

Vermont

Enhanced Implementation Plan for the
Long Island Sound TMDL

Nonpoint Source Section

Final report section submitted to the LIS TMDL Workgroup – April, 2013

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Appendix A: Table 7. Water quality management programs and associated timelines.

Vermont Introduction

The primary focus of the Vermont portion of this report is to address the agreements set forth in the nonpoint source (NPS) section of Long Island Sound Enhanced Implementation Plan which in part states:

“...all states will complete a preliminary evaluation of current stormwater and nonpoint source control efforts with a goal of qualitatively assessing whether they are adequate for meeting the 2000 TMDL LAs.”

And more specifically to:

“Qualitatively assess the scope and effectiveness of MS4 stormwater and urban, agricultural and other NPS control programs being implemented”

In recent decades in Vermont there has been no concerted effort to focus specifically on nitrogen control because of its perceived minor impact to local water bodies. Nor has there been any impetus to track its sources or the effectiveness of applied BMPs that may have an impact on nonpoint source nitrogen and its control. However, for several decades there has been a focus on controlling sediment and phosphorus runoff because of their measurable impact on local waters. Because of this known impact, many programs and associated projects focus heavily on controlling or preventing sediment and phosphorus to improve or maintain local water quality. With the implementation of these management programs it's believed that significant improvement in nitrogen control is an ancillary benefit since many of the drivers of sediment/phosphorus control are also sources of nitrogen.

After an initial assessment, it was determined that there was little or no quantitative information collected on nonpoint source nitrogen control across numerous management program and associated BMP implementation across the CT River basin. Therefore, there was no attempt here to quantitatively assess the amount of nitrogen reduced or prevented from entering the Connecticut River. There simply is not enough compiled information to make that assessment currently. However, if in moving forward nitrogen reduction quantification becomes the primary focus of TMDL compliance, a considered program of best management practices (BMPs) tracking and accounting will need to be built from the ground up with agreed upon measures of success.

With the basic underlying premise outlined above, this report looks to:

First, identify the VT sources of nitrogen as they are currently understood, across broad land use sectors, such as developed, agricultural and forested;

Second, identify the current status and trends of important drivers of nitrogen export such as the intensity of agricultural and development activities and investigate how these might have changed since the TMDL baseline time period of 1990;

Third, identify the management programs that address these drivers of nitrogen loading that have a significant effect on reducing or preventing nitrogen export. As part of this, identify a timeline as to when programs were initiated or enhanced; and

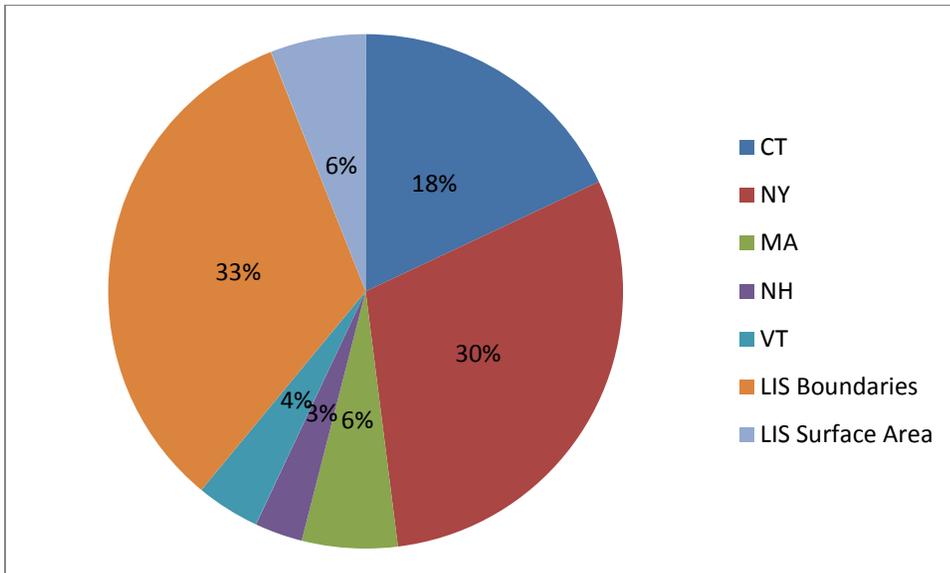
Forth, using a weight-of-evidence approach, assess the combined management programs/projects to develop a qualitative evaluation as to whether management efforts are sufficient to meet the original 2000 TMDL of a 10% NPS nitrogen reduction and if these actions are sufficient to maintain that control into the future.

Vermont nitrogen export to LIS

In conjunction with the original data forming the basis of the LIS TMDL, multiple modeling tools have been developed since the issuance of the initial Long Island Sound TMDL that describe nonpoint and point source nitrogen contributions to the Sound. With these modeling efforts, it’s possible to estimate Vermont’s contribution to the Connecticut River, and thus the Long Island Sound (LIS) and also to estimate the breakdown of Vermont’s nonpoint source nitrogen export by broad sectors.

Vermont’s contribution of delivered nitrogen to LIS has been previously summarized in a NEIWPC report and presented below (Figure 1). Specifically, the data shown in Figure 1 has been taken from Figure 3 of the 2010 “Briefing Book”. According to this analysis, when considering all sources, Vermont’s total nitrogen contribution represents 4% of the total load to LIS.

Figure 1. Estimated percentage breakdown of nitrogen loading sources to Long Island Sound.



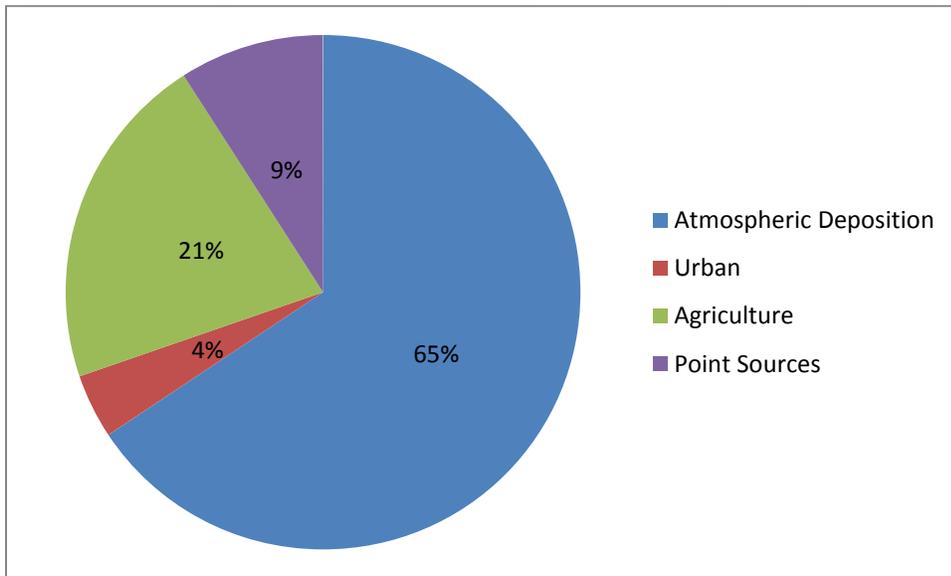
When considering Vermont sources of nitrogen export, two recent modeling efforts are extremely useful, identified here as New England SPARROW and Northeastern AVGWLF. While modeling methodologies differ across both models, there appear to be enough similarities in the nonpoint source breakdown to gather a well-founded summary of Vermont’s nitrogen source categories. Table 1 gives results from these modeling efforts as a percent of the total load that is eventually delivered to LIS. That is, they account for any nitrogen loss from the source areas in Vermont as it travels in tributaries of the CT River and ultimately to the LIS. These summary estimates were developed through a joint effort of the LIS TMDL Workgroup and NEIWPC.

Table 1. Water quality model results comparing Vermont’s nitrogen loading to Long Island Sound.

Model	Percent VT Contribution of Total Delivered Load to LIS					
	Agriculture	Developed	Forest	Atmospheric	Total NPS	Total PS
New England SPARROW	21	4	-	65	91	9
Northeastern AVGWLF	20	6	67	-	93	7

Figure 2 below represents the NE SPARROW data, which compares well with AVGWLF results, that estimates the breakdown of nitrogen sources in Vermont. Approximately 21 % of Vermont’s nitrogen export originates from agricultural areas and approximately 4% originates from developed areas. Of note is that approximately 65% of the nitrogen exported from Vermont originates as atmospheric deposition. These source categories can help to prioritize nitrogen reduction efforts as Vermont moves forward in developing an efficient and cost-effective nitrogen control plan as part of the forthcoming TMDL.

Figure 2. New England SPARROW modeling results showing nitrogen loading sources for Vermont.



Status and Trends of Nitrogen Drivers

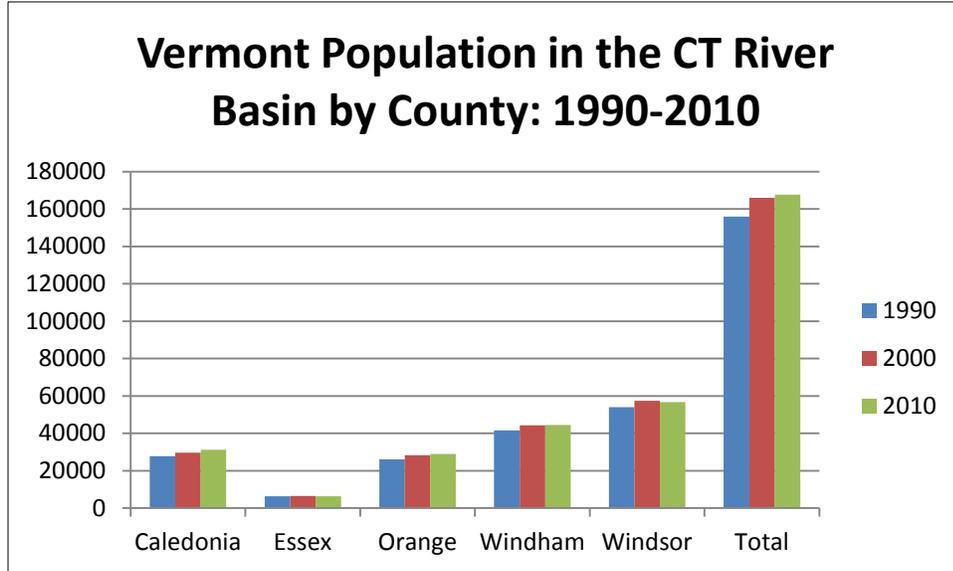
In the absence of an extensive water quality monitoring program to determine the trend of nitrogen export from Vermont, one can substitute trends of large scale drivers of nitrogen export. These drivers include changes in land use and population that can have a significant impact on nonpoint source nitrogen export. Although coarse, trends in these drivers can provide a general approximation of how the potential for nitrogen export may have increased, decreased or remained the same over time. Trends in several of these drivers are discussed below. Fortunately, the five Vermont counties along the easternmost portion of the state closely approximate the CT River watershed boundaries. Of these five counties, 93% of the acreage falls within the CT River basin and of the entire CT River basin in Vermont, 89% is contained within the five counties. Throughout this report, several data are compiled on a

county-wide basis as noted above and are presented to reflect conditions for the CT River basin in Vermont.

Population changes

In order to compare the population changes in the CT River basin from the baseline year of 1990, two separate analyses of US Census county data were compiled. The first analysis is presented in Figure 3 which gives the breakdown by county of the population changes for 1990-2010.

Figure 3. US Census data for the five Vermont counties comprising the majority of the CT River basin.



The US Census data indicates an approximate 7% population increase since 1990 but this represents a relatively minor increase of only 11,609 persons across the 10,000+ square kilometer watershed. According to the county data, this population increase was not particularly concentrated in any given area since 1990 and suggests there are no concentrated areas of significant development.

A second population analysis was conducted by EPA that compared population change between 1990 and 2010 according to HUC12 watershed (Figure 4). As shown from the map, all but two of the HUC12 units showed either a decline in population over the 20 year time period or a modest increase of less than 1,000 people. For the remaining two units, one showed an increase of between 1,000 and 2,000 people and the other an increase of between 2,000 and 5,000. It should be noted however that these two watersheds also extend beyond the Vermont border by an equal area so it’s likely that a portion of the population increase occurred in New Hampshire. The overall population change across the basin is estimated at 3.0 persons/square mile. As with the previous population analysis, it appears that most of the population change occurred over the entire basin area and not particularly concentrated in one area.

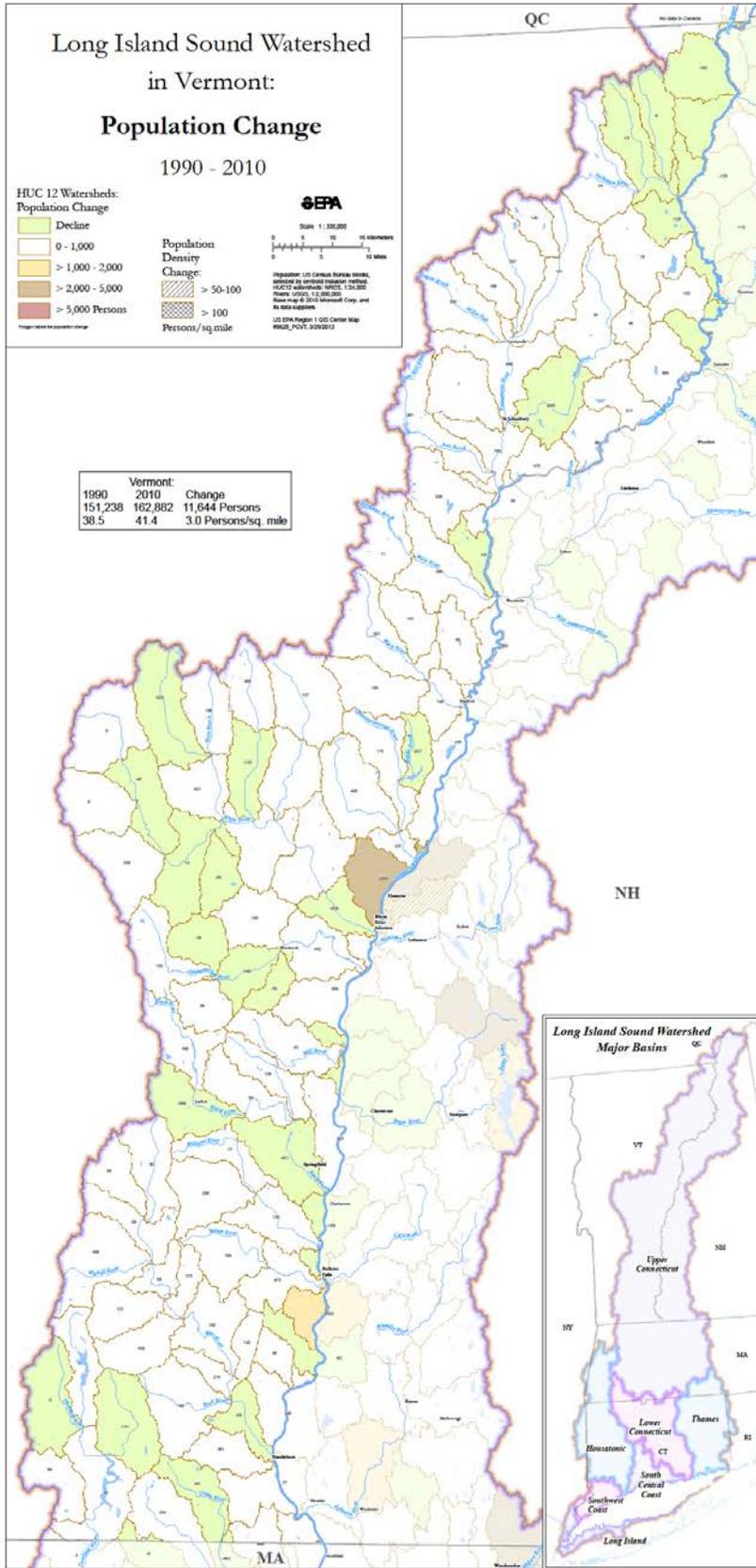


Figure 4. Population changes in the CT River basin in Vermont: 1990-2010.

