

# Vermont Nonpoint Source Management Program



August 6, 2015

Vermont Department of Environmental Conservation

1 National Life Drive, Main 2

Montpelier, VT 05602

# Vermont Nonpoint Source Management Program Plan

## Table of Contents

<b>Executive Summary .....</b>	<b>4</b>
<b>Chapter I. Introduction.....</b>	<b>7</b>
<b>Chapter 2. Vermont NPS Management Program Mission, Goals &amp; Guiding Principles... </b>	<b>10</b>
<b>Chapter 3. Framework of Vermont’s NPS Pollution Management Program .....</b>	<b>12</b>
A. <i>Key Federal &amp; State Laws .....</i>	<i>12</i>
B. <i>Statewide and Watershed-specific Approaches.....</i>	<i>16</i>
<b>Chapter 4. Nature of NPS Problem Affecting Vermont’s Surface &amp; Ground Waters.....</b>	<b>18</b>
A. <i>Overview of Vermont’s Water Resources.....</i>	<i>18</i>
B. <i>Surface Water Assessment.....</i>	<i>21</i>
C. <i>Protecting and Improving Surface Waters by Managing Stressors .....</i>	<i>25</i>
D. <i>Special Areas of NPS Concern.....</i>	<i>29</i>
<b>Chapter 5. Statewide Watershed Prioritization.....</b>	<b>36</b>
A. <i>Priority NPS Impaired Surface Waters in Need of Restoration .....</i>	<i>36</i>
B. <i>Priority NPS Threatened Surface Waters in Need of Protection .....</i>	<i>39</i>
<b>Chapter 6. Vermont River Basin &amp; Watershed-based Approach for NPS Planning &amp; Implementation .....</b>	<b>40</b>
A. <i>State Water Quality Planning Approaches .....</i>	<i>40</i>
B. <i>EPA Watershed-based Plans.....</i>	<i>44</i>
C. <i>NPS Watershed Implementation.....</i>	<i>45</i>
D. <i>Measuring, Monitoring or Evaluating Results.....</i>	<i>47</i>
<b>Chapter 7. Vermont NPS Programs, Federal Programs &amp; NPS Partnerships .....</b>	<b>48</b>
A. <i>Vermont NPS Management Programs .....</i>	<i>48</i>
B. <i>Vermont NPS Program - Federal Partners .....</i>	<i>71</i>
C. <i>NPS Partnerships with Non-Governmental Organizations .....</i>	<i>76</i>

<b>Chapter 8. Funding Resources to Support Vermont’s NPS Management Program.....</b>	<b>79</b>
A. <i>Federal Sources</i> .....	79
B. <i>State Sources</i> .....	85
<b>Chapter 9. NPS Control Strategies with Five Year Objectives, Actions, Milestones &amp; Schedule .....</b>	<b>88</b>
A. <i>Agricultural NPS Pollution</i> .....	88
B. <i>Stormwater Runoff and Transportation NPS Pollution</i> .....	100
C. <i>Hydromodification (River Channel Stability)</i> .....	107
D. <i>Forest Management</i> .....	113
E. <i>NPS Program Partnerships and Funding Strategies</i> .....	117
F. <i>NPS Program Administration and Oversight</i> .....	119
<b>Chapter 10. Measuring Environmental Progress &amp; Evaluating Vermont’s NPS Management Program .....</b>	<b>123</b>
A. <i>Measuring Environmental Conditions, Progress &amp; Success</i> .....	123
B. <i>Introduction to Water Quality Monitoring</i> .....	125
C. <i>Vermont NPS Program Evaluation</i> .....	132
<b>Conclusion.....</b>	<b>134</b>
<b>Appendices .....</b>	<b>135</b>
A. <i>Elements of Effective NPS Management Programs (taken from EPA guidance)</i> .....	135
B. <i>Stressors that Affect Goals and Strategies for Surface and Ground Waters</i> .....	135
C. <i>Dam Removals – Completed and Active</i> .....	135
D. <i>NPS Impaired Waters in Need of Restoration</i> .....	135
E. <i>NPS Threatened Waters in Need of Protection</i> .....	135
F. <i>Examples of Noteworthy Section 319 Funded Projects (1990 – 2011)</i> .....	135
G. <i>Act 64 of 2015 (aka Vermont Clean Water Act) Section by Section Summary</i> .....	135

## Executive Summary

Nonpoint source (NPS) pollution is the leading cause of water use impairment to Vermont's surface water and ground water resources. Recently completed assessments of Vermont surface waters and ground waters indicate that water quality impacts from NPSs of pollution occur in each of Vermont's fifteen river drainage basins. The types and extent of problems and threats associated with these pollution sources show a considerable degree of variation within and between basins.

The control, prevention, reduction and overall management of nonpoint source pollution has been underway throughout Vermont since establishment of the federal Water Pollution Control Law in the early 1970s and consequent enactment of Vermont's water pollution control statute. A wide variety of state and federal programs, rules, procedures, permits and practices exist and have been modified since their creation to help clean up, avoid or minimize the generation of NPS runoff and the contribution of NPS pollutants to Vermont's waters. Although much progress has been made including some notable accomplishments, significant challenges remain with respect to controlling and preventing NPS pollution to Vermont's waters.

The Vermont NPS Management Program document has been prepared by the Vermont Department of Environmental Conservation (DEC) in fulfillment of a federal requirement arising from Clean Water Act Section 319 program guidance promulgated by the US Environmental Protection Agency (EPA). The document, which updates earlier versions of the Vermont NPS Management Program, contains the key components EPA requires for states to remain eligible for continued 319 grant funding to combat eligible types or sources of NPS pollution. DEC considers this document to be consistent with the implementation plan associated with the phosphorus-based Total Maximum Daily Load (TMDL) being prepared by EPA for the Vermont portion of Lake Champlain and its drainage and with the Vermont Clean Water Initiative.

Chapter Two of this document includes the mission, goals and guiding principles behind the State's NPS management program. An effective nonpoint source management program will continue to rely on a combination of education and information, the application of effective controls and techniques that involve structural and non-structural measures in regulatory and non-regulatory contexts and the ability to monitor or measure program outcomes.

Chapter Three provides the framework behind Vermont's overall NPS management program, summarizing key State and Federal laws and the statewide and watershed based approaches which guide Vermont's overall approach to controlling NPS pollution.

Chapter Four gives the reader an understanding of the nature of nonpoint source pollution that is affecting or threatening Vermont's surface and ground water resources. Defining causes,

stressors and sources is supported in large measure by water quality monitoring data. DEC recognizes eight subject areas of NPS concern and five major categories of NPS pollution.

Identification and prioritization of waters affected or threatened by NPS pollution is a fundamental element of Vermont's approach to NPS management dating back to 1988. Chapter Five identifies waters impaired and threatened by NPS pollution. Priority nonpoint source impaired waters are defined. (Note: Vermont plans to refine its list of priority nonpoint source threatened waters by 2018. A current list nonpoint source threatened waters in need of protection is included in Appendix E).

Water quality management planning and the generation of river basin plans, two hallmark measures of Vermont's commitment of restore and protect its water resources, have helped to define water quality problems, needs and solutions and launch implementation efforts whether intended for protection or restoration purposes. Chapter Six describes how water quality management and implementation are being conducted in order to target limited resources to address NPS pollution priorities.

Vermont's NPS pollution management program is built upon and continues to rely on a collection of programs at state, federal and regional levels. The Vermont NPS Management Program has evolved due to collaboration amongst an extensive network of functional partners including town government, non-profit groups, research and academic institutions. Chapter Seven describes the many programs and partnerships critical to ongoing and effective NPS pollution management within Vermont.

Chapter Eight includes descriptions of several different sources of funding available within Vermont to help carry out NPS assessment, NPS planning and NPS implementation work. Clean Water Act Section 319 dollars, one source of federal funding, is used by DEC in a variety of ways for eligible NPS activities. Most funding sources are highly competitive, as the demand for dollars typically exceeds the amount available. Consequently, the challenge is to target financial resources to address the highest priority nonpoint source pollution needs.

Having established the nature of NPS pollution as well as the priorities, programs, partnerships and funding to address these forms of pollution, Chapter Nine identifies objectives, actions, milestones and associated five year schedules for addressing five major NPS categories of pollution (agriculture; stormwater runoff from developed areas and transportation network; hydromodification; and forest management) as well as major NPS program activities (partnerships and funding strategies and administration and oversight). This chapter also identifies gaps and deficiencies and outlines steps to improve existing NPS program activities. Additional program activities may be identified in the Vermont Lake Champlain Phosphorus TMDL Phase One Implementation Plan which will be finalized following issuance of a Lake

Champlain phosphorus-based TMDL developed by the New Regional Office of EPA in summer 2015.

Measuring environmental progress and evaluating Vermont's multi-faceted NPS management program is the focus of Chapter Ten. This chapter provides a glimpse into monitoring efforts to show improvements to water resources and other approaches to evaluate the success of managing NPS pollution being carried out by the State of Vermont.

The various chapters comprising the Vermont NPS Management Program represent an acknowledgement of the need for continuing to apply successful approaches from the past plus the integration of new initiatives to address particular shortcomings regarding NPS control. This combination of past successes and new efforts provide a high degree of optimism that meaningful and measurable reductions in NPS pollution control can and will be achieved.

## Chapter I. Introduction

Nonpoint source (NPS) pollution<sup>1</sup> is the leading cause of water use impairment to Vermont's surface water and ground water resources. NPS pollution is also the major threat affecting the high quality of water. Recently completed assessments of Vermont surface waters and ground waters indicate that NPS-related impacts occur in each of Vermont's fifteen river drainage basins. The types and extent of water quality problems and threats associated with these NPS pollution sources, however, show a considerable degree of variation within and between basins. Two of Vermont's largest lakes, Lake Champlain and Lake Memphremagog, have water quality problems predominantly caused by NPS. Both of these waters are shared with other jurisdictions (New York State, the Province of Quebec) where NPS issues within contributing watersheds in those jurisdictions are also documented as major concerns.

In Vermont, there are five major sources of NPS including agriculture; stormwater from developed areas; stormwater from transportation network; hydromodification; and forest management. Sources of pollution identified as having the greatest impacts are streambank erosion/de-stabilization; removal of riparian vegetation; agricultural land uses and activities; developed land and roadway runoff; flow alteration from different facilities; and channel instability. Additional significant sources of impacts include atmospheric deposition, flood impacts resulting from poorly sited or designed human structures or activities, land development (active development as opposed to runoff from existing roads and development), and upstream impoundments.

Overall, the major causes of use impairment to Vermont surface waters from NPS were siltation and turbidity, nutrients (especially phosphorus), flow alteration and noxious aquatic plants. Other less than major causes affecting Vermont surface waters include pathogens, elevated temperature and toxic substances. The major causes of ground water contamination were from pollutants originating from unlined landfills, petroleum product storage or transport and human waste disposal systems. This document includes brief descriptions of the ten stressors which affect Vermont's water resources.

The control, prevention, reduction and overall management of NPS pollution has been underway within Vermont since the establishment of the federal Water Pollution Control Law (aka Clean Water Act) in the early 1970s and since enactment of Vermont's water pollution control statute (Title 10, Chapter 47). A wide variety of state and federal programs, rules, procedures, permits and practices exist and have been modified since their creation to minimize the generation of NPS runoff and the contribution of NPS pollutants to Vermont's waters. Although progress has been made, there are significant challenges that remain regarding NPS pollution and the protection and improvement of Vermont's waters.

---

<sup>1</sup> Nationally, NPS pollution is the leading cause of water quality degradation. It's been defined by EPA as "...caused by diffuse sources that are not regulated as point sources and normally is associated with agricultural, silvicultural and urban runoff, runoff from construction activities, etc. Such pollution results in the human-made or human-induced alteration of the chemical, physical, biological and radiological integrity of water. In practical terms, NPS pollution does not result from a discharge at a specific, single location but generally results from land runoff, precipitation, atmospheric deposition or percolation..." (EPA, Section 319 Program Guidance, 1987). Refer to: US EPA, Nonpoint Source Pollution: The Nation's Largest Water Quality Problem, EPA841-F-96-004A: <http://water.epa.gov/polwaste/nps/outreach/point1.cfm>

This document is an update of the State of Vermont’s Nonpoint Source Management Program plan document. The Vermont Nonpoint Source Management Program plan (the Plan) establishes the overall strategy the State of Vermont will use when carrying out and implementing various NPS pollution control and management programs during the next five year period (2015 – 2019). The Plan supersedes and replaces the Vermont Nonpoint Source Management Program upgrade (1999) and the original Nonpoint Source Management Program plan (1989).

The United States Environmental Protection Agency (EPA) requires states to have an updated NPS Management Program Plan in place to qualify for federal Section 319 grant awards under the Clean Water Act. Once awarded by EPA, DEC uses 319 dollars consistent with an EPA-approved work plan in a variety of ways for eligible activities. In 2013, EPA issued 319 program guidance which describes eight key components to be included in an effective state NPS management program (see Appendix A). Table 1.1 below summarizes how these key elements have been incorporated into Vermont’s plan.

**Table 1.1. Key Elements of an Effective State NPS Management Program.**

<b>Program Element Number</b>	<b>Key Program Element as per EPA guidance</b>	<b>Vermont NPS Management Program Plan Chapter</b>
1	The state program contains explicit short- and long-term goals, objectives and strategies to restore and protect surface water and ground water, as appropriate.	2 & 9
2	The state strengthens its working partnerships and linkages to appropriate state, interstate, tribal, regional, and local entities (including conservation districts), private sector groups, citizens groups, and federal agencies.	7 & 9
3	The state uses a combination of statewide programs and on-the-ground projects to achieve water quality benefits; efforts are well-integrated with other relevant state and federal programs.	6 & 7
4	The state program describes how resources will be allocated between abating water quality impairments from NPS pollution and protecting high quality waters from significant threats caused by present and future NPS impacts.	8
5	The state program identifies priority waters impaired by NPS pollution for restoration as well as priority unimpaired waters for protection. The state establishes a process to assign priority and to progressively address identified watersheds by conducting more detailed watershed assessments, developing watershed-based plans and implementing the plans.	4 & 5
6	The state implements all program components required by Section 319b of the Clean Water Act and establishes strategic and adaptive management approaches to achieve and maintain WQS as expeditiously as practicable. The state reviews and upgrades program components as appropriate. State program includes a mix of regulatory, non-regulatory, financial and technical assistance, as needed.	9 & 10
7	The state manages and implements its NPS management program efficiently and effectively, including necessary financial management.	1 - 10
8	The state reviews and evaluates its NPS management program using environmental and functional measures of success and revises its NPS management program at least every five years.	10

The Plan draws from several other existing State water quality management documents, each of which play a role in defining the status, objectives and direction to be taken by the State when managing NPS and protecting or improving water quality in the near term future. Other existing State water quality management documents that play a role in NPS management include but are not limited to: the [Vermont Water Quality Standards \(10/2014\)](#), the [2012 and 2014 Vermont Clean Water Act, Section 305b Reports](#), [the 2014 NPS Priority Waters List](#), the [Vermont Surface Water Management Strategy \(2011\)](#), [the Vermont Lake Champlain Phosphorus TMDL Phase One Implementation Plan \(2014\)](#), and various ANR-approved river basin water quality management plans.

The Vermont NPS Management Program Plan sets state agency priorities and strategically targets the use of certain federal Clean Water Act funds (Section 319) and certain state funds to address Vermont's most pressing NPS problems and threats. The Plan describes how multiple government agencies will operate, coordinate with each other and with watershed groups and contribute human and/or financial resources to meet various NPS management goals or objectives whether concerning the protection of unimpaired or threatened waters or the restoration of impaired or otherwise degraded waters. The Plan also makes clear what were formerly considered as nonpoint sources but now are managed as point sources. The Plan will help direct how state and certain federal funds can be used to control or reduce NPS pollution. The Clean Water Act requires Vermont (and all other states) produce this strategic management plan in order to continue to qualify for annual Section 319 grant awards.

In the pages that follow, the Plan:

- summarizes the causes and sources of NPS pollution;
- sets priorities for Vermont state agencies to prevent and reduce on a statewide basis Vermont's most pressing NPS pollution sources;
- identifies strategies, funding resources and partnerships that will be used to restore surface and ground water impaired by NPS pollution and to protect waters that are threatened by NPS pollution; and
- describes five year objectives, actions and milestones towards making incremental progress when achieving longer term goals of Vermont's NPS Management Program.

## Chapter 2. Vermont NPS Management Program Mission, Goals & Guiding Principles

The Vermont Nonpoint Source (NPS) Management Program, in existence since the inception of the Clean Water Act some 40 years ago, is guided by the following mission, long term goals and principles. Chapter 9 of the Plan includes objectives, actions and milestones that will be used to achieve program goals over the next five years to address Vermont's priority NPS problems.

### Vermont NPS Management Program Mission:

Vermont's lead state NPS agencies (Agency of Natural Resources' Department of Environmental Conservation, Department of Forests, Parks and Recreation, Department of Fish and Wildlife, Agency of Agriculture, Food and Markets, Agency of Transportation) administer various programs and promote the adoption, use and maintenance of effective practices in conjunction with a variety of partners to help prevent, control or abate water pollution caused by the myriad of nonpoint pollution sources in such a manner that ground and surface waters of Vermont meet or exceed applicable standards and that beneficial uses of water resources are maintained or restored.

The NPS Management Program Mission noted above is consistent with the Vermont Watershed Management Division's mission to protect, maintain, enhance and restore Vermont's surface waters.

### The long term goals of the Vermont NPS Management Program concern:

**Restoration of Waters** - To restore waters that are impaired by nonpoint sources so that they meet water quality standards.

**Protection of Waters** - To prevent, avoid or minimize NPS-related impairments of unimpaired waters.

**Targeting of Resources** – To effectively target human and financial resources in order to protect, maintain, enhance and restore waters in the most efficient and timely manner possible.

The guiding principles for use by Vermont's lead state NPS agencies that are central to meeting the mission above and to achieving the long term goals of Vermont's overall NPS management program include:

1. Promote the use, inspection and maintenance of best management practices (BMPs) defined, required or recommended by various state NPS agencies throughout the entire state to effectively control or prevent NPS pollution;
2. Promote voluntary, locally-led, incentive-based strategies to address the variety of NPS issues;
3. Ensure ongoing compliance with applicable regulatory requirements;

4. Establish, expand and strengthen partnerships among stakeholders at local, state, academic and federal levels when managing NPS pollution sources;
5. Encourage proper management of wetlands, river corridors, riparian areas, lake shorelands, floodplains, natural areas, and other so-called green infrastructure resources within watersheds of all sizes to help protect, maintain, enhance and restore the quality of Vermont's waters;
6. Avoid resolving a NPS surface runoff problem that creates a groundwater quality problem (e.g. infiltration of surface runoff pollutants within a groundwater recharge or source water zone);
7. Use watershed and river basin-based planning and management approaches as a coordinating framework to organize efforts to identify, prioritize, and implement activities. These activities include practices that restore waters impaired or degraded by NPS pollution or protect waters threatened by NPS pollution; and,
8. Encourage integration of monitoring into implementation activities to improve the ability to track and evaluate NPS management program effectiveness.

## Chapter 3. Framework of Vermont's NPS Pollution Management Program

A wide variety of state and federal programs, rules, procedures, permits and practices exist to minimize the generation of NPS pollution and the contribution of NPS pollutants to Vermont's waters. The history of Vermont's NPS program means there have also been lessons learned and research findings applied when revising programs, rules, permits and practices. Due to the variability, persistence and severity of NPS pollution, there are significant challenges that remain regarding NPS pollution and the protection and improvement of Vermont's water resources.

As Vermont's designated lead water quality agency, DEC is responsible for developing and implementing water quality protection and improvement programs required under various state and federal laws. DEC manages regulatory, non-regulatory and voluntary programs and collaborates with a wide variety of local, other state and federal agencies to plan and carry out programs, strategies and practices to protect the State's water quality and water resources. The following sections summarize key State and Federal laws that provide the essential underpinnings of Vermont's NPS management program and the statewide and watershed based approaches that guide Vermont's overall approach to controlling NPS pollution.

### A. Key Federal & State Laws

#### *Clean Water Act Section 319*

Congress enacted Section 319 in 1987 with amendments to the Clean Water Act which established a national program to control NPS pollution. NPS pollution sources are typically diffuse and do not result from a discharge at a specific single location such as a pipe. NPS pollution has been defined by the US Environmental Protection Agency (EPA) as:

“...caused by diffuse sources that are not regulated as point sources and normally is associated with agricultural, silvicultural and urban runoff, runoff from construction activities, etc. Such pollution results in the human-made or human-induced alteration of the chemical, physical, biological and radiological integrity of water. In practical terms, NPS pollution does not result from a discharge at a specific, single location but generally results from land runoff, precipitation, atmospheric deposition or percolation....” (EPA, Section 319 Program Guidance, 1987).

Funding appropriated under §319 can be used to implement state NPS programs including, as appropriate, non-regulatory or regulatory programs for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects to achieve implementation of best management practices and to meet water quality goals. EPA provides grants to states, tribes, and territories (since 1990) to implement programs that control and prevent nonpoint source pollution to waters. To be eligible for §319 funding, states must implement updated NPS Management Programs and follow other program guidelines.

In order for the goals of the Clean Water Act to be met, control programs are to be established and, when necessary, modified through the interactions of various assessment, planning, management and implementation documents and ensuing activities. For Vermont, notable documents that affect control programs include, but are not limited to, the State of the State's biennial Water Quality Section 305b Report, the State's biennial listing of impaired and other waters, river basin tactical water quality management plans, the NPS Management Program, the Vermont Water Quality Standards, Total Maximum Daily Load (TMDL) determinations and associated TMDL implementation plans.

A few but notable state laws that have important bearing on NPS management within Vermont are briefly described below. Importantly, a significant piece of state legislation concerning achievement of clean water has been recently enacted and became law that will strengthen and expand many of Vermont's NPS management control efforts. The new law is known as Act 64 (also referred to as the 'Vermont Clean Water Act'). A section by section summary of Act 64 is provided as Appendix G.

### *Vermont Water Pollution Control Statute (Title 10, Chapter 47)*

<http://legislature.vermont.gov/statutes/chapter/10/047>

This state law establishes it is the policy of the State of Vermont to:

- 1) protect and enhance the quality, character and usefulness of its surface waters and to assure the public health;
- 2) maintain the purity of drinking water;
- 3) control the discharge of wastes to the waters of the state, prevent degradation of high quality waters and prevent, abate or control all activities harmful to water quality;
- 4) assure the maintenance of water quality necessary to sustain existing aquatic communities;
- 5) provide clear, consistent and enforceable standards for the permitting and management of discharges;
- 6) protect from risk and preserve in their natural state certain high quality waters, including fragile high-altitude waters, and the ecosystems they sustain;
- 7) manage the waters of the state to promote a healthy and prosperous agricultural community, to increase the opportunities for use of the state's forest, park and recreational facilities, and to allow beneficial and environmentally sound development;
- 8) upgrade the quality of waters and to reduce existing risks to water quality.

This law includes a number of provisions. Notable provisions connected to NPS pollution and NPS management include classification of waters, the need for discharge permits, management

of stormwater and wetlands, discharges of phosphorus and the application of phosphorus fertilizer, detergents and household cleaning products and Lake Champlain water quality.

### ***Vermont Flood Hazard Area Statute (Title 10, Chapter 32)***

<http://legislature.vermont.gov/statutes/chapter/10/032>

The purpose of this chapter is to minimize and prevent the loss of life and property, the disruption of commerce, the impairment of the tax base, and the extraordinary public expenditures and demands on public service that result from flooding. The chapter seeks to ensure that the development of the flood hazard areas within Vermont is accomplished in a manner consistent with the health, safety and welfare of the public; federal, State, and local management activities for flood hazard areas are done in a coordinated fashion; to encourage local government to manage flood hazard areas and other flood-prone lands; to provide State assistance to local government in management of flood-prone lands. Further, this chapter's purpose is also to comply with FEMA's National Flood Insurance Program (NFIP) requirements for the regulation of development; to authorize adoption of state rules for management of uses exempt from municipal regulation in a flood hazard area; to maintain the agricultural use of flood-prone lands consistent with the NFIP; to carry out a comprehensive statewide flood hazard area management program in order to ensure eligibility for flood insurance under the requirements of the NFIP.

### ***Vermont Lake Shoreland Protection Statute (Title 10, Chapter 49A)***

<http://legislature.vermont.gov/statutes/chapter/10/049A>

The Vermont Legislature passed the Shoreland Protection Act which regulates certain activities within 250 feet of the mean water level of lakes having a surface area greater than 10 acres. The intent of the Shoreland Protection Act (effective 7/1/2014) is to allow reasonable development along the shoreland areas of lakes and ponds while protecting near-shore lake aquatic habitat and lake water quality and maintaining the natural stability of shorelines.

### ***Vermont Agricultural Pollution Control Statute (Title 6, Chapter 215)***

<http://legislature.vermont.gov/statutes/chapter/06/215>

The purpose of this state law is to ensure that agricultural animal wastes do not enter waters of the State. To meet that purpose, it is State policy that all farms must meet certain standards in the handling and disposal of animal wastes and the cost of meeting these standards shall not be borne solely by farmers, but rather by all members of society who stand to benefit. Accordingly, State and federal funds shall be made available to farms, regardless of size, to help defray the major cost of complying with the law's requirements. State and federal conservation programs to assist farmers should be directed to those farms that need to improve their infrastructure to prohibit direct discharges or bring existing water pollution control structures into compliance with standards issued by the US Department of Agriculture Natural Resources Conservation Service. Additional resources should be directed to education and technical assistance for farmers to improve the management of agricultural wastes and protect water quality.

Subchapters include provisions for runoff control practices, regulating large, medium and small farms and programs related to agricultural buffers and agronomic practices.

***Vermont Groundwater Protection Statute (Title 10, Chapter 48)***

<http://legislature.vermont.gov/statutes/chapter/10/048>

Groundwater of Vermont is recognized as a precious, finite, and invaluable resource upon which there is an ever-increasing demand for present, new, and competing uses and that an adequate supply of groundwater for domestic, farming, dairy processing, and industrial uses is essential to the health, safety, and welfare of the people of Vermont. The law establishes that the withdrawal of groundwater should be regulated in a manner that benefits all Vermonters and is done to be compatible with long-range water resource planning, proper management, and use of the water resources of Vermont.

The law establishes it is the policy that the State shall protect its groundwater resources to maintain high-quality drinking water; groundwater resources are to be managed to minimize the risks of groundwater quality deterioration by regulating human activities that present risks to the use of groundwater in the vicinities of such activities while balancing the state's groundwater policy with the need to maintain and promote a healthy and prosperous agricultural community; and, that the groundwater resources of the state are held in trust for the public.

***Vermont Municipal & Regional Planning & Development Statute (Title 24, Chapter 117)***

<http://legislature.vermont.gov/statutes/chapter/24/117>

Also known as the Vermont Planning and Development Act, the intent and purpose of this law includes, but is not limited to, encourage the appropriate development of all lands in Vermont by the action of its municipalities and regions, with the aid and assistance of the State, in a manner which will promote the public health, safety against fire, floods, explosions, and other dangers; to facilitate the growth of villages, towns, and cities and of their communities and neighborhoods so as to create an optimum environment; and to provide means and methods for the municipalities and regions of this State to plan for the prevention, minimization, and future elimination of such land development problems as may presently exist or which may be foreseen and to implement those plans when and where appropriate.

***Vermont Land Use and Development Control Statute (Title 10, Chapter 151)***

<http://legislature.vermont.gov/statutes/chapter/10/151>

The goal and purpose of chapter are designed to mitigate the effects of development through an application process that addresses environmental and community impacts of certain projects exceeding a particular threshold in size. The law has created nine District Environmental Commissions that are to review large-scale development projects using ten criteria intended to safeguard the environment, community life, and aesthetic character of Vermont.

## **B. Statewide and Watershed-specific Approaches**

### ***Statewide Approach***

Vermont's statewide approach targets five major categories of NPS pollution: stormwater from developed areas; stormwater from transportation; agricultural runoff; forestry runoff; and hydrologic modification (river channel/corridor impacts). Other noteworthy NPS pollution categories of concern include: on-site wastewater disposal; lake shorelands development; waste management and non-native nuisance aquatic species. The State's lead NPS agencies and other cooperating agencies and partners collectively implement an array of regulatory and non-regulatory programs to control pollution from these NPS categories.

Regulatory programs that include permitting, compliance assistance and enforcement are administered under several core environmental laws such as those noted above as well as rules or other requirements related but not limited to stormwater management, construction erosion control, management of lakeshore lands, pesticide application, water supply and on-site wastewater disposal and forestry operations that involve harvesting 40 or more acres. These various laws and rules limit or control specific activities and require use of BMPs or other specified control measures to manage NPS pollution and pollutant delivery.

The nature and geographic scope of NPS pollution means that Vermont will need to increase the regulatory oversight of NPS management through laws, rules or other program requirements in conjunction with increasing investments in technical assistance, grants and loans. These sorts of increases will accompany an equally vital component of Vermont's NPS Management Program which involve efforts to encourage more widespread voluntary use of proven effective BMPs. Non-regulatory programs typically involve providing technical assistance; education and outreach to municipalities, landowners, businesses, schools and non-governmental organizations; social marketing to change behaviors and BMP trainings and demonstrations. Monitoring is invaluable when describing water quality effectiveness of certain practices or approaches. Recognition programs play an essential role in Vermont's NPS Management Program when highlighting efforts directed at preventing or reducing NPS pollution.

### ***River Basins and Watersheds Approach***

To complement its statewide approach for NPS management, Vermont also uses its tactical river basin and watershed approach to restore and protect waters from NPS pollution. Through its long standing and legislatively mandated river basin planning process, DEC is able to assess surface waters and characterize NPS problems and threats, then develop and prioritize strategies for restoration and protection followed by basing project related funding decisions to linkage(s) to an identified or prioritized strategy. Restoration needs for specific waters are identified and driven by biennial listing efforts that become integrated into tactical river basin plans. DEC's rotational assessment/monitoring efforts also assist during the evaluation of success or effectiveness. DEC's requirement for source protection plans are aimed at protecting public and community drinking water sources from contamination.

Success of the river basin and watershed approach aspect of the Vermont NPS Management Program depends on a broad base of partnerships with other state agencies and interstate, regional and local entities, private sector as well as citizens and non-profit groups, academic institutions and federal agencies. These partners and their affiliated programs have interests, goals and needs that align or overlap with the goals of Vermont NPS Program. It is without question that effective yet flexible partnerships strengthen the NPS Program by attracting new ideas and input, increasing understanding of NPS problems and building commitment to implementing solutions. Vermont's lead NPS agencies use a variety of formal and informal means to develop, maintain and enhance these partnerships. Chapter 7 of the Plan provides further descriptions concerning many of these partnerships.

### *Restoring Impaired Waters and Protecting Waters Threatened by NPS Pollution*

This plan outlines methods and approaches to restore the relatively small number of waters impaired by NPS pollution and protect the many other waters currently threatened by NPS pollution. Vermont's 2014 State of the State's Water Quality Report indicates aquatic life is supported on approximately 92% of assessed river/stream miles and on 59% of assessed inland lake/pond acres. Swimming uses are supported on 97% of assessed river/stream miles and on 76% of assessed inland lake/pond acres. For Lake Champlain, although levels of phosphorus impairs swimming uses in the majority of the lake's acres, aquatic life use is in fact supported on 88% of the waterbody. That said, many of Vermont's good condition waters that are presently attaining standards are considered threatened due to NPS pollution.

Given the relatively high proportion of un-impaired waters and relatively low number of impaired waters found in Vermont, DEC needs to balance the use of available NPS resources intended to restore impaired waters and protect threatened waters. Since DEC believes pollution prevention or protection of threatened waters is often times more feasible and less expensive than restoration of an already impaired or degraded water, DEC along with other state NPS agencies (and many partners) devotes some program resources for projects and activities that protect waters considered threatened or at risk. The NPS Priority Waters list (see Chapter 5) identifies particular priority waters impaired and waters threatened<sup>2</sup> by NPS pollution.

---

<sup>2</sup> The term 'threatened' in this context refers to unimpaired waters that are subject to potential and likely to occur impacts from NPS pollution. Importantly, the term in this context is not connected nor to be confused with 'threatened' under Clean Water Act Section 303d listing purposes where waters are anticipated to become non-attainment waters within a two year period (i.e., by the next 303d listing cycle/submittal).

## Chapter 4. Nature of NPS Problem Affecting Vermont's Surface & Ground Waters

### A. Overview of Vermont's Water Resources

Within its borders, Vermont has approximately 7,100 miles of rivers and streams, 300,000 acres of fresh water wetlands and 812 lake and pond waterbodies (those at least 5 acres in size or those named on US Geological Survey maps) that total about 230,900 acres. Surface waters (not including wetlands) are classified as Class A or Class B. Class A waters are managed for enjoyment of water in its natural condition, as public drinking water supplies (with disinfection when necessary) or as high quality waters which have significant ecological values. Class B waters are managed for aquatic biota and wildlife sustained by high quality habitat; good to excellent aesthetic value; suitable swimming, fishing and boating among other uses. There are 172 wastewater treatment facilities found within Vermont and each facility is operated in accordance with a National Pollutant Discharge Elimination System (NPDES) permit issued by the State of Vermont.<sup>3</sup>

Vermont's border waters include the Connecticut River on the east (border with New Hampshire), Lake Memphremagog and Lake Champlain on the north (partial border with the Province of Quebec) and the Poultney River and Lake Champlain on the west (partial border with New York). The 15 major river basins of Vermont drain to one of four large regional drainages: Lake Champlain, Connecticut River, Lake Memphremagog, or the Hudson River. Additional surface water resource information is contained in Table 4.1 found on page 20. The map appearing on the following page shows the various river basins and the larger regional drainages.

---

<sup>3</sup> Under authority of the Clean Water Act and starting in 1974, Vermont was given delegation authority by EPA to issue and administer NPDES permits.

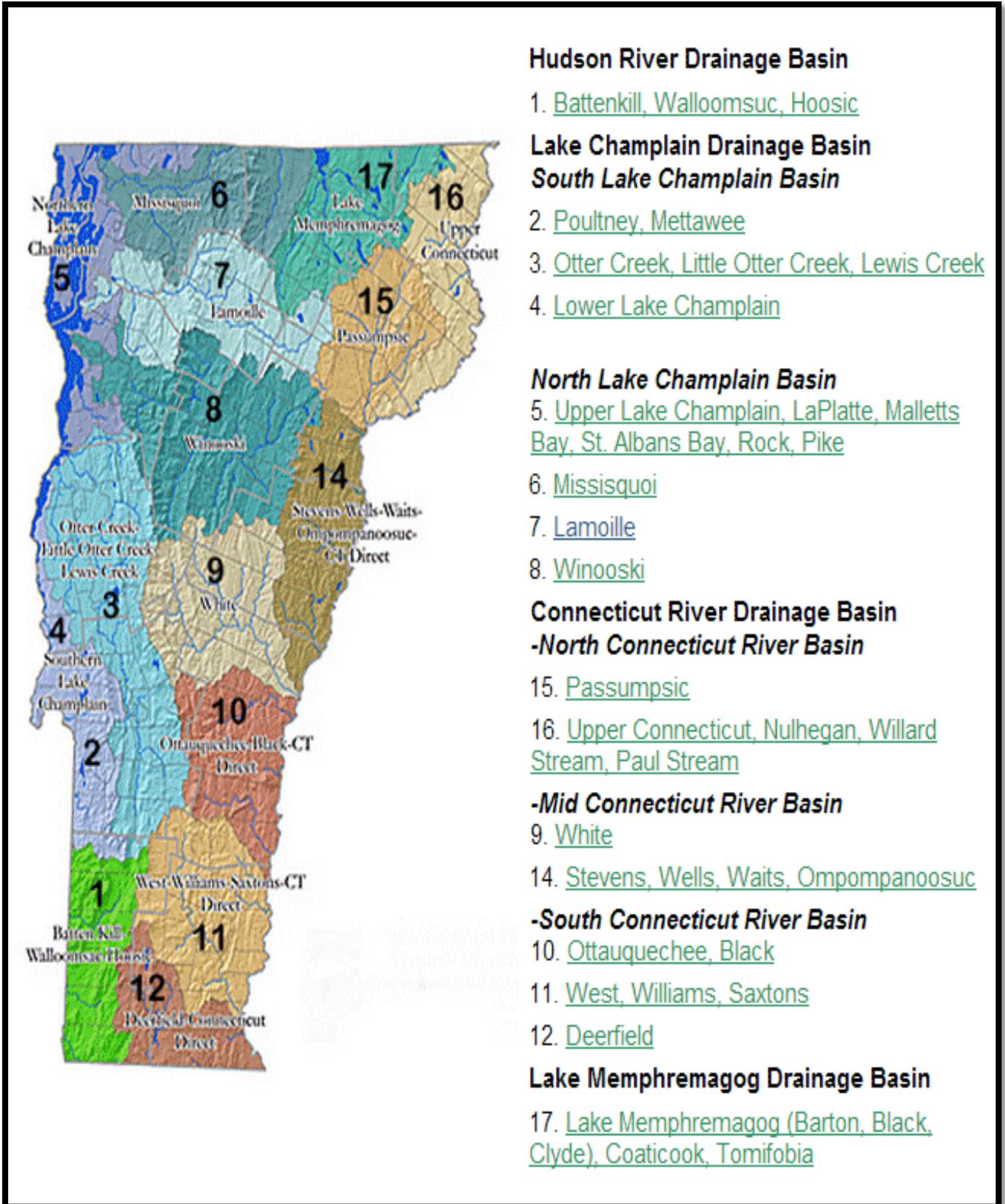


Figure 4.1. Vermont's Major River Basins and Regional Drainages.

**Table 4.1. Surface Waters Atlas.**

State population (July 1, 2013 estimate)	626,630
State population change (2000-2010)	2.8% increase
State surface area	9,609 square miles
State population density	65 persons/square miles
Miles of perennial rivers & streams	7,099 (includes CT River)
Border miles of shared rivers/streams (subset)	262 (CT R. 238, Poultney 24)
Longest river in the state (not including Conn R.)	100 miles (Otter Creek)
Largest river watershed in the state (not including Conn R.)	1,080 square miles (Winooski River watershed)
Number of lakes, reservoirs & ponds over 20 acres	280
Number of lakes, reservoirs & ponds from 10 to 20 acres	190
Number of lakes, reservoirs & ponds (at least 5 acres but less than 10 acres)	148
Number of significant lakes, reservoirs & ponds less than 5 acres (or size unmeasured)	206
Deepest in-land lake (Willoughby)	308 feet
Greatest depth of Lake Champlain (off Thompsons Point)	394 feet
Acres of lakes, reservoirs & ponds <sup>1</sup>	230,927
Acres of freshwater wetlands <sup>2</sup>	300,000

Table Notes:

1 Number includes the Vermont portion of Lake Champlain, some private waters and some waters less than 5 acres in size. This figure also accounts for two CT River impoundments, Moore and Comerford Reservoirs, which are 1,255 and 777 acres in size respectively. The figure also accounts for newly inventoried ponds that were not previously tracked in Vermont's Lake Inventory Database and for some minor lake size changes that were identified via GIS analyses.

2 Number does not include wetlands found on agricultural lands that are actively used for agricultural purposes.

There are approximately 1,192 miles of Class A rivers and streams and 3,383 acres of Class A lakes and ponds in Vermont. Approximately 908 stream miles are Class A(2) public water supplies and 284 miles are Class A(1) ecological waters. For lakes and ponds, there are about 2,990 acres of Class A(2) public water supplies and 393 acres Class A(1) ecological waters.

Approximately 315 miles of the Class B rivers and about 15 acres of Class B lakes have a Waste Management Zone. The Waste Management Zone (WMZ), similar in effect to an overlay zone in land use regulation, is created on a site-specific basis to accommodate the direct discharge of treated sewage effluent to surface waters. The length of the zone must meet Class B standards but with recognition there is an increased risk for contact recreation.

Wetlands within Vermont are classified as Class One, Class Two or Class Three. Class One wetlands are those wetlands that are exceptional or irreplaceable in their contribution to Vermont's natural heritage and that merit the highest level of protection. Class Two wetlands are those wetlands, other than Class I wetlands that, are so significant, either taken alone or in conjunction with other wetlands, that they merit protection. Class Three wetlands are those wetlands that have not been determined to be so significant that they merit protection either because they have not been evaluated or because when last evaluated were determined not to

be sufficiently significant to merit protection. The majority of wetlands within Vermont are Class Two.

Groundwater is currently used for drinking water by approximately 70% of Vermont's population. About 46% of the population is self-supplied while about 24% is served by public water systems. About 87% of the public community water systems in the State have their corresponding Source Protection Areas or aquifer recharge areas mapped on a hydro-geologic basis. The remaining 13% of public community water systems are using 3,000 foot radius circles as their Source Protection Areas. Results of a study on groundwater interference caused by the pumping of Public Community Water Supply (PCWS) sources indicate that, overall, groundwater interference is not a chronic problem in Vermont. There has been no comprehensive statewide assessment of groundwater quality in spite of several isolated instances of degraded groundwater quality.

## **B. Surface Water Assessment**

Overall, the major causes of use impairment to Vermont surface waters from NPS pollution are siltation and turbidity, nutrients (especially phosphorus), flow alteration and noxious non-native aquatic plants. Other less than major causes affecting Vermont's surface waters include pathogens, elevated temperatures and toxic substances. The major causes of groundwater contamination are from pollutants originating from unlined landfills, petroleum product storage and human waste disposal systems.

### ***Causes & Sources of Impairment, Alteration and Stress for Rivers & Streams***

A cause is a pollutant or condition that results in a water quality or aquatic habitat impairment, alteration or stress. A source is the origin of the cause and can be a facility, a land use, or an activity. Tables 4.2 and 4.3 below, taken from Vermont's 2014 305b Report, summarize miles of rivers and streams affected by various causes and sources, respectively.

Because a stretch of river or stream may be affected by more than one cause or source, the same mileage may be tallied in several places in the tables. For this reason, the second and third columns of Table 4.2 and Table 4.3 appearing below are not necessarily additive since the total figure appearing in the fourth column overestimates the total number of miles affected by all causes and sources in Vermont. The purpose of these summary tables with the two columns showing total lengths is to give readers an idea of the relative size of the impact from different pollutants or conditions on Vermont's waters and from which land uses or activities they may originate.

Sedimentation has been listed as the cause of stress and impairment of aquatic life use support affecting the most river and stream miles since Vermont began reporting the impacts of NPS pollution. Sedimentation occurs in a stream reach when the capacity to transport a sediment load is exceeded by the actual load. This process may occur when either the load is increased or the transport capacity is decreased. In either case, the sediment deposited stresses or impairs habitat. Unnatural levels of sediment alter or destroy macro-invertebrate habitat and fish

spawning areas and fill in swimming holes among other impacts. The streams with the most documented miles of sediment impact are found in the watersheds drained by the Winooski River, Lamoille River and Otter Creek, all of which empty into Lake Champlain.

**Table 4.2. Summary of Causes Impacting Vermont Rivers & Streams (in miles).**

Cause of impairment, alteration or stress	Length impaired or altered by cause	Length stressed due to the cause	Total length on which causes have an impact
Sediments	136.6	809.5	946.1
Physical habitat alterations <sup>1</sup>	135.9	493.7	629.6
Nutrients	62.7	490.5	553.2
Temperature	62.0	467.5	529.5
Pathogens	135.5	248.6	384.1
Turbidity	45.8	230.0	275.8
Flow alterations	202.1	72.5	274.6
Metals	68.4	84.3	152.7
pH	45.8	30.3	76.1
Organic enrichment	26.5	48.0	74.5
Total toxics <sup>2</sup>	0	73.5	73.5

Table Notes:

1 These numbers do not necessarily include all the miles of river and stream channelized and dredged post-Tropical Storm Irene (2011). Vermont DF&W estimated 77 miles of major impact along with an indication they were unable to survey all the streams at the time of their summary and report.

2 Toxics has combined organic compounds and metals. This information is dated and needs re-visiting.

Sources of pollution identified as having the greatest impacts, or causing the greatest stresses on miles of river and stream are streambank erosion/de-stabilization; removal of riparian vegetation; agricultural land uses and activities; developed land runoff, which includes road runoff; flow alteration from hydroelectric facilities, snowmaking water withdrawals and other sources; channel instability and developed land runoff. Additional significant sources of impacts include atmospheric deposition, flood impacts resulting from poorly sited or designed human structures or activities, land development (active development as opposed to runoff from existing roads and development), and upstream impoundments. The table appearing on the next page provides a summary of sources affecting Vermont rivers and streams.

**Table 4.3. Summary of Sources Impacting Vermont Rivers & Streams (in miles).**

Source of impairment, alteration or stress	Length impaired or altered due to source	Length stressed due to source	Total length on which sources have an impact
Streambank erosion/de-stabilization	111.6	669.0	780.6
Riparian vegetation removal	90.3	554.0	644.3
Agriculture	123.3	486.8	610.1
Developed land runoff <sup>1</sup>	87.2	324.7	411.9
Channel instability	53.3	223.2	276.5
Flow modification (hydro, snowmaking withdrawals)	204.6	66.1	270.7
Atmospheric deposition	87.5	71.7	159.2
Channelization	27.0	122.8	149.8
Flooding (including infrastructure failures)	31.5	112.3	143.8
Impoundment	34.6	71.9	106.5
Land development	33.8	60.8	94.6
Hazardous waste sites	8.9	58.7	67.6
Resource extraction	20.8	37.5	58.3
Municipal point sources	29.3	23.5	52.8

Table Note:

1. Developed land runoff includes road/bridge runoff.

### *Causes & Sources Affecting Impairment, Alteration and Stress for Lakes & Ponds*

Taken from Vermont’s 2014 305b Report, causes of impact to Lake Champlain and Vermont's inland lakes are shown in Table 4.4, and the related sources of impact to these waters are provided in Table 4.5. For Lake Champlain, the most widespread causes of impairment are mercury and PCB contamination in fish tissue, with atmospheric deposition of toxics and improper waste disposal being the respective sources. The third most widespread cause of impairment for Lake Champlain is phosphorus pollution. The sources of phosphorus vary by lake segment but predominantly arise from various categories of NPS pollution (along with some contribution from treated effluent associated with municipal wastewater treatment plants). Toluene and xylenes are the cause of impairment from contaminated sediments at the six acre Pine Street Barge Canal site adjacent to Burlington Bay. Eurasian watermilfoil, water chestnut and zebra mussel infestations are the causes of alterations to Lake Champlain which result from transport of plant fragments and larval zebra mussels (veligers) through recreational boating and fishing activities.

For Vermont’s inland lakes, mercury in fish tissue impairs the largest number of lake acres, resulting largely from atmospheric deposition. In the case of two reservoirs in the Connecticut River, mercury levels are also attributed to water-level fluctuations. In the case of reservoirs within the Deerfield River drainage, mercury levels are also attributed to natural watershed susceptibility. The cause of the second largest number of impaired acres for inland lakes is phosphorus pollution. For all nutrient-impaired lakes, the sources of phosphorus are largely of NPS origin, including agriculture, road maintenance, and sediment losses related to

development. Acidity due to atmospheric deposition of acid-forming precursors and natural susceptibility also impairs a significant number of inland lake acres. The principal causes of alterations to inland lakes arise from water-level management and Eurasian watermilfoil infestations that originate from the transport of plant fragments through recreational boating and fishing activities.

**Table 4.4. Summary of Causes Impacting Vermont Lakes & Ponds (in acres).**

Waterbody Type ↓	Assessment of waterbody ↓	Use →	Aesthetic	Aquatic Biota, Wildlife, and Aquatic Habitat	Boating, Fishing, and Other Recreational Uses	Fish Consumption	Public Water Supply	Swimming and Other Primary Contact Recreation	
		Cause of Impact ↓							
Inland Lakes	Impaired	Mercury in Fish Tissue				8,165			
		Organic Enrichment - DO		700					
		pH		4,468					
		Phosphorus	7,874	7,874	7,874			7,874	
		Sedimentation/Siltation	100	100	100			100	
	Altered	Eurasian Water Milfoil	2,284	2,284	2,284			2,284	
		Exotic Species	118	118	118			118	
		Flow Alteration	1,490	6,195	2,803			612	
	Fully Supporting but Stressed	Escherichia coli							25
		Eurasian Water Milfoil	6,582	6,076	6,435			6,455	
		Excess Algal Growth	27	27	27				
		Exotic Species	1,605	3,017	701			701	
		Flow Alteration	193	4,385	193			3	
		Mercury in Fish Tissue				45,859			
		Noxious Aquatic Plants - Algae	9,285	9,277	9,647			9,665	
		Noxious Aquatic Plants - Native	886	889	1,346			1,346	
		Nutrient/Eutrophication Biological Indicators		7					
		Nutrients	3,716	3,874	3,515			3,612	
		Oil and Grease	79						
		Organic Enrichment - DO		1,419					
		pH		5,965					
Phosphorus	3,716	3,874	3,515			3,612			
Salinity		9							
Sedimentation/Siltation	3,353	3,612	3,166			3,203			
Zebra Mussel		829				829			
Lake Champlain	Impaired	Mercury in Fish Tissue				174,175			
		PCB in Fish Tissue				166,171			
		Phosphorus	132,053					132,053	
		Toluene		6	6			6	
		Xylenes (total) (mixed)		6	6			6	
	Altered	Eurasian Water Milfoil	6,832	17,195	17,195			6,832	
		Exotic Species		1,101	1,101				
		Zebra mussel		21,503			15,673	6,832	
	Fully Supporting but Stressed	Escherichia coli						49	
		Eurasian Water Milfoil	10,363					10,363	
		Exotic Species	2,701	1,600	1,600			2,701	
		Noxious Aquatic Plants - Native			500			500	
		Sedimentation/Siltation	5,388	5,388				5,388	
Zebra mussel	5,281					6,162			

**Table 4.5. Summary of Sources Impacting Vermont Lakes & Ponds (in acres).**

Waterbody Type ↓	Assessment of waterbody ↓	Use →					
		Source of Impact ↓	Aesthetic	Aquatic Biota, Wildlife, and Aquatic Habitat	Boating, Fishing, and Other Recreational Uses	Fish Consumption	Public Water Supply
Inland Lakes	Impaired	Agriculture	1,456	2,156	1,456		1,456
		Animal Feeding Operations (NPS)	1,456	2,156	1,456		1,456
		Atmospheric Deposition - Acidity		4,468			
		Atmospheric Deposition - Toxics				8,165	
		Flow Alterations from Water Diversions				2,012	
		Internal Nutrient Recycling	54	506	54		54
		Managed Pasture Grazing	1,854	2,554	1,854		1,854
		Natural Sources		4,468		3,692	
		Non-irrigated Crop Production	1,908	2,608	1,908		1,908
		Non-Point Source	7,422	7,422	7,422		7,422
		Post-development Erosion and Sedimentation	452	452	452		452
	Streambank Modifications/destabilization	100	100	100		100	
	Altered	Flow Alterations from Water Diversions	1,280	5,985	2,803		612
		Impacts from Hydrostructure Flow Regulation/modification	300	2,198	235		215
Other Marina/Boating On-vessel Discharges		2,240	2,240	2,402		2,240	
Lake Champlain	Impaired	Agriculture	31,859				30,259
		Atmospheric Deposition - Toxics				174,175	
		Combined Sewer Overflows	13,725				13,725
		Contaminated Sediments		12	12		12
		Highway/Road/Bridge Runoff (Non-construction Related)	13,725				13,725
		Inappropriate Waste Disposal				166,171	
		Industrial Point Source Discharge	4,423				4,423
		Natural Sources	5,388			58,184	5,388
		Non-Point Source	132,053				130,453
	Post-development Erosion and Sedimentation	13,725				13,725	
Altered	Other Marina/Boating On-vessel Discharges	6,832	39,799	18,296		15,673	
All Waters	Stressed	Sources are not attributed to stressed waters					

### C. Protecting and Improving Surface Waters by Managing Stressors

In developing the 2011 Statewide Surface Water Management Strategy (SWMS), DEC undertook an intensive evaluation process aimed at identifying areas of program duplication and program “gaps,” as a way to ensure program efficiency in meeting SWMS goals and objectives. A key element of this approach is the recognition that individual pollutants (often more than one) can be simultaneously mitigated by managing surface water stressors. These stressors are of critical interest to DEC and many other State, Federal and local agencies and organizations in Vermont having an interest in surface water quality management.

DEC has identified ten major stressors with unique causes and sources, and sometimes overlapping effects, which result in documented surface water impacts. By identifying stressors and approaches to their management, the SWMS sets the stage for DEC’s approach to multi-agency planning and implementation affecting Vermont’s water resources.

The ten major stressors affecting Vermont’s surface waters are introduced below according to stressor ranking: high, moderate or low. The importance of each stressor has been previously evaluated by DEC in light of its extensiveness, intensity, duration and urgency and also in regards to programs available to address the stressor.<sup>4</sup> There are NPS management and control

<sup>4</sup> Extensiveness concerns how widespread and frequent the problem is. Intensity concerns the consequence of the problem related to water resource goals (ranging from: none/positive to substantial and quantifiable). Duration

implications for each stressor described below. Appendix B contains additional information concerning each stressor. Readers are also referred to Table 4.6 below to gain a better understanding of how management of each stressor meets one or more objectives of the SWMS.

### *Stressors with high ranking (5)*

**Channel erosion** - The effects of channel erosion are pervasive and consequential throughout the state making this a highly ranked stressor. Excessive channel erosion occurs on rivers and streams throughout Vermont, brought about by human activities that alter runoff patterns and channel morphology and that lead to stream disequilibrium. Channels and floodplains that once had the capacity to accommodate stream flows and store sediment and associated nutrients are now scouring and or transporting these materials. Excessive channel erosion adversely affects stream habitat and higher loads of nutrients and sediments have become pollutants in downstream receiving waters such as inland lakes, wetlands and Lake Champlain. Successful management of channel erosion achieves Objectives A, B, and C of the SWMS.

**Encroachment** – A highly ranked stressor, the placement of public or private infrastructure upon lakeshores, wetlands and river corridors results in the loss of riparian zone buffers, increasing sunlight penetration of shallows and reducing aquatic habitat quantity and quality. Encroachments along river corridors can also create or perpetuate stream disequilibrium, both immediately adjacent to the structure, and in areas far upstream or downstream. Encroachments are pervasive along Vermont lakes and streams. In wetlands, fill, alteration of vegetation, and changes to hydrology result in a loss of the functions and values. Lakes with poor lakeshore habitat from overdevelopment can be three times more likely to have poor ecological integrity. Management of encroachments meets Objectives A, B, and C of the SWMS.

**Invasive species** – A highly ranked stressor, invasive aquatic species such as Eurasian watermilfoil, purple loosestrife, water chestnut, and “Didymo” (rock-snot algae) cause severe impacts to aquatic habitat. Japanese knotweed, an invasive terrestrial plant species is also of concern. Collectively, these invasive species readily out-compete native plants, algae and animals, ruin or seriously degrade recreational opportunities, and alter entire ecosystem functions. Invasive species are spreading rapidly throughout Vermont surface waters, especially lakes, and are transported from one waterbody to the next by natural spread (avian transfer), human dispersion (such as aquaria or ballast release, boat/trailer transfer, fish tournaments) or by following drainage or road ditches. Successful control of invasive species meets Objective B of the SWMS.

**Land erosion** – A highly ranked stressor, erosion of sediments off land surfaces delivers sediment and adsorbed nutrients to surface waters. These sediments can readily alter the dynamic equilibrium of naturally functioning stream channels, resulting in stream instability and delivery of sediments and nutrients to downstream waters, resulting in eutrophication. Land erosion occurs in all landscape types such as urban areas, construction sites, unpaved gravel

---

concerns the length of time for the resource to repair itself once the problem(s) is abated. Urgency concerns the likelihood of the problem arising, improving or becoming worse.

roads, and improperly managed forests and farms. Successful control of land erosion meets Objectives A, B, and C of the SWMS.

**Nutrient loading** – A highly ranked stressor, direct discharge or runoff of nutrients also occurs independently of channel or land-based erosion. Nonpoint sources such as septic systems, over-fertilizer usage in residential areas and agricultural settings and animal or milkhouse wastes can deliver nutrients directly to surface or ground waters. Nutrients, like phosphorus and nitrogen, are beneficial in naturally-occurring low levels. Excessive contributions of nutrients, however, results in eutrophication of lakes and streams and increases the likelihood of toxic algae growth. Elevated levels of nitrogen in groundwater is a public health concern. Successful control of excessive nutrient contributions meets Objectives A, B, and D of the SWMS.

#### *Stressors with moderate ranking (4)*

**Acidity** – A moderately ranked stressor, acidification of Vermont’s lakes and streams is a major problem caused primarily by the atmospheric deposition of acidic nitrogen and sulfur compounds (aka acid rain). Acidification can also result from runoff of active or abandoned mines. Acidification is widespread in the higher-elevations of Vermont, resulting in considerable impacts to lake and stream biology. Acidification from abandoned mines in Vermont is limited to a handful of sites. Successful management of acidity meets Objectives A, B, and D of the SWMS.

**Flow alteration** – A moderately ranked stressor, altering the natural flow regime of rivers and streams through impoundment or dewatering or the fluctuation of lake levels affects the extent and quality of aquatic, riparian and wetland habitats, water temperature, dissolved oxygen and other aspects of water chemistry, including concentrations of toxins in aquatic organisms. Since flow alteration is a consequence of water withdrawals and hydroelectric power generation, these NPS activities must be properly managed to avoid impacting aquatic biota and recreational uses. Successful management of flows and water levels meets Objectives A, B, C, and D of the SWMS.

**Toxic substances** – A moderately ranked stressor, several categories of toxic contaminants may be present in Vermont’s surface waters. Mercury contamination of lake fishes is widespread, reflecting that mercury is an atmospheric contaminant. Hazardous waste sites can result in localized contamination of PCB’s, heavy metals and other toxic compounds. Toxic cyanobacteria (linked to excessive nutrient levels) are becoming more frequently observed in certain lakes and ponds. Pesticide application and storage can contribute toxic substances to ground and surface waters. Of particular concern are “new generation” compounds such as endocrine-mimicking compounds, pharmaceutical degradates and personal care products. These compounds come from an array of products society uses as part of daily living. They occur at very low concentrations, have poorly understood but consequential impacts to aquatic life, and are a direct manifestation of people living, working and moving about as an integral part in each of Vermont’s many watersheds. Successful management of toxic substances meets Objectives A, B, and D of the SWMS.

**Thermal stress** – A moderately ranked stressor, excess warming of surface waters occurs as a result of riparian buffer removal, the impoundment of water or cooling water discharge. It is anticipated that climate change will also contribute to this stressor. Excessive warming of surface waters impacts aquatic species that are intolerant of warm temperature. Further, excess warming can turn an otherwise cool babbling brook into bathwater; an undesirable effect for humans and certain aquatic biota on a hot day. Successful management of thermal stress meets Objectives A, B, and C of the SWMS.

### *Stressor with low ranking (1)*

**Pathogens** – A lower ranked stressor, pathogenic organisms of human and non-human origin can be present in Vermont’s surface waters. When swimmers are exposed to certain pathogens in excessive levels, they may become ill, typically with gastrointestinal distress. Pathogenic organisms are the result of fecal contamination from several sources: poorly functioning septic systems, episodic events at wastewater treatment facilities, unmanaged agricultural runoff, pet waste, and natural sources such as wildlife. Vermont employs a readily-measured indicator organism called *E. coli* to assess the potential presence of pathogens from warm-blooded animals. Monitoring and controlling pathogens meets Objective A of the SWMS.

The manner in which each of the ten stressors described above relates to the SWMS goals and objectives is shown (X) in Table 4.6 on the following page. Each stressor is linked to one or more sources of NPS pollution and therefore to Vermont’s ongoing and adaptive approach for NPS management.

**Table 4.6. Vermont Surface Water Management Strategy Stressors, Goals & Objectives.**

<i>Strategy Goals</i>	Biological, Chemical, Physical Integrity Public Use & Enjoyment Public Health & Safety	Biological, Chemical, Physical Integrity Public Use & Enjoyment -----	----- Public Use & Enjoyment Public Health & Safety	Biological, Chemical, Physical Integrity Public Use & Enjoyment Public Health & Safety
<b><u>Objectives</u>→ Stressors ↓</b>	<b>A. Minimize anthropogenic nutrient &amp; organic pollution</b>	<b>B. Protect &amp; restore aquatic &amp; riparian habitat</b>	<b>C. Minimize flood &amp; alluvial erosion hazards</b>	<b>D. Minimize toxic, pathogenic pollution &amp; chemicals of emerging concern</b>
Acidity	X	X		X
Channel erosion	X	X	X	
Flow alteration	X	X	X	X
Encroachment	X	X	X	X
Invasive species	X	X		
Land erosion	X	X		X
Nutrient loading	X	X		X
Pathogens				X
Thermal stress	X	X	X	
Toxic substances	X	X	X	

### **D. Special Areas of NPS Concern**

In light of DEC’s Surface Water Management Strategy, the Strategy’s ten major stressors and recently completed but ongoing statewide assessment of water quality conditions, there are eight areas of NPS concern that deserve recognition. These eight areas of NPS concern will be further expanded upon in Chapter 7 and Chapter 9 of this Plan.

#### ***Agricultural NPS Runoff***

Controlling agricultural NPS pollution is a key element in reducing sediment and nutrient loading and pathogenic contributions to Vermont’s surface waters and meeting water quality standards. Controlling agricultural nutrients and pathogens is also an important consideration for Vermont’s groundwater. The control of agricultural NPS pollution presents a major challenge due to the diffuse nature of pollutant contributions which can originate from production areas, farm fields, pasturelands and field drainage networks. Some of these sources, especially from field or cropping activities, are difficult to identify, quantify and control from season to season and from year to year. New NPS concerns have arisen resulting from the extensive and seemingly growing in popularity installation and use of tile drainage.

In working to control the variety of agricultural NPS runoff, Vermont has invested heavily in programs to provide technical and financial assistance to farmers to help reduce and improve farmstead runoff and provide incentives for soil-based conservation practices such as cover cropping, reduced tillage and improved nutrient and manure management. While there is a regulatory component to managing agricultural NPS runoff, a strong agriculture conservation partnership exists between state and federal agencies, as well as with non-profit and academic sectors, that provides non-regulatory outreach and education about these programs and practices.

Concerns continue to exist, however, regarding the ongoing and extensive impacts from agricultural NPS runoff, especially from farm fields and the many small farms that have been less regulated due to limited staff resources at the Vermont Agency of Agriculture, Food and Markets (AAFM). Concerns also arise as a result of lingering water quality problems in spite of prior implementation of agricultural soil and water conservation practices over the previous many decades. DEC and AAFM have worked extensively in the agricultural community over many years and, more recently, over the past 2 years in preparation for policy and programmatic changes resulting from the Lake Champlain TMDL, since any changes will have statewide implications. DEC and AAFM recently convened an Agricultural Workgroup which helped develop proposed changes to the state AAPs and ideas for additional incentives. The reports from the Workgroup include statewide recommendations for improving surface water quality by modifying certain regulatory requirements as well as increasing enforcement and educational outreach.

### ***Stormwater NPS Runoff from Developed Areas***

Controlling stormwater NPS runoff – its volume and its quality - is another key element needed when reducing sediment and nutrient contributions to Vermont’s surface waters and to achieve water quality standards. The control of stormwater NPS pollution, even in a largely rural state, presents a major challenge due to the significant extent of impervious surfaces and the diffuse nature of land use activities occurring on or adjacent to those impervious surfaces. Some of these sources, especially from older developments or from more densely developed areas, are challenging and expensive to remedy - or even partially remedy.

### ***Dams & Dam Removal (Hydrologic Modification)***

There are over 1,200 inventoried dams on Vermont’s rivers, streams and lakes. Recent stream assessments indicate there are many more structures that are not included in the state dam inventory. While many of the inventoried dams continue to serve one or more useful purposes – such as recreation, flood control, water supply, hydroelectric power generation – many more do not serve any purpose and are considered to be sources of NPS pollution. Most of the dams no longer serving a useful purpose were built many years ago, often to provide power for a mill that has long since ceased to operate and may no longer exist. These old (sometimes historic) dams remain and continue to have significant ecological impacts. Fundamentally, these dams change free-flowing streams to unnatural impoundments, impacting species that depend on riverine habitat for their survival and altering ecosystem processes.

The degree to which dams and associated impoundments disrupt river ecology make them one of the most significant NPS alterations humans have wrought on surface water systems. The recent string of dams that have been removed and dams being considered for removal within Vermont (see Appendix C) demonstrate the multiple water quality and aquatic habitat benefits that can be captured through restoration of free flowing conditions. As pressure to dam rivers persists in light of interest for local renewable energy development, it is becoming increasingly important to communicate the benefits of free flowing rivers and streams to the public and to ensure that resources are available to resolve the conflict presented by dams that have outlived their utility but which continue to exert a NPS and ecological impact on riverine systems.

### *Invasive Exotic Plants & Animals in Vermont Surface Waters*

Invasive exotic aquatic plants and animals are established in Vermont - at least 49 non-native aquatic plant and animal species are known – and many of the state's waters, especially lakes, have a history of impacts related to these invasions. Although the number of new introductions of species already known from Vermont increases annually, many of these populations are found early in the invasion, when control efforts can be more successful. Invasive exotic species have been considered to be a form of NPS pollution since the 1989 NPS Management Program Plan. There are close to 140 lakes (20 acres or larger) deemed as threatened by Eurasian Watermilfoil given their 10 mile distance from lakes with a confirmed infestation.

As reported in the 2014 305b Vermont Water Quality Assessment Report, there were a number of invasive species expansions or events:

- No new Eurasian watermilfoil (*Myriophyllum spicatum*) lakes or other waters were discovered. The total number of lakes with Eurasian watermilfoil stands currently at 67. With a dam removal at Beaver Pond in Mendon, this lake switches to an “other water.” The number of other waters infested with this species is 30.
- Water chestnut (*Trapa natans*) was discovered in three more waterbodies bringing the total number of waterbodies in Vermont with water chestnut to 26.
- Control and search efforts continued on Vermont’s first variable-leaved watermilfoil (*Myriophyllum heterophyllum*) population in Halls Lake in Newbury (confirmed in 2008). Surveys conducted in 2012 and 2013 found no variable-leaved watermilfoil. Variable-leaved watermilfoil has not been found in the lake since June 2011. The only other populations known from a Vermont waterbody is in Lake Champlain - confirmed in both Missisquoi and South (NY) bays.
- One new brittle naiad (*Najas minor*) water was confirmed, the 839-acre Waterbury Reservoir in Waterbury and Stowe, bringing the total number of known lakes with populations of this species to eight. This species was first confirmed in Vermont in 1984.
- A new exotic crayfish species, big water crayfish (*Cambarus robustus*), was confirmed for the first time in the White River. Extensive crayfish surveys done in the White River in 2005 did not find this species suggesting is a recent introduction. Extensive monitoring of crayfish in Vermont has not been performed.
- Alewives (*Alosa pseudoharengus*) were first confirmed in Lake Champlain in 2005. Alewives of all age classes have now been documented in the lake, and schooling alewives were observed for the first time during summer 2007 indicating a significant

population increase. These fish have the potential to seriously alter trophic conditions and food chain dynamics as they have in the Great Lakes and Finger Lakes. A fish kill involving millions of alewives in the winter of 2008 resulted in fouled beaches and shorelines along the entire length of Lake Champlain.

- Zebra mussels (*Dreissena polymorpha*) are pervasive in Lake Champlain and Lake Bomoseen but have not emerged or become established elsewhere in Vermont.

While not an exotic aquatic plant species, Japanese knotweed (*Fallopia japonica*) tends to invade riparian habitat and overwhelm all other nearby plant species making this species a cause for concern as it affects the integrity and function of streambanks and lakeshores throughout Vermont. Recent storm events that modified many riparian areas resulted in significant re-location of the species into what had been previously uninfested riparian areas. Japanese knotweed is found in scattered areas of high abundance in each Vermont's fifteen river basins.

### *Atmospheric Deposition of Pollutants*

The long-distance transport and deposition of air-borne pollutants (mercury, sulfate, and nitrous oxides) to Vermont's landscape has been principally responsible for the impairment of fish consumption uses on 8,165 inland lake acres, all of Lake Champlain's acres, and 56 river and stream miles. Acidity due to atmospheric deposition impairs aquatic life uses on 4,468 inland lake acres and has resulted in 38 lakes listed as impaired because of acidity.

Over the past 32 years, various regional US and Canadian emission control programs have resulted in substantial reductions in the deposition of sulfate, nitrate and acidity as measured in Bennington, Vermont at the National Atmospheric Deposition Program site. Reductions in deposition have translated into significant reductions of in-lake concentrations of acidifying pollutants. Acid lakes in Vermont have responded to these changes in deposition with many waters showing reduced in-lake sulfate concentrations and increasing pH levels. However, in-lake calcium concentrations remain too low to support sensitive aquatic organisms, such as fingernail clams. Future reductions in acid deposition and increases in calcium and other base cation concentrations are necessary for healthy waterbodies. Recent federal regulations such as the 2014 EPA Tier 3 Motor Vehicle Emission and Fuel Standards are expected to further reduce the acidifying pollutants in the atmosphere and in Vermont lakes. It is anticipated that these reductions will improve water quality of Vermont's acid lakes. However, changes in precipitation volume and intensity due to climate change will have, as yet, unpredictable effects on Vermont's acid sensitive lakes.

### *River Corridors & Water Quality*

Vermont ANR is pursuing river corridor protection as the primary tool to restore and protect dynamic equilibrium in rivers. River corridors consist of lands adjacent to, and including, the present channel of the river. Delineations are based primarily on floodplain function, the lateral extent of stable meanders (i.e., the meander belt width) and a wooded riparian buffer to provide streambank stability. The meander belt width is governed by valley landforms, surficial geology, and the length and slope requirements of the river in its most probable stable form.

A River Corridor Easement Program, established in 2007, focuses on conserving river reaches identified as high priority sediment and nutrient storage areas. The opportunity to purchase and sell river corridor easements was created to augment Fluvial Erosion Hazard (FEH) zoning which, if adopted, avoids future encroachment and flood damage, but does not restrict channelization.

DEC's Rivers Program works closely with state and federal farm service agencies, the Vermont Housing and Conservation Board (VHCB) and land trust organizations to combine corridor easements with other land conservation programs. The easement ensures that watercourses and wetlands are not manipulated to alter natural water level or flow, or intervene in the natural physical adjustment of the water bodies. To date, the program and its various partners have completed 42 river corridor easements across Vermont which encompass a total of about 23.3 river miles and 933 acres of adjacent land.

### *Lakeshore Development, Alteration of Littoral Habitat & Need for Vegetated Lakeshore Buffers*

The National Lakes Assessment found that the most widespread stressor to lakes in Vermont is lakeshore disturbance caused by excessive clearing and impervious areas close to the water's edge. The Report found that 82% of Vermont's lakes greater than 25 acres in size are in fair or poor condition for lakeshore disturbance, a figure that was greater than both the NAP ecoregion and the nation. These findings were presented in DEC's [2013 Gauging the Health of Vermont Lakes](#) report.

Vermont's 2005-2009 Littoral Habitat Assessment study found that the way Vermont was developing its lakeshores was degrading aquatic habitat and biota in conflict with Vermont Water Quality Standards (Merrell, Howe and Warren, 2009). In 2011, DEC and the Maine Department of Environmental Protection collaborated on a joint study to determine if lakeshore developed in compliance with Maine's mandatory shoreland zoning act standards would protect aquatic habitat and biota in compliance with Vermont's water quality standards. The study found that it is possible to develop a lakeshore and protect aquatic habitat and biota in compliance with Vermont's narrative standards; development that meet Maine's mandatory shoreland zoning act standards protected aquatic habitat. These findings were presented in DEC's 2013 [Determining if Maine's Mandatory Shoreland Zoning Act Standards are Effective at Protecting Aquatic Habitat](#) report.

In response to recommendations in a legislatively mandated report on how to better protect Vermont's waters, a shoreland commission, consisting of members from the Vermont House, Vermont Senate and ANR was formed to take public input at a series of public meetings held over the course of a summer. During the 2014 legislative session, the Governor signed legislation that went into effect on July 1, 2014 and includes minimum standards for vegetated buffers around lakeshores in Vermont.

## *Climate Change*

Climate trend data for Vermont and the larger Northeast region serve as helpful guides in understanding NPS-related risks associated with climate change impacts being faced today and when structuring and executing actions needed to minimize those risks in the future. Scientists have documented changes in Vermont's climate over the past 50 years and trends indicate warmer surface temperatures are probable to likely. Warmer surface temperatures are, in turn, changing precipitation patterns and snowpack. On an annual basis, more precipitation is falling as rain during the winter months which reduces snowpack.

Trends towards more frequent high intensity precipitation events are of particular concern for Vermont and the northeast region. More frequent high intensity precipitation events are also of concern for the future of NPS management. Precipitation in Vermont has increased by 15 to 20% over the past 50 years and increases in more frequent and intensive severe weather are projected to continue (Betts 2011a, UCS 2006, Hayhoe et al. 2007, Karl et al. 2009). The ANR 2011 report entitled, [\*Resilience: A Report on the Health of Vermont's Environment\*](#), released in the aftermath of Tropical Storm Irene, reported that storms now "release 67 percent more rain than they did 50 years ago."

The [\*Vermont Climate Assessment Report\*](#) (UVM, 2014) indicates the state's average temperature has increased by 1.3 degrees (F) since 1960 with about 45% of this increase occurring since 1990. The Report notes that precipitation has increased across Vermont with the largest increases found in the higher elevations and mountainous areas. Average annual precipitation across Vermont has increased by 5.9 inches since 1960 where 48% of this increase has occurred since 1990. Annual average stream flows are increasing as precipitation increases. Records show that heavy rainfall events are becoming more common in Vermont which poses growing threats to more runoff, more erosion and further flooding, whether localized or more widespread.

Climate change impacts on precipitation appear to magnify the effects of land use on water quality, placing a greater burden on already stressed ecological systems. The greater frequency of climate change induced severe precipitation events, coupled with increases in impervious surfaces from existing and new development are likely to generate additional runoff and erosion and further water quality degradation. The degree and extent of impact associated with climate change is believed to be a function of *localized factors* – the current condition of Vermont's landscape that either heightens or minimizes its vulnerability to storm runoff and erosion.

Climate change is projected to increase the intensity as well as the frequency of so called 'extreme precipitation events,' thereby exacerbating delivery of nutrients, sediment, bacteria and other pollutants to receiving waters from existing sources or stressors. The three major NPS stressors that comprise most of the sediment and nutrient loading to Vermont's surface waters include (a) runoff and erosion from developed lands, agricultural lands, construction, and logging operations; (b) non-erosion-related nutrient loading from sources such as over-fertilization of cropland or poor manure management practices; and (c) stream channel

erosion. The magnitude and extent of each of these stressors are closely linked to present and future climate conditions.

While considerable uncertainty remains about the magnitude and extent of climate change impacts on temperature, precipitation, soil moisture (especially important for vegetation in general as well as for agricultural production and forest management) as well as other factors, uncertainty is not an excuse for inaction. Uncertainty requires commitment to a process of re-evaluation of progress, applying lessons learned, incorporation of weather and water quality-based monitoring and assessment data, and adjustment of NPS and land management/BMP actions. This process is otherwise collectively known as an adaptive management approach. This approach, which accommodates new information as a result of research and implementation progress, provides a means to identify and carry out necessary adaptations whereby the negative consequences of climate change are avoided or minimized.

## Chapter 5. Statewide Watershed Prioritization

Identification and prioritization of waters and watersheds on a statewide basis is an organic element of Vermont's NPS Management Program. Vermont's original listings of NPS priority waters (targeted-impaired and targeted-threatened) were first developed back in 1988 as part of Vermont's initial NPS Management Program plan document that received EPA approval. Vermont's NPS impaired waters listings have been substantially revised on an on-going and biennial basis since 1992. Vermont NPS impaired waters listings are done in conjunction with reporting requirements under Clean Water Act Section 303d.

The listings that have been prepared for this document were developed to help DEC define and prioritize water quality management and water pollution control efforts as well as to guide program partners when undertaking activities to reduce or avoid NPS pollution whether to restore impaired waters or protect threatened waters. For this document, DEC has prepared a statewide listing of NPS impaired waters and a statewide listing of NPS threatened waters. DEC reviews and updates the overall and priority NPS listings on a regular basis as monitoring, assessment and implementation findings dictate. Many of the listed NPS waters, whether impaired or threatened, are associated in some way with one or more of the special NPS areas of concern mentioned in Part 4 of the Plan.

To complement its listing of waters process, DEC also conducts regular reviews of NPS priority watersheds through its tactical river basin planning process with an eye towards identifying a smaller subset of highest priority waters to receive focused water quality monitoring, TMDL development or grant funding to carry out discrete NPS projects. These reviews help DEC direct its limited NPS program resources towards critical needs and opportunities when restoring or protecting waters.

Whether expressed by the Surface Water Management Strategy, the delivery of various NPS control efforts or EPA's Section 319 program guidelines, Vermont applies a balanced approach when restoring impaired waters and protecting unimpaired yet threatened waters. Tactical river basin plans and other water quality management plans define waters and approaches for restoration and protection. Restoring waters impaired by NPS to meet water quality standards has been and remains a high priority focus of Vermont's water quality management efforts. Protecting waters that currently meet water quality standards but are threatened by NPS pollution is viewed as a priority since such an approach avoids the need for restoration and can be a remarkably cost effective means to maintaining high quality of waters.

### A. Priority NPS Impaired Surface Waters in Need of Restoration

Waters appearing as NPS impaired waters fall within one of two categories. In one category are surface waters where there are chemical, physical and/or biological data collected from quality assured and reliable monitoring efforts that reveal an ongoing violation of one or more of the criteria in the WQS and a pollutant of human or human-induced origin is the most probable

cause of the violation. A Total Maximum Daily Load (TMDL) may have been prepared for some of these waters.

In the second category are surface waters where a lack of flow, water level or flow fluctuations, modified hydrology, physical channel alterations, documented channel degradation or stream type change is occurring and arises from some human activity OR where the occurrence of exotic species has had negative impacts on designated uses. The aquatic communities are altered from the expected ecological state. This second category (referred to as altered waters) includes those waters where there is documentation of WQS violations for flow and aquatic habitat but EPA does not consider the problem(s) caused by a pollutant or where a pollutant results in WQS not being met due to historic or previous human-caused channel alterations that are presently no longer occurring. The two categories noted above, when combined, represent the entire extent of Vermont's NPS impaired waters. The list of NPS impaired waters found throughout Vermont is found in Appendix D.

A smaller subset of NPS impaired waters, an indication of priority NPS impaired waters, is helpful to promote and elevate the need (urgency) for NPS abatement work in drainages and watersheds degraded by NPS pollution. The list of priority NPS impaired waters is used to help prioritize DEC's NPS water pollution control and management efforts as well as draw the attention of local communities and partner groups to take action to restore waters impaired by NPS pollution. The waters appearing on the priority NPS impaired waters list were evaluated using certain guiding factors. One factor was that any listed water needed to have NPS pollution as the primary or predominant source of impairment. A second factor was that water quality conditions were likely to improve if NPS funding and support were devoted to implementing NPS control measures to fix the problem. The third factor was related to DEC's perception of the presence of a higher degree or level of public interest or concern to improve/restore the water. Lastly, all these factors, when combined, had to result in a manageable number of priority NPS impaired waters so that resources – whether federal or state resources - could be effectively targeted, committed and invested where they are most needed.

The list of priority NPS impaired waters for Vermont is shown in Table 5.1 appearing on the following page.

**Table 5.1. Vermont's Priority NPS Impaired Waters.**

Waterbody Name	Waterbody ID Number	Town(s)	Pollutant(s) Causing Impairment	Nonpoint source(s) of pollution
<b>***** Waters within Lake Champlain Drainage *****</b>				
Mettowee River	02-05	Pawlet	Elevated temperature	Loss of riparian vegetation; close proximity of agricultural uses
Little Otter Creek	03-07	Ferrisburg	E.coli & TBD <sup>1</sup>	Agricultural runoff
Lewis Creek & Pond Brook	03-08	Ferrisburg, Charlotte, Hinesburg, Monkton	E.coli	Agricultural runoff
Lower Middlebury River	03-12	Middlebury	E.coli	Agricultural runoff, livestock, possible failed septic systems
Rock River & Saxe Brook	05-01	Highgate, Franklin	TBD	Agricultural runoff
Jewett Brook	05-07	St. Albans	Sediment, nutrients, E.coli	Agricultural runoff
Rugg Brook	05-07	St. Albans	E.coli & TBD <sup>1</sup>	Agricultural runoff
Stevens Brook	05-07	St. Albans	Sediment, nutrients, E.coli, oil, grease, hydrocarbons	Agricultural runoff, morphological instability
Mill River	05-07	Georgia	Sediment, nutrients, E.coli	Agricultural runoff
Stone Bridge Brook	05-08	Georgia, Milton	TBD <sup>1</sup>	Agricultural runoff, land development
Direct small drainages to inner Malletts Bay	05-09	Colchester	E.coli	Urban runoff, failed/failing septic systems
Potash Brook	05-11	South Burlington	Stormwater, E.coli	Stormwater runoff, land development, erosion; beach closures
Berry, Godin, Samsonville & Trout Brooks	06-04	Berkshire	Sediment, nutrients, E.coli	Agricultural runoff
Deer Brook	07-03	Georgia	Sediment	Stormwater discharge, sand pit, corroding culverts
Mill Brook	07-09	Fairfax	Sediment, nutrients	Algae growth
Allen Brook	08-02	Williston	Stormwater, E.coli	Stormwater runoff, land development, erosion
Muddy Brook	08-02	South Burlington, Williston	Toxics, nutrients, elevated temperature	Lack of buffer, land development
Folsom Brook	08-20	Waitsfield	E.coli	Failed/failing septic systems, agricultural runoff
<b>***** Waters within Connecticut River Drainage *****</b>				
Crosby Brook	13-13	Brattleboro	Sediment	Channelization & loss of riparian buffers
Newton Brook	13-16	Vernon	Sediment	Agricultural activity
Tributary to Tabor Branch	14-05	Topsham	TBD <sup>1</sup>	Agricultural & barnyard runoff, milkhouse effluent
<b>***** Waters within Lake Memphremagog Drainage *****</b>				
Crystal Brook	17-01	Derby	Sediment, nutrients	Agricultural activity

Table Note: 1. TBD means "to be determined." In some cases, specific pollutants have not been measured. Impairment based only on biological sampling.

## B. Priority NPS Threatened Surface Waters in Need of Protection

Waters appearing as NPS threatened waters are waters that support the uses for the classification but the water quality and/or aquatic biota/habitat have been disturbed to some degree by NPS pollution and the water may require some attention, including human and financial resources, to maintain or restore its high quality; the water quality and/or aquatic habitat may be at risk of not supporting uses in the future; or the structure or integrity of the aquatic community has been changed but not to the degree that the standards are not met or uses not supported. Available data or other information confirms water quality or habitat disturbance but not to the degree that any designated or existing uses have become altered or impaired (i.e. not supported). NPS threatened waters described above are referred by DEC as “stressed” waters.

Certain lakes showing the potential for water quality decline, whether determined through water quality monitoring (as reflected by DEC’s lake “water quality scorecard”), by levels of lakeshore disturbance or by proximity to other lakes infested with Eurasian watermilfoil, have been added to these stressed waters. Vermont’s list of NPS threatened waters is found in Appendix E.

Protection of NPS threatened waters is a priority for Vermont NPS management. Often times DEC is able to broaden its reach concerning protection efforts by working closely with partner groups and organizations. Many of these partners are not only able to understand the nature and extent of NPS threats but, because of their close proximity to the water and landowners affected, are able to effectively carry out the broad range of protection activities such as monitoring and assessment, education and implementation. DEC views protection of healthy but NPS threatened waters of comparable importance to restoration of NPS impaired waters. Rather than a specific annual allocation of resources set aside for protection purposes, DEC makes protection an integral component of its ongoing water resources management efforts.

Given the number, distribution and distinct nature of threat affecting these waters found across Vermont, DEC intends to develop criteria and a process to better define priority NPS threatened waters (see Chapter 9, Table 9.12 for a schedule).

## Chapter 6. Vermont River Basin & Watershed-based Approach for NPS Planning & Implementation

### A. State Water Quality Planning Approaches

As described in Chapter 3 and in Chapter 7, a wide variety of programs are in place within Vermont to prevent, avoid or otherwise reduce impacts to Vermont's surface and ground waters. However, without an overall planning and plan development process to identify, prioritize, fund and implement necessary water pollution control strategies, time and money are likely to be applied in a less than effective manner. In order to promote and deliver the most efficient and cost effective system to address NPS management and the implementation of BMP controls, DEC has developed a coordinated watershed assessment, planning, project identification and funding effort. The development of "tactical river basin plans" supported by targeted funding efforts provided by the Ecosystem Restoration Program (ERP), in most cases provides the required synergy between identified priority NPS projects and available funding whether used for protection or restoration of surface waters. In other cases, the tactical river basin plans will be augmented to meet planning requirements under the Section 319 grant program (see Section C below). The development of source water protection plans supported by funding efforts provided by state funds provides a mechanism to link NPS prevention work with source water protection.

#### *Tactical River Basin Plans & Planning*

River basin water quality management planning has been and remains an organic ingredient to the Vermont's approach when managing NPS pollution. Dating back to the late 1970s and Section 208 of the Clean Water Act, Vermont has devoted significant resources when defining the nature and extent of NPS problems and when prioritizing treatment programs and geographic areas needing attention. The portion of Vermont's land area that drains into Lake Champlain has been and continues to be a high priority area for NPS management, especially reducing sediment and nutrient (phosphorus) contributions. More recently, additional priority areas for NPS management include lands in Vermont that drain to the Connecticut River and Lake Memphremagog (refer to Chapter 4, Figure 4.1. for a map illustrating these priority regional drainages). Vermont's river basin planning efforts are conducted in such a manner so as to be consistent with Section 303e of the Clean Water Act and 40 CFR 130.6 and a number of state requirements.

Federal regulations (40 CFR 130) in part, direct state agencies to prepare basin plans, to focus on priority issues and geographic areas, to identify priority point and nonpoint water quality problems, consider alternatives and recommend control solutions and funding sources. At the state law level, basin and watershed planning requirements are found in a number of statutory and regulatory provisions, including but not limited to, Title 10 V.S.A. §§ 1251, 1253 and 1258, and Section 1-02.D of the Vermont Water Quality Standards (WQS). Title 10 V.S.A. §1253d provides that basin plans must be developed on a five year rotational basis. Section 1-02.D of the WQS requires that basin plans include:

- Inventory the existing and potential causes and sources of pollution that may impair waters.
- Establish a strategy to improve or restore waters and to ensure full support of uses.
- Identify strategies, where necessary, by which to allocate levels of pollution between various sources as well as between individual discharges.
- To the extent appropriate, contain specific recommendations by the Vermont ANR Secretary that include but are not limited to:
  - the identification of all known existing uses, salmonid spawning or nursery areas important to the establishment or maintenance of such fisheries;
  - reference conditions appropriate for specific waters;
  - any recommended changes in classification and designation of waters;
  - schedules and funding for remediation, stormwater management, riparian zone management, and other measures or strategies pertaining to the enhancement and maintenance of the quality of waters within a basin.

Formerly known as river basin water quality management planning, DEC currently carries out tactical river basin planning to identify the highest priority opportunities for protection and restoration actions affecting NPS and surface waters. At present, tactical basin planning relies on monitoring and assessment results, combined with sector-specific planning processes, to identify and prioritize opportunities for NPS implementation projects and activities. Tactical river basin plans, to be developed on a five year recurring cycle, help ensure that state and federal funds are directed to the highest merit NPS implementation opportunities based on identification, targeting, and treatment of specific sites determined to be at greatest risk of delivering NPS pollutant loads to surface waters. These critical sources are identified within land use categories including agricultural land, urban and developed land, road networks, and river corridors. Tactical river basin planning is carried out by a group of five DEC water quality planners, each of which is assigned a district comprised of three major river basin planning units.

Table 6.1 on the following page indicates the completion status and anticipated schedule for subsequent revisions/updates to river basin plans.

**Table 6.1. River Basin Plans & Planning Schedule.**

Basin ID Number	River Basin Name	Year Plan approved	Schedule for Plan Update	Regional Drainage
1	Batten Kill, Walloomsac, Hoosic	underway	2021	Hudson River
2	Poultney, Mettowee	2013	2017	Champlain
3	Otter Creek, Lewis Creek, Little Otter	2012	2017	Champlain
4	Lower (southern) Lake Champlain direct	2014	2017	Champlain
5	Upper (northern) Lake Champlain direct	2014	2019	Champlain
6	Missisquoi, Pike, Rock	2013	2016	Champlain
7	Lamoille	2009	2016	Champlain
8	Winooski	2012	2018	Champlain
9	White	2012	2018	CT River
10	Ottawaquechee, Black	2011	2017	CT River
11	West, Williams, Saxtons	2008	2015	CT River
12	Deerfield	2012	2019	CT River
13	Lower (southern) CT River direct	2011,2013,2015	2017,2019,2021	CT River
14	Ompompanoosuc, Waits, Wells,	2014	2020	CT River
15	Passumpsic	2012	2018	CT River
16	Upper (northern) CT River direct	2014	2020	CT River
17	Lake Memphremagog	2011	2016	St. Lawrence

Tactical river basin planning is DEC’s current planning and management approach to integrate and focus NPS implementation. Tactical basin plans facilitate implementation of remediation efforts by translating results of integrated basin water quality assessments into specific geographical areas for project-level intervention. These science based assessments also serve to identify where additional regulatory program requirements may be brought to bear by relevant programs. Implementation tables in each tactical river basin plan will be frequently updated to reflect the implementation of practices that should be prioritized for funding or that are required as a result of regulatory program requirements. Further, such implementation tables may identify the appropriate restoration strategies based on monitoring and assessment data and identify regulatory programs or financial incentives best suited to implement one or more particular restoration strategies. Tactical basin planning is further described in Chapter 7.

One core component of each tactical basin plan is the plan’s implementation table. The implementation table outlines the priorities of DEC and partner organizations for protection or restoration of particular surface water segments affected by specific NPS pollution sources, which are to be addressed by application of interventions, strategies or BMPs outlined in DEC’s *Surface Water Management Strategy*. The implementation table serves to notify partner organizations about the types and locations of NPS projects that DEC will support with grant or loan programs or promote to other funding sources where DEC has leverage. Readers having interest with identified implementation needs can inspect river basin specific implementation tables by visiting the river basin planning web site shown below and then accessing particular river basin plans: (<http://www.watershedmanagement.vt.gov/planning.htm>).

The implementation table is updated as a report card of implementation progress in each river basin. The DEC planners biennially review progress with respect to the implementation of specific items and conduct public outreach to re-visit the projects identified. New priority items that are more recently identified are added to the table. As such, the implementation table is a useful chronicle of identified priority interventions needed to achieve NPS load reductions in Vermont river basins and sub-watersheds.

### *Source Water Protection Plans & Planning*

Source water protection plan and planning is separate and distinct from river basin planning but plays an important role regarding the avoidance or minimization of contamination affecting water used for drinking water purposes. Beginning in 1992, all Public Community Water Systems (PCWS) and all Non-transient Non-community Water Systems (NTNC) within Vermont must have in place a DEC-approved Source Protection Plan (SPP). An approved SPP addresses actions the water system provider will perform or undertake to minimize the contaminant risks to their drinking water supply source(s), whether the supply source is surface water or ground water. An approved SPP is also necessary in order to receive from DEC an operating permit and a Phase II/V monitoring waiver. The water system provider is required to submit to DEC an updated SPP every three years for review and re-approval.

An approvable SPP must contain a particular set of required information. Items in each plan must include, but are not limited to, a brief description of the water system (nature of the source, construction details, extent of storage, population served, number of connections, land use setting), how the source protection area was delineated, a contingency plan in the event of an emergency and, if groundwater is the source, the well log. The source protection area (SPA) is the area of land that likely recharges or passes groundwater through to the source. This area is the basis of the activities that the water system will perform to minimize source water contamination.

A major component of each SPP is an inventory listing potential or actual sources of contamination found within the SPA. Sources of contamination include many examples of nonpoint sources such as large or small septic systems, gas stations, farm operations or parking lots. Each potential or actual contamination source, needs to be given a risk rating (high, moderate or low) based on factors such as proximity to the water source, amount of contamination, well construction.

Importantly, each SPP needs to have a strategic plan for dealing with the potential and actual sources of contamination and future needs of the water system. This part of the SPP needs to include a list of landowners and local, regional and state officials with contact information. The strategic plan section should also outline the specific steps the water system will take to mitigate the threat from identified contamination sources and include future plans the water system may have in the realm of advancing source protection (e.g. purchasing land, development rights).

As of September 2014, DEC has approved about 650 SPPs. There are about 20 plans affecting surface water supply sources and 630 plans affecting ground water supply sources. In spite of the differences by type of source water, the number of people served by each type is almost equivalent. Each water system has made progress when addressing potential and actual sources of contamination which tend to be of a NPS nature.

Source water protection plans and planning is further described in Chapter 7.

## B. EPA Watershed-based Plans

Starting in 2003 and expressed by EPA in *Nonpoint Source Program and Grants Guidelines for State and Territories*, EPA requires watershed-based plans to guide Section 319-funded work in impaired watersheds. The EPA-required watershed-based plans (WBP) have to address nine key elements. The nine elements for a watershed-based plan are noted below.

1. An identification of the causes and sources that will need to be controlled to achieve the load reductions and goals defined or specified in the plan;
2. An estimate of the load reductions expected to occur following implementation of the management measures (BMPs) in the plan;
3. A description of the NPS management measures that will need to be implemented to achieve the load reductions estimated and an identification of the critical areas in which those measures will be needed to implemented;
4. An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement the plan;
5. An information and education component that will be used to enhance public understanding of the project;
6. A schedule for implementing the NPS management measures;
7. A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented;
8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and that substantial progress is being made towards water quality standards; and
9. A monitoring component to evaluate the effectiveness of the implementation efforts.

Historically, DEC's tactical river basin water quality management plans have been consistent with many but not all of the nine elements specified by EPA. To address these deficiencies, DEC will increase staffing in 2015 and begin updating its tactical basin plans to ensure that Vermont's watershed-based plans comply with national NPS program guidelines. For example, starting in 2015, tactical river basin plans concerning those larger river systems draining to Lake Champlain (Poultney/Mettowee, Otter Creek, Missisquoi, Lamoille, Winooski plus the Northern and Southern direct-to-lake drainages) will include estimates of phosphorus pollutant loading and estimates of phosphorus pollutant loading reduction expected from NPS BMP

implementation. These estimates will address elements 1 and 2 of EPA's required nine WBP elements. Tactical basin plans, although not regulatory or enforceable, will also include a schedule for implementing identified BMPs and milestones to chart implementation progress. DEC will work closely with EPA during development of these 'enhanced' tactical basin plans to ensure they are consistent with the nine elements specified in EPA guidance. Refer to page 42 for the role tactical river basin plans play in NPS management.

EPA's Section 319 program guidance allows for two other situations where alternative watershed based plans may be warranted or can be developed. One situation is when the impairment is not specific to a pollutant but due to a water quality problem (e.g. a dam which results in altered flow regimes). The second situation where an alternative plan can be developed is when DEC may need a plan when responding to a NPS pollution emergency that has created urgent public health risk. While no such alternative watershed based plans have recently been developed in Vermont, DEC commits to work closely with EPA if the need for such a plan(s) arises as each alternative watershed based plan needs approval by EPA.

### C. NPS Watershed Implementation

Implementation of strategies and projects found in river basin plans is typically a cooperative effort involving state DEC staff, staff from agencies such as NRCS, Vermont AAFM, VTrans and local entities such as conservation districts, municipalities and watershed groups. Implementation activities vary depending on the nature of the water quality impairment or threat and watershed characteristics but often include agricultural NPS practices such as cover cropping, changes in tillage, nutrient management and buffers; stormwater retro-fit projects, roadside erosion control and streambank restoration when supported by appropriate stream geomorphic assessments. The implementation of many of these projects and practices is increasingly being coordinated through one or more programs within DEC.

Funding for implementation comes from a variety of sources including DEC's Ecosystem Restoration Program (ERP), EPA Section 319, USDA and Vermont AAFM cost share programs, municipal or privately funded sources and other grant programs. Projects to control runoff from roads are often supported by Better Backroads funding (administered by VTrans), municipal funds or direct VTrans investments. Chapter 8 of this Plan provides a more in-depth description of sources of NPS implementation funding available.

Most agricultural projects are supported on a cost share basis with funds from USDA and/or AAFM. USDA has committed \$45 million of its regular program funds towards Lake Champlain watershed implementation projects over the next five years. Significant additional USDA implementation funds have been obtained for work in both the Lake Champlain and Connecticut River drainages through the Regional Conservation Partnership Program (RCPP). Coordination among DEC and the agricultural agencies has increased on recent years. For example, NRCS in coordination with DEC and AAFM, has identified four small priority watersheds to focus implementation efforts over the coming five year period (Rock River, Pike River, St Albans Bay watershed and small drainages in western Addison County known

collectively as McKenzie Brook). USDA also provides funding to support erosion control on certain abandoned logging roads.

DEC's ERP is a key funding source and provides state-funded capital construction grants to fund projects that accelerate the reduction of sediment and nutrient pollution from uncontrolled nonpoint sources. ERP targets implementation of priority projects in priority geographic areas largely identified in river basin plans produced as part of DEC's tactical river basin planning process. This process uses monitoring and assessment results, combined with sector-specific planning efforts to identify and prioritize NPS projects for implementation. Projects for implementation under ERP are considered to be one of four category types: project scoping; project planning feasibility or design; implementation; and easements for permanent protection.

Traditionally, implementation of priority NPS control projects is managed via ERP's competitive grant program, which funds 45 to 60 grant projects each year worth \$2 - \$3.75 million. ERP will continue to support a competitive grant program. Beginning in 2015, ERP will be placing a greater emphasis on targeting funds to implement those priority NPS remediation projects specifically identified in respective tactical river basin plans.

State legislation enacted in June 2015 created a new Clean Water Fund which will further assist NPS implementation efforts. The Fund will assist Vermont in complying with water quality requirements and construction or implementation of projects or programs. While details are forthcoming regarding how \$4.85 million from the Fund is to be distributed, the Fund will be administered by a Clean Water Fund Board which consists of the Secretaries from Vermont agencies of Administration, Agriculture, Commerce and Community Development, Natural Resources and Transportation.

For many years DEC would also use a portion of its Section 319 award to help with implementation of NPS projects identified through state priorities and basin planning (see Appendix F for examples of noteworthy NPS projects assisted by 319 dollars).<sup>5</sup> In 2014 and 2015, in place of using a competitive 319 pass through grant program, DEC received EPA approval to 'leverage' an amount of state ERP funds equal to 100% of its annual 319 award for carrying out NPS watershed implementation projects. Consistent with EPA guidelines, this approach allows DEC to continue funding critical state positions involved with NPS program administration, NPS technical assistance and overseeing NPS implementation work. As noted in Chapter 9, Table 9.11, DEC will annually evaluate the possibility of restoring a 319 pass through program. In the event restoring a 319 pass through to a level described in guidance is deemed infeasible, DEC will continue to coordinate with EPA and pursue the 'leverage' option. Regardless of which approach is used to fund NPS watershed implementation work, DEC remains committed to working with partners to address the most pressing NPS problems with the goal of restoring and protecting priority waters.

---

<sup>5</sup> See also <http://water.epa.gov/polwaste/nps/success319> to learn more about how and where DEC and partners have restored certain NPS waters in Vermont.

## D. Measuring, Monitoring or Evaluating Results

Restoration and protection of Vermont's water resources is an ongoing process. Restoration of NPS impaired waters will take time and, in the majority of cases, will span years or even decades. Addressing threats and carrying out NPS protection is equally vital work that should never cease. River basin plans produced by DEC will be subject to regular evaluation and periodic updating to remain relevant. DEC has made a commitment, in conjunction with the other state NPS agencies and the many partners, to update its river basin plans on a five year basis as well as delivering status updates of progress regarding implementation of tactical river basin plan recommendations.

River basin water quality management plans include a monitoring component to assess progress toward the plan's restoration and protection goals. To effectively track progress over time, the progress monitoring component involves not only water quality monitoring but also some land use or BMP implementation monitoring. Some of this work can be conducted by lead state NPS agencies or by local stakeholders. The resulting information, once deemed as reliable and then compiled and shared, can be used to assess incremental restoration and protection progress over time. Biological monitoring using DEC-developed field protocols to determine if a stream's macro-invertebrate population has improved as certain BMPs are installed is an example of how progress monitoring can be carried out. Local groups can also rely on DEC's monitoring programs (e.g. LaRosa Lab Partnership Grants) to assess local water quality conditions which also helps DEC determine a water's attainment status. Chapter 10 of this Plan provides added details and information on monitoring NPS environmental success.

## Chapter 7. Vermont NPS Programs, Federal Programs & NPS Partnerships

Managing and controlling NPS pollution throughout Vermont is one of if not **THE** key element in preventing and reducing pollutant loads to surface waters and groundwaters and when meeting applicable water quality standards. The control of NPS pollution presents a major challenge for Vermont due to the diffuse nature of NPS contributions which, as a result of precipitation or snow melt, may arise from runoff from buildings and parking lots and other impervious surfaces, farm fields and barnyards, lawns and other sorts of turf, forests and back roads. Those challenges become even greater when one includes NPS pollution from river and stream channel erosion. Many NPSs are also difficult to identify from place to place, difficult when quantifying the amount of pollution contribution and difficult to implement effective and consistently reliable controls.

Vermont's NPS Management Program relies on a collection of varied programs at state, federal and regional levels and on an extensive network of partnerships. This chapter of the Plan will touch on many of the programs and partnerships deemed essential to an ongoing, effective overall NPS management program within Vermont.

This chapter will first describe a variety of NPS management programs that are administered by DEC. Following that will be descriptions of other NPS management programs administered by other state agencies or departments (transportation, agriculture, forestry). The chapter will next include descriptions of federal NPS management programs and then be followed by descriptions of partnerships with non-governmental organizations.

### A. Vermont NPS Management Programs

#### Stormwater Management

DEC has issued stormwater 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, has been set at one acre of impervious cover. Projects requiring permit coverage must design a management system in compliance with standards contained in the Vermont Stormwater Management Manual (VSMM). DEC is currently engaged in an update process for the VSMM with a goal of increasing the application of low impact development and green stormwater infrastructure practices.

#### ***Nonpoint Source State Stormwater Runoff Management from Developed Lands & Lands Undergoing Development***

##### STATE STORMWATER PERMIT PROGRAM (OPERATIONAL OR POST-CONSTRUCTION)

The State's Stormwater Permit Program regulates runoff from impervious surfaces (rooftops, paved/gravel roads, parking areas, etc.). The Program has specific jurisdictional thresholds

based on the amount of impervious surface as per the Stormwater Management Rules - either Chapter 18 (Stormwater Management Rule for Non-Stormwater Impaired Waters) or 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, [Volume One](#) and [Volume Two](#)). The VSMM, developed for the State by the Center for Watershed Protection, includes sizing criteria to meet water quality, groundwater recharge, channel protection, overbank flood protection and extreme flood control. The VSMM is currently under revision.

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 about 1,307 acres of impervious surface under an active post-construction stormwater permit within the CT River basin and about 6,020 acres of impervious surface under an active post-construction stormwater permit within the Lake Champlain basin.

#### GREEN STORMWATER INFRASTRUCTURE (GSI) INITIATIVE

Traditionally, stormwater runoff has been collected and conveyed in closed systems to off-site locations where it is then discharged, without treatment, to surface waters. The series of pipes, catch basins, and storm drains that result is known as 'gray infrastructure.' Because 'gray infrastructure' does little to improve water quality and reduce water quantity, stormwater discharges from these older or traditional systems often contribute to unhealthy stream flow regimes marked by chronic flash flooding, altered stream morphologies, elevated nutrient and contaminant levels, excessive sedimentation, loss of species diversity, and higher water temperatures.

Starting in 2009, DEC created its GSI Initiative as a non-regulatory, educational and technical assistance approach to broaden the manner and techniques in which stormwater may be generated and managed. GSI is a complimentary and sometimes alternative system to 'gray infrastructure' that more effectively utilizes infiltration, evapotranspiration, storage and reuse. GSI is decentralized by design and either prevents runoff from occurring or treats it as close to the source as possible. In 2011, the Green Infrastructure Roundtable, a collection of partners working closely with DEC, defined GSI as "systems and practices that restore and maintain natural hydrologic processes in order to reduce the volume and water quality impacts of the built environment while providing multiple societal benefits." In 2015, DEC is developing terms of a cooperative agreement and partnership with the University of Vermont Sea Grant Program to enhance green infrastructure technical assistance within the Lake Champlain basin.

GSI provides multiple benefits and functions such as reduced and delayed stormwater flows, enhanced groundwater recharge, stormwater pollutant reductions, reduced sewer overflows, urban heat island mitigation, improved air quality, additional wildlife habitat and recreational space, improved human health, and increased land values. GSI can be used at many spatial scales, ranging from an individual site to an entire watershed. Since 2009 and under a [2012 Executive Order](#) issued by the Vermont Governor, awareness and deployment of GSI and low impact development techniques have been embraced by four State of Vermont agencies (Natural Resources, Transportation, Commerce and Community Development, Buildings and General Services). As noted above, DEC is incorporating low impact development practices and techniques – an organic component of GSI - into the revised State Stormwater Management Manual.

#### ILLICIT DISCHARGE & DETECTION ELIMINATION (IDDE)

In 2000, the Vermont Legislature required DEC 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 all the communities in the greater Burlington area required to perform IDDE in compliance with the EPA's Phase II Stormwater Rule to encompass all developed areas of Vermont. Following the legislature's mandate, DEC has assisted municipalities not subject to the Phase II Stormwater Rule by mapping drainage systems and performing IDDE activities. This work has been completed for all major municipalities in the Missisquoi, Lamoille and Winooski River basins (outside the greater Burlington area) and in the three largest Connecticut River basin towns (Brattleboro, Springfield, St. Johnsbury). Work is presently on-going in the Otter Creek basin.

The stormwater infrastructure mapping is meant to provide an overall picture and understanding of the connectedness of the storm system on both public and private properties and raise awareness of the need for regular maintenance. The generation and transport of NPS pollution, including nutrients, increases with increasing connectivity of the drainage system. 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(s).

Another benefit of mapping the stormwater system is the potential to address untreated stormwater discharges. This work 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 ordinances or enhance existing locally based stormwater management programs.

The primary goal of this IDDE effort, after the elimination of discovered illicit discharges, is to develop up-to-date municipal drainage maps identifying NPS stormwater pathways from impervious areas via transport devices to the ultimate outfalls. The second goal is to establish potential locations for stormwater BMP retrofit sites. These are sites where stormwater treatment structures could be added in the most cost effective and efficient manner resulting in

sediment and nutrient removal. Delineated drainage areas have been prioritized based on the relative amounts of NPS sediment and nitrogen each could potentially produce.

### ***Regulated Stormwater Runoff under Clean Water Act***

#### **MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4)**

As of June 2014, there are 12 communities and 3 non-traditional entities designated as municipal separate storm sewer systems (MS4) within Vermont. All designated MS4 entities are found within watersheds draining to Lake Champlain. Under the MS4 permitting program, permittees are required to develop a stormwater management program that includes six Minimum Control Measures (MCM) designed to reduce the potential for pollutants to enter the MS4 system and discharge to surface waters. The six MCMs include public education and outreach, public participation/involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control, and pollution prevention/good housekeeping. The regulated MS4s submit annual reports detailing their progress on MCM implementation.

In addition, 14 of the 15 regulated MS4s discharge to waters impaired by stormwater and are also required to develop Flow Restoration Plans to implement the hydrology-based stormwater TMDLs. The extensive deployment of stormwater management infrastructure associated with this requirement will contribute substantially to phosphorus reduction in Lake Champlain. Further, regulated MS4 municipalities are required to track phosphorus reductions associated with the deployment of BMPs.

#### **MULTI-SECTOR GENERAL PERMIT (MSGP)**

The Multi-Sector General Permit (MSGP) 3-9003, originally issued in 2006, addresses stormwater runoff associated with industrial facilities, and is a requirement of the federal Clean Water Act. In Vermont, DEC 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 for specific pollutants, 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 pollutant(s) in the discharge.

#### **CONSTRUCTION STORMWATER PERMIT (CSP)**

The Construction Stormwater Permit (CSP), originally issued in 1997, addresses stormwater runoff from earth disturbance activity involving one or more acres of land and is a requirement of the federal Clean Water Act. DEC is delegated to issue these permits. In general, compliance with the CSP requires the development of an erosion prevention and sediment control plan. The goals of each CSP-based plan is to minimize the erosion of disturbed land and soils and to minimize or eliminate the discharge of sediment through the implementation of appropriate erosion prevention and sediment control measures. There are currently about 800 active Construction Stormwater Permits.

### RESIDUAL DESIGNATION AUTHORITY (RDA)

In 2009, DEC issued a NPDES general permit for stormwater “residually designated discharges” pursuant to delegated authority within the federal Clean Water Act. The RDA General Permit 3-9030 covered certain designated discharges not covered by the MS4 permit in five of the urban stormwater impaired streams located in Chittenden County. Properties were designated and issued a general permit under RDA if their impervious surface discharged directly to a stormwater impaired stream. Seventy-eight designated properties were divided into three categories. First, 53 properties without a previously issued state stormwater permit and less than one acre of impervious surface were directed to implement DEC’s *Small Sites Guide* which includes good housekeeping and low impact development practices. Second, 5 properties without a previously issued state stormwater permit and more than one acre of impervious had to complete a site assessment, gathering information on current site conditions to be used in the development of site specific flow restoration plans (FRPs). Third, 20 sites with previously issued state stormwater permits were required to conduct an Engineering Feasibility Analysis (EFA) to upgrade their existing stormwater treatment practices. The EFA directs affected property owners to infiltrate or detain the 1-year design storm which will reduce phosphorus as well as benefit runoff flows. DEC plans on expanding the RDA permit to the remaining urban stormwater impaired waters in the near future in order to assist with implementation of the TMDL for Lake Champlain.

Managing stormwater, stormwater runoff discharges and associated pollutants within designated MS4 areas and under MSGP, CSP and RDA provisions as noted in the paragraphs above are all considered to be point sources of pollution. Consequently, each of these affected stormwater related programs is considered to be outside the scope of the Vermont NPS Management Program. Nonetheless, Vermont does issue state permits for runoff from developed lands and lands undergoing development. As these state permits are issued for NPS pollution, they are considered to be vital and important components of the Vermont NPS Management Program.

### Rivers Program

The goal of DEC’s Rivers Program is to resolve conflicts between human investments and the dynamics of rivers in an environmentally and economically sustainable manner. The Program supports and implements channel assessment and channel management practices that recognize the functions and value of floodplains, conservation flows, and streams in their equilibrium condition. The Program provides regulatory review and technical assistance for protection, management, and restoration projects that affect the flow and physical nature of streams and rivers. The objective is to guide and encourage projects that provide increased property and infrastructure protection and maintain or restore the ecological functions, economic values, and restorative processes of river and floodplain systems.

Since 2010, four separate legislative acts have focused on stream stability and floodplain function having goals of reducing Vermont’s vulnerability to flood and fluvial erosion hazards and improving water quality. Vermont laws establish stream equilibrium and river corridor protection as explicit management objectives. These relatively new public policies have put DEC

and its Rivers Program in the vanguard of implementing an avoidance-centric approach to watershed restoration by protecting floodplain and riparian features where natural fluvial process enhances and sustains water, sediment and nutrient storage.

The aftermath and recovery from Tropical Storm Irene in 2011 and 2012 (and even years more recent) reminded everyone that unregulated, post-flood channel management can erase decades of progress in restoring stream equilibrium. Consequently, Act 138 (2012) gave municipalities the authority to conduct in-stream emergency protective measures as long as they were consistent with rules established by ANR. State policies focused on flood hazard mitigation now address stream erosion.

The three major sub-programs within DEC's Rivers Program that manage rivers, river corridors and floodplains, thereby indirectly reducing or avoiding NPS impacts are described in brief below.

### ***River Management***

The River Management Program provides regulatory review and technical assistance to landowners, municipalities, non-governmental organizations and other agencies to help determine the appropriate river/stream channel management practices necessary to resolve and avoid conflicts with river systems. The practices selected are designed to recognize and accommodate the stream's natural stable tendencies (aka equilibrium conditions). Conflicts are resolved with the recognition of a stream's long-term physical response to past and proposed management practices. The resulting work is intended to provide increased property and infrastructure protection and to maintain or enhance the ecological functions, economic values, and restorative processes of the river system. Regulation and permitting is conducted pursuant to 10 V.S.A., Chapters 41 and 32 and Section 401 of the Clean Water Act.

Stream Alteration Rules and a General Permit have been adopted that establish first-in-the-nation equilibrium and connectivity standards<sup>6</sup> and which regulate next-flood and emergency protective measures. This new regulatory program is supported by the publication and ongoing refinement of standard river management principles and practices to maximize equilibrium conditions when managing conflicts between human activities (encroachments) and the dynamic nature of rivers.

Program staff are experienced in river dynamics, conflict resolution, and the environmental damage and human suffering that occur when projects fail during floods. It is their day-to-day field exposure to Vermont river systems and the communities and their inhabitants that live along them that has created accountability back and forth between the service provider and the communities they serve and toward sustainable relationships at larger natural and economic scales. The number of stream alteration permits issued in a year is a small fraction of the field visits and face-to-face technical assistance provided to help project proponents

---

<sup>6</sup> To meet the equilibrium and connectivity standards, a proposed project shall not: (a) result in conditions that cause or perpetuate the un-natural raising or lowering of the channel's bed elevation or (b) create a significant disconnect in the stream bed, banks or floodplain that will cause damage related to erosion or deposition in the stream or create a barrier to the movement of aquatic biota.

understand the eventual river response and the risks they create to the environment, themselves, and their neighbors. On average, Vermont has experienced a flood disaster every year for the past twenty years and a major regional-scale (>100 year) flood every 15 years. The River Management Engineers work with local officials in putting things back together after a flood disaster.

### ***Streamflow Protection***

Within the River Management Program, the goal of the Streamflow Protection Program is to maintain river or stream flows necessary to protect aquatic habitat and stream ecology. In addition to minimum flows, the Program addresses the timing, frequency, duration and magnitude of both high and low flow events and their influence on the physical and biological attributes of a stream or river. From a regulatory standpoint, this Program issues Section 401 water quality certifications to moderate or cease streamflow and reservoir level fluctuations, including those associated with hydroelectric projects and other dams. In their extremes, peaking operations at hydropower stations result in rapid increases in downstream discharges in river reaches which are vulnerable to erosion under higher velocity flows. Large daily to seasonal decreases in reservoir water levels may result in the erosion of saturated shoreline soils. The Program considers these NPS impacts and seeks flow regimes that maximize the stability of stream banks and shorelines.

Program staff partner with the State Public Service Department and have developed guidance for small hydro power developers. Providing this guidance is important at a time when there are numerous incentives or drivers for small scale, independent, non-carbon burning power production. These projects may result in the same type of bed and bank erosion as larger dams or diversions. The Program also works with DEC's Lakes Program providing technical assistance to lakeshore property owners concerned about water level fluctuations, shoreline erosion and effects on near shore aquatic habitat. In addition, the Program has partnered with non-governmental organizations (NGO) to develop guidance for project managers of dam removal projects. Appendix C provides information on dam removals that have been completed or that are underway.

Dam inventory data, maintained by the Program, is used to support DEC's tactical river basin planning process. The Program has supported efforts to assess, design and find the funding for numerous restoration projects identified under river basin planning and from the work of the Dam Task Force, a group of NGOs and state and federal partners. Each year the Program identifies priority stream sections where flow studies are completed to determine compliance with flow criteria in the Vermont WQS. These studies are primarily done below unlicensed hydro power projects and to determine necessary remediation actions.

### ***River Corridor & Floodplain Protection***

This Program has established state floodplain rules that set a high standards of “no adverse impact” (NAI)<sup>7</sup> in floodplains and river corridors and address all developments exempt from municipal regulation, including state buildings and transportation facilities, utility projects and agricultural structures. Flood Hazard Area and River Corridor Protection Procedures have also been adopted by DEC to guide the regulation of developments under Act 250 and Section 248; establish map amendment and revision procedures; and, river corridor BMPs (e.g. establishment and maintenance of riparian buffers).

Under an annual cooperative agreement with the Federal Emergency Management Agency (FEMA), DEC provides technical support to 242 Vermont communities enrolled in the National Flood Insurance Program (NFIP). The River Corridor and Floodplain Management Program provides technical assistance, education and outreach on floodplain management, flood hazard mapping and flood insurance. In addition, the Program is required to conduct community compliance reviews and serve in a liaison capacity on FEMA enforcement actions. The Program provides floodway determinations to Act 250 District Commissions and the Public Service Board. Program staff provide river corridor and floodplain development reviews for municipal permits in accordance 24 VSA Chap.117, Section 4424. Technical assistance is available to communities wishing to better protect river corridors from potential encroachments that will cause conflicts with stable channel functions and potentially increase future flood and fluvial erosion damages. In addition, the Program provides support to the Vermont Division of Emergency Management and Homeland Security, communities, watershed associations, Regional Planning Commissions and individuals to help plan for, design and implement flood hazard avoidance, reduction, mitigation and recovery planning and projects, all of which are significant components to an effective NPS Management Program.

The Program also provides technical assistance through a “Flood Ready” web page which provides a wide array of planning and implementation tools to increase municipal adoption of enhanced floodplain, river corridor and riparian buffer protection bylaws and other mitigation measures to minimize flood and erosion risks and maximize floodplain function. The web page has promoted cross agency flood resiliency planning as per Act 16 (2011) by offering peer-to-peer learning and community progress “barometers.”

As required by Act 138 (2012), a Flood Resilient Communities Program has been established to create funding and technical assistance incentives for municipalities to adopt regulations for floodplains, river corridors and riparian buffers. The Vermont Emergency Relief and Assistance Fund (ERAF) increases the state cost share of meeting recovery costs in towns where enhanced bylaws have been adopted.

Program engineers, floodplain managers and scientists provide technical assistance and state funding, and use FEMA flood hazard and pre-disaster mitigation grants to assist non-government entities and municipalities with planning and implementation of flood and erosion

---

<sup>7</sup> To meet NAI standard, a proposed project shall not: (a) be located within a river corridor, (b) decrease storage capacity within FEMA designated flood hazard area without providing compensatory storage to offset impacts or (c) increase flood elevations or velocities for adjacent landowners.

hazard mitigation projects. Mitigation projects and the Program's assistance are increasingly used as leverage to get landowners and communities involved in greater river corridor and floodplain protection. FEMA pre-disaster mitigation planning funds in Vermont are also be used to help communities develop strategic hazard mitigation plans to restore, remove, or retrofit infrastructure likely to become damaged during or after floods. Recent Stafford Act amendments (44 CFR Part 201.6) required local governments to adopt Hazard Mitigation Plans in order to retain eligibility for certain FEMA grant programs. The State Hazard Mitigation Plan and 12 Regional (multi-jurisdictional) Hazard Mitigation Plans all set high priority on mitigation and avoidance of fluvial erosion hazards through river corridor protection. In this way, hazard mitigation planning is complementary to NPS management and water quality objectives and can be a powerful local planning tool.

As of January 2015, a statewide river corridor map layer has been completed providing a detailed corridor for every stream in Vermont over 2 square miles (or 1,280 acres) in drainage area. The publication of a statewide layer has created a level playing field with respect to implementing regulations and promoting incentives. Nonetheless, the Program's extensive stream geomorphic data and river corridor planning outputs have not been attributed to the statewide layer which limits the ability to identify strategic protection and restoration projects.

A River Corridor Easement Program has been established to conserve river reaches identified as high priority sediment and nutrient attenuation areas. The purpose of river corridor conservation easements is to allow rivers or river segments to re-establish a natural slope, meander pattern and access to floodplains in order to provide flood inundation and fluvial erosion hazard mitigation benefits, improve water quality through hydrologic, sediment and nutrient attenuation, and protect riparian habitats and the natural processes which form them. The opportunity to purchase and sell river corridor easements was created to augment state and municipal fluvial erosion hazard zoning which, once adopted, avoids future encroachment and flood damage but does not restrict 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. Easements associated with agricultural areas likely represent considerable potential for avoiding or minimizing flood damages and preventing or lowering the export of NPS pollutants.

### [Ecosystem Restoration](#)

The original Center for Clean and Clear was established in 2002 to enhance Vermont's commitment to improve water quality in Lake Champlain. The Center for Clean and Clear brought together resources dedicated to improving water quality that were previously spread among many state programs. In 2008, the Center for Clean and Clear was re-structured and became part of DEC's Watershed Management Division to be known as the Ecosystem Restoration Program (ERP). As described in Chapter 6 above, ERP plays a prominent NPS management role by guiding the award of water quality grants and contracts to municipalities, watershed organizations, natural resource conservation districts, regional planning commissions and other partners across Vermont. As part of ERP's ongoing efforts to reduce

impacts to surface water from NPS pollution, the state budget has included capital funds to support ecosystem restoration projects.

### *Wetlands Protection*

Wetlands are natural landscape based regulators of storm event runoff which temporarily store storm water volumes and then slowly release waters downstream. While water from storms is being stored in wetlands, sediments and nutrients can settle out and become retained. As much as 80 to 90% of sediments in water may be removed while moving through natural wetlands, resulting in cleaner water. Wetlands are one of the most important micro-topographic features abating NPS nutrients across a watershed. Between 1780 and 1980, it is believed that Vermont lost over 35% of its natural wetlands, subsequently losing many place-based opportunities for pollutant removal. The potential increase in sediment and nutrient retention (phosphorus) from restoring the natural hydrology of many of these lost wetlands would result in substantial water quality improvement for many waters in Vermont.

DEC's Vermont Wetlands Program is responsible for identifying and protecting wetlands which provide significant functions and values for the people of Vermont. Wetlands function as water quality protection, flood storage, wildlife habitat, erosion control, and have recreational value. The goal of the Program is to achieve no net loss of significant wetlands or wetland function through regulatory and non-regulatory means. This goal is mainly achieved by assisting the Vermont public and professional community in avoiding impacts to wetlands and wetland buffers through personal contact with Program ecologists. The number of wetland permits issued in a year is a small fraction of the field visits and face-to-face technical assistance provided to help effectively avoid and minimize wetland impacts.

### *Water Quality Management Planning*

As described in Chapter 6 above, a wide variety of State programs are in place to plan, prevent, avoid or reduce impacts from NPS pollution to Vermont's surface and groundwaters. Chapter 6 includes detailed information about tactical river basin plans, source water protection plans and EPA required watershed-based plans.

### *Lake Shoreland Management*

Development on or along lake shorelands is one of the densest forms of residential development found occurring in Vermont. Studies in Vermont have shown the majority of shoreland development includes the removal of most of the natural vegetation from the shore or near shore area. Recently enacted state legislation has enabled DEC to create regulations on shoreland development that provide for retention of natural vegetation and avoiding or controlling NPS runoff from sites being developed. Prior to the new state legislation, only about 20% of Vermont towns had local regulations which provided only minimal shoreland protection and only 2.5% (10 towns) had municipal regulations which ANR considered as providing sufficient shoreland protection (e.g. a vegetated buffer width of 100 feet).

DEC will continue to provide technical assistance to towns wishing to improve lake protection by effective shoreland management through the town zoning process. For many years DEC staff provided model bylaws, information, technical review, workshops and meetings with planning

commissions, select boards and RPCs to inform and encourage towns to adopt effective shoreland management measures. Dating back to 2004, DEC began funding a position at the Vermont League of Cities and Towns (VLCT) to provide assistance to towns on a variety of municipal measures that reduce flood damage and NPS pollution impacts, including shoreland ordinance review and assistance. In light of program history and the new state legislation, DEC will continue to work closely with VLCT to review and develop model standards for shoreland management as needed.

“[Lake Wise](#)” is a new addition to DEC’s lake shoreland management effort that provides outreach and technical assistance methods directed towards management of vegetation and runoff near lake shores. Launched in summer 2013, the Program provides on-site review of shoreland conditions and recommendations for lessening the impact of existing near shore development. Previously, handouts, workshops and technical assistance were available to the public, and the Lake Wise Program improves on these efforts by updating and consolidating web-based and written information. More importantly, the Program is designed to recognize and reward good shoreland management by providing landowners with a sign to post on their property indicating they are “Lake Wise.” Landowners wishing to retrofit their property into one that meets Lake Wise standards are given a list of BMPs that can be easily implemented. Participation is tracked and a cumulative benefit of the program in terms of improved property management will be calculated.

As part of promoting good shoreland management and the value of a well-vegetated shore in flood resilience and protection of aquatic habitat, DEC supports and encourages the use of vegetated stabilization means whenever technically feasible over those means that are primarily hardened (ie rock) or structural. “*The Shoreline Stabilization Handbook*” prepared by the Northwest RPC in 2003 is considered to be the source about stabilization approaches and designs.<sup>8</sup> Since the Lake Champlain basin floods of 2011, DEC has funded a grants program managed by the RPC to promote and demonstrate vegetated stabilization measures.

### **[Nuisance Aquatic Species Management](#)**

DEC’s Watershed Management Division coordinates a range of management activities associated with aquatic invasive and nuisance species. Aquatic invasive species, are viewed as those non-native species whose introduction can cause environmental or economic harm or harm to human health. Nuisance species are native species that reach proportions of abundance that may cause economic harm or harm to human health. The overland movement of boats, personal watercraft, fishing gear, and other water-based equipment is a significant means by which aquatic invasive species “hitch a ride” between waterbodies making the transport of aquatic plants, zebra mussels and quagga mussels illegal within Vermont. Aquatic invasive and nuisance species are considered to be significant forms of NPS pollution and program and management efforts are summarized below. Appendices D and E identify the many waters altered or threatened by aquatic invasive species, respectively.

---

<sup>8</sup> The Handbook can be inspected at:  
<http://www.nrpcvt.com/Publications/Reports/NaturalResourcesWaterQuality/ShorelineHandbook.pdf>

Residents and visitors to Vermont learn and become informed about aquatic invasive species through a variety of educational materials including pamphlets and newsletters, slide shows, identification posters, metal boater warning signs, web pages and public meetings. Technical assistance on aquatic invasive and nuisance species identification and control is provided to towns, waterbody associations, and other interested groups. Demonstration projects have been implemented on a number of Vermont lakes to evaluate new control methods and to refine established techniques.

Surveys, undertaken to assess the type and spatial extent of aquatic plants growing in a waterbody, are regularly conducted to monitor existing plant growth and to detect newly introduced invasive plant populations. The Vermont Invasive Patrollers Program is a citizen-based, early detection program that trains volunteers to help DEC search waterbodies for new aquatic invasive species infestations. A network of trained public access 'greeters' offer visual inspections of boats and associated equipment to locate and remove any plant material or animals, and educate water users on the importance of spread prevention and appropriate spread prevention techniques.

Financial assistance is available through DEC's Aquatic Nuisance Control Grant-in-Aid program. Grants are made available on a competitive basis to municipalities for qualified applicants to implement restoration, management, or protection projects.

### *Hazardous & Solid Waste Management*

DEC's Waste Management and Prevention Division oversees the use, treatment and handling of hazardous and solid wastes. The Division performs emergency response for hazardous materials spills, issues permits for federal and state programs regulating hazardous wastes, solid wastes and underground storage tanks, and manages clean up and restoration at hazardous sites and former industrial sites known as 'brownfields' under state and federal authorities, including the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA, also known as Superfund).

The generation, transportation, storage, treatment, recycling and disposal of hazardous waste, used oil, and universal hazardous waste are regulated by and the responsibilities of the Hazardous Waste Management Program within the Division. The program, which is authorized by EPA to be implemented in lieu of the federal hazardous waste program, maintains the Vermont Hazardous Waste Management Regulations (VHWMR). The program also conducts inspections to evaluate compliance with the VHWMR; tracks hazardous waste manifests (shipping papers) to ensure all hazardous wastes are delivered to appropriate facilities; issues permits to facilities that engage in long-term or commercial storage and facilities that treat or dispose of hazardous waste; responds to citizens' complaints regarding the mismanagement of hazardous waste; provides regulatory assistance; and tracks hazardous waste data.

The Solid Waste Program within the Division oversees laws, rules, policies, and planning related to solid waste management in the state. The Program regulates solid waste management facilities and activities and certifies the state's landfills, transfer stations, haulers, composting,

and recycling facilities. The Program also provides solid waste technical and financial assistance to towns and the 16 solid waste districts and ensures remediation of illegal disposal sites. In an effort to move from solid waste management to sustainable materials management, the statewide Materials Management Plan (MMP) was amended in 2014 and significantly updates and improves the previous solid waste management plan which was re-adopted in 2006. The 2014 Plan is based on five material specific chapters (recyclables, organics, construction/demolition materials, septage/sludge/residual waste, household hazardous/electronics/universal waste) and a chapter addressing general materials waste planning needs. Each plan chapter contains tools of action, state goals, and performance standards. The state goals and performance standards establish deliverables for the planning period that includes reporting, outreach and education, and convenience requirements.

### *Underground Injection Control (UIC) Program*

In 2014, DEC completed the rulemaking process for amending the UIC Rules which are rules regulating the discharge of wastes into any subsurface disposal system. Vermont administers the UIC Program by authorization from the federal government which created the program nationally under the Safe Drinking Water Act.

The amended Rules replace the original UIC Rules which were adopted more than 30 years ago. Historically, the definition for a “injection well” (essentially a hole in the ground) and wastes (including stormwater) were very vague and the earlier version of Vermont’s UIC Rule attempted to be inclusive of any activity that fell under these broad definitions. The result was a program which was inundated by low risk discharges to groundwater which bottle-necked the permitting process and resulted in a serious permitting backlog with no clear operational focus.

According to EPA’s definition, there are six classes of injection wells. Classes I, II, III are generally very deep, high-technology type wells used for the disposal of hazardous and radioactive wastes or enhancement of oil and gas and mineral recovery through a process known as ‘hydrofracking.’ These types of wells do not exist in Vermont and are banned under the 2014 amended UIC Rule. Class IV wells, which involve the shallow injection of hazardous wastes, are only allowed in Vermont in conjunction with a groundwater remediation effort under State supervision. Class VI wells, which potentially involve the injection of carbon dioxide into deep geologic formations, do not currently exist in Vermont and, for the foreseeable future, are not expected to be proposed.

Class V wells are defined by EPA as any well which does not fall into the category of Class I, II, III, IV, or VI. These are typically shallow disposal systems which may pose a risk of groundwater contamination. Class V wells which pose a high risk to the quality of groundwater are now banned in Vermont under the 2014 amended UIC Rule. Examples include discharges to groundwater from vehicle maintenance activities, from gas stations and other fuel distribution locations, from locations where hazardous materials are stored, from salt storage locations, and from photo finishing operations. The UIC Program will be collaborating with other State programs and property owners to ensure proper closure of each prohibited injection well and eliminate ongoing potential sources of groundwater contamination.

The 2014 UIC Rule clearly identifies those activities that pose a moderate risk to groundwater quality and that require a permit such but not limited to the listed industrial processes, boiler blowdown waste and mineral processing wastes. Some activities may be conditionally exempt from permitting (e.g. certain water treatment system backwash systems, geothermal extraction wells, some mining wastes). In addition to clarifying what needs a permit and what doesn't, the new UIC Rule provides technical standards that will need to be applied to permitted activities. A better understanding of risks and requirements will improve management of the State's groundwater resource.

Finally, the new 2014 UIC Rule eliminates permit redundancy by not requiring UIC Permits for injection wells or injection-type activities that are subject to management and regulation under other ANR or DEC permitting programs. This includes, but is not limited to solid waste facilities, indirect discharge systems, stormwater systems and wastewater systems.

### *Pollution Prevention Program*

Pollution prevention has become the preferred environmental management strategy for both businesses and government. The prevention of waste at the source before it is created and substitution of non-toxic materials, where possible, benefits the environment and the budgets of businesses and government. In 1991, the Vermont Legislature passed the state's pollution prevention planning law. The law requires businesses that generate greater than 2,640 pounds per year of hazardous waste or certain manufacturers (SIC Codes 20-39) that use 1,000 pounds or more per year of certain toxic chemicals on EPA's Toxic Release Inventory to prepare plans to reduce the generation and/or use of these materials.

The purpose of pollution prevention planning is to identify opportunities to reduce or eliminate the generation of hazardous waste and the use of toxic chemicals at the source rather than treating or controlling these materials after they have been created or used. Vermont's Pollution Prevention Planning law requires businesses that exceed certain thresholds to complete pollution prevention plans, submit annual progress reports that describe progress made toward reduction goals established in the plan, and to submit annual fees. DEC's Pollution Prevention Program has prepared a series worksheets with instructions to assist businesses that are subject to the law with the development of a pollution prevention plan.

### *On-Site Wastewater*

Beginning July 2007, every parcel of land found within Vermont came under the authority of the State's on-site wastewater and potable water supply system program. As a result of this change, a state permit is needed for most repairs, upgrades and new construction of on-site wastewater treatment and disposal facilities, on-site potable water supplies, and connections to municipal water distribution and wastewater collection systems.

DEC's Drinking Water and Groundwater Protection Division issues wastewater permits for soil based wastewater systems with flows of less than 6,500 gallons per day. Wastewater system permits are issued under the Wastewater System and Potable Water Supply Rules (2007). Permitting staff are located in four regional offices. Program staff also review innovative and alternative wastewater systems for potential use in Vermont.

Municipalities may elect to receive delegation to issue wastewater permits in addition to enforcing the State regulations for the wastewater and potable water systems. A municipality must request and receive delegation of the State permit program from DEC to take on this responsibility. Municipalities that receive delegation of the state permit program must administer all aspects in accordance with the Wastewater System and Potable Water Supply Rules. Municipalities that have, to date, received delegation for wastewater and water supply permitting are Charlotte and Colchester.

The Division also administers the Indirect Discharge Rules (IDR) which contain requirements for permitting land-based, sewage disposal facilities with design flows greater than 6,499 gallons per day. The IDRs require a certified operator for all wastewater treatment facilities other than septic tank/leachfield systems. The wastewater treatment facility operator and assistant operator must possess a current wastewater treatment plant operator's certificate for the correct grade based on the system. Holders of indirect discharge permits are required to have their sewage treatment and disposal systems inspected by a Vermont registered professional engineer on an annual basis.

The IDRs also contain requirements for permitting the land-based disposal of non-sewage wastes such as those resulting from dairy or food processing activities. The Rules require a certified operator for the land application of food processing wastes where wastes are spread directly onto farm fields. A certified operator, however, is not required for disposal of food processing wastes into farm digesters or farm manure pits.

### *Residuals Management*

The residuals management section found within DEC's Watershed Management Division oversees the management of residuals, such as septage and wastewater sludge (aka biosolids). Although septage and biosolids are byproducts of wastewater treatment, these wastes are regulated in Vermont as solid wastes and as such fall within the purview of the Solid Waste Management Rules. The Rules provide for three main options available for managing these wastes which include: treatment followed by use on the land, landfilling or incineration.

The residuals management section has also produced guidelines intended to provide a summary of the technical elements necessary for the proper management of diffuse disposal of sludges and other biosolid wastes on the land surface. These wastes can include wastewater treatment plant sludges, septage, wood ash, sludges resulting from the production of paper and sludges resulting from the treatment of food wastes.

DEC-approved Sludge Management Plans or Solid Waste Management Certifications are required for all domestic wastewater treatment plants that generate biosolids. Certifications are required for land application sites where either septage or biosolids are managed. Commercial hauler permits are required for commercial vehicles having a rated capacity greater than one ton used to transport these wastes.

### Transportation Runoff Management

A major Vermont land use segment within the developed lands category with regards to potential NPS pollutant runoff and export is that associated with the transportation sector. There are over 14,000 miles of public roads across Vermont, nearly all of which require conveyances such as ditches and culverts for drainage. Approximately 80% of these road miles are maintained by Vermont municipalities (most of which are unpaved gravel or unimproved roads) where it is believed that a significant percentage of these municipal roads need one or more forms of NPS sediment and erosion control improvement. If these structures are not properly constructed and maintained, there is significant potential for erosion of sediment and associated nutrients into the drainage network and adjoining streams and eventually into larger receiving waters. Water quality improvement and protection has become a major NPS focus in recent years as it relates to the roads network generally and to BMP implementation and project development specifically.

Vermont Transportation Agency (VTrans) is strengthening its stormwater runoff programs, building partnerships to improve water quality throughout the state, and making water quality protection fundamental to the Agency's business. In addition to increased staffing and financial investments, several new programs, highlighted below, have helped to achieve a number of environmental improvements:

- Providing 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.
- Partnerships with ANR, municipalities and watershed groups aimed at implementing water quality enhancement projects across the state. Keeping waters from becoming impaired or regulated under TMDL or MS4 programs avoids costs. In addition, certain federal grant funds are not available for permit compliance.
- Maintaining stormwater infrastructure such as street sweeping, catch basin cleaning, culverts, ditches and side slopes that serves as a model for municipal public works' efforts. These activities use a thoughtful and evolving set of BMPs.
- VTrans regulates "drain on" activities into the State right-of-way, within its authority under Title 19 Section 1111, requiring proposed dischargers to treat stormwater prior to discharging into the right-of-way. Furthermore, the Agency prohibits the illegal connection or illicit (non-stormwater) discharge to its right-of-way statewide. Examples include working with ANR 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 and a roadway reconstruction project in Johnson 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 DEC's Watershed Management Division staff meet on a monthly or biweekly basis to stay abreast of emerging regulatory issues, research, planning and other topics.

### *Vermont Better Back Roads Program*

The Better Backroads Program, established in 1997, has been a long-standing partnership between the Vermont Local Roads Program, VTrans, DEC, and up until 2012, the Northern Vermont Resource Conservation and Development Council (RC&D). The program which had formerly been administered by the RC&D is now managed by VTrans.

The Vermont Better Backroads Program, targeted at NPS runoff from unpaved gravel roads found throughout the State, provides grants and technical assistance to towns to correct erosion problems and adopt road maintenance and runoff control BMPs 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 properly fix a chronic NPS erosion problem (such as rock-lining 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 Program is to enable and encourage towns to adopt and maintain BMPs in road maintenance and repairs and institutionalize these practices into town capital budget priorities.

The Program offers improved infrastructure and maintenance practices for proper road crowning and turn-outs, eroding ditches, unstable culvert inlets or outlets and eroding roadside banks all of which can also help prevent flash flood damage during heavy or prolonged rain events. Program grants are provided for two 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.

### *Agricultural Runoff Management*

Sources of agricultural NPS pollution are responsible for a variety of sediment, nutrient, pathogen and temperature related problems and threats to surface waters throughout Vermont. Agricultural NPS pollution has been responsible for several incidences of groundwater contamination. Water quality management efforts in this sector have the potential for significant reductions as well as prevention of NPS pollutant export. The agricultural programs described below (with one exception) are administered by the Vermont Agency of Agriculture, Food and Markets (AAFV) and play an important role in the overall management of NPS pollution, with a particular focus on sediment, nutrients and pathogens and to a lesser but significant extent on temperature and organic matter. The NPS management programs noted below provide varying degrees of pollutant control or prevention but overall and in conjunction with one another, they provide significant sediment and nutrient management.

### ***Accepted Agricultural Practices (AAP) Rules***

AAPs provide the base level of water pollution management required for all farms in Vermont regardless of type, size or location. The AAP rules are considered to be readily observable, easy to implement and low-cost solutions for addressing water resource concerns. The AAPs are intended to reduce nonpoint pollutant discharges through implementation of improved farming techniques rather than requirements which rely on costly investments in structures and equipment. State law requires these practices must be technically feasible as well as cost effective for farmers to implement without governmental financial assistance. Consistent with an agricultural NPS memorandum of understanding (April 1993) between DEC and AAFM, the AAPs are enforced by AAFM on a complaint driven system. Importantly, substantial revisions to the AAPs will become effective by July 2016.

### ***Medium Farm Operations (MFO) Program***

All dairies with 200 to 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 state-issued General Permit. 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. AAP provisions still apply unless made more restrictive by terms of the General Permit. Currently, AAFM indicates there are 142 MFOs found within Vermont involving about 100,000 acres of cropland.<sup>9</sup>

### ***Large Farm Operations (LFO) Program***

An individual state issued permit for farms with more than 700 mature dairy cows, 1,000 beef cattle or cow/calf pairs, 1,000 young stock or heifers, 500 horses, 55,000 turkeys, or 82,000 laying hens. 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 and specific to each large farm and also regulate odor, noise, traffic, insects, flies, and other pests. If a LFO falls within the CAFO permit coverage, a CAFO permit will still be required. At present, there are 27 LFOs within Vermont involving about 50,837 acres of cropland.<sup>10</sup> Nineteen LFOs are located in the Lake Champlain drainage, 4 LFOs are within the Connecticut River drainage and 4 LFOs are in the Lake Memphremagog drainage.

### ***Concentrated Animal Feeding Operation (CAFO) Permits***

The Vermont CAFO general permit has been in effect since June 2013 and is administered by DEC. The Vermont CAFO permit meets requirements under the NPDES permit program which has been delegated by EPA to DEC. While the permit is not pollutant specific, any farm that discharges to a surface waterbody can be required to obtain a permit. Each issued CAFO permit requires farms to properly design, construct, operate, and maintain production areas to control

---

<sup>9</sup> Total consists of 132 dairy, 5 young stock, 2 beef, 1 chicken-eggs, 1 chicken-broilers, 1 turkey. There are 104 MFOs are located within the Lake Champlain basin.

<sup>10</sup> Total consists of these operations types: 25 dairy, 1 young stock, 1 beef.

waste and to develop and implement a nutrient management plan. The permit prohibits a discharge of manure, litter, or wastewater, except when direct precipitation equivalent to or greater than a 25-year, 24-hour storm event causes a discharge. At present, there is no farm within Vermont regulated by a CAFO permit. Farms operating under a CAFO permit would no longer be considered to be a nonpoint source of pollution and are, therefore, outside the scope of the Vermont NPS Management Program.

### ***Best Management Practices (BMP) Program***

Provides state funded cost share payments for voluntary installation of conservation practices to address water resource concerns. Commonly funded production area practices include waste storage facilities, silage leachate systems, milkhouse waste systems, and barnyard runoff collection, most of which are expensive and would not be affordable without financial support. 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, AAFM 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.

The program identifies farms that present a risk to water quality arising from a determination that current infrastructure and practices are insufficient when addressing risk. BMPs must be constructed in a manner that meets the federal Water Pollution Control Act and state water quality standards. Prior to 2015, Vermont statute required AAFM to determine sufficient funding was available before requiring one or more BMPs. Changes in statute (arising out of Act 64 of 2015) stipulates that when BMPs are required, the farmer will be made aware of all available resources and it continues to be a goal of AAFM to prioritize available funding where a water quality impact has been identified.

### ***Conservation Reserve Enhancement Program (CREP)***

In partnership with USDA, this program encourages the voluntary installation of conservation buffers along waterways by providing agricultural landowners with a yearly rental payment and by covering the cost of buffer planting. Additionally, CREP covers the cost of installing fencing and livestock watering systems where animals on pasture are excluded from waterways. Contracts are either 10, 15 or 30 years in length and payment is dependent upon past land use and buffer composition (trees or grasses). Minimum buffer widths are 25 feet for grass and 35 feet for treed 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. At present and dating back to the first year of the program in 2002, there are about 2,760 acres throughout Vermont that are enrolled under CREP. About 63% of the enrolled land (1,750 acres) is located within Addison County or Franklin County.

### ***Farm Agronomic Practices Program (FAPP)***

This program provides farms with state financial assistance (up to \$5,000 per farm per year) for voluntary implementation of soil-based practices that improve soil quality, increase crop production, and reduce erosion and agricultural waste discharges. Eligible FAPP practices are:

cover cropping (\$30/acre); 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). Interest in this program has grown in the past few years and request for funding far exceed available funds. For this reason, FAPP no longer provides financial assistance for cover crops, deferring the consistently high number of requests to financial assistance programs offered by NRCS.

### ***Nutrient Management Plan Incentive Grant (NMPIG) Program***

The program previously provided state funds for the development of a nutrient management plan (NMP) and for three additional years of plan updates. Due to increased NRCS funding, AAFM now refers farmers to federal financial assistance offered by NRCS for NMP development and updating. Nonetheless, substantial state funds have been allocated to this effort and NMP development, NMP update and NMP implementation are still considered to be a high priority for AAFM.

### ***Turf Fertilizer Management***

A law enacted by the Vermont Legislature relating to the application of fertilizer became effective on January 1, 2012. The law's primary focus is to limit the use of non-agricultural turf fertilizers and reduce the likelihood of nutrients from entering surface waters. Specific to phosphorus fertilizer, application is generally prohibited except for where it is shown through soil testing the soil of the site 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 non-agricultural 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: application to impervious surfaces; applications to turf before April 1<sup>st</sup> or after October 15<sup>th</sup> or at any time the ground is frozen; and applications to turf within 25 feet of waters of the state.

Golf courses are also required to develop and submit to AAFM a NMP affecting the use and application of fertilizers. The goal is to ensure proper fertilizer application consistent with agronomic rates for site-specific conditions of each golf course facility.

### ***Agricultural Buffer Program (ABP)***

This program offers state funding for a 5-year maximum rental contract for the voluntary installation of conservation grassed buffers on cropland. Unlike the CREP program noted above, ABP 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 (\$90 - \$150 per acre per year); forage in buffer can be harvested between June 1 and September 1; and most buffers are 25 feet wide unless a water quality concern deems the need for a larger width buffer.

### ***Agricultural Resource Specialist Program (ARS)***

Offered by the Vermont Association of Conservation Districts (VACD) with 3 personnel statewide supported by funding from DEC (Section 319) and AAFM. Main services are offered by ARS personnel to farmers include assistance with AAPs, helping AAFM with responding to requests for winter time manure application waivers, agricultural environmental management assessments and farm well water quality testing. 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 in finding the best solution to correct the problem.

### ***Accepted Agricultural Practices (AAP) Assistance***

Offers farmers free technical assistance and information to help them meet the requirements of AAP regulations. ARS personnel 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 and protecting the quality of the farm natural resources as the foundation of the farmer's long-term economic viability. AEM 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.

### ***Land Treatment Planners (LTP)***

LTPs 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 NMP. Although LTP is not required for Vermont farms, the program provides the core data needed to develop a NMP. A NMP is required for all MFOs and all LFOs. NMPs are encouraged for Small Farm Operations (SFOs). This free program is provided to farmers through a partnership between NRCS, Conservation Districts and AAFM.

### ***Forestland and Forestry Practices Runoff Management***

#### ***Vermont Acceptable Management Practices (AMP) Rules***

Acceptable Management Practices (AMP), first effective dating back to August 1987, are administered by the Vermont Department of Forests, Parks and Recreation (DFPR) and are rules for maintaining water quality on logging jobs in Vermont. Since adoption of the AMPs, DFPR has worked with the Vermont forest industry to support DEC's Compliance and Enforcement Division (CED) in an effort to eliminate or reduce the number and severity of NPS pollution resulting from logging operations, particularly soil erosion and sedimentation associated with logging roads and log landings. With forestland covering about 75% of Vermont's total land base (important for green infrastructure and tempering changes in runoff from climate change),

forestry remains an important NPS management focus. The AMPs are undergoing revision during 2014 and 2015.

A Memorandum of Understanding (MOU) was renewed in 2010 between CED and DFPR and remains in effect. The MOU outlines a process to be followed that provides a consistent approach to remediation and enforcement of water quality violations associated with logging operations. Under the MOU, five AMP Technical Advisory Teams assist loggers and landowners when there is a real or potential discharge, a complaint or a request for assistance.

Enforcement leading to abatement of NPS pollution 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.

AMPs or equivalent requirements are mandatory on close to 60% of the 4.6 million acres of forest land found in Vermont. A similar percentage applies to forest land in Vermont found within the Lake Champlain basin (see table below). These percentages are expected to increase over time arising to the following three factors: the US Forest Service conducts new forest land acquisitions within the Green Mountain National Forest proclamation boundary; new forest land acquisitions by Vermont ANR; and, more private forest lands are enrolled into the Forest Legacy and Current Use programs.

**Table 7.1 Extent of Forestlands (Statewide & in Lake Champlain Basin) Subject to Water Quality Management Practices.**

Forest Land Category	Statewide acres (approximate)	Lake Champlain Basin acres (approximate)
Use Value Appraisal (Current Use)	1,780,000	710,670
ANR	475,650	186,570
Forest Legacy	50,630	11,570
GMNF	400,000	265,490
Sub-total	2,706,280	1,174,300
Total forestland	4,591,000	1,953,420

### ***Vermont Heavy Cutting Law (Act 15)***

In 1997, the Vermont Legislature passed H.536 (Act 15) known as Vermont’s “Heavy Cut” law to regulate heavy cutting/clear cutting of forest land. “Heavy cut” means a harvest that leaves a residual stocking level of acceptable growing stock below the C line, as defined by the US Department of Agriculture’s silvicultural stocking guides for the applicable timber type. The “C” line is a silvicultural stocking level provided for in US Forest Service guidelines when 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. AMPs are among the requirements of this

law. The law requires landowners to file a notice of intent to cut with DFPR at least 15 days before commencing a heavy cut when:

- (1) a landowner intends to conduct a heavy cut of 40 acres or more on land owned or controlled by the landowner.
- (2) a landowner intends to conduct a heavy cut and has conducted heavy cuts on other lands owned or controlled by the landowner within a previous five year time frame that is:
  - a) within a 1,000 foot radius of the proposed harvest so that the total acreage subjected to a heavy cut has exceeded or will exceed 40 acres or,
  - b) within a two mile radius of the proposed harvest so that the acreage subjected to a heavy cut has exceeded or will exceed 80 acres.

### *Portable Skidder Bridge Initiative*

Portable skidder bridges are designed and intended for use as temporary structures when crossing streams during logging activities. Portable skidder bridges are becoming widely viewed as a best management practice for controlling logging related NPS pollution. When properly installed, used and removed, these bridges create less streambank and stream bed disturbance as compared to other alternatives such as culverts or poled fords. These bridges are also economical since they are re-useable, easy to install and can be transported from job to job. Portable skidder bridges will reduce the potential for sedimentation, channeling and degradation of aquatic habitat while allowing loggers to harvest timber and remain in compliance with Vermont's AMPs.

The goals of this initiative are three-fold and can be summarized as:

- (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 (or lease) portable skidder bridges.

The Portable Skidder Bridge Rental Program, administered by the Vermont Natural Resources Conservation Districts (NRCD), provides bridges to loggers on a rental basis for \$100 per month. Eleven NRCDs participate with the rental program. Rental bridges are located at participating saw mills and log yards for loggers to pick up and return. Loggers who rent bridges are provided an educational packet that illustrates guidelines to follow for installation, use and removal. On occasion, hands-on portable skidder bridge fabrication courses are offered so that loggers can construct their own structures. Demand for rental bridges has continued to grow since the program was established in 2005. At present, DFPR reports that portable skidder bridges are rented by about 25 loggers per year.

## **B. Vermont NPS Program - Federal Partners**

The following section includes brief descriptions of important and the most prominent federal NPS-related programs that play a vital role in managing and controlling NPS pollution within Vermont.

### ***US Environmental Protection Agency - Section 319***

EPA provides annual funding to Vermont to help DEC carry out NPS activities and program through Section 319 of the Clean Water Act. EPA personnel also provide extensive program guidance and technical assistance to DEC in conjunction with carrying out an effective NPS Program and regarding annual 319 NPS grant awards to ensure compliance with EPA guidelines and reporting requirements. In 2015, the annual 319 program grant to Vermont DEC was \$1.1 million. DEC performance objectives, priorities and commitments are detailed in annual 319 work plans which are reviewed and approved by the New England Regional office of EPA. DEC also regularly negotiates additional objectives, priorities and commitments with EPA concerning air, waste and other water programs in multi-year Performance Partnership Agreements.

### ***US Environmental Protection Agency - Section 604b***

With annual funding provided by EPA under Section 604b of the federal Clean Water Act, DEC's 604b program is focused on water quality management planning activities. Annual funding is typically \$100,000 of which 40% is passed through to the eleven Regional Planning Commissions (RPC) in Vermont. A wide variety of NPS-planning related activities are undertaken by the RPCs using these funds. The remaining 60% is used by DEC in conjunction with its ongoing water quality and NPS pollution assessment and reporting efforts.

### ***US Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS)***

#### ***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 installed and 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 up to \$300,000 are limited to a person or entity during any 6-year period.

#### ***Agricultural Management Assistance (AMA) Program***

Assists 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 to 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 Stewardship Program (CSP)***

A voluntary program that encourages agricultural and forestry producers to address resource concerns by undertaking additional conservation activities and 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-year period. At present, there are 8 landowners in Vermont that are enrolled in CSP involving about 2,870 acres of land.

### ***Agricultural Conservation Easement Programs (ACEP)***

As a result of changes to the 2014 Farm Bill, three important easement related programs have been rolled into one program under ACEP. The three former easement programs, shown by their former names, are highlighted below.

### ***Farm and Ranch Lands Protection Program (FRPP)***

A voluntary program that helps farmers and ranchers keep their land in agriculture in perpetuity. 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. 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. At present, about 63,805 acres of farmland have been conserved throughout Vermont under the Program. Protecting and conserving farmland in this fashion (to

maintain Vermont's rural qualities and prevent lands from being converted to some other use) is considered to be a highly effective element in the State's overall NPS management strategy.

### ***Wetlands Reserve Program (WRP)***

A voluntary program that provides technical and financial assistance to private landowners to restore, protect, and enhance wetlands in exchange for retiring eligible land from agriculture. Wetlands provide a number of benefits including helping to 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. At present, about 3,382 acres of wetlands across Vermont have been protected under WRP. Conserving wetlands in this fashion is considered to be a highly effective element in the State's overall NPS management strategy.

### ***Grassland Reserve Program (GRP)***

No longer available, GRP was 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 emphasized 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 under the former program included privately owned grasslands; land that contained forbs for which grazing is the predominant use; or land located in an area that historically has been dominated by grassland, forbs, or shrubland that had 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 was required. In addition to permanent easements, other GRP enrollment options include rental contracts of 10-20 years or restoration agreements. When the program existed, USDA could also enter into cooperative agreements with entities to enable them to acquire easements. At present, about 535 acres of grassland in Vermont has been protected under GRP. Protecting grassland areas in this manner is considered to be an effective element in the State's overall NPS management strategy.

### ***Regional Conservation Partnership Program (RCPP)***

The Regional Conservation Partnership Program (RCPP) is a new funding source offered by USDA which promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS provides assistance to producers through partnership agreements and through program contracts or easement agreements.

RCPP combines the authorities of four former conservation programs – the Agricultural Water Enhancement Program, the Chesapeake Bay Watershed Program, the Cooperative Conservation Partnership Initiative and the Great Lakes Basin Program. RCPP assistance is delivered in accordance with rules of four other NRCS programs: EQIP, CSP, ACEP and HFRP.

Vermont priorities to address under RCPP funding are: soil erosion, soil quality, water quality degradation, inadequate habitat for fish and wildlife and energy. Starting in early 2015, there are two National RCPP efforts and one State RCPP effort that recently began and got underway in designated portions of Vermont – the Lake Champlain and Connecticut River drainages. In 2015, an application for RCPP funding was submitted to address agricultural concerns in Vermont watersheds draining to Lake Memphremagog. A decision on this application is expected in fall 2015.

### ***US Department of Agriculture – Farm Services Agency (FSA) Conservation Reserve Program (CRP)***

A voluntary program for agricultural landowners where persons can receive annual rental payments and cost-share assistance to establish long-term, resource conservation 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 and enhancing wildlife and aquatic habitat, 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 vegetative cover; maintenance incentive payments for certain practices; and cost-share assistance at up to 50% of the participants' costs in establishing approved practices. In many cases, CRP improves its effectiveness by working in conjunction with funding from the State of Vermont. CRP dollars combined with State funds is known as CREP (Conservation Reserve Enhancement Program). As of December 2014, there are about 2,726 acres in Vermont that have been enrolled under CREP.

### ***US Department of Agriculture – Forest Service***

The Green Mountain National Forest (GMNF), managed by the USDA Forest Service, is a national forest located in two areas of Vermont (southwest region and central region). The forest was established in 1932 as a result of uncontrolled over-logging activities, fire and flooding events. The GMNF currently consists of about 399,150 acres and includes eight wilderness areas designated by Congress under authority of the 1964 Wilderness Act.

USDA's Forest Service is the agency that manages and protects 153 other national forests and 20 grasslands found in 44 states and Puerto Rico. The mission of the Forest Service (FS) is to

sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations.

The FS has the world's largest forestry research organization whose experts provide technical and financial assistance to state and local government agencies, businesses and private landowners when protecting and managing non-federal forest and watershed lands.

The FS augments its work through partnerships with public and private agencies when helping to plant trees, improve trails, educate the public and improve forest conditions in rural areas and in wildland/urban interfaces. The FS also promotes sustainable forest management and biodiversity conservation.

### ***US Department of the Interior – Fish and Wildlife Service (FWS)***

The Service's Partners for Fish and Wildlife (PFW) Habitat Restoration Program was established in 1987 for on-the-ground wetland restoration projects on private lands. At the heart of FWS' mission is 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. PFW Program provides technical and financial assistance to private landowners who are willing to work with FWS and other partners on a voluntary basis to help meet the habitat needs of Federal Trust Species. The 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. PFW Program field staff help landowners find other sources of funding and help them through the permitting process, as necessary.

### ***US Army Corps of Engineers (COE)***

The US Army Corps of Engineers (COE or Corps) is a worldwide organization that provides engineering services and construction support for a wide variety of military and civil projects. The Corps primary civilian mission is to develop, manage and protect water resources throughout the country. Corps projects reduce flood damage, improve harbors and navigation channels, protect streambanks and shorelines, generate hydroelectric power, and preserve and safeguard the environment. Through its regulatory program, the Corps administers laws to regulate various activities in waters and wetlands.

The COE regulates work and structures that are located in, under or over navigable waters of the United States under Section 10 of the 1899 Rivers and Harbors Act. The COE regulates the discharge of dredged or fill material into waters of the United States under Section 404 of the Clean Water Act. The COE also regulates the transportation of dredged material for the purpose of disposal in the ocean (under Section 103 of the Marine Protection, Research and Sanctuaries Act). For the Corps, "Waters of the United States" are navigable waters, tributaries to navigable

waters, wetlands adjacent to those waters and/or isolated wetlands that have a demonstrated interstate commerce connection.

The COE issues different types of permits to authorize construction and fill activities. The Corps distinguishes between two categories of permits; individual permits and general permits. Individual permits, individually reviewed by the Corps, are required if the project does not fall under the criteria for general permits. General permits apply to activities the Corps has determined are substantially similar in nature and cause minimal environmental impacts, both individually and cumulatively. The Corps requires notification for some general permits before the activity is authorized and work can begin.

There are two types of general permits: nationwide permits and regional permits. Nationwide permits are a series of permits which are defined in Corps regulations for certain minor projects (examples are outfalls and intakes which have received an NPDES permit, single private mooring buoys, backfill and bedding for utility lines, minor bank stabilization, and minor road crossings). All nationwide permits have special conditions which must be met in order for a project to qualify for nationwide permit status. Some nationwide permits also require notification to the Corps before work begins. Regional permits apply to certain minor activities authorized by the Corps on a regional or statewide basis. Activities allowed by a regional permit may include docks, piers and mooring buoys in tidal waters, minor road work by a town or state agency, minor hydroelectric projects and maintenance dredging with upland disposal. In Vermont, the Corps authorizes certain activities under State Program General Permits. Most regional permits require that the Corps be notified before work begins.

As these brief descriptions above may suggest, the Corps and its regulatory program play a considerable technical and regulatory role regarding NPS pollution management within Vermont.

### **C. NPS Partnerships with Non-Governmental Organizations**

#### ***Lake Champlain Basin Program (LCBP)***

The Lake Champlain Basin Program is a major partner playing a vital role in Vermont's NPS Management Program. LCBP is a Congressionally-designated initiative to restore and protect Lake Champlain and its surrounding watershed. LCBP works with partners in New York, Vermont and Québec to coordinate and fund efforts to address challenges in the areas of phosphorus pollution, toxic substances, biodiversity, aquatic invasive species and climate change. The Program also administers the Champlain Valley National Heritage Partnership, which builds appreciation and improves stewardship of the region's rich cultural resources by interpreting and promoting its history.

LCBP produces [its \*Opportunities for Action: An Evolving Plan for the Lake Champlain Basin\*](#) which is the pollution prevention, control and restoration plan that guides LCBP's efforts. The Plan was first endorsed in October 1996 by the governors of New York and Vermont and the respective regional administrators of EPA. The 1996 Plan called for periodic updates, and new

versions of the Plan were signed in April 2003 and November 2010. In addition to the Plan, LCBP periodically publishes the *State of the Lake* report to update the public and policy makers on the condition of Lake Champlain and its watershed. The most recent version of the report was released in August 2012.

### ***University of Vermont Extension System (UVM-EXT)***

UVM-EXT has multiple programs and staff located throughout Vermont. Related to agricultural NPS pollution control, staff agronomists advise farmers on topics such as crop production to reduce erosion and nutrient loss from fields, farmstead BMPs for improved manure and water management, animal exclusion fencing and field practices. UVM-EXT also demonstrates field equipment such as, but not limited to, soil aeration and alternative manure applicator systems and planting equipment. UVM-EXT provides guidance and trainings to producers on whole-farm nutrient balances, field nutrient management and precision feed management. UVM-EXT is in a unique role of being able to blend research findings with the delivery of soil and water conservation technical assistance. As a result of the nature and variety of its programs and messaging, UVM-EXT plays a critical role in delivering effective technical assistance and education to the agricultural community throughout Vermont.

### ***University of Vermont – Lake Champlain Sea Grant (LCSG) Program***

A cooperative program of the University of Vermont and SUNY Plattsburgh, Lake Champlain Sea Grant is a part of a national network of 35 projects and programs at coastal and Great Lakes colleges that is coordinated by the National Oceanic and Atmospheric Administration. LCSG is dedicated to improving the understanding and management of Lake Champlain, Lake George and their respective watersheds for long-term environmental health and sustainable economic development.

LCSG is guided by a program-specific strategic plan that aligns with the National Sea Grant strategic plan. Outlined in this plan are focus areas that guide LCSG's research, outreach and education. The 3 focus areas are central to Vermont's Sea Grant program are as follows:

Healthy Ecosystems - Lake Champlain Sea Grant provides science-based information to increase awareness among basin residents of priority aquatic and watershed resource issues and to improve the capacity of residents, decision-makers, planners and managers to protect and restore basin resources.

Sustainable Development - LCSG works to engage communities throughout the basin in applying the best available scientific knowledge, and to use its outreach and education capabilities to support the development of healthy communities that are economically and socially inclusive, are supported by diverse and vibrant economies, and function within the carrying capacity of their ecosystems.

Hazard Resilient Communities - LCSG promotes and funds applied research that contributes to an improved understanding of how climate change may affect efforts to improve Lake Champlain and management of basin resources. LCSG works to provide scientifically sound information about regional climate change and the potential impacts in the basin to the public and communities when planning for and adopting practices that mitigate climate change impacts.

LCSG recently achieved 'institute' status. As part of that, a cooperative venture will be created bringing together DEC and LCSG in promoting and supporting green infrastructure in the portion of Vermont that drains to Lake Champlain.

### ***Connecticut River Joint Commissions (CRJC)***

New Hampshire's Connecticut River Valley Resource Commission, created by the New Hampshire legislature in 1987, and Vermont's Connecticut River Watershed Advisory Commission, similarly created by the Vermont legislature in 1988, were directed to cooperate with each other to preserve and protect the resources of the Connecticut River Valley, and to guide its growth and development. Both Commissions are advisory and have no regulatory powers, preferring instead to advocate and ensure public involvement in decisions which affect the Connecticut River and its valley. The two commissions have met together as the Connecticut River Joint Commissions since 1989.

By engaging local leadership and initiative and focusing its limited resources to benefit the River and the people of its Valley, the CRJC have produced a river corridor management plan and a water resources plan. The Connecticut River Corridor Management Plan was adopted in 1997. Prepared under the auspices of the New Hampshire Rivers Management and Protection Act after five years of citizen-based planning along the river in New Hampshire and Vermont, this plan guides the management and protection of the upper Connecticut River's unique assets and resources.

The Water Resources Plan (2009) is an expansion and update of the Water Quality section of the 1997 Connecticut River Corridor Management Plan. The result of three years of discussion and consensus by a diverse group of citizens representing their riverfront towns, the plan fulfills the requirements of the New Hampshire Rivers Management and Protection Act. The Plan explores water and sediment quality, fish tissue toxins, instream flow and flood management, dams, groundwater issues, point and nonpoint pollution sources, erosion, the effects of land use on water quality, and the condition of tributaries, among other topics. The Plan offers a valuable guide to local officials and landowners intent upon improving the condition of the Connecticut River and other local waters.

### ***Vermont Association of Conservation Districts (VACD)***

VACD and its 14 member Natural Resources Conservation Districts (NRCD) provide education and technical assistance in agriculture and in all natural resources areas such as stormwater, forestry, river management and invasive species. NRCDs help agricultural producers by providing non-regulatory assessment and technical assistance and by leveraging additional funding through grants or other programs.

VACD oversees the Agricultural Resource Specialist and Land Treatment Planners as described above. VACD also administers many programs that serve to assist with agricultural water quality protection and improvement. Example programs include: Trees for Streams; BMP implementation; livestock exclusion; soil, manure and water testing; cover crop incentives; and, demonstration equipment rentals.

## Chapter 8. Funding Resources to Support Vermont's NPS Management Program

There are several different sources of funding available within Vermont to help carry out NPS assessment, NPS planning and NPS implementation work. These include state and federal grant funds and low- to no-interest loan programs. Many funding programs also require or recommend match (as cash or in-kind) contributions to make grant funds go even further. Many of these NPS funding sources have their own specific purposes, requirements and application processes. Most funding sources are highly competitive as the demand for dollars typically exceeds the amount available. As a result, it remains a significant challenge to get the financial resources needed to address NPS pollution and to restore and protect Vermont's waters.

Successful NPS management and control efforts often must rely on more than one funding source, may often need to be broken up into phases over multiple years and/or involve the commitment to raise more than just interest or concern from members of the local community. The main and primary NPS funding resources deployed as part of Vermont's NPS Management Program are described in the following pages.

### A. Federal Sources

#### *Clean Water Act Section 319*

Congress enacted Section 319 of the Clean Water Act in 1987 establishing a national program to control and abate nonpoint sources of water pollution. Section 319 grant funds became available for the first time in federal fiscal year 1990. Section 319 funds have been awarded to Vermont by EPA since that time and, through 2014, Vermont has received about \$29.3 million. Section 319 funds have been applied throughout Vermont to assist DEC plus a wide variety of groups and organizations carry out an equally varied set of NPS projects and activities. Section 319 requires a forty percent non-federal match. Appendix F contains examples of noteworthy projects completed in Vermont that were assisted by one or more years of Section 319 funding.

EPA National Section 319 Program Guidance (updated in 2014) specify that at least 50% of a State's 319 funding must go to watershed implementation projects with the remaining balance of funds eligible for use towards supporting NPS program activities. EPA guidelines, however, also provide flexibility on this requirement if substantial separate state funding is available for NPS implementation projects. DEC has made use of this flexibility provision in 2014 and 2015 by applying more than \$1.1 million each year in Vermont Ecosystem Restoration Program funding for NPS projects. This so called 'leveraging' has allowed DEC to apply close to the full 319 award to NPS programmatic needs involving DEC personnel who provide technical assistance, project oversight and watershed restoration work with about 18% of 319 funds going to the Vermont AAFM for their use in controlling agricultural NPS pollution. DEC revisits whether to propose this leveraging option each year at the time the Section 319 work plan is submitted to EPA.

### *Clean Water Act Section 604b*

Section 604b funds, awarded by EPA to Vermont since 1989, are used for water quality management planning purposes that may include a host of planning related activities for NPS management. Vermont customarily receives \$100,000 in 604b funds each year. As specified by the Act, DEC must pass through at least 40% of its annual award to regional comprehensive planning organizations. In Vermont, those organizations are considered to be the 11 Regional Planning Commissions. Provided the funds are used for planning purposes, Section 604b has no match requirement.

### *Lake Champlain Basin Program (LCBP) – Clean Water Act Section 120*

The Lake Champlain Basin Program is a Congressionally-designated initiative to restore and protect Lake Champlain and its surrounding watershed. With federal funding provided by EPA, the LCBP works with partners in New York, Vermont, and Québec to coordinate and carry out efforts to address challenges in the areas of phosphorus pollution, toxic substances, biodiversity, aquatic invasive species and climate change. LCBP also administers the Champlain Valley National Heritage Partnership, with funding from the National Park Service, which builds appreciation and improves stewardship of the region’s rich cultural resources by interpreting and promoting its history.

Local involvement in planning and implementation is a cornerstone of LCBP and the work it performs. Public input meetings, citizen perception surveys, focus group discussions, technical workshops, and research, monitoring, and demonstration projects are critical to the development and implementation of LCBP’s Opportunities for Action Plan. Since 1992, LCBP has awarded more than \$5.2 million to over 770 projects in New York and Vermont through several competitive grant programs. Funding for these projects are typically from EPA, Great Lakes Fisheries Commission and the National Park Service.

These competitive grant programs concern five different focus areas including: pollution prevention and wildlife habitat conservation; aquatic invasive species spread prevention; education and outreach; organizational support; and, local water trail development. Projects supported by LCBP competitive grants address a wide array of activities some of which include a NPS element. For example, a project may restore riparian buffers or provide cover cropping to help reduce NPS phosphorus runoff to Lake Champlain, restore and improve fish habitat in a tributary to the lake or reduce stormwater runoff from residential properties.

In December 2000, the Secretary of the Army was authorized to establish a program for providing environmental assistance to non-Federal interests in the New York and Vermont portions of the Lake Champlain basin through the US Army Corps of Engineers (USACE). Congress is authorized to appropriate up to \$20 million to carry out what is known as the Lake Champlain Watershed Environmental Assistance Program (WEAP). The goal of the Lake Champlain WEAP is to provide assistance with planning, designing and implementation of large scale projects that protect and enhance water quality, water supply, ecosystem integrity and other water related issues within the New York or Vermont portions of the basin. The LCBP is the administrative partner of the USACE to implement the WEAP program. Due to a variety of administrative and other challenges, WEAP has not been fully or effectively utilized.

### ***Clean Water State Revolving Fund (CWSRF)***

As noted by EPA, the CWSRF under Title VI of the Clean Water Act is the largest water quality financing source in the nation. Through the CWSRF program, each state and Puerto Rico maintain revolving loan funds to provide independent and permanent sources of low cost financing for a wide range of water quality infrastructure projects. Funds to establish or capitalize the CWSRF programs are provided through federal grants and state matching funds (equal to 20% of federal grant). States may choose from a variety of assistance options including loans, refinancing, purchasing or guaranteeing local debt and purchasing bond insurance. States can also set up specific loan terms, including interest rates from 0% to market rate and repayment periods up to 20 years. States have the flexibility to target resources to their particular environmental needs including polluted runoff from urban and agricultural areas, wetland restoration, groundwater protection, brownfields remediation, wastewater treatment and for coastal communities, estuary management.

In Vermont, the CWSRF is administered by DEC which provides low cost loans for planning, design and construction of wastewater and stormwater facilities and infrastructure. CWSRF loan funds are made available to municipalities and municipal sponsored privately-owned systems. Nearly all clean water projects within the ten or so identified 'growth areas' of Vermont are eligible which will further health and environmental protection objectives of the Clean Water Act. DEC expects demand on the CWSRF loan fund for stormwater projects is likely to increase. In response to that anticipated demand, DEC is planning for ways to enhance the level of available state funding that can be used to assist with overall project costs.

Loans are issued for planning and final design purposes and for construction purposes. Examples of eligible CWSRF projects include: wastewater collection system or treatment facility construction, upgrade or refurbishment; combined sewer overflow elimination; stormwater treatment, green infrastructure and low impact development; community decentralized wastewater disposal; water and energy efficiency or environmental innovation projects and NPS pollution prevention. While there has been some limited use of the CWSRF for NPS projects in Vermont, the vast majority of CWSRF dollars in Vermont have been applied on more traditional projects such as wastewater and combined sewer overflows.

Projects must apply to be on the annual project priority list. The most recently adopted Municipal Pollution Control Projects Priority List and Clean Water Intended Use Plan (IUP) includes a listing of construction projects which may apply and receive CWSRF in State fiscal year 2015. Readers interested with the contents of the most recent IUP can go to the following web site: <http://www.anr.state.vt.us/dec/fed/fed.htm>.

### ***Drinking Water State Revolving Fund (DWSRF)***

The DWSRF, also administered by DEC, provides low cost loan financing to municipal and privately owned public water systems for capital improvements that improve public health protection and facilitate compliance with the Safe Drinking Water Act. Between 1997 and

2012, federal funds by EPA to Vermont's DWSRF totaled about \$125.68 million, averaging about \$7.4 million per year.<sup>11</sup>

The DWSRF has three separate, but often related, funding opportunities. The Construction Loan Program provides funding for a variety of water system improvements, for public community water systems (PCWS) and non-profit non-community water systems (ie both non-transient/non-community and transient non-community types). Construction loans are awarded through a priority ranking system, with the strongest emphasis on projects that address the most significant health problems and facilitate compliance with the Safe Drinking Water Act. The Construction Loan Program is funded through a capitalization grant from EPA and a State match appropriated annually by the Vermont Legislature through the Capital Bill.

The DWSRF develops an Intended Use Plan (IUP) on an annual basis. The IUP for DWSRF outlines how the program intends to spend the money, both to support special water system projects and staffing, and infrastructure improvement projects. The IUP is receives public input and is approved by EPA. One of the primary components of the IUP is the statewide construction priority list. Water systems must apply annually for placement on the list.

An important expenditure proposed in the IUP is money for the Planning Loan Program. The Planning Loan Program provides 0% interest, 5-year term loans to public water systems seeking to conduct preliminary and final design engineering. This preliminary engineering can range from source exploration to feasibility studies for water system acquisition to preliminary and final design of a construction project. One of the most attractive aspects of the planning loan program is the opportunity for municipally-owned systems to obtain principal loan forgiveness, based on system population, projected user rate, eligible project costs and funding source. Readers interested with the contents of the most recent IUP for DWSRF can go to the following web site: <http://www.anr.state.vt.us/dec/fed/fed.htm>.

Source Protection Loans can be used to purchase land or conservation easements to help protect public water sources and ensure compliance with state and federal drinking water standards. Source must have a hydro-geologically delineated source protection area and an approved Source Protection Plan prior to loan award. These loans are limited to public community water systems. The water system must demonstrate how the project will directly promote public health protection or compliance with national drinking water regulations.

In 2012, the Vermont Legislature established a fourth funding mechanism known as the Vermont Wastewater and Potable Water Revolving Loan Fund (aka the On-site Loan Program). This loan program was created to provide Vermont residents or homeowners a source of low-cost financing for the repair or replacement of failed septic and/or water supply systems. The goal of this program is to protect public health and the environment while assisting Vermonters with limited financial resources to upgrade increasingly expensive failed systems.

---

<sup>11</sup> Figures provided include \$18.4 million one-time 2009 ARRA funds.

On-site Loan Program funds are underwritten and serviced by the Opportunities Credit Union of Winooski, Vermont.

### ***Farm Bill – Natural Resources Conservation Service (NRCS)***

Federal programs, funded through the US Agriculture Act of 2014 (aka Farm Bill) assist Vermont agricultural producers with a broad range of offerings, including programs to protect and improve Vermont water quality. NRCS, along with the Farm Services Agency (FSA), provide technical and financial assistance for conservation practices and program implementation. NRCS has made a major commitment of approximately \$45 million over the next five years to help with implementation of soil and water conservation practices in the Lake Champlain basin. NRCS provides additional funding via multiple programs in other areas outside the basin for high priority water quality projects.

### ***Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP)***

CRP is a financial assistance program offered by the USDA Farm Services Agency which seeks to enter into 10, 15 or 30 year agreements with landowners interested in converting riparian cropland land into grassland or forest land. CREP, which is similar CRP, involves state funding as the ‘enhancement’ to provide higher financial incentives to encourage program participation. Vermont AAF+M views CREP as a critical tool in the State’s effort to address agricultural NPS pollution.

Between 2002 (the first year of CREP) and 2014, there has been \$11.1 million in federal payments and \$2.7 million in State of Vermont enhancement payments under CREP. Combined, these funds have resulted in a total of 382 contracts affecting 2,193 acres of pasture land and 533 acres of crop land. The majority of contracts (369) are in effect for a 15 year period. Eighty-one percent of the contracts (309) are located within watersheds draining to Lake Champlain and 15% of contracts (57) are within the Connecticut River drainage.

### ***Environmental Quality Incentive Program (EQIP)***

EQIP, NRCS’s key soil and water conservation program, was re-authorized by 2014 Farm Bill. EQIP’s funding authorization on a national basis involves over \$1 billion annually with at least 60% of funds directed to addressing livestock resource concerns and at least 5% of funding for practices benefitting wildlife habitat. EQIP’s payment limitation is set at \$450,000 for all contracts entered into between FY2014 – 2018.

In 2012, EQIP funding for financial assistance to help agricultural and forest landowners across Vermont implement soil and water conservation practices was \$6.2 million. In 2013, that figure rose to \$9.65 million and the figure increased to \$10.51 million in 2014.

Starting in 2015 with \$9.2 million, Vermont will be able to achieve a much higher level of conservation practice implementation through EQIP. About \$6.6 million is committed to the Lake Champlain basin with the remainder being available throughout other areas of Vermont.

### ***Agricultural Conservation Easement Program (ACEP)***

The 2014 Farm Bill consolidated three former conservation easement programs (wetlands reserve, grasslands reserve and farm and ranch lands protection). Under the new Farm Bill, ACEP has two components: wetlands reserve easements (WRE) and agricultural land easements (ALE). WRE provide habitat for fish and wildlife including threatened and endangered species, improve water quality by filtering sediments and chemicals, reduce flooding, recharge groundwater, protect biodiversity and provide opportunities for educational, scientific and limited recreational activities. ALE protects the long term viability of the nation's food supply by preventing conversion of productive working lands to non-agricultural uses.

In 2014, ALE and WRE funding in Vermont was about \$3 million and \$0.43 million, respectively. ALE program funding helped to conserve 24 parcels across Vermont involving close to 3,050 acres. WRE funding helped to conserve one parcel involving 486 acres. For 2015, ALE expects to conserve 17 farms and WRE expects to acquire and restore about 140 acres of wetlands.

### ***Regional Conservation Partners Program (RCPP)***

RCPP is a new program for NRCS arising out of the 2014 Farm Bill that promotes the implementation of conservation activities through agreements between partners and landowners. RCPP has 3 funding pools: critical conservation areas designated by the Secretary of USDA, national and state. Starting in 2015 and continuing out to 2019, Vermont will be receiving RCPP funding for three projects, two through the national pool and one through the state pool. RCPP funding to Vermont is being delivered through three programs: EQIP, Healthy Forest Reserve Program and ACEP.

Vermont's national funding pool project, focused on land treatment in watersheds within the Lake Champlain basin, is authorized to receive \$7.17 million (EQIP), \$3.89 million (ACEP-ALE) and \$0.92 million (ACEP-WRE) for financial assistance purposes (i.e. implementation of agricultural conservation practices and easements and forestry-related erosion control). Additional funds will cover technical assistance. This is being managed by DEC. A second national funding pool project, coordinated by Connecticut-based partners, involves Vermont and the five other states in the Connecticut River watershed. Funding allocations for Vermont work efforts in the watershed are under discussion.

Vermont's state funding pool project, focused on improving nutrient management on farms in watersheds draining to Lake Champlain, is authorized to receive close to \$0.7 million (includes financial and technical assistance). This effort is being coordinated by VACD.

### ***Transportation/Highway***

There are two federally funded transportation related programs used in Vermont that are helpful to addressing NPS impacts from roads and highways.

### ***Transportation Alternatives Program***

VTrans administers this program for non-traditional transportation-related projects. One eligible activity under this program involves environmental mitigation of stormwater runoff.

### ***Federal Highway Administration - SAFETEA-LU<sup>12</sup>***

VTrans administers the federal Municipal Highway Stormwater Mitigation Grant Program by directing funds to municipalities for roadway stormwater management. Over the past 5 years about \$5.4 million has been expended on highway stormwater mitigation work. Approximately 50% of these funds have been spent in Chittenden County and the remaining 50% have been expended in other Vermont counties. Available funding for this grant program is anticipated to be depleted before the end of 2016 and it is unlikely additional federal funding will be forthcoming.

## **B. State Sources<sup>13</sup>**

### ***Ecosystem Restoration Program (ERP)***

Since 2002, ERP and its predecessor, the Clean and Clear Program, manages state funds annually appropriated by the Vermont Legislature for NPS pollution control purposes (refer to introduction to this program in Chapter 6 above). ERP funds are issued on a competitive basis to municipalities, watershed organizations, natural resources conservation districts, regional planning commissions and other partners across the entire state. As part of ERP's ongoing efforts to reduce impacts to surface water from NPS pollution, the state budget includes about \$2.5 million per year to support ecosystem restoration projects.

It is the goal of DEC to ensure that watershed implementation priorities identified in tactical river basin plans or watershed based plans become priority NPS items to be funded using ERP grant monies. To this end, the process by which ERP and other water quality planning and NPS funds are distributed has been re-engineered to align with DEC's tactical planning process. Throughout the process of plan development, partner organizations are encouraged to participate in a meaningful prioritization exercise to identify the highest priority NPS items for funding support.

Importantly, ERP funds are provided as 'leverage' in conjunction with DEC's expenditure of Clean Water Act Section 319 funds awarded by EPA.

### ***Conservation License Plate – Watershed Grant Program***

The Vermont Watershed Grants Program fund was established by the Vermont Legislature and is funded from half the proceeds from sales of Vermont Conservation License Plates. The other half of the proceeds are used by the Non-game and Natural Heritage Program. The Departments of Environmental Conservation and Fish and Wildlife co-administer the Watershed Grants program.

---

<sup>12</sup> Stands for Safe Accountable Flexible Efficient Transportation Equity Act – a Legacy for Users. Now known as MAP-21, the Moving Ahead for Progress in the 21st Century Act.

<sup>13</sup> Act 64 of 2015, referred to as the Vermont Clean Water Act, resulted in the creation of a Clean Water Fund. The Fund, to be used by ANR and a small number of other specified state agencies, will result in about \$5.3 million of state dollars per year for additional strategic investment in water pollution control efforts, including efforts directed at NPS pollution. As of the date of this document, details are being worked out concerning how the Fund will be allocated and distributed.

The grant program has been underway since 1998 and has thus far provided about \$1.3 million to over 300 projects, most of which are funded at just a few thousand dollars. About 50 applications are received each year. In 2015, a total of \$100,000 was granted out to 15 projects (out of 46 proposals) with the largest individual grant amount being \$15,000 and the smallest at \$3,500, with an average of just over \$7,000. Projects assisted by Watershed Grant Program funds have occurred in each of Vermont's 17 river basins. Project year 2016 will be the 18th year of the program.

Municipalities, local or regional governmental agencies, nonprofit organizations, and citizen groups are eligible to receive watershed grant dollars for NPS management work on public or private lands. Individuals and state and federal agencies are not eligible to receive funds directly but may be partners of a project.

The program annually accepts applications on a competitive basis and distributes grants for local and regional water-related projects within Vermont. Example projects include streambank plantings, a native plant nursery for future riparian plantings, stormwater rain gardens, fish passage improvements at stream barriers, water quality sampling, educational outreach and watershed planning.

### ***Vermont Agency of Agriculture, Food and Markets (AAFM) - Best Management Practices (BMP)***

The BMP program was created to provide state financial assistance to Vermont farmers. Funding through the BMP program is available for the voluntary construction of on-farm improvements designed to abate NPS agricultural waste discharges into the waters of the state. Such construction must meet standards that are consistent with goals of the federal Water Pollution Control Act and with state water quality standards. BMP funds can be combined with federal cost share to provide a maximum of 85% towards an approved project. State cost share is limited to a maximum of 35% when combined with federal cost share and up to 80% without federal cost share. The program specifies a minimum of 15% of the costs will be covered by the farmer. On an average annual basis (2012-2015), about \$0.925 million has been appropriated by the Vermont legislature for this program.

### ***AAFM - Farm Agronomic Program (FAP)***

The intent of FAP is to provide Vermont farms with state financial assistance for the implementation of soil-based practices that improve soil quality, increase crop production, and reduce erosion and agricultural waste discharges. The program also encourages continued assistance for nutrient management plan update/maintenance and outreach on agricultural water quality impacts and agricultural water quality regulations through educational and instructional activity grants.

Any land under contract to receive payment for a practice or otherwise currently within a contract lifespan for one of these practices from any other state or federal program may be ineligible to receive FAP payments for the same conservation practice. Pending availability of funding, the FAP payment cap is \$5,000 per farm per year within the state fiscal year and all practices must be performed during the state fiscal year that is applied for. Conservation

practices eligible for assistance may be prioritized or acreage limits may be established by AAFM as funding is drawn down and becomes limited. On an average annual basis (2012-2015), about \$0.4 million has been appropriated by the Vermont legislature for this program.

### ***Vermont Agency of Transportation – Better Backroads Program (BBR)***

Established in 1997, the Vermont Better Back Roads Program provides financial assistance (as grants) to towns to correct erosion problems and adopt road maintenance practices that protect water quality while reducing long-term highway maintenance costs. BBR financial and technical assistance demonstrates to towns that the proper fixes and maintenance of those practices are cost-effective. A long-term goal for the program is to encourage and enable towns to adopt and implement and maintain best management practices in unpaved road maintenance and repairs and institutionalize these practices into town capital budget priorities.

The Vermont BBR Program is administered by the Vermont Agency of Transportation (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. VTrans' BBR 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.

## Chapter 9. NPS Control Strategies with Five Year Objectives, Actions, Milestones & Schedule

This chapter of the Vermont NPS Management Program, organized by the major NPS pollution categories, identifies the objectives, actions and associated schedule or timeline for milestones for the years 2015 through 2019 (and beyond in some cases) by each particular program activity. The combination of objectives, actions and scheduled milestones with supporting narrative, in spite of their varying degree of specificity, will allow Vermont to move the respective programs forward as well as identify and address any gaps or deficiencies in NPS management. The milestones are intended to be specific enough to allow EPA to make determinations about Vermont's progress in managing its collective NPS program.

Tables 9.1 – 9.10 include objectives for Vermont's approach on a statewide basis to address the major NPS pollution categories including runoff from: agriculture, stormwater from developed areas and transportation network, hydromodification (includes river corridor and channel erosion) and forestry. Table 9.11 includes objectives for NPS related partnerships and funding. Table 9.12 is directed at efforts specific to Vermont's NPS program administration and oversight.

The milestones and associated schedules for several program activities appearing in the tables below are considered provisional. This is due to a pending phosphorus-based TMDL being developed by the New England Regional office of EPA that concerns NPS runoff from lands and tributaries draining to Lake Champlain (about 55% of Vermont's land area). The expected release date for the TMDL is August 2015. In order to allow EPA to issue the TMDL and provide "reasonable assurances" that NPS controls, when combined with phosphorus reductions from point sources, would ensure water quality standards will be met in the various lake segments, Vermont issued a draft Lake Champlain Phosphorus TMDL Phase One Implementation Plan containing state commitments to control NPS phosphorus contributions to the Lake. Once the TMDL is issued, Vermont will finalize the Phase One Implementation Plan. Once finalized, the NPS commitments in the Phase One Plan should be considered a supplement to the program activities listed below. Any dates specified in the Phase One Plan will take precedent over any conflicting dates specified in the pages appearing below.

### A. Agricultural NPS Pollution

#### ***Program Activity 1: Accepted Agriculture Practices – Rule Update & Compliance***

The Vermont Accepted Agricultural Practice Rule (AAPs), initially adopted in 1995 and updated in 2006, requires that all farms in the state, regardless of location, size and type of operation, adopt and implement a set of minimum conservation practices to protect water quality. Examples include the winter spreading ban which forbids spreading between December 15 and April 1, no allowance for any direct discharges, 10 foot wide buffers between row cropland along surface waters, no stacking or storage of manure on lands subject to annual overflow, and mortality management requirements. The AAPs do not require a written nutrient

management plan (NMP), however the rules require compliance with many aspects of nutrient management planning, including required soil tests every five years, applying nutrient applications consistent with soil tests, and not exceeding twice the tolerable soil erosion rate (a factor sometimes known as “2T”). Education and enforcement of certain provisions of the AAPs has been limited due to lack of resources.

AAPs are enforced by AAFM through a complaint driven system (unlike inspection-based approach for the MFO and LFO programs noted below). AAFM has never received funding specific to enforcing the AAPs, rather this program is essentially driven by internal or external reports/complaints of possible violations. State-initiated and public reports about suspected AAP rule violations result in site investigations to determine compliance. The AAP enforcement protocol is outlined in a 1993 Memorandum of Understanding between DEC and AAFM which concerned DEC’s delegation of the agricultural NPS program to AAFM.

With the current staffing level, AAFM performs approximately 120 AAP-related investigations annually. The investigations target specific complaints or obvious violations; they do not involve evaluating the entire farm operation to determine the extent of AAP compliance. Understanding this staff resource limitation