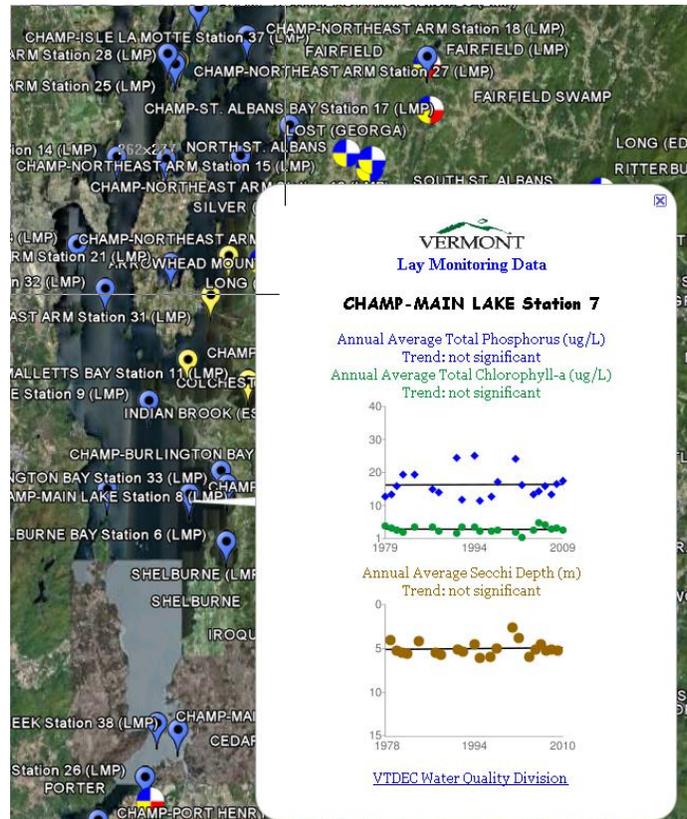
Vermont Lay Monitoring Program

During 2010, volunteers through the Vermont Lay Monitoring Program continued to collect weekly summer phosphorus and chlorophyll-a samples, as well as Secchi disk clarity readings from 22 stations on Lake Champlain and 24 inland lakes within the Lake Champlain Basin. All data from the Lay Monitoring Program are now available through the new Vermont Lake Score Card and showcased through the free Google Earth internet program. The score card conveys a range of simple to complex monitoring data using three colors: blue indicating good conditions, yellow representing fair conditions, and red signaling reduced conditions.

The score card rates conditions for Lake Champlain stations in terms of long-term statistical water quality trends. Inland lakes are scored for the conditions of water quality trends, shoreland and lake habitat, atmospheric pollution, and aquatic invasive species.

A lake's score appears by clicking on any lake from the Google Earth map. Also, specific layers of information, such as the Lay Monitoring data, aquatic plants, or fish species for each lake can be selected. The Vermont DEC Lake Information folder also reveals the more comprehensive Lake Champlain data collected through the state's professional monitoring efforts. The Vermont Water Quality Division's Lakes and Ponds web site has a link to the score card in Google Earth.
<http://www.vtwaterquality.org/lakes.htm>

The Lay Monitoring Program not only provides annual monitoring data, but also a network of lake stewards who support and promote cleaning up Lake Champlain through shared responsibility and partnerships. The score card also provides a checklist of lake protection actions citizens can take to best care for Lake Champlain and inland lakes. Quoted below is the response from the 20 year Burlington Bay Lay Monitor when he reviewed the Lake Score Card to learn what the data say as well as what actions are being done to protect Lake Champlain.



Example of lake data available from the on-line Vermont Lake Score Card.

- [Vermont DEC Lake Information](#)
Click here for information and links
- Lake Scores
- Lay Monitoring Data
- Spring Phosphorus Data
- Aquatic Plants
- Fish

“I find that a tremendous amount of effort, on the part of many groups, is going into addressing the problems facing the Lake.”

Burlington Bay Lay Monitor after 20 years of monitoring

Program Indicators

The 2010 Revised Implementation Plan for the Lake Champlain Phosphorus TMDL included a preliminary list of program-specific indicators. During the past year, ANR and AAFM staff have worked to refine these indicators in close coordination with concurrent efforts by the Lake Champlain Basin Program to develop an adaptive management process for the lake. Consistent with the adaptive management concept, it will be necessary to define in advance the acceptable levels for each indicator, and to report periodically on the status of the indicators with respect to their ultimate acceptable levels.

Indicators are being sought that have a direct and easily understood cause-and-effect link to phosphorus reduction, and that are practical to measure. In some cases, the data already exist or could be readily obtained by the management programs to determine the current status and define the acceptable levels for the indicators. In other cases, additional resources will be needed in order to evaluate the current status or to inventory the remaining implementation needs.