Land use and impervious cover changes

Based on the AVGWLF evaluation of nonpoint sources loading to LIS, generalized land use estimates were determined and are given below in Table 2. These data represent the conditions from 2001.

Table 2. Vermont land use composition in the CT River basin from AVGWLF modeling report.

Land use category	% composition of CT River basin in Vermont
Open water	0.7
Forest/shrub land	84.1
Wetlands	2.3
Agricultural land	7.9
Urban land	4.9
Disturbed land	0.1

According to a recent EPA GIS analysis, between 2001 and 2006 land use change from undeveloped to developed categories in the CT River basin in Vermont was estimated to be 158 acres – an almost imperceptible 0.01% (Figure 5). This analysis too was based on changes according to the HUC12 watersheds and also shows no areas of particularly concentrated land use change. While this analysis does not extend back to the baseline date of 1990, it is likely reflective of the relatively minor population increases in the basin since the baseline year.

Another EPA GIS analysis presents the change in the amount of impervious cover in the CT River basin between 2001 – 2006 by HUC12 watersheds (Figure 6). An estimated 49 acres of additional impervious surface was added to the entire CT River basin amounting to a 0.01% increase. As with the conversion to developed land analysis, this only represents a portion of time and doesn’t extend back to the baseline year of 1990. However, based on the modest population gains since the baseline, it’s not unreasonable to assume a similarly modest rate impervious surface increase over the entire time period.

Agricultural Lands

According to the New England SPARROW model results shown in Figure 2, agricultural land represents the largest source of land-based nitrogen export at 21% of the total export load from Vermont. Therefore, changes to the nature and extent of agricultural activity could have a substantial impact on nonpoint source nitrogen loading to the CT River. For this report, selected data was used from the USDA Census of Agriculture to describe agriculture related activities and statistics that play a primary role in driving nitrogen export. Since the Census is conducted every 5 years and collects much of the same data each time, trends in agriculture can be tracked from the baseline year for the LIS TMDL. Data from the 1987 Census was used as a “start date” from which indicators are tracked through 2007. Compilation of the 2012 data was not available for this report but would be a good future addition when it becomes available. County data was compiled from the 5 easternmost counties which nearly mirror the CT River basin in Vermont.

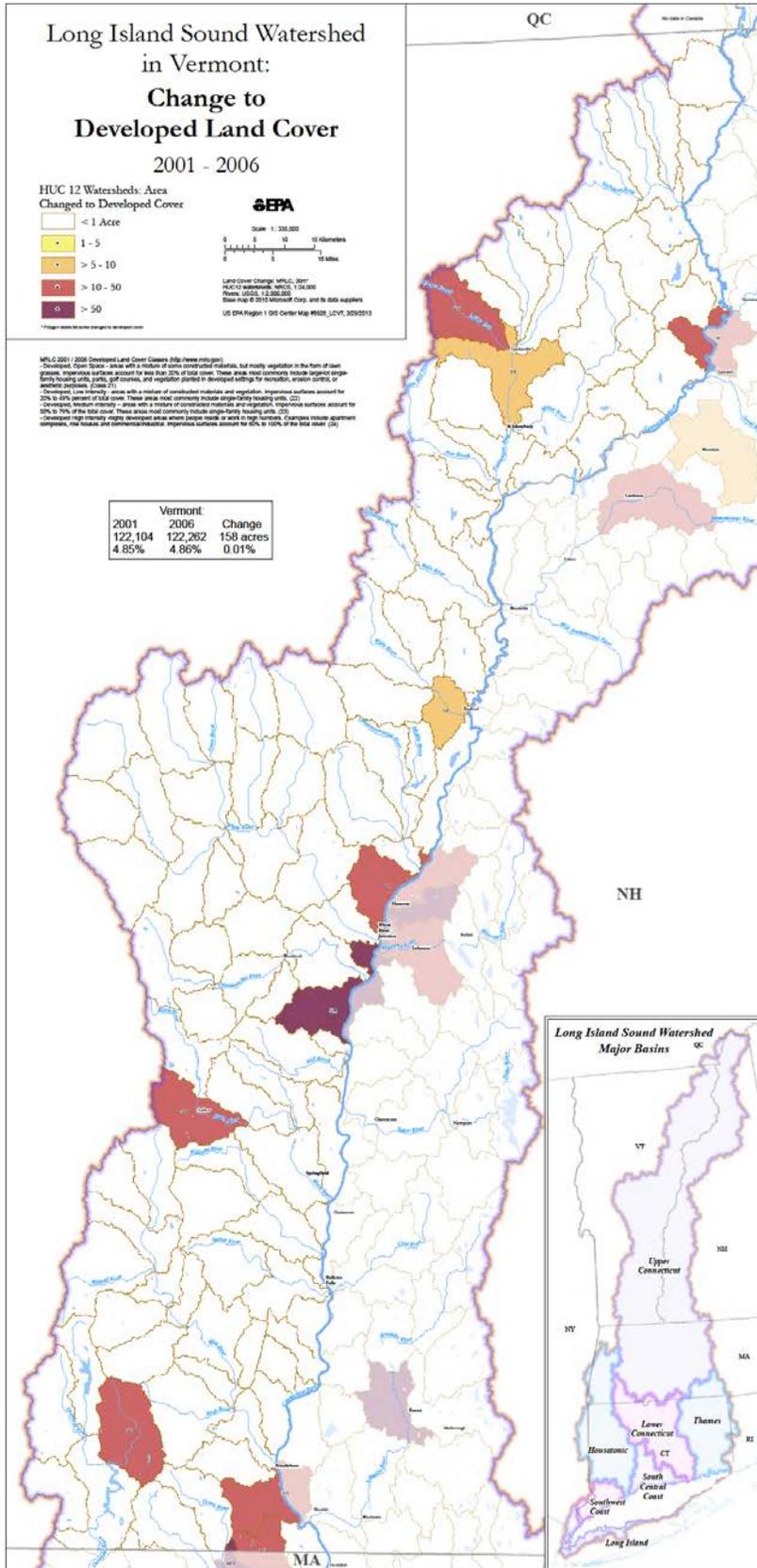


Figure 5. Change in developed land cover in the CT River basin in Vermont: 2001-2006.

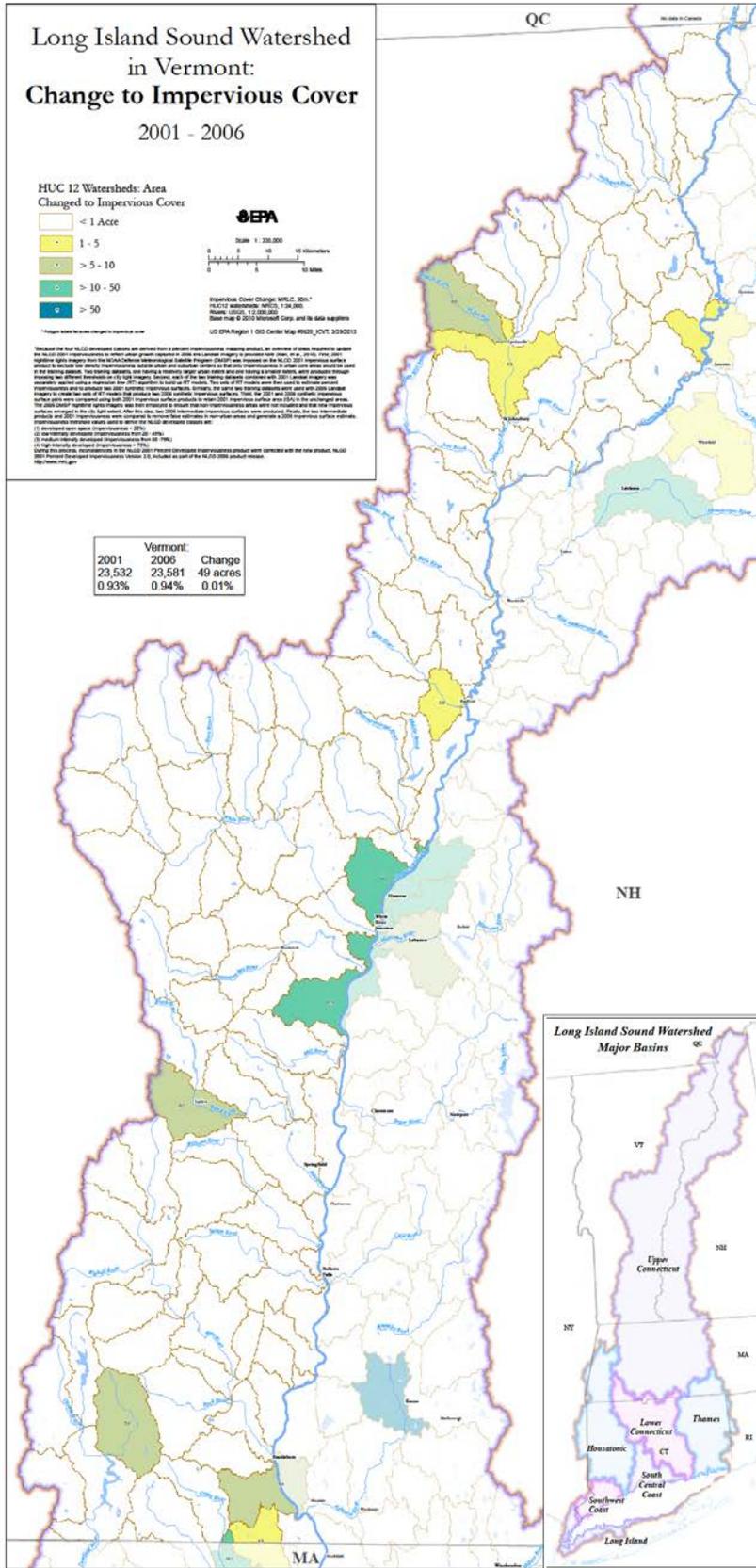


Figure 6. Change in impervious land cover in the CT River basin in Vermont: 2001-2006.

Two important agricultural land use statistics that can drive the likelihood of nitrogen export are the acreage of farmland and in particular, the acreage of cropland which normally exhibits some of the highest nitrogen export rates. Figures 7 and 8 show the trends of these two statistics. Both indicators show a general trend of decreasing acreage with the cropland decrease showing a more consistent decreasing trend. Since 1987, total farm acreage and cropland acreage have decreased 8% and 25% respectively.

Figure 7. Change in total farm acreage in the CT River basin in Vermont as reported in the USDA Agricultural Census County Data from 1987-2007.

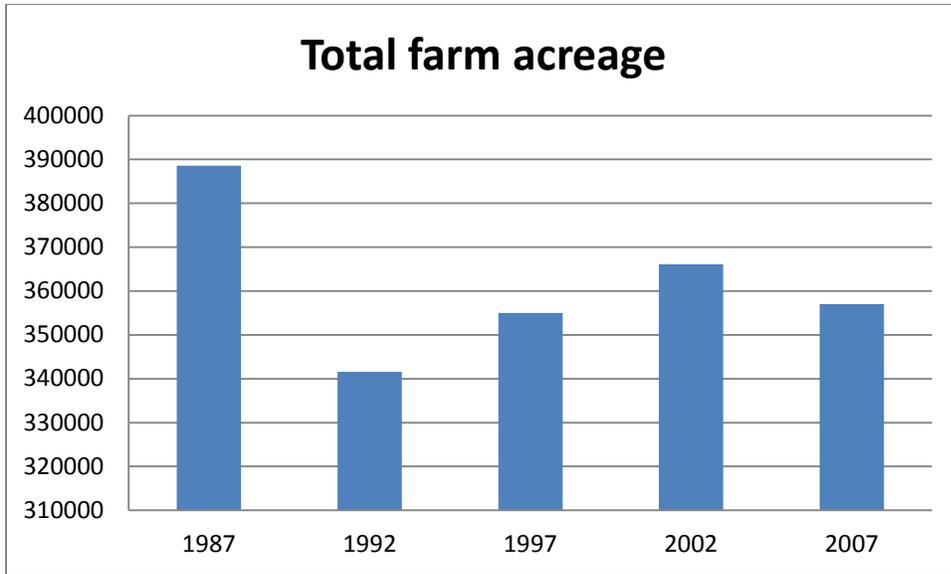
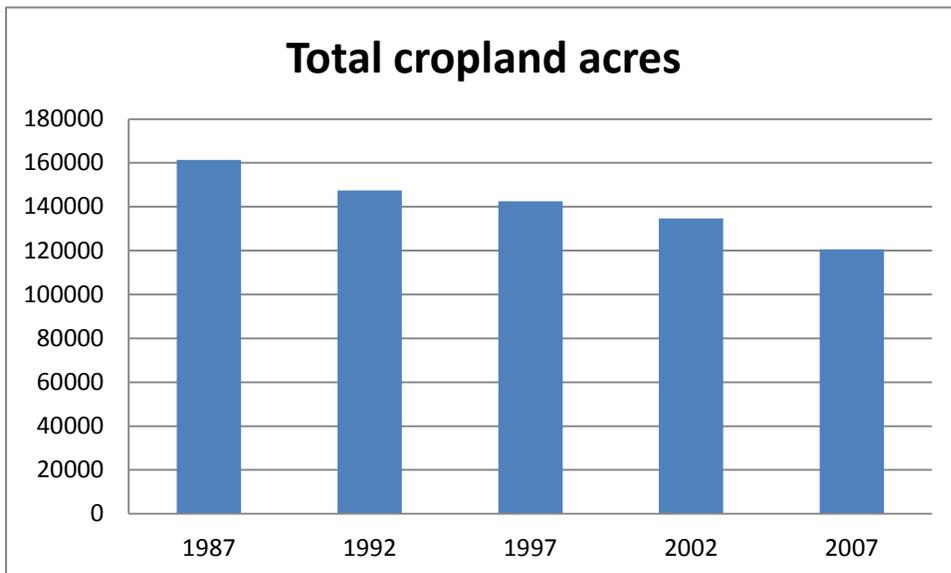


Figure 8. Change in total cropland acreage in the CT River basin in Vermont as reported in the USDA Agricultural Census County Data from 1987-2007.



Another farm statistic that can have a major impact on nitrogen runoff is animal inventory. Increasing numbers of animals produce more manure that must be managed and often result in a farm utilizing more cropland for animal feeding. Figures 9, 10 and 11 below give the inventories for cattle, hogs and sheep. Cattle represent the largest animal class on CT River basin farms and of those, dairy cows are far and away the majority cattle type. For all animal types there has been a steady and decreasing trend in the number of animals – 23% decrease for cattle, 34% decrease for hogs and a 28% decrease in sheep.

Figure 9. Change in cattle inventory in the CT River basin in Vermont as reported in the USDA Agricultural Census County Data from 1987-2007.

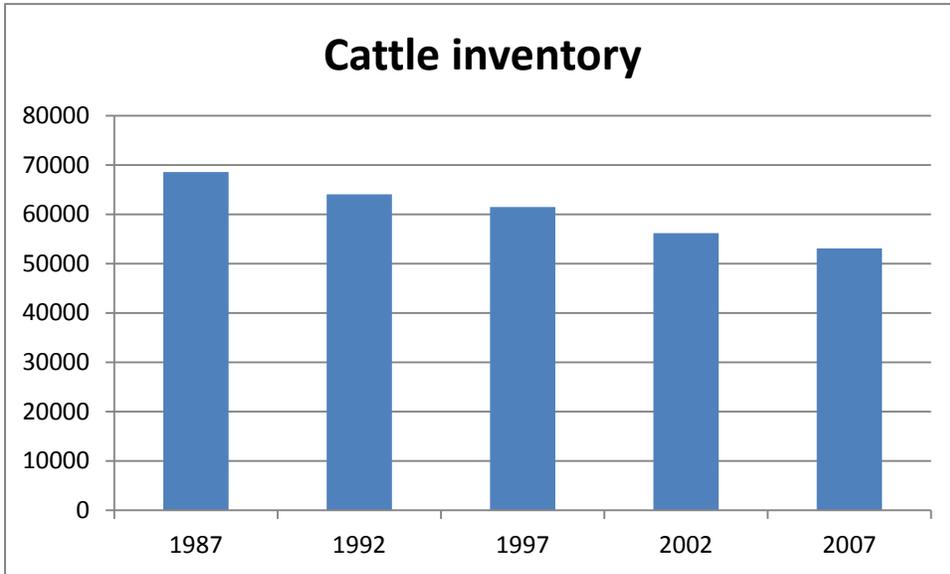


Figure 10. Change in hog and pig inventory in the CT River basin in Vermont as reported in the USDA Agricultural Census County Data from 1987-2007

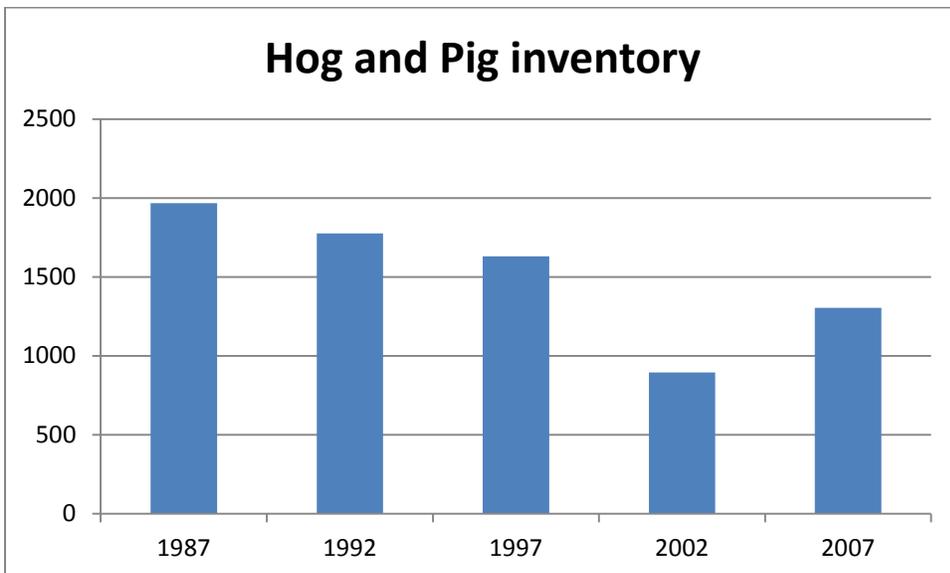
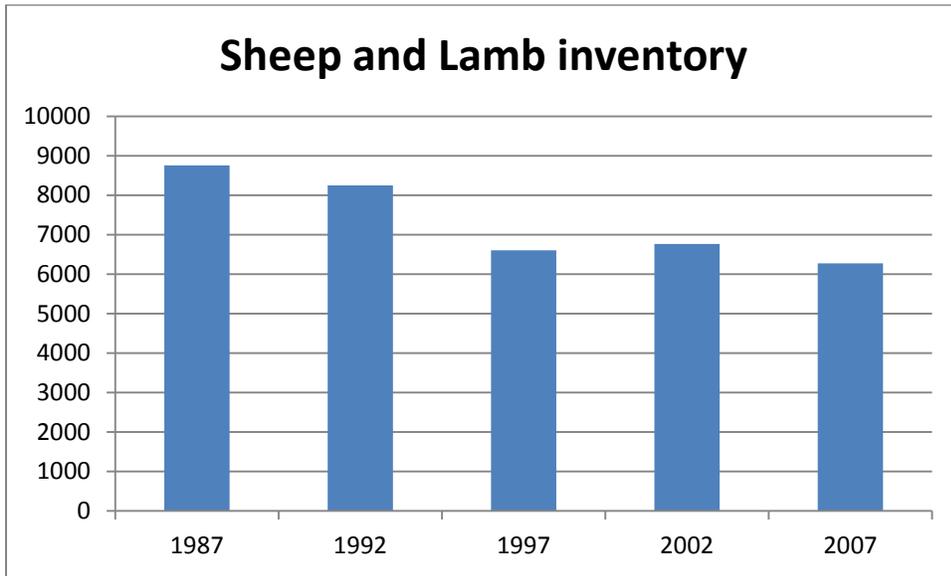
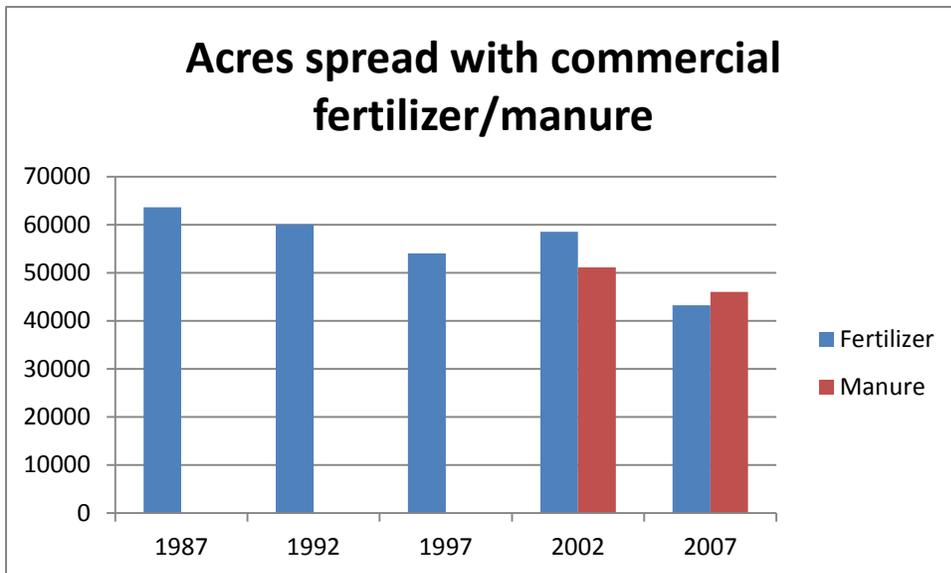


Figure 11. Change in sheep and lamb inventory in the CT River basin in Vermont as reported in the USDA Agricultural Census County Data from 1987-2007



A significant potential driver of nitrogen export from agricultural lands is the spreading of fertilizers and manure, both of which contain a high concentration of nitrogen and without proper management can runoff to nearby waterbodies. Available records exist to 1987 for fertilizer spreading and from 2002 for manure spreading. As with farm acreage and numbers of animals, fertilizer spreading statistics have been decreasing (Figure 12). Since 1987 there has been a 32% decrease in fertilizer spread and since 2002 a 10% decrease in manure spread.

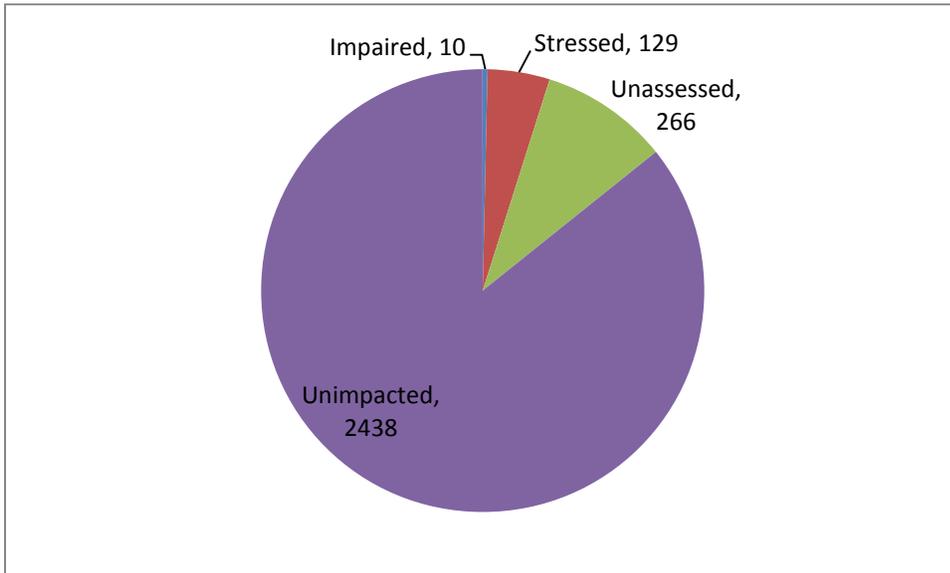
Figure 12. Change in acreage spread with either commercial fertilizer or manure in the CT River basin in Vermont as reported in the USDA Agricultural Census County Data from 1987-2007



Water quality assessment in Vermont

Figure 13 relates water quality assessment information on the streams that drain to the CT River in Vermont. There are a total of 2,843 stream miles of which 90.7% have been assessed as to their water quality condition. Only 0.4% and 4.5% have been identified as either impaired or stressed, respectively, due to nutrients. While most nutrient problems in Vermont’s stream are usually attributed to phosphorus, the activities on the ground that cause those water quality problems are often related to sources of nitrogen as well (e.g. agricultural or developed areas runoff). The low incidence of localized water quality problems caused by nutrients is a secondary indicator of the low incidence of excessive problematic nutrient loading to CT River.

Figure 13. 2012 Nutrient assessment summary (miles) for the CT River basin in Vermont.



Nonpoint Sources Management

Regulated Stormwater and Other Permitted Programs (MS4)

Vermont currently has no designated MS4 communities in the CT River basin. However, Vermont does issue state permits for runoff from developed lands, outside the scope of the MS4 permit, and are addressed below.

Developed Lands

Based on the modeling efforts previously discussed, nitrogen export from developed areas ranges between 4 – 9% of the total nitrogen delivery from Vermont. When compared to agricultural sector land use, developed lands contribute a relatively minor portion of nitrogen export. This is certainly a function of the relatively small percentage (5%) of the CT River basin comprised of developed areas. Nevertheless, numerous statewide and targeted management programs are in place that contribute to nitrogen control.

State Stormwater Permits

The Vermont Department of Environmental Conservation Stormwater Program issues separate permits for runoff from impervious surfaces, construction sites and industrial facilities. All new projects, redevelopment projects and expansion projects should be evaluated to determine whether coverage under a State Stormwater Permit and/or a Construction Permit is needed in order to comply with state law and the federal Clean Water Act. Also, if a new project is industrial in nature or is an existing industrial facility, then it may also need to seek coverage under a Multi-Sector General Permit. Many projects require both a State Stormwater Permit and a Construction Permit; some projects may require all three permits.

The State Stormwater Permit Program (a.k.a. operational or post-construction)

This program regulates discharges (runoff) from impervious surfaces (i.e. rooftops, paved/gravel roads, etc.). The State Stormwater Permit Program has specific jurisdictional thresholds based on the amount of impervious surface, per the Stormwater Management Rules: Chapter 18 (Stormwater Management Rule for Non-Stormwater Impaired Waters) and Chapter 22 (Stormwater Management Rule for Stormwater Impaired Waters). In general, projects creating more than one acre of new impervious surface, or projects that expand existing impervious surfaces where the total resulting impervious surface is greater than one acre require permit coverage. Projects requiring permit coverage must apply for coverage under General Permit 3-9015, unless the project is located within a watershed impaired for stormwater, in which case individual permit coverage is required.

Projects that require permit coverage must implement a stormwater management system designed in Compliance with the Vermont Stormwater Management Manual (VSMM). The VSWMM was developed by the Center for Watershed Protection, and includes sizing criteria to meet water quality, groundwater recharge, channel protection, overbank flood protection and extreme flood control. Although nitrogen removal is not a specific performance criterion for the selection of BMPs, the BMPs implemented to satisfy water quality, groundwater recharge, and channel protection are shown to provide important nitrogen removal benefits. For example, Table 3 is taken from the Vermont Stormwater Management Manual (VSMM) which gives reasonable estimates of pollutant removal efficiencies for the general groups of accepted practices allowed under the permit.

Table 3: Pollutant removal matrix from the Vermont Stormwater Management Manual (Table A.5)

Practice	TSS [%]	TP [%]	TN [%]	Metals ¹ [%]	Bacteria [%]	Hydrocarbons [%]
Wet Ponds	80	51	33	62	70	81 ²
Stormwater Wetlands	76	49	30	42	78 ²	85 ²
Filtering Practices	86	59	38	69	37 ²	84 ²
Infiltration Practices ³	95 ²	80	51	99 ²	N/A	N/A
Open Channels ⁴	81	34	84 ²	70	N/A	62 ²
Quantity Control Ponds ^{2,5}	3	19	5	7.5	78	N/A

1. Average of zinc and copper. Only zinc for infiltration
2. Based on fewer than five data points (i.e., independent monitoring studies)
3. Includes porous pavement, which is not on the list of approved practices for Vermont. At this time, there are no known field studies that have measured sediment removal in infiltration trenches. However, it can logically be presumed that a properly operating infiltration trench will remove nearly 100% of the TSS load associated with the design treatment volume.
4. Higher removal rates for dry swales.
5. Quantity control ponds (a.k.a. dry detention basins or vaults) do not meet the WQ_v requirement and must be used in conjunction with acceptable water quality STPs.
N/A: Data not available
Removals represent median values from R. Winer (2000) National Pollutant Removal Performance Database for Stormwater Treatment Practices, version 2.

As discussed, VT DEC's Stormwater Program administers the post-construction stormwater discharge permit program for projects that create greater than one acre of impervious surface. These permits remain necessary for the life of the project and are renewed on a five or ten year cycle. Currently, there are 1,307 acres of impervious surface under an active post-construction stormwater permit within the CT River basin.

Construction Permit

The Construction Stormwater Permit Program addresses stormwater runoff from earth disturbance activity of one or more acres of land, and is a requirement of the federal Clean Water Act. In Vermont, the Agency of Natural Resources is delegated to issue these permits.

In general, compliance with the Construction Stormwater Permit requires the development of an erosion prevention and sediment control plan. The goal of the plan is to minimize the erosion of disturbed land and to minimize or eliminate the discharge of sediment to waters of the State through the implementation of appropriate erosion prevention and sediment control measures.

Multi-Sector General Permit

The Multi-Sector General Permit (MSGP) 3-9003 addresses stormwater runoff associated with industrial facilities, and is a requirement of the federal Clean Water Act. In Vermont, the Agency of Natural Resources is delegated to issue these permits. A facility must obtain coverage under the MSGP if the Standard Industrial Classification (SIC) code that describes the facility is listed within Table D-1. All regulated activities are required to implement BMPs such as Good Housekeeping, Erosion Prevention, and Minimizing Exposure; all which serve to reduce potential pollutant discharges. Several sectors of

industrial activity are required to monitor specifically for nitrogen, including Agricultural Chemical and Industrial Inorganic Chemical manufacturers, Soap and Detergent Manufacturers, Sand and Gravel Mines, and Fabricated Metal facilities. If monitoring results are above the level set in the permit, the facilities must modify their plans to reduce the nitrogen discharge.

Changes in scope/effectiveness of State Stormwater Programs since 1990

The Department has issued operational permits under authority based in state law since the late 1970s, with the scope of the permit program expanding substantially over time. Program technical standards were updated in 1980, 1987, 1997, and 2002. The jurisdictional threshold has also been revised over time, and since 2005 it has been set at one acre of impervious cover. Projects requiring permit coverage must design a management system in compliance with the Vermont Stormwater Management Manual standards developed by the Center for Watershed Protection. The Department is currently beginning an update process for the VSMM with a goal of increasing the application of LID practices.

VT DEC is the delegated NPDES authority, and implements construction, industrial, and municipal NPDES stormwater permit programs. The construction permit was originally issued in 1997 and was applied to sites with a minimum of five acres of disturbance. In 2006, the permit was reissued to be applied to sites with one acre of disturbance. The Multi-Sector General Permit was originally issued in 2006.

Illicit Discharge and Detection Elimination Program

In 2000, the Vermont Legislature required the Department of Environmental Conservation (VTDEC) to implement a statewide program to promote detection and elimination of improper or illegal connections and discharges. (Sec. 3. 10 V.S.A. § 1264 (b)(9)). Illicit discharges are discharges of wastewater or industrial process water into a stormwater-only drainage system. The legislature's intent was to expand illicit discharge detection and elimination (IDDE) efforts from the communities—all in the greater Burlington area—required to perform IDDE in compliance with the Environmental Protection Agency's Phase II Stormwater Rule to encompass all developed areas of the Vermont. Following the legislature's mandate, VTDEC has assisted municipalities not subject to the Phase II Stormwater Rule by mapping drainage systems and performing IDDE. This work, funded through state Clean & Clear water quality grants and federal Section 319 and Lake Champlain Basin Program grants, has been completed for all major municipalities in the Missisquoi, Lamoille and Winooski River Basins (outside the greater Burlington area), the three largest Connecticut River Basin towns and is ongoing in the Otter Creek River Basin.

About twenty-five communities have had GIS drainage maps completed. Stone Environmental, Inc. in conjunction with several watershed associations (Friends of the Winooski River, Friends of the Mad River) has conducted IDDE surveys in thirteen non-designated MS4 communities, ten of which overlap the state mapping effort. Stone identified 497 discharge points, 237 of which were flowing when inspected. A wastewater source was indicated at 28 discharge points. Other types of contamination included petroleum (11 locations), treated drinking water (13 locations), heated water, and road salt. By combining drainage mapping, environmental investigative work, and municipal cooperation, VTDEC and Stone eliminated seven wastewater discharges, decreasing phosphorus by an estimated 154 kg per year to Lake Champlain and reducing the risk of pathogen exposure.

CT River Basin IDDE Mapping Project: St Johnsbury, Springfield and Brattleboro

The stormwater infrastructure mapping is meant to provide an overall picture and understanding of the connectivity or connectedness of the storm system on both public and private properties in order to raise awareness of the need for regular maintenance. The generation and transport of nonpoint pollution, including nutrients, increases with increasing connectivity of the drainage system. Knowledge of the extent of the system is also essential for the detection and elimination of illicit discharges. Outfall locations and system connectedness data are used as a base for locating illicit discharges of non-stormwater to the municipal storm system and tracking it upstream to the source.

Another benefit of the mapped stormwater system is the potential to address untreated stormwater discharges. This project provides information for the potential retrofit treatment locations and opportunities. Finally, by providing a more thorough understanding of the system, it may facilitate the development of local stormwater ordinance or enhance existing stormwater management programs.

The primary goal of this project was to develop up to date municipal drainage maps identifying stormwater pathways from impervious areas, via transport devices to the ultimate outfalls.

The second goal of this project was to establish potential locations for best management practice stormwater retrofit sites. These are sites where stormwater treatment structures could be added and where they would be most cost effective and efficient for sediment and nutrient removal. Delineated drainage areas were prioritized based on the relative amounts of sediment and nitrogen they could potentially produce.

VTDEC has determined that 34 towns (Table 4) in the watershed qualify for a stormwater mapping and illicit discharge detection project based on the criteria of population size, the existence of a wastewater treatment plant and the presence of a storm sewer system. As of September 2012, the 3 largest towns have all completed the stormwater mapping phase: Brattleboro, Springfield and St. Johnsbury.

Brattleboro has completed the illicit discharge and detection phase and currently the illicit discharge and detection phase is ongoing in Springfield.

Table 4. 34 qualifying towns for stormwater mapping and IDDE projects.

Bethel Village	Hartford: White River Jct.	St. Johnsbury
Bradford Village	Killington Town	Townshend Town
Brattleboro/West Brattleboro	Londonderry Village	Weathersfield Village
Bridgewater Town	Ludlow Village	West Windsor Town
Burke (East)	Lunenburg Village	Wilmington Village
Canaan Village	Lyndonville	Windsor Village
Cavendish Village	Norwich Village	Winhall Town
Chelsea Village	Quechee Village	Woodstock Village
Chester Village	Randolph Village	N. Springfield
Danville Village	Rochester Town	S.Royalton Village
Dover Town	Rockingham, Saxtons River, and Bellows Falls Villages	
Groton Village	Springfield	

Brattleboro IDDE Project

As a follow-up to the mapping projects described above, the project conducted in Brattleboro outlines the next phase necessary to identify and eliminate illicit discharges. The goal of this project was to improve water quality by identifying and eliminating contaminated, non-stormwater discharges entering stormwater drainage systems and discharging to Whetstone Brook, the West River, Crosby Brook, and the Connecticut River in Brattleboro.

A thorough assessment was made of the storm sewer systems in Brattleboro for the presence of illicit discharges. Over 300 structures were assessed. Eleven sources of wastewater/washwater and tapwater were found, at least two of which have been corrected to date. The Brattleboro DPW has committed to further the investigations into these sources to seek their correction.

To date this program has found 6 illicit discharges in Brattleboro; two of which have been resolved. One involved a household lateral with an estimated instantaneous mass loading of 11 g/day (.0044 tons N/yr). The second illicit discharge involved a clogged and backed up sewer main. This is a nuisance problem for the Town and has occurred occasionally due to the piping grade. A very rough estimate for the illicit loading eliminated is 224 kg N (0.24 tons) for the estimated 30 day period of discharge. The problem was fixed immediately and the Town is periodically checking the pipe to prevent future blockages. The latter illicit discharge is not the typical type of discharge the IDDE program locates.

Future IDDE Projects

Seven CT River basin towns are proposed for the stormwater mapping phase in 2012-2013. All work to date has been funded by state funds through Ecosystem Restoration Program competitive grants. The VTDEC Ecosystem Restoration Program will continue to submit grant proposals for future mapping work on a sub basin basis over the next few years. Typically the illicit discharge and detection phase follows one year behind the mapping phase and is carried out by a nonprofit organization in collaboration with a consulting firm.

Stormwater Impairments and Water Quality Remediation Plans

Five mountain watersheds associated with ski area development are listed as impaired primarily due to stormwater runoff on the 2012 303(d) List. Four of these watersheds are within the CT River basin. These mountain watersheds differ substantially from other stormwater impaired areas which are more urbanized “lowland” watersheds in terms of density of development, geographic position, hydrology, impairment source, and land ownership. Based on these factors, the Department has concluded that use of the so-called “4b alternative,” a non-TMDL based alternative pollution control strategy, is the best implementation strategy. The Department is working with responsible parties developing watershed-specific Water Quality Remediation Plans (WQRPs) for the four impaired mountain watersheds. Combined, the four watersheds in the CT River basin cover approximately 4,563 acres and will ultimately receive extensive stormwater retrofits in order to alleviate local stream impairments. Implementation of these retrofits to existing impervious areas as well as high erosion areas should result in significant nutrient and nitrogen reductions.

Transportation

A major segment within developed lands category with regards to potential nitrogen export via runoff is the transportation sector. Water quality improvement and protection has become a major focus in recent years as it relates to the roads network generally and to BMP implementation and project development specifically.

Vermont Agency of Transportation (VTrans)

VTrans is strengthening its stormwater programs, building partnerships to improve water quality throughout the state, and making water quality protection fundamental to the agency's business. Increased staffing, financial investments and new programs across the Agency have helped to achieve a number of improvements identified below.

Staffing:

- In 2007 a new position was created in the Operations Division to focus on compliance with state and federal stormwater regulations. Given work load and increased need to manage stormwater compliance efforts the Operations Division Environmental Program added a Stormwater Technician position in 2012
- The Landscape Coordinator position in the VTrans Operation Division is tasked with vegetation management, erosion control, riparian restoration and management of the use and application of herbicides/pesticides statewide. This position has been in place since the 1950s, but in 2007 has been added to the Operations Environmental Program where more focus has been on roadway bank stabilization, riparian restoration, development of vegetation best management practices benefitting water quality and reduction in use of chemicals and fertilizers to manage vegetation/invasive species.
- In 2010 a new environmental program in the Operations Division staffed by employees responsible for managing stormwater, hazardous materials, and roadside & riparian vegetation was created
- The Program Development Division Environmental Section responsible for obtaining state and federal water quality permits for most VTrans projects includes a stormwater engineer, three hydraulics engineers, three environmental specialists and two biologists. The Environmental Section has staff including Permitting Specialists (3), Natural Resource Biologists (2), Cultural Resource Specialists (4), a Stormwater Engineer (1), and Supervisor and Management staff
- In 2003 VTrans created and filled a new full-time Construction Environmental Engineer (CEE) position in the VTrans Construction Division. The VTrans CEE is a board member of the International Erosion Control Association (Vermont's rep to Northeast Chapter), is CPESC Certified and obtained status as a licensed Professional Engineer in December of 2006. An Assistant CEE (ACEE) was added to the Construction Section in May of 2006. This is a full time year-round position with similar duties to that of the CEE. The ACEE became a licensed Professional Engineer in June 2006 and applied to test for certification as a professional in Erosion and Sediment Control in December 2006. He sat for and passed the exam in February 2007. Primary goals of the CEE and ACEE are to ensure VTrans compliance with the Construction General Permits or Individual Permits, review and update construction erosion control details

and specifications, provide training for VTrans Staff Statewide, Consultants and Contractors, and conduct construction site assurance visits. These employees will visit VTrans construction sites throughout the state as an educator, monitor, and technical expert

- The Policy and Planning Environmental Policy Manager assists in the agency's water quality efforts at the planning and policy level. This position has been in place since 2003.
- Nine Operation's Maintenance Districts are well staffed and trained in water quality compliance and pollution prevention. They provide guidance and oversight to construction and maintenance activities within the Agency's right-of way.

Programs/Activities

- VTrans provides on-going water quality related training for VTrans designers, contractors and staff.
- State transportation funds are used to leverage federal funds on roadway/bridge/enhancement projects, some include stormwater treatment and others are eligible for up to 20% FHWA funding for environmental mitigation
- VTrans has robust partnerships with the ANR, municipalities and watershed groups aimed at implementing water quality enhancement projects across the state. Keeping waters from becoming regulated under TMDL or MS4 programs avoids costs. In addition, certain federal grant funds are not available for permit compliance.
- VTrans maintains stormwater infrastructure such as street sweeping, catch basin cleaning, culverts, ditches, side slopes, etc and is a model for municipal public works' efforts. These activities use a thoughtful and evolving set of Best Management Practices
- VTrans regulates "drain on" activities into the State right-of-way, within its authority under Title 19 Section 1111 and requires proposed dischargers to the right-of-way treat stormwater prior to discharging into the ROW. Furthermore, VTrans prohibits the illegal connection or illicit (non-stormwater) discharge to its right-of-way statewide. Examples include working with VANR and local health officer to correct failed septic systems discharging into State Highway Stormwater System with direct discharge to waters of the state in Bakersfield, VT and a roadway reconstruction project in Johnson, VT which included the replacement of stormwater system and elimination of historic connections from basement floor drains.
- VTrans manages its infrastructure to allow drainage from municipal and private property onto the State right-of-way. Accommodating this additional stormwater volume and potential pollutants requires more design, construction, and maintenance work for VTrans to the benefit of these dischargers
- VTrans and ANR Water Quality Division staff meet on a quarterly basis to stay abreast of emerging regulatory issues, research, planning and other topics

Financial - significant financial investments are being made to comply with water quality regulations or assist municipalities in doing the same. Examples include:

- Municipal Town Highway (TH) Grants **\$13.8 million state funds annually** (w/local match)

VTrans administers and provides grants to municipalities under the TH Structures, Class 2 Roadway, and TH Emergency Fund appropriations. A significant amount of this funding is tied either directly or indirectly to stormwater related activities. By adopting TH Road and Bridge Standards, municipalities will receive an additional 10% match in funding for the Structures and Class 2 Roadway grants. These Standards include stormwater best management practices directly tied to improving water quality

- Town Highway Aid **\$25 million state funds annually**
VTrans administers and provides annual appropriation for State aid to municipalities based on the number of miles of Class 1, 2, and 3 town highways in each. These funds must be used solely for town highway construction, improvement, and maintenance purposes, following their adopted Town Road and Bridge Standards. A portion of these funds are directly tied to stormwater treatment.
- Transportation Alternatives Program **\$3 million federal funds annually** (w/local match)
VTrans administers this federally funded program for non-traditional transportation-related projects. One eligible activity under this program involves environmental mitigation of stormwater runoff.
- FEMA Public Assistance Program **\$29.5 million mixed funds over past 10 years**
VTrans administers and provides grants to eligible applicants/owners of publicly-owned facilities who suffered damage during a federally declared disaster (primarily municipal roads/bridges not on federal-aid highways). The vast majority of these grants involve repairs, improvements, and mitigation activities associated with stormwater. FEMA funds 75% and the State & applicant split 25%.
- FHWA SAFETEA-LU **\$5.4 million federal funds over 5 years** (w/local match)
VTrans administered the federal Municipal Highway Stormwater Mitigation Grant Program directing funds to municipalities over the past 5 years allowing the implementation of \$5.4 million worth of highway stormwater mitigation, with roughly 50% spent in Chittenden County and 50% spent outside.

Vermont Better Back Roads Program

Established in 1997, the Vermont Better Back Roads Program provides grants and technical assistance to towns to correct erosion problems and adopt road maintenance practices that protect water quality while reducing long-term highway maintenance costs. Better Backroads financial and technical assistance demonstrates to towns that the proper fixes and maintenance practices are cost-effective. 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. This information increases the likelihood that towns will implement such road improvement projects on their own. A long-term goal for the Better Backroads Program is to enable and encourage towns to practice best management practices in road maintenance and repairs and institutionalize these practices into town capital budget priorities.

The Vermont Better Back Roads Program is a partnership with the Vermont Local Roads Program, Vermont Agency of Transportation (VTrans), and the Vermont Agency of Natural Resources (VTANR). The program is administered by VTrans.

After receiving a grant, most towns adopt the recommended practices for future road maintenance work. Therefore, the grants leverage improved maintenance practices that both reduce pollution and save towns money. 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: (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.

Although the Better Back Roads Program has been active since 1997, comprehensive statistics for the CT River basin are currently compiled for 2004-2012. Figures 14 and 15 show the cumulative road inventory projects and the associated costs respectively. Since 2004, 28 inventories have been funded at a cost of \$95,593.

Figure 14. Better Back Roads cumulative road inventory projects in the CT River basin, 2004-2012.

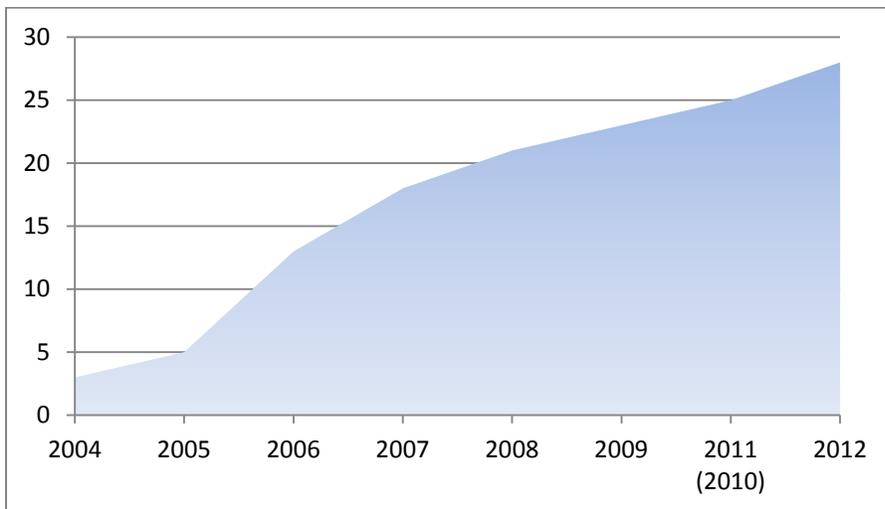


Figure 15. Better Back Roads cumulative road inventory project costs in the CT River basin, 2004-2012.

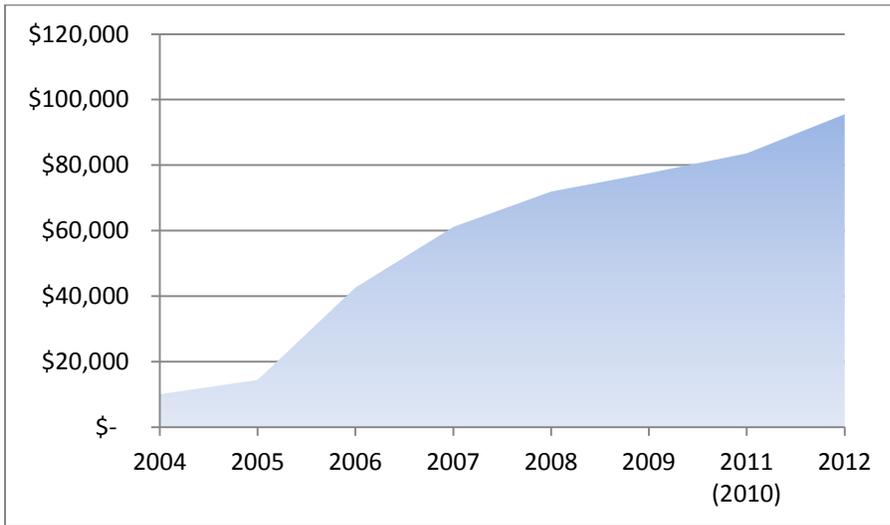


Figure 16 gives the cumulative number of erosion control projects that have been funded in the CT River basin and Figure 17 shows the associated costs. Since 2004, 144 erosion control projects have been undertaken at a total cost of \$1,022,490.

Figure 16. Better Back Roads cumulative erosion control projects in the CT River basin, 2004-2012.

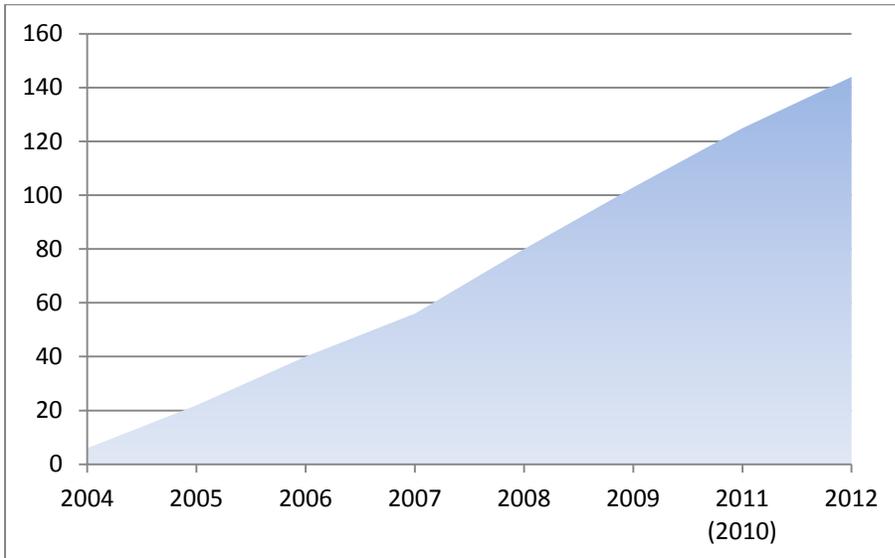
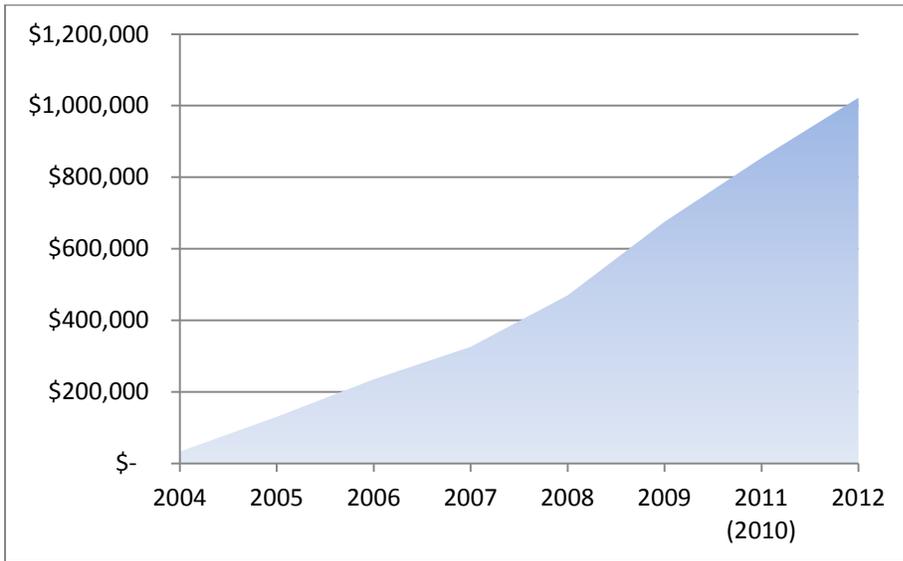


Figure 17. Better Back Roads cumulative erosion control project costs in the CT River basin, 2004-2012.



Agricultural Lands

As estimated by the previously discussed modeling efforts, agricultural nonpoint sources of nitrogen account for approximately 21% of the overall nitrogen load delivered to LIS from Vermont.

Management efforts in this sector have the potential to contribute to significant reductions as well as prevention of nitrogen export. As a part of Vermont’s Surface Water Management Strategy (SWMS), the agricultural programs described here that play an important role in the overall management of nonpoint source pollution, with a particular focus on sediment and nutrients. These programs may provide varying degrees of pollutant control or prevention but overall and in conjunction with one another they provide significant sediment and nutrient management.

Vermont Agency of Agriculture, Food & Markets (VAAFMM)

Accepted Agricultural Practices (AAP)

Base level of management required for all farms in Vermont. Easy to implement, low-cost solutions for addressing water resource concerns. The AAPs were designed to reduce non-point pollutant discharges through implementation of improved farming techniques rather than investments in structures and equipment. State law requires that these practices must be technically feasible as well as cost effective for farmers to implement without governmental financial assistance.

Alternative Manure Management Program (AMM)

Provides funding to farmers interested in implementing new technologies dedicated to enhancing water quality and improving waste management. Projects funded through this program have included solid separation, nutrient removal, and waste treatment systems. Maximum cost share is limited to \$100,000 through the AMM program. Total VAAFMM payment is limited to 35% if the project is coupled with federal cost share.

Best Management Practices Program (BMP)

Provides cost share payments for installation of conservation practices to address water resource concerns. While farmers may realize an economic benefit from BMPs, it is unlikely that they will be affordable without governmental cost sharing. Commonly funded production area practices include waste storage facilities, silage leachate systems, milkhouse waste systems, and barnyard runoff collection. Production area practices are eligible for up to 80% cost share. Field practices, such as animal trails and walkways, are eligible for 50% cost share. If coupled with federal cost share, Agency cost share is limited to 35%. The yearly maximum payment for a single practice is \$50,000 and \$75,000 for two or more practices.

Conservation Reserve Enhancement Program (CREP)

In partnership with the USDA, encourages the installation of conservation buffers along waterways by providing land owners with a yearly rental payment and by covering the cost of planting the buffer. Additionally, CREP covers the cost of installing fencing and livestock watering systems where animals on pasture are excluded from waterways. Contracts are either 15 or 30 years in length and payment is dependent upon past land use and whether the buffer is comprised of either trees and/or grasses. Minimum buffer widths are 25 feet for grass and 35 feet for tree buffers. Buffers cannot be harvested under this program. Payments can cover up to 100% of practice costs (for fencing, watering systems and plantings) and include a signup incentive of \$2,005/acre and annual rental payments of \$266/acre/year.

Farm Agronomic Practices Program (FAP)

Provides farms with state financial assistance for implementation of soil-based practices that improve soil quality, increase crop production, and reduce erosion and agricultural waste discharges at up to \$5,000 per farm. FAPP will provide funding incentive for NMP update, implementation, and maintenance with the aim of improving outreach education on agricultural water quality impacts and regulations. Eligible practices are: Cover Cropping (\$30/acre); Nurse Crops (\$25/acre); Strip Cropping (\$25/acre); Conservation Crop Rotation (\$25/acre); Alternative Manure Incorporation (\$25/acre); Cross-Slope Tillage (\$10/acre); Conservation Tillage (\$12/acre); and Educational and Instructional Activities (up to \$1,000).

Nutrient Management Incentive Grant Program (NMPIG)

Provides for development of a nutrient management plan (NMP) and three additional years of updates. The initial payment to develop NMP is \$9 per acre, \$15 per soil test, and \$35 per waste storage facility test. Up to \$5,000 is available for plan updates for following three years (not to exceed \$14,000 total for NMPIG). Plans must meet state requirements for nutrient management, as explained in the General Permit for Medium Farm Operations, before receiving payment. Farms with NMP's that have completed the NMPIG or farms that developed their plans through alternate means can apply for annual update payments of \$3 per acre (up to \$1000). Funding is also available for Pre-sidedress Nitrate Tests (\$8 per test).

Vermont Agricultural Buffer Program (VABP)

The program offers a 5-year maximum rental contract for the installation of conservation grassed buffers on cropland. Unlike the CREP program, VABP consists of planting harvestable grassed buffers.

Areas in crop fields that are prone to erosion caused by flood events, which can be classified as flood chutes, are also eligible under this program to be planted into grass and harvested. Additional program details include that, no manure can be spread in the buffer area; fertilizer can be used with soil test and nutrient recommendation; payment of \$123/ac to cover the establishment costs of new filter strips in addition to the annual incentive payments of \$90 to \$150 per acre per year; forage in buffer can be harvested between June 1st and September 1st only; and most buffers are 25 feet wide unless a water quality concern deems the need for a larger buffer

Local Government Programs

Agricultural Resource Specialist Program (ARS)

Offered by the Vermont Association of Conservation Districts and supported by funding from the VAAFM. Three main services are offered to farmers: AAPA, AEM and FWWT:

Accepted Agricultural Practices Assistance (AAPA)

Offers farmers free technical assistance and information to help them meet the requirements of VAAFM's AAP regulations. The ARS works with farmers on developing strategies specific to the farm, accommodating seasonal changes and soil characteristics. If strategies involve implementation costs, the ARS provides information and referrals for State and Federal cost-share programs.

Agricultural Environmental Management (AEM)

A statewide, voluntary program that assists farmers in environmental stewardship, protecting the quality of the farm natural resources as the foundation of the farmer's long-term economic viability. Assessments cover farmstead water supplies, nutrient management, pesticide use, and many other farm practices. Suggested actions are linked with technical resources for design and implementation and financial resources for cost-share opportunities.

Farm Well Water Testing (FWWT)

A free drinking water protection service for farms. Water testing for farm wells provides information on bacteria, nitrates and common pesticide levels. If a water quality problem is found, ARS staff will assist the landowner in trying to determine the cause of the contamination and to find the best solution.

Land Treatment Planners (LTP)

Assist farmers in developing land treatment plans, which provide detailed information on farm soil and water resources, recommendations for continued stewardship and compliance with state and federal regulations. Land treatment planning is the foundation of a nutrient management plan (NMP). Although LTP is not itself required for Vermont farms, it provides the core data needed to develop a NMP. A NMP, however, is required for all Medium and Large Farm Operations and is encouraged for Small Farm Operations (SFOs). This free program is provided to farmers through a partnership between the USDA NRCS, Conservation Districts, and VAAFM.

Federal Programs

Agricultural Management Assistance (AMA) program

Assists agricultural producers to manage risk and voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation practices into their farming operations.

Producers may construct or improve water management or irrigation structures; plant trees for windbreaks or to improve water quality; and mitigate risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming. An AMA plan of operations, developed with NRCS, is required. Participants are expected to maintain cost-shared practices for the life of the practice. Contracts are for 1-10 years. Applicants must own or control the land and comply with adjusted gross income limitation provisions. Eligible land includes cropland, rangeland, grassland, pastureland, non-industrial forestland, and other private land that produces crops or livestock where risk may be mitigated through operation diversification or change in resource conservation practices. Total payments shall not exceed \$50,000 per year.

Conservation Reserve Program (CRP)

A voluntary program for agricultural landowners. Through CRP, you can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers on eligible farmland. Participants enroll in CRP contracts for 10 to 15 years. CRP protects millions of acres of American topsoil from erosion and is designed to safeguard the Nation's natural resources. By reducing water runoff and sedimentation, CRP protects groundwater and helps improve the condition of lakes, rivers, ponds, and streams. Acreage enrolled in the CRP is planted to resource-conserving vegetative covers, making the program a major contributor to increased wildlife populations in many parts of the country. Eligible producers must have owned or operated the land for at least 12 months prior. Eligible land must be either cropland that is planted to an agricultural commodity 4 of the previous 6 crop years or pastureland that is suitable for use as a riparian buffer or for similar water quality purposes. Payments include; Annual Rental Payments for establishing long-term, resource-conserving covers; Maintenance Incentive Payments for certain practices; and Cost-share Assistance at up to 50% of the participants' costs in establishing approved practices.

Conservation Stewardship Program (CSP)

A voluntary program that encourages agricultural and forestry producers to address resource concerns by (1) undertaking additional conservation activities, and (2) improving and maintaining existing conservation systems. CSP provides financial and technical assistance to help land stewards conserve and enhance soil, water, air, and related natural resources on their land. CSP is available to all producers, regardless of operation size or crops produced. Eligible lands include cropland, grassland, prairie land, improved pastureland, rangeland, nonindustrial private forest land, and agricultural land under the jurisdiction of an Indian tribe. CSP pays participants for conservation performance—the higher the performance, the higher the payment. An annual payment is available for installing new conservation activities and maintaining existing practices. A supplemental payment is available to participants who also adopt a resource conserving crop rotation. NRCS makes payments for activities installed and maintained in the previous year. Contracts may not exceed \$40,000 in any year or \$200,000 in any five-years.

Environmental Quality Incentives Program (EQIP)

A voluntary conservation program that provides financial and technical assistance to farmers and ranchers who face threats to soil, water, air, and related natural resources on their land. NRCS develops

contracts with agricultural producers to implement conservation practices to address environmental natural resource problems. Payments are made to producers once conservation practices are completed according to NRCS requirements. Persons engaged in livestock or agricultural production and owners of non-industrial private forestland are eligible for the program. Eligible land includes cropland, rangeland, pastureland, private non-industrial forestland, and other farm or ranch lands. An EQIP plan of operations, developed with NRCS, is required. NRCS provides conservation practice payments to landowners under these contracts that can be up to 10 years in duration. Program payments are limited to a person or entity to \$300,000 during any 6-year period.

Farm and Ranch Lands Protection Program (FRPP)

A voluntary program that helps farmers and ranchers keep their land in agriculture. The program provides matching funds to State, Tribal, or local governments and non-governmental organizations with existing farm and ranch land protection programs to purchase conservation easements. From 1996 through 2007, FRPP has enrolled over 533,000 acres in cooperation with more than 400 entities in 49 States. The program allows for long term agreements with cooperating entities. Such agreements may be 3-5 years in duration. The share of the easement cost must not exceed 50% of the appraised fair market value of the conservation easement. As part of its share of the cost of purchasing a conservation easement, a state, tribal, or local government or nongovernmental organization may include a charitable donation by the landowner of up to 25% of the appraised fair market value of the conservation easement. As a minimum, a cooperating entity must provide, in cash, 25% of the appraised fair market value or 50% of the purchase price of the conservation easement.

Grassland Reserve Program (GRP)

A voluntary program for landowners and operators to protect grazing uses and related conservation values by conserving grassland, including rangeland, pastureland, shrubland, and certain other lands. The program emphasizes support for working grazing operations; enhancement of plant and animal biodiversity; and protection of grassland and land containing shrubs and forbs under threat of conversion. Eligible land includes privately owned or Tribal grasslands; land that contains forbs for which grazing is the predominant use; or land that is located in an area that historically has been dominated by grassland, forbs, or shrubland that has the potential to serve as wildlife habitat of significant ecological value. GRP rental contracts and easements prohibit crop production other than hay. A grazing management plan is required. GRP enrollment options include: Rental Contracts of 10-20 years, Permanent Easements or Restoration Agreements. USDA can also enter into cooperative agreements with entities to enable them to acquire easements.

Partners for Fish and Wildlife Habitat Restoration Program (PFW)

Established in 1987 for on-the-ground wetland restoration projects on private lands. At the heart of the Service's mission are the conservation and management of the Federal Trust Species: migratory birds; threatened and endangered species; inter-jurisdictional fish; certain marine mammals; and species of international concern. The Partners Program provides technical and financial assistance to private landowners and Tribes who are willing to work with us and other partners on a voluntary basis to help meet the habitat needs of our Federal Trust Species. The Partners Program can assist with projects in all habitat types which conserve or restore native vegetation, hydrology, and soils associated with

imperiled ecosystems such as longleaf pine, bottomland hardwoods, tropical forests, native prairies, marshes, rivers and streams, or otherwise provide an important habitat requisite for a rare, declining or protected species. Locally-based field biologists work one-on-one with private landowners and other partners to plan, implement, and monitor their projects. Partners Program field staff help landowners find other sources of funding and help them through the permitting process, as necessary.

Watershed and River Basin Planning and Installation - Public Law 83-566 (PL566)

Technical and financial assistance is provided in cooperation with local sponsoring organizations, state, and other public agencies to voluntarily plan and install watershed-based projects on private lands. The purposes of watershed projects include watershed protection, flood prevention, water quality improvements, soil erosion reduction, rural, municipal and industrial water supply, irrigation management, sedimentation control, fish and wildlife habitat enhancement and create/restore wetlands and wetland functions. Technical and financial assistance can be provided for installation of works of improvement specified in the plans. Project sponsors get assistance in installing land treatment measures when plans are approved. Technical assistance is furnished to landowners and operators to accelerated planning and application of needed conservation on their individual units.

Wetlands Reserve Program (WRP)

A voluntary program that provides technical and financial assistance to private landowners and Tribes to restore, protect, and enhance wetlands in exchange for retiring eligible land from agriculture. Over 1.9 million acres are currently enrolled in WRP. Wetlands provide habitat for fish and wildlife, including threatened and endangered species; improve water quality by filtering sediments and chemicals; reduce flooding; recharge groundwater; protect biological diversity; and provide opportunities for educational, scientific, and limited recreational activities. Permanent Easements are paid at 100 % of the easement value and up to 100 % of the restoration costs. Thirty-Year Easements are paid at up to 75 % of the easement value and up to 75 % of the restoration costs. For both permanent and 30-year easements, USDA pays all costs associated with recording the easement in the local land records office, including recording fees, charges for abstracts, survey and appraisal fees, and title insurance. Restoration Cost-Share Agreements are established to restore or enhance the wetland functions and values without placing an easement on the enrolled acres. USDA pays up to 75% of the restoration costs with payments not to exceed \$50,000 per year.

Wildlife Habitat Incentive Program (WHIP)

A voluntary program for developing or improving high quality habitat that supports fish and wildlife populations of National, State, Tribal, and local significance. WHIP provides technical and financial assistance to landowners for the development of upland, wetland, aquatic, and other types of wildlife habitat. Land eligible for WHIP includes: Private agricultural land including cropland, grassland, rangeland, pasture, and other determined by NRCS to be suitable for fish and wildlife habitat development; Non-industrial private forest land including rural land that has existing tree cover or is suitable for growing trees; and Tribal land. Cost-share agreements for practices are 1-10 years. NRCS will reimburse up to 75% of the cost to install practices for priority fish and wildlife habitat. Participants are expected to maintain the cost-shared practices for their anticipated lifespans. For contracts with long-term cost-share agreements (15 years or longer), NRCS can pay up to 90% of the cost.

Additional Programs

Farmland Access Program (FAP)

Provides farmers with opportunities to purchase or lease affordable farmland so that they can start up or expand agricultural businesses. Supporting local communities, local food production, and the long-term productive use of farmland are all objectives of this program. Gaining access to high quality, affordable farmland is one of the most difficult obstacles for beginning farmers and expanding agricultural operations. The challenge is especially acute for enterprises that depend on being near Vermont's economic growth centers—areas where land values remain strong even in the current economic climate.

Minimum qualifications require candidates to have 3 years of commercial farming experience, strong agricultural references, plans to develop an agricultural enterprise that would gross \$100,000 per year within 5 years of startup, and sufficient financial resources (or ability to be financed) for start-up expenses. The focus is on farms producing food and fiber that would use at least 25 acres of land.

Farmland Preservation Program (FPP)

Focused on retaining the state's quality agricultural land base in strong farming regions of the state. The purchase of conservation easements on farmland preserves Vermont's working landscape--the open farm fields, woodlands and farmsteads that comprise the third largest sector in the state's economy and draw visitors that make tourism the largest sector. Because of VHCB's investment in conservation easements, some of Vermont's most productive farmland will remain undeveloped and the best soils will remain available for farming in the future. Selling conservation easements enables a landowner to keep land in agricultural use and be compensated for potential development value of the land, recognizing the asset value of the land. The landowner retains title and agrees to terms of a conservation easement limiting future ability to subdivide and develop the land.

Technical Assistance Programs (TAP) through Northeast Organic Farming Association

Free to farmers - made possible by grants from the VHCB's VFP and VAAF. Vegetable and Fruit Technical Assistance provides technical assistance to organic farmers in Vermont seeking production and financial assistance on small fruit and vegetable operations. Dairy and Livestock Technical Assistance provides Information, Services and Support for Vermont's Organic Dairy & Livestock Community.

Agricultural BMPs

Agricultural BMP data was gathered from the Vermont Agency of Agriculture, Food and Markets for both the Best Management Practices (BMP) and Farm Agronomic Practices (FAP) Programs. Both programs provide funds to farmers to address, either directly or indirectly, lessening impacts to water quality. As described in a previous section, the BMP Program commonly funds practices such as waste storage facilities, silage leachate systems, milkhouse waste systems, and barnyard runoff collection. The FAP Program provides farms with state financial assistance for implementation of soil-based practices that improve soil quality, increase crop production, and reduce erosion and agricultural waste discharges. Eligible practices include cover cropping, nurse crops, strip cropping, conservation crop

rotation, alternative manure incorporation, cross-slope tillage, conservation tillage, and educational and instructional activities.

Figure 18 shows the cumulative number of these BMPs implemented since 1997. At this time, the data concerning the BMP type, acreage treated and specific location has not been compiled. Figure 19 gives the cumulative costs associated with the BMP installations. Since 1997, the costs associated with these BMPs is approximately \$5.6 million.

Figure 18. Cumulative BMP projects implemented since 1997 in the CT River basin in Vermont as part of the VAAFM BMP and FAP programs.

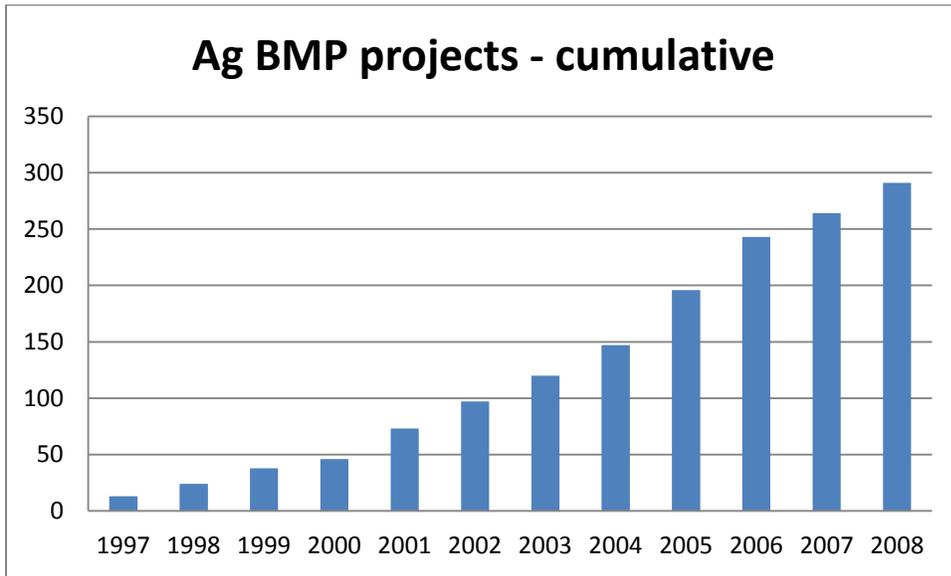
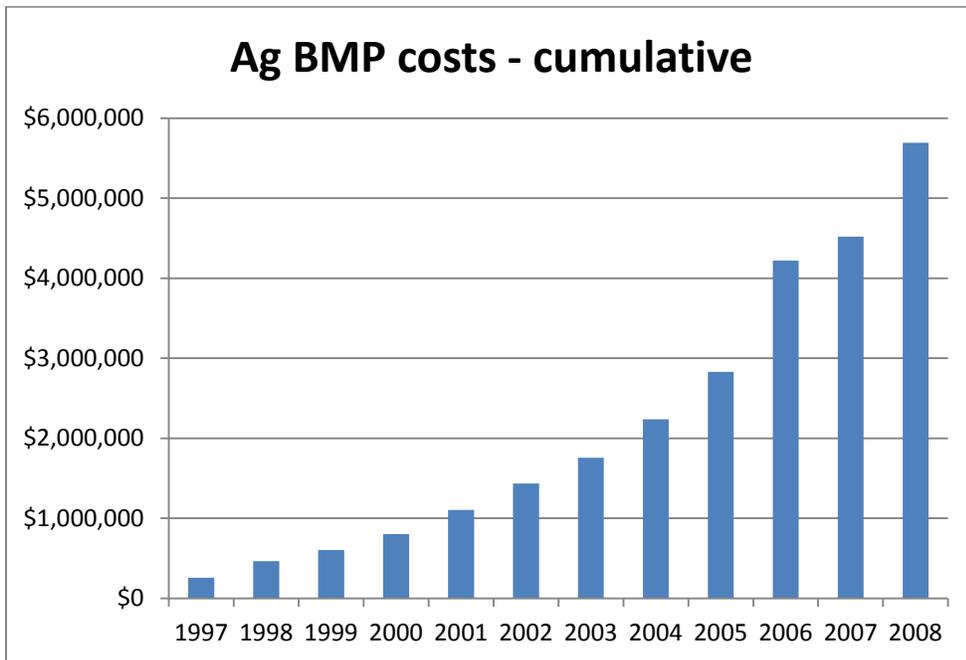


Figure 19. Cumulative BMP project costs since 1997 in the CT River basin in Vermont as part of the VAAFM BMP and FAP programs.



Permitted Agricultural Activities

Medium Farm Operations (MFO)

All dairies with 200-699 mature animals, whether milking or dry, qualify as a MFO. Other common MFOs include beef operations (300-999 cattle or cow/calf pairs), horse operations (150-499 horses), turkey operations (16,500-54,999 turkeys), and egg facilities (25,000-81,999 laying hens without liquid manure handling system). The MFO program provides coverage under a single Vermont state General Permit and is managed by the Vermont Agency of Agriculture, Food and Markets. The General Permit prohibits discharges of wastes from a farm's production area to waters of the state and requires manure, compost, and other wastes to be land applied according to a nutrient management plan. VAAFM is required to inspect all farms permitted under these rules at least once every five years. The MFO general permit has been in existence since 2007 and was revised in 2012.

Large Farm Operations Program (LFO)

An individual permitting process for farms with more than 700 mature dairy cows, 1,000 beef cattle or cow/calf pairs, 1,000 youngstock or heifers, 500 horses, 55,000 turkeys, or 82,000 laying hens. This permit is also managed by VAAFM. A LFO permit prohibits the discharge of wastes from a farm's production area to waters of the state and requires the farm to land apply manure, compost, and other wastes according to a nutrient management plan. Unlike the MFO Program, LFO permits are individual to each farm and also regulate odor, noise, traffic, insects, flies, and other pests. All LFOs are inspected annually by VAAFM. If a LFO falls within the CAFO permit coverage, a CAFO permit will still be required.

CAFO Permits

The Vermont statewide CAFO general permit is currently on notice for public comment. The comment period closes April 29, 2013. While the permit is not pollutant (nitrogen) specific, any farm that discharges to a surface waterbody can be required to obtain a permit.

Forestry Practices

Agency of Natural Resources, Department of Forests, Parks and Recreation

Vermont Acceptable Management Practices (AMP)

Acceptable Management Practices (AMPs) for maintaining water quality on logging jobs in Vermont became effective on August 15, 1987. Since adoption of the AMPs, the Department of Forests, Parks and Recreation (DFPR) has worked with the Vermont forest industry to support Agency of Natural Resources Enforcement Division in an effort to eliminate discharges resulting from logging operations.

In 1990, a Memorandum of Understanding between the Enforcement Division and the Department of Forests, Parks and Recreation was developed which establishes a process that the DFPR and the forest industry may use to assist loggers or landowners when there is a discharge while maintaining the legal enforcement responsibilities assigned the Enforcement Division.

According to the agreement, five AMP Technical Advisory Teams were created to directly assist any logger or landowner when there is a potential discharge, complaint or request for assistance.

Enforcement would be pursued in instances where:

- 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 non-compliance with the AMPs coupled with discharges to State waters.

Vermont Heavy Cutting Law (Act 15)

The Vermont Legislature passed the so-called heavy cutting law in 1998. The purpose of the law is to monitor and regulate the amount and approach to heavy cutting being done in Vermont. Heavy cutting is defined as cutting below the “C” line in excess of forty acres or 80 acres in a two-mile radius. The “C” line is a silvicultural stocking level provided for in US Forest Service guidelines for managing various forest types. This level establishes the minimum stocking for stands of trees that would allow stands to return to a fully stocked condition. The AMPs (see above) are among the requirements of this law.

Portable Skidder Bridge Initiative

The goals of this initiative are three-fold.

- (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.

Other

Conservation Easements

A River Corridor Easement Program has been established by the VTDEC River Management Program 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 re-strict channelization practices. The key provision of a river corridor easement is the purchase of channel management rights. The program 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 hydro-logic, sediment and nutrient attenuation, and protect riparian habitats and the natural processes which form them.

The extent of the Corridor Easement Program achievements in the CT River basin can be seen in the ERP Grant Program (Table 6) whereby most of the “Conservation Easement” project types are a result of this

program. Easements associated with agricultural areas likely represent the greatest potential for nitrogen reductions and export prevention however; they have not been specifically identified here.

Turf Fertilizer Law

A law enacted by the Vermont legislature relating to the application of fertilizer became effective on January 1, 2012. The primary focus of the law is to limit the use of nonagricultural turf fertilizers and to reduce the likelihood of nutrients from entering surface waters. Specific to phosphorus fertilizer, application is prohibited in general except for where it is shown through soil testing that the soil is phosphorus deficient. Exceptions are also made for application intended to facilitate establishment of a new turf. Portions of this law also limit the type of nitrogen fertilizer that can be applied to nonagricultural turf; specifically, no nitrogen fertilizer may be applied to turf if the nitrogen content consists of less than 15% slow-release nitrogen. Additionally, regarding turf fertilizer application in general, prohibitions include: 1) application to impervious surfaces, 2) applications to turf before April 1st or after October 15th or at any time the ground is frozen, and 3) applications to turf within 25 feet of waters of the state.

Golf courses are also required to develop and submit to the State a nutrient management plan for the use and application of fertilizers. The goal is to ensure proper fertilizer applications consistent with agronomic rates for site specific conditions of the golf course.

Projects

319-Funded

Congress enacted Section 319 of the Clean Water Act in 1987 establishing a national program to abate non-point sources of water pollution. These grants, known as Section 319 Grants, are made possible by the federal funds provided to VTDEC by the USEPA, and are available to assist in the implementation of projects to promote restoration of water quality by reducing and managing non-point source pollution in Vermont waters.

Table 5 below identifies the Section 319 grants and their value that have been awarded in the CT River basin in Vermont. These projects fall into two categories, either outreach, planning and assessment projects or implementation projects. The category type is identified in the third column. For the most part, Section 319 grants are awarded for the control of sediment and nutrients for the improvement of localized water quality, either through direct implementation or through planning efforts that set the stage for project identification and implementation. Overall, these types of management efforts can have significant benefits in the control of nitrogen loading to the CT River.

Due to the lack of information, an accurate assessment of the amount of nitrogen loading reduction is not possible to calculate at this time. However, the Section 319 project grants have undoubtedly had a beneficial impact to reduce nitrogen runoff and loading.

Table 5. Vermont §319 Grants awarded within the CT River basin. (*) identifies outreach, assessment, planning projects and () identifies implementation-based efforts.**

Federal FY1997		
Elizabeth mine hydrologic assessment, White River NRCD	\$12,000	*
Federal FY1998		
Elizabeth mine assessment & outreach, White River NRCD	\$2,575	*
Federal FY1999		
CT River watershed erosion control, CT River Joint Commission	\$50,000	*
CT River main stem erosion inventory, CT River Watershed Council	\$25,000	*
Elizabeth Mine NPS Remediation project, Town of Strafford	\$6,000	*
Integrated crop Management, Windham County NRCD	\$48,164	**
Integrated crop management, Caledonia County NRCD	\$38,204	**
Lynburke streambank & buffer project, Caledonia NRCD	\$26,400	**
Geomorphology design for upper White River, White River Partnership	\$5,000	**
Analysis of mercury levels in CT River fish tissue, NEIWPC	\$20,000	*
Federal FY2000		
Integrated crop Management (yr. 2), Caledonia NRCD	\$42,810	**
Integrated crop management (yr. 2), Windham NRCD	\$42,851	**
White River swimming use protection, UVM	\$2,000	*
Interim (5/01-2/02) White River planner, DEC	\$18,600	*
Resource restoration on tribs to West River, Bonneyvale Environmental Education Ctr.	\$15,500	**
Barton River riparian area protection, Lake Region Union High School	\$10,000	**
Passumpsic River riparian area protection, Lyndon Institute	\$10,000	**
Federal FY2001		
Passumpsic/Moose rivers stability assessment, Caledonia NRCD	\$3,000	*
CT River outreach/WQ coordination, CRJC	\$30,500	*
Integrated crop management (yr. 3), Caledonia NRCD	\$10,884	**
Integrated crop management (yr. 3), Ottauquechee NRCD	\$29,632	**
Locally led lake protection, Ticklenaked Pond Association	\$8,430	*
Federal FY2003		
White River watershed geomorphic data upgrade, White River Partnership	\$5,400	*
CT River watershed NPS targeting & priorities, CRJC	\$15,500	*
West River watershed outreach, assessment, erosion control, Windham NRCD	\$42,000	*
Integrated crop management program (yr. 4), Caledonia NRCD	\$12,000	**
Improving Lake Runnemedede shoreline habitat, Town of Windsor	\$3,434	**
Federal FY2004		
CT River watershed NPS targeting & priorities, CRJC	\$15,500	*
Basin 11 management planning & pollution reduction, Windham NRCD	\$45,000	*
Federal FY2005		
Basin 11 management, planning and pollution reduction (yr. 3), Windham NRCD	\$40,000	*
Ottawaquechee watershed bridge & culvert survey & reach break delineation, Two Rivers RPC	\$5,100	*
Federal FY2008		
Crosby Brook watershed head cut restoration, Windham NRCD	\$17,000	*
Federal FY2011		
Crosby Brook floodplain & buffer restoration, Windham NRCD	\$10,850	**

Ecosystem Restoration Program

The original Center for Clean and Clear was established in 2007 to enhance Vermont’s commitment to improve water quality in Lake Champlain. That Program brought together resources dedicated to improving water quality that were previously spread among many state programs. In 2008, the former Center restructured the Ecosystem Restoration Grant Program to guide the award of state water quality grants and contracts to municipalities, watershed organizations, conservation districts, regional planning commissions, and other partners across the entire state. As part of the Ecosystem Restoration Program’s on-going efforts to reduce surface water pollution from nutrients and sediment, the state budget has included capital funds to support ecosystem restoration projects. The typical project budgets have ranged between \$5,000 and \$75,000.

Table 6 below identifies CT River basin projects that have been awarded funding from the ERP Grant Program. Projects are categorized into three general project types: development, implementation, and conservation easements.

Table 6. Ecosystem Restoration Grant Program project funding awarded in the CT River basin.

Project type	Description	Amount
Fiscal Year 2006		
Development	Black River Phase I Stream Geomorphic Assessment (SGA)	\$21,645
Development	Ottauquechee FEH Assessment	\$26,450
Development	Water quality restoration projects within the West, Williams, Saxtons	\$90,000
Conservation Easement	Passumpsic River SGA	\$35,500
Development	Passumpsic River Phase I SGA	\$6,500
Implementation	Upper Passumpsic River Watershed Management Corridor Planning	\$18,850
Implementation	Nulhegan River Phase I and II SGA	\$12,881
Development	White River Corridor Planning	\$19,096
Fiscal Year 2007		
Implementation	Black River SGA	\$27,906
Development	Whetstone/Crosby SGA	\$63,595
Development	Waits SGA	\$33,414
Development	Moose River SGA	\$22,953
Conservation Easement	Ayers Brook	\$32,179
Development	White and Mill Rivers	\$23,498
Development	White and Mill Rivers	\$7,832
Implementation	Tweed River SGA	\$19,642
Fiscal Year 2008		
Implementation	Whetstone, Crosby, BMB and Rock River Project Dev.	\$72,000
Development	Ompompanoosuc SGA	\$15,608
Conservation Easement	Ticklenaked buffers, rain gardens, rain barrels, driveways	\$5,341
Conservation Easement	Ompompanoosuc Trees for Streams Program	\$3,000
Development	West Branch Passumpsic River SGA	\$20,900
Development	Waits River Corridor Planning	\$34,590
Implementation	Upper White River Project Development	\$14,698

Project type	Description	Amount
Conservation Easement	Ayers Brook Conservation Easement on Hammond Farm	\$41,243
Fiscal Year 2009		
Development	Phase II SGA and Corridor Planning (Trib. to Lake Rescue)	\$23,107
Implementation	Saxtons River Corridor Planning	\$24,834
Development	North Branch Deerfield Corridor Plan	\$11,700
Conservation Easement	Crosby Brook Head Cut Stabilization	\$12,261
Conservation Easement	Lot 2 Easement Acquisition	\$65,000
Development	Stevens River Watershed Geomorphic Assessment Updates	\$36,900
Implementation	Waits River Watershed Corridor Planning	\$12,000
Conservation Easement	NEK Lakeshore Buffering Program	\$4,625
Development	White River Phase II SGA	\$43,900
Conservation Easement	Ayers Brook Project Development and Implementation	\$15,000
Conservation Easement	Thrailkill Easement on the White River	\$45,429
Development	Class IV Town Roads Assessment	\$10,000
Fiscal Year 2010		
Conservation Easement	Crosby Brook Restoration Projects	\$17,500
Conservation Easement	NEK Lakeshore Buffering Program	\$5,107
Implementation	FEH and Stream Geomorphic Assessments	\$11,704
Fiscal Year 2011		
Implementation	Ottauquechee River SGA & Corridor Plan	\$49,961
Conservation Easement	Billings Farm Streambank Stabilization	\$2,700
Conservation Easement	Bull Creek River Corridor Easement Acquisition	\$50,790
Implementation	Roberts Parcel Easement Scoping on Saxtons River	\$5,800
Conservation Easement	Construction of Phase II Floodplain Restoration and Engineering Services	\$191,377
Conservation Easement	Maple Valley Farm CREP Match	\$4,000
Development	IDDE in Brattleboro	\$42,435
Implementation	Upper Passumpsic Watershed Proj Dev	\$20,000
Implementation	St. Johnsbury SW Remediation Proj Dev	\$15,000
Conservation Easement	Nullhegan River Easement	\$30,000
Development	Ticklenaked Pond Internal Tx Alternatives Analysis	\$41,455
Conservation Easement	Ag Water Quality BMP Project Development	\$13,100
Fiscal Year 2012		
Development	IDDE in Springfield	\$49,110
Conservation Easement	Roberts Parcel Easement Acquisition	\$13,500
Development	Lower Ompomp Phase II SGA	\$23,960
Development	Wells River Corridor Planning	\$12,125
Conservation Easement	Leach Stream Easement	\$50,764
Implementation	White River Corridor Ecosystem Restoration	\$12,000
Development	First Branch River Corridor Planning	\$65,490
Implementation	Ag Water Quality BMPs	\$17,550
Implementation	Lincoln Street Stormwater Erosion Remediation	\$5,100
Implementation	Rock River Bridge Abutment Removal	\$6,725
Development	Passumpsic Phase I SGA	\$16,000
Conservation Easement	Johnson Farm MOA	\$75,000

Relative change in scope and effectiveness of programs from 1990 to present

Table 7 in Appendix A graphically identifies many of the management programs described in previous sections and are listed on the left hand side of the chart. Years are identified across the top of the diagram starting from 1990 which represents the baseline year of the current and proposed TMDL. The shading across each row represents when specific programs were initiated and to what degree they are ongoing. If programs have undergone substantial increases in management scope, this is represented by a darkening of the shading – progressively darkened shading represents increased management scope. An “X” represents a smaller but important increase in scope. For programs where BMP installations were summed for a given year, that number is provided.

Based on the data as presented here, it’s evident that programs that either directly or indirectly act to reduce or prevent nitrogen export have increased substantially since the baseline year of the TMDL. This is not a quantitative analysis showing compliance with the TMDL but it does lend strong support that Vermont, while not focused on NPS nitrogen control in the past, has developed a substantial body of management efforts over the last two decades.

Basin Planning as a Framework for Implementation

Introduction

As seen from the preceding discussions, multiple programs are in place to both prevent and reduce excess nitrogen runoff to the Connecticut River and ultimately the Long Island Sound. However, without an overall plan to implement the necessary pollution prevention measures, programs may not be fully integrated to realize a truly efficient means of getting projects installed on the ground. Vermont has recently formulated such a plan statewide. As nitrogen loading concerns continue to grow and when the Long Island Sound TMDL is completed with attendant load allocations, Vermont is poised to execute a concerted planning and implementation effort to address nitrogen loading. The overall plan is described below

In 2010, the WSMD was reshaped to create an organizational structure and management tools designed to promote the implementation of integrated water resources management. The WSMD reorganization provides a coordinated, efficient means of managing water resource issues through entire watersheds, with the primary objective of maximizing environmental benefit and water resource protection. This effort included three primary components:

- As a **first step**, the WSMD integrated its monitoring, assessment and planning sections into a new Monitoring, Assessment and Planning Program (MAPP). Effective watershed management begins with effective planning, which must have a solid, scientific foundation for decision-making. The water resource planning process is closely linked to and dependent upon monitoring and assessment activities. The creation of MAPP will enhance holistic monitoring, assessment and planning through an integration of the WSMD’s water resource programs.

- The **second step** in promoting integrated watershed management was the development of the Statewide Surface Water Strategy. The Strategy serves as an overall guide during the development of basin plans by focusing management, planning, regulatory and funding efforts on basin-specific stressors, thereby allowing for prioritization of efforts to maximize environmental gain. The Strategy will be used by basin planners, stakeholders and the public to identify and collectively prioritize the stressors impacting each basin and sub-basin.
- The **third step, described in detail below**, is the Tactical Planning Process, which is WSMD’s revised approach to watershed-specific management planning. These revisions are based on years of planning and resource management experience by the WSMD. The WSMD recognizes that the basin planning process needs “buy in” from a large constituency, including federal, state, local agencies, the Legislature, watershed councils, planning groups, and the public. Over the past two years, the WSMD has engaged all of these constituencies in discussions regarding the benefits of the tactical planning process, which is described completely here.

Tactical Basin Plans

The Tactical Basin Planning Framework espoused by this Strategy is not a new program, but rather a way of coordinating existing programs and building new partnerships that will result in efficient and environmentally sound management of Vermont’s surface water resources. Inherent in the design of the Framework is the belief that many stakeholder groups and individuals must have ongoing opportunities to effectively participate in planning for the management of Vermont’s watersheds. Further, the framework envisions a tight coupling between the priorities expressed in tactical basin plans, and the project-level work funded by the Ecosystem Restoration Program and other state and Federal water quality improvement funding programs. This chapter describes the process for developing individual, basin-specific and geographically explicit plans, establishing priority monitoring and assessment approaches, and, permitting or project-level initiatives to protect or restore surface waters.

Process for Developing Tactical Basin Plans

Step 1 - Scoping and information gathering (monitoring and assessment)

For targeted basins (and sub-basins) within the rotational queue (see Figure 1. Basin Map for basin boundaries and planner assignments), there will be a compilation of existing assessment data including but not limited to biological assessment data, stream geomorphic assessments (and corresponding river corridor plans), chemical water quality monitoring data, lake assessments, rare-threatened-endangered species, natural community inventories, among others. In addition to data compilation, this may include attendant process information such as:

- Assessment protocol - including the identification of very high quality waters and existing uses.
- Initial prioritization process (based on review of assessment information) for highest priority protection, restoration, and conservation actions
- Summary of assessment data and reports used in the prioritization process

Step 2 - Prioritization and Targeting of Resources (internal State process)

A series of pre-basin planning meetings within ANR programs (within DEC – Watershed Management, Groundwater and Drinking Water Protection, and Waste Management Divisions, DFW – Fisheries, and DFPR – Watershed Forestry as examples) and external to ANR (Agency of Agriculture, Food and Markets, VTRANS) will be held to review current and long term water quality monitoring data, discuss known issues in the basin, direct additional, near term monitoring, identify both protection and restoration priority projects, and current levels/ areas of funding. This formula is an inter-agency tool for prioritizing sub-basins within a major river basin for further action, based upon a ranking system that considers both ecological and human health to meet restoration and protection goals and objectives. It provides a basis for decision making and targeting of program resources.

Step 3 - Prioritization and Targeting of Resources (external)

Once current monitoring and assessment data has been compiled and reviewed, DEC will initiate external stakeholder meetings with sister agencies, technical entities, watershed and other organizations (e.g., Conservation Districts, Watershed Associations, Regional Planning Commissions, etc). The group will identify and coordinate shared priorities and develop their “tactical” approach to planning and project implementation for the basin in queue. In addition, DEC will identify partner programs for areas of mutual opportunity – funding and project priorities.

Step 4 – Public Outreach and Awareness of the Basin Planning Process

Once outlines for a tactical plan are assembled, public forums and targeted meetings will be convened to present data on known impairments as well as waters exhibiting very good to excellent biological or physical integrity (or other high quality characteristics), to identify and solicit public input to identify gaps and seek recommendations on priority areas (surface waters) for protection and restoration identified in Steps 1-3.

Step 5 - Development of Tactical Basin Plans and Attendant Strategies

Develop draft workplan that identifies priority projects and enhanced program implementation. Workplan elements will include strategies for the protection of very high quality waters, remediation of impaired waters remediation, and project-specific recommendations for stressed waters. Priorities will be identified as per concurrent management plans (e.g. river corridor management plans, source protection plans) and the stakeholder prioritization process. The final plans and implementation tables will be presented at a final round of public meetings/ presentations.

Step 6 – Implementation of Tactical Basin Plans

Initiate implementation of tactical plan. Develop agreements and MOUs between stakeholder groups as to the lead partners for project implementation and identification and procurement of project funding sources.

Structure of the Tactical Basin Plans

Each Tactical Basin Plan will provide an introduction about the tactical planning process, a description of the basin and priority sub-basins that are areas of focus and a prioritization of primary stressors in the basin, such as nitrogen runoff to the Connecticut River, where strategies will be focused to address the activities causing the stressor(s).

In general, tactical basin plans will be developed to incorporate the following strategies:

- Strategies that address impaired or altered waters
- Strategies that address protection of certain high quality waters and “Healthy Watersheds”
- Strategies that address new threats to surface waters, stressors that affect large areas of the basin, or stressors that are top priorities for other reasons. These stressors may be targeted by:
 1. Specific sub-basins within the rotational basin planning process for focused monitoring, assessment, protection, restoration and outreach - (i.e., *targeted sub-basins*)
 2. By stream order- *in order to target priority statewide and surface water stressors and strategies for focused areas of the basin and sub-basins.*

Where problems affecting impaired waters are known and solutions are clear, the plan will contain specific remediation actions. For such waters, this would include a list of actions to be taken, who will take those actions, a timeline for completion of the actions, an estimate of the cost of the action and an indication of the most probable funding for the action. Where the problems are not fully known, or solutions are not clear, an adaptive management strategy will be adopted. Here, the plan will contain a strategy for reasonable actions that should improve the impaired waters, as well as a process to acquire the necessary information to further define the problem and develop new solutions as soon as reasonably possible. In this regard, ongoing monitoring and assessment programs will determine whether or not we are moving towards desired water quality improvement goal(s).

An implementation table included in each Plan will identify objectives and frame-out geographically or programmatically specific actions. It is anticipated that the list of action items will first be expanded, based on input from Agency staff and watershed partners, and later prioritized and refined based on technical input and stakeholder outreach. Financial resources will be identified to implement specific actions. Action items include both data collection and assessment efforts and specific implementation activities. Action items should be able to be accomplished within the next five years, and reflect goals and objectives identified in the Statewide Surface Water Management Strategy. The implementation table will be catalogued by restoration, protection, and monitoring and assessment activities, and will catalogue necessary as well as completed projects.

Implementation tables will also point to specific projects or actions that are necessary to achieve compliance with a TMDL for a specific impaired water. In these instances, as feasible the Division will include pollutant load reduction estimates that may result from complete implementation. This information will be provided in fulfillment of EPA requirements for “Watershed Based Plans.” All actions

that are intended to support a major TMDL (e.g., Champlain, Memphremagog, Long Island Sound) will be so-identified in the implementation table such that TMDL implementation can be tracked through tactical basin planning. Components of the implementation table will ultimately be served online via the Vermont Integrated Watershed Assessment System, which is currently under development.

Funding

The Division's intent is that the identified priorities that are explicitly identified in tactical basin plans become the priority items to be funded using the Division's implementation funding mechanisms. To this end, the process by which Ecosystem Restoration Program and other water quality planning and remediation funds are distributed has been re-engineered to align with the Tactical Planning Process. Throughout the process of Plan development, partner organizations are encouraged to participate in a meaningful prioritization exercise that will identify the highest priority items for State support. As a component of the Tactical Planning Process, watershed coordinators serve as a focal point for the development of Ecosystem Restoration Program grant applications. Projects that are specifically identified in Tactical Plans and associated river corridor or other relevant Plans receive higher scoring in the allocation rubric.

Data Gaps and Recommended Improvements

During the development of this assessment, a few overarching information gaps became apparent that should be addressed as development of a revised LIS TMDL move forward.

- There is currently no systematic, long term, instream nitrogen monitoring occurring in the upper CT River. Without these data, assessment of TMDL compliance or loading status will forever be reliant on secondary indicators. Instream monitoring data will ultimately be necessary if a truly quantitative measure of Vermont's (and NH's) non-point source nitrogen loading is required in the future TMDL.
- Since atmospheric deposition of nitrogen accounts for the majority of nitrogen export reaching the LIS from Vermont, a better understanding of the linkage between air pollution control efforts at a national scale and the ultimate reduction in runoff is needed. How will decreases in atmospheric deposition affect BMP relative efficiency? How will accounting of nitrogen reductions via BMPs be separated from reductions attributed to air pollution controls? Will expected atmospheric reductions be sufficient to meet future TMDL goals for Vermont?
- Development of a unified protocol among all states to account for BMP "credits" (tracking tool?). If BMPs are intended to ultimately track progress in nitrogen reductions, all states should be using the same assumptions for BMP types and effectiveness.

Agricultural lands

- ERP grant and Section 319 project tracking could incorporate better environmental benefit indicators in addition to financial tracking/accounting. Within the CT River watershed this should specifically include nitrogen reduction benefits.

- Lack ability to account for non-VTDEC funded BMP programs and to easily initiate nitrogen accounting factors. E.g. Agency of Agriculture, NRCS, Agency of Transportation
- Lack of a systematic approach to BMP accounting across all agricultural programs. Basic information such as BMP type, location, acreage treated, pre-BMP conditions, and BMP efficiency should be tracked.
- Lack of thorough understanding of BMP efficiencies for nitrogen for commonly used BMPs.

Developed lands

- Lack permit tracking over time that captures changes in impervious cover being treated and the ability to distinguish between redevelopment and new development.
- Municipal actions – Undoubtedly, numerous municipalities conduct public works activities to improve/maintain infrastructure that have the indirect benefit of nitrogen control. For example, street sweeping, catch basin cleaning and erosion control are common BMPs towns rarely track, let alone quantify a level a nitrogen reduction.

Qualitative Assessment Summary

The precise status of nonpoint source nitrogen loading to LIS from Vermont is currently unknown. Additionally, the ability to quantify the effective change in nitrogen loading caused by broad-based drivers and specific BMP implementation is equally unknown. The lack of long-term, instream nitrogen monitoring in the Upper Connecticut River plays a major part in the lack of loading knowledge and extensive data gaps in BMP implementation tracking account for the lack of nitrogen control information. Currently, and into the foreseeable future, a reasonable quantitative assessment of Vermont's nitrogen control efforts will not be available.

However, based on the information presented in this report, a qualitative assessment of Vermont's overall efforts to control nitrogen loading can be inferred. Based on trends in drivers of nitrogen and the increasing number and types of BMPs and management programs, Vermont believes that it is currently meeting the original nonpoint source nitrogen allocation. Basis for this assessment is described in the following summary.

Agricultural lands

Through the review of agricultural status and trends and BMP implementation, it appears that nitrogen export from the agricultural sector has declined since the baseline of 1990. The status of key agricultural indicators point to this in several instances:

- Agricultural land use changes – The USDA Farm Census was mined for data between 1987 and 2007 and two land use indicators that have the biggest impact on nitrogen export were examined – total farm acreage and total cropland acreage. Total farm acreage gives an overall indication of the extent of agricultural activity while the cropland indicator tracks a high nitrogen exporting land use. Since 1987, total farm acreage has decreased approximately 8% and total cropland acreage has shown a steady decline totaling 25%.

- Animal inventories – Perhaps the most significant change in agricultural activity can be related to farm animal inventories since these animals drive significant nitrogen producing agricultural activities. The higher the animal inventory the higher the cropland production, manure management needs and fertilizer usage; three of the most significant factors leading to nitrogen runoff. Among farm animals, cattle far outweigh the others and dairy cows are by far the most prevalent of the cattle. During the period 1987-2007, all animal inventories have fallen substantially; cattle, hogs and sheep have fallen 23%, 34% and 28% respectively.
- Fertilizer usage – A direct result of fewer farm acreage and animals is a comparative drop in fertilizer and manure usage. Between 1987-2007, commercial fertilizer usage steadily declined by 32% and since 2002 manure usage declined approximately 10%.

In conjunction with lessening impact of major agricultural indicators of nitrogen export, significant water quality improvement efforts have been instituted in the agricultural community. These relate to either BMP implementation, financial or technical assistance. These factors build upon the lessening pressure from the current agricultural trends and further decrease nitrogen load from Vermont's agricultural areas. Some of these efforts include:

- At the state and federal level, 20 of the current 21 agricultural programs concerning water quality improvement (see Appendix A) have been initiated since 1990
- At the state level, the Best Management Practices (BMP) and Farm Agronomic Practices (FAP) Programs have combined to implement nearly 300 water quality improvement practices on farms since 1997
- Costs associated with BMP and FAP water quality improvements total \$5.6 million
- Vermont has implemented the LFO (1999) and MFO (2007) farm permitting programs and the CAFO permit has been developed and is soon to be implemented

Developed lands

In the CT River basin in Vermont, developed land pressures that contribute to nitrogen export have been minimal since 1990 and are the lowest rates of the five states contributing to LIS.

- Population – Between 1990 and 2010, Vermont population in the CT River basin increased by roughly 11,000 persons or a 7.4% increase. A USEPA GIS analysis shows this increase was distributed broadly across the basin with no significant concentrated growth. This change represents an increase of 3.0 persons/square mile, the lowest in the LIS watershed where NH, MA, CT and NY showed increases of 6.2, 10.6, 58.4 and 86.2 persons/square mile.
- Developed land changes – A USEPA GIS analysis indicates that land use conversion to “developed” land in Vermont between 2001 – 2006 was nearly imperceptible at 158 acres or a 0.01% increase. As with population, this land use conversion rate was the lowest in the LIS watershed whereby NH, MA, NY and CT showed changes of 0.02%, 0.17%, 0.32% and 0.68% respectively.
- Impervious cover changes – A USEPA GIS analysis estimates that approximately 49 acres of impervious surfaces were created between 2001-2006. While it's unclear how accurate this analysis is; it indicates that Vermont showed the lowest impervious cover increase in the LIS

watershed. NH, NY, MA and CT showed increases of 149, 222, 1,280 and 6,394 acres respectively.

While overall trends in developed lands do not suggest significant increases in nitrogen export, there have been substantial water quality management programs initiated and BMPs implemented since 1990. As describe in the preceding report and presented in Appendix A, 19 of the 20 water quality improvement efforts related to developed land runoff have been initiated since 1990. Below are a few important efforts:

- Technical standards for the Vermont operational stormwater permits were updated in 1980, 1987, 1997, and 2002. The jurisdictional threshold has also been revised over time, and since 2005 it has been set at one acre of impervious cover.
- Many of the operational permit treatment practices (Table 3) are effective at preventing nitrogen runoff. Currently, 1,307 acres of impervious surface are covered under the VT operational stormwater permit
- Approximately 4,563 acres of high elevation watersheds impaired due to stormwater runoff are scheduled for water quality remediation plan development and implementation in the coming years. These plans will target nutrient and sediment control
- Vermont has an active and expanding IDDE program in the CT River basin even though no MS4 communities are present. This mapping and investigative program has already identified many problematic discharges and adds an important tool for communities to develop comprehensive stormwater planning
- The Vermont Agency of Transportation has invested significant resources to better manage runoff from its roads and highways in the form of better water quality planning, project oversight, staffing and funding
- Since 2004, the Vermont Better Back Roads program has funded 28 road inventories at a cost of \$95,593
- Since 2004, the Vermont Better Back Roads program has funded 144 erosion control projects at a total cost of \$1,022,490

Other Nitrogen Reduction Efforts

Aside from BMPs and management programs targeted at either agricultural or developed areas, several other efforts contributed in part to nitrogen control efforts in Vermont.

- The Ecosystem Restoration Grant Program has provided funding for 63 water quality improvement projects focused on development, implementation or conservation easements at a total cost of over \$1.8 million.
- The §319 Grant Program has provided funding for 33 water quality improvement projects focused on either outreach, planning and assessment or implementation projects at a total cost of over \$669,000.
- In 2012, Vermont enacted a non-agricultural turf fertilizer law that limits the use of turf fertilizers and to reduce the likelihood of nutrients from entering surface waters. Aside from

prohibiting certain types of nitrogen formulations, the law also prohibits: 1) application to impervious surfaces, 2) applications to turf before April 1st or after October 15th or at any time the ground is frozen, and 3) applications to turf within 25 feet of waters of the state. Also, golf courses are also required to develop and submit to the State a nutrient management plan for the use and application of fertilizers.

- Tactical Basin Planning forms a significant part of Vermont’s Surface Water Management Strategy that provides the necessary framework to target specific water quality problems with focused funding and BMPs implementation. Since the Tactical Basin Plans are developed on a watershed specific basis, nitrogen reduction opportunities are readily identified and targeted for implementation measures. This planning effort surveys all available protection, restoration and funding resources so the proper water quality improvement measure can be implemented.

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Appendix A

Table 7. Water quality management programs and associated timelines.

The following table identifies many of the management programs described in previous report sections and are listed on the left hand side of the chart. Years are identified across the top of the diagram starting from 1990 which represents the baseline year of the current and proposed TMDL. The shading across each row represents when specific programs were initiated and to what degree they are ongoing. If programs have undergone substantial increases in management scope, this is represented by a darkening of the shading – progressively darkened shading represents increased management scope. An “X” represents a smaller but important increase in scope. For programs where BMP installations were summed for a given year, that number is provided.

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Agricultural Areas	VAA&F Programs																								
	Accepted Agricultural Practices (AAP)																		X						
	Alternative Manure Management Program (AMM)																								
	Best Management Practices Program (BMP)																								
	Conservation Reserve Enhancement Program (CREP)																								
	Farm Agronomic Practices Program (FAP)																								
	Large Farm Operations Program (LFO)																			X					
	Medium Farm Operations (MFO)																								X
	Nutrient Management Incentive Grant Program (NMPIG)																								
	Vermont Agricultural Buffer Program (VABP)																						X		
	Capital Equipment Assistance Program (CEAP)																								
	Local Government Programs																								
	Agricultural Resource Specialist Program (ARS)																								
	Agricultural Environmental Management (AEM)/Farm-A-Syst Program																								
	Land Treatment Planners (LTP)																								
	Federal Programs																								
	Agricultural Management Assistance (AMA) program														X							X			
	Conservation Reserve Program (CRP)																								
	Conservation Stewardship Program (CSP)																								
	Environmental Quality Incentives Program (EQIP)																								
Farm and Ranch Lands Protection Program (FRPP)																									
Grassland Reserve Program (GRP)																									
Watershed and River Basin Planning and Installation - Public Law 83-566 (PL566)																									
Wetlands Reserve Program (WRP)																									
Wildlife Habitat Incentive Program (WHIP)																									
Developed Areas																									
Vermont Stormwater Programs																									
Operational permits ¹																									
Construction permits ²																									
Multi sector general permits																									
Illicit Discharge and Detection Elimination Program																									
Transportation																									
Vermont Better Back Roads Program inventory projects (# /yr)																3	2	8	5	3	2	2		3	
Vermont Better Back Roads Program erosion control projects (# /yr)																6	16	18	16	24	23	22		19	
VT Agency of Transportation activities																									
Compliance with State Operational Stormwater Permit/Manual																									
Compliance with NPDES/State Construction Stormwater Permit																									
Compliance with NPDES/State MS4 ³																									
Compliance with NPDES/State MSGP																									

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
	Winter Maintenance – Sand Reduction with introduction of Salt Brine																								
	Culvert and Ditching Procedures with focus on water quality																								
	Water Quality Enhancement Program under Environmental Division																								
	Trainings: Contractor & District EPSC & Stormwater																								
	MS4 conditions updated to prohibit and regulate illicit discharges																								
	VTrans EPSC Protocol was developed																								
Other	Section 319 - # of projects by type																								
	Outreach, Assessment and Planning									1	1	4	2	3		3	2	2			1				
	Implementation											4	5	2		2								2	
	ERP Grants - # of projects by type																								
	Development																		5	5	3	5		2	5
	Implementation																		2	2	2	2	1	4	4
	Conservation Easement																		1	1	3	5	2	6	3
	Other																								
Vermont turf fertilizer law																									

1-Program technical standards were updated in 1980, 1987, 1997, and 2002. The jurisdictional threshold has also been revised over time, and since 2005 it has been set at one acre of impervious cover.

2-Construction permit jurisdictional threshold decreased from 5 acres to 1 acre of disturbance

3-Even though MS4 does not apply to CT River Basin, VTrans applies a majority of the MS4 requirements statewide