The following table presents the current working draft framework for program-specific indicators of phosphorus reduction progress in the Vermont portion of the Lake Champlain Basin. The current status and acceptable levels for these indicators are included in this table where known. Additional data collection projects that would be necessary to support certain indicators are also noted. The ANR and AAFM are continuing to refine this framework in coordination with the Lake Champlain Basin Program, and are seeking the resources needed to fill the data gaps. It is anticipated that the 2011 Annual Clean and Clear Report will include a focus on the status of these phosphorus reduction indicators.

Proposed Program-Specific Indicators for the Vermont Lake Champlain Phosphorus TMDL Implementation Plan

(Bold indicates a data project need.)

Indicator (P = Prevention; R = Reduction)	Reporting Frequency	Current Level (Lake Champlain Basin unless noted otherwise)	Near-Term Acceptable Level	Ultimate Acceptable Level
<i>Stormwater Management</i>				
Percent of impervious area that is under stormwater management (R)	5 years	Current area can be calculated from Stormwater Program permit database		Total impervious area would need to be determined by a remote sensing/GIS analysis
Percent of land area in stormwater impaired watersheds in need of treatment that is receiving treatment (R)	Annual, starting in 2015	Must first complete flow restoration plans before treatment can be implemented and tracked		100%
Percent of all permitted construction stormwater sites in substantial compliance with their permit (P)	Annual	Inspections of a representative selection of sites will begin in 2011		100%
Percent of all permitted operational stormwater sites in substantial compliance with their permit (P)	Annual	Inspections of a representative selection of sites will begin in 2011		100%
Percent of municipalities with storm sewer systems that have completed Illicit discharge detection and elimination (IDDE) projects and eliminated any illicit discharges found (R)	Annual	28 towns are expected to have completed IDDE projects by the end of 2011		100% of the 56 towns with urbanized areas that need IDDE review
Percent of towns with good water quality protection provisions in zoning ordinances, including river and lakeshore buffer protection, fluvial erosion hazard prevention, and incorporation of Low Impact Development standards where appropriate. (P)	Annual	Need to develop a method for consistently evaluating town ordinances for all water quality elements		100% of the 136 towns in the Lake Champlain Basin
<i>Better Backroads and State Road Standards</i>				
Percent of Vermont towns participating in the Better Backroads Program since 1997 (R)	Annual	71%		100% of the 136 towns in the Lake Champlain Basin

Indicator (P = Prevention; R = Reduction)	Reporting Frequency	Current Level (Lake Champlain Basin unless noted otherwise)	Near-Term Acceptable Level	Ultimate Acceptable Level
Percent of towns that have completed road erosion needs inventories and capital budget plans since 1997(R)	Annual	39		100% of the 136 towns in the Lake Champlain Basin
Cumulative percent of priority erosion control projects identified in erosion needs inventories that have been completed (R)	5 years	Town personnel will be surveyed to assess status of projects.		100% of priority projects completed. (The total number of priority projects is available from individual town erosion needs inventories.)
Percent of towns having adopted Town and Bridge Standards in accordance with Act 110 (2010) that contain a suite of water quality based BMPs (R)	Annual			100% of the 136 towns in the Lake Champlain Basin
<i>River Management</i>				
Percent of river miles in stream geomorphic assessment category II (incised and steepening) or III (incised and widening) (R)	Stratified probabilistic assessment every 5 years	60% statewide	50% by 2020	30%
Cumulative percent of river miles classified, as part of a statewide sediment regime departure analysis, to be unconfined, sediment transport reaches (i.e., incised reaches that should be depositional, and not under active management) for which floodplain access is either actively or passively restored (R)	Annual	The baseline number of transport reach miles can be estimated from analysis of existing River Management Program database		80% of baseline transport reach miles
Cumulative number of river corridor easements secured for reaches of river identified as key sediment attenuation areas in completed geomorphic-based river corridor plans (R)	Annual			Obtain target number from river corridor plans
Percent of stream miles with perennial vegetated buffers - differentiated by adjoining land use, buffer width class, vegetation type (woody, non-woody), programmatic coverage (e.g., CREP, WRP), and consistency with any regulatory standards that apply. (R)	5 years	Would require a remote sensing/GIS project to assess status		Total stream miles would need to be defined based on the spatial scale and stream order to be included

Indicator (P = Prevention; R = Reduction)	Reporting Frequency	Current Level (Lake Champlain Basin unless noted otherwise)	Near-Term Acceptable Level	Ultimate Acceptable Level
<i>Wetland Restoration</i>				
Cumulative area of wetland restored (R), and cumulative area of wetland lost	Annual	591 acres restored ? acres lost	2,000 acres restored by 2012 Less than (?) acres lost	Net gain of wetland area
<i>Wastewater Discharges</i>				
Total wastewater phosphorus load, by lake segment watershed (R)	Annual	Data are compiled annually and readily available	Less than the applicable TMDL allocation for the lake segment	Less than the applicable TMDL allocation for the lake segment
Percent of facilities meeting their TMDL wasteload allocations (R)	Annual	93% (56 of 60)	100% by 2012	100%
Percent of wastewater treatment facilities having an approved sewage spill prevention plan for (a) the treatment plant and (b) the collection system (P)	Annual	a. near 100% b. 7%	a. 100% by 2012 b. 100% by 2015	a. 100% b. 100%
<i>Forest Watershed Management</i>				
Percent of sampling units within logging jobs where harvesting operations have caused measurable amounts of sediment to enter streams. (R)	5 years	Perform assessment using US Forest Service Best Management Practices Monitoring Protocol.		0%
Percent of tree canopy coverage within urban landscape zones in the Lake Champlain Basin (R)	5 years	Urban landscape zones are already delineated for Vermont. Would need to develop a GIS data layer on canopy coverage.		40%
<i>Agricultural Water Quality Management</i>				
Percent of farm inspections identifying violations of Accepted Agricultural Practices (R)	Annual		5%	0%

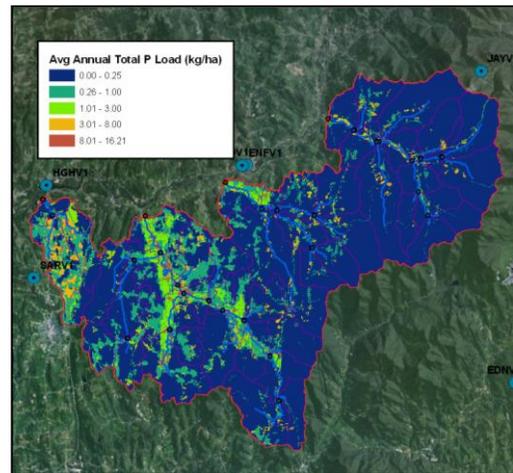
Indicator (P = Prevention; R = Reduction)	Reporting Frequency	Current Level (Lake Champlain Basin unless noted otherwise)	Near-Term Acceptable Level	Ultimate Acceptable Level
Percent of farms in need of Best Management Practice structures, by farm type (LFO, MFO, SFO) (R) a. Manure storage b. Silage leachate treatment c. Barnyard runoff treatment d. Milkhouse waste treatment	Annual	Statewide numbers LFO a. 0% LFO b. 0% LFO c. 0% LFO d. 0% MFO a. 10% MFO b. 37% MFO c. 20% MFO d. 0% SFO a. 50% SFO b. 30% SFO c. 50% SFO d. 65%	Statewide numbers LFO a. 0% LFO b. 0% LFO c. 0% LFO d. 0% MFO a. 0% MFO b. 0% MFO c. 0% MFO d. 0% SFO a. 5% SFO b. 5% SFO c. 5% SFO d. 5%	0% for all farms and all practices
Number of farms with an approved nutrient management plan, by farm type (LFO, MFO, SFO) (R)	Annual	Easily determined for LFOs and MFOs Estimates are possible for SFOs		100% of all farms (total numbers of farms are known for each type)
Area of agricultural land under enhanced land management for (R) : a. Cover cropping b. Alternative manure spreading methods c. Conservation tillage	Annual		By 2010: a. 12,000 acres b. 15,000 acres c. 500 acres	Analysis would need to be done using NRCS method that was applied to the Missisquoi watershed
Percent of river miles adjoining pasture lands where livestock have uncontrolled access to the stream (R)	Annual	Use CLU data, where available, to identify pasture. Use GIS analysis to determine the miles of streams within pasturelands. Develop methodology for determining where livestock have uncontrolled access to the streams.		0%

Watershed Modeling

Missisquoi Bay Watershed Critical Source Area Study

The International Joint Commission has provided funding to the Lake Champlain Basin Program to conduct an analysis of critical source areas of phosphorus in the Missisquoi Bay watershed in Vermont. Critical source areas are locations on the landscape where a significant source of phosphorus coincides with a mechanism for transporting the phosphorus to receiving waters. Phosphorus source factors include such things as livestock, manure, fertilizer, tillage practices, urban features, soil phosphorus levels, streambanks and channels, and wastewater discharges. Phosphorus transport mechanisms include climate and weather patterns, soil characteristics, slope and topography, runoff rates, and distance to a watercourse. By identifying critical source areas, management resources and conservation practices can be targeted more efficiently.

The Lake Champlain Basin Program has contracted with Stone Environmental, Inc. to conduct a watershed modeling analysis to identify critical source areas in the Missisquoi watershed. Stone Environmental is using the Soil and Water Assessment Tool (SWAT) to predict the phosphorus contributions from various portions of the landscape. The SWAT model will be used to identify the land uses where phosphorus contributions are disproportionately high, and help direct conservation practices to those the areas. The model will also be used to simulate alternative scenarios to determine how phosphorus loads might be affected by changes in management practices.



Example of a critical source area high-resolution model output. Figure courtesy of Stone Environmental, Inc.

Vermont ANR and AAFM staff have provided data and are actively participating in various advisory capacities with this project in order to ensure that the needs of the management agencies will be met. A final report to the International Joint Commission is due at the end of 2011.

USDA Bank Stability and Toe Erosion Model

A fundamental question which has remained unaddressed in the modeling of sediment and nutrient loading to Lake Champlain is how much of the load is coming from stream instability. To date, load allocations have been for wash-off from urban, agricultural, and forest land covers. The Vermont DEC River Management Program, in partnership with the Center for Clean and Clear and the Lake Champlain Basin Program, developed a cooperative agreement with the USDA Agricultural Research Station in Oxford, Mississippi to carry out research employing the Bank Stability and Toe Erosion Model (BSTEM) in the Missisquoi River Watershed.

The primary objectives of the USDA BSTEM research are the following:

1. Estimate of the percentage of the total suspended sediment yield/load entering Lake Champlain from the studied portion of the Missisquoi River watershed that is coming

from stream channel erosion processes. These results will be combined with total phosphorus data collected from the eroded soil strata to give insight into P loading into Lake Champlain as a result of stream erosion processes.

2. Increase our understanding of the correlation between stream equilibrium and bank stability in Vermont. Study a range of geomorphic conditions (via careful site selection) to see if geomorphic condition can be used to explain the quantity and rate of bank erosion and planform adjustment. This information will help inform river corridor protection work and the selection of specific floodplain restoration projects.
3. Model the effectiveness of different best management practices in reducing fluvial process derived sediment and nutrient loading. Best management practices modeled would include watershed, floodplain, and channel management practices consistent with the State's goal of managing river systems toward equilibrium conditions over time.

Effectiveness of Best Management Practices

Urban Best Management Practices in the Englesby Brook Watershed

The U.S. Geological Survey has been monitoring the effectiveness of urban stormwater control practices in the Englesby Brook watershed in Burlington since 2000, with support from the Lake Champlain Basin Program and the Vermont DEC. Structural practices installed during the study included a retrofit of a golf course irrigation pond, a wet extended detention facility treating runoff from Shelburne Road, and a shallow marsh wetland treating runoff from a residential area. Water quality measures included phosphorus, nitrogen, suspended sediment, E. coli bacteria, and mercury. Data collection efforts ended in 2010, and a draft final report is due in 2011.



USGS flow monitoring weir installed on Englesby Brook.

Rock River Targeted Watershed Implementation Initiative

The Lake Champlain Basin Program is supporting a Targeted Watershed Implementation Initiative in the Rock River Watershed (tributary to Missisquoi Bay). This project will provide concentrated funding and technical support for approximately 16 farms to implement best management practices within a 3,500 acre sub-watershed of the Rock River. The Basin Program has issued a contract for \$100,000 for the first phase of this work to develop farm-specific action plans, and it is anticipated that a follow-on project will be funded at a substantially higher amount for the administration of financial incentives and disbursements to participating farmers.

One purpose of the Targeted Watershed Implementation Initiative is to demonstrate that when agricultural producers implement a suite of priority conservation practices in a short period of time, measurable progress in water quality can be achieved. However, no provisions were made to conduct water quality monitoring as part of this initiative.

In order to move quickly and meet the need for obtaining critical pre-implementation water quality monitoring data while the opportunity still existed, the Vermont DEC Clean and Clear Program used state funds to initiate a monitoring study starting in October 2010. State funds

were used to (1) support the construction and operation of a new U.S. Geological Survey flow gage on the Rock River immediately downstream of the project area, (2) provide a grant to the Friends of Northern Lake Champlain to conduct both dry-weather and storm event sampling in the Rock River at two sites immediately above and below the project area, and (3) cover Vermont DEC Laboratory analytical costs for total phosphorus, dissolved phosphorus, and total suspended solids samples.

To evaluate the water quality benefits of the Targeted Watershed Implementation Initiative, this sampling program must continue for at least 4-6 years in order to obtain sufficient data before and after implementation of agricultural practices. Data collected by Vermont DEC at these two sites during 2008-2009 for another study are available to supplement the pre-implementation dataset. The monitoring program will support an “upstream-downstream” and/or a “before-and-after” experimental design to compare pollutant concentrations and loads. Analysis of covariance may be used to control for hydrologic differences between pre- and post-implementation periods, with either flows at the gage station or concurrently measured upstream concentrations and loads as covariates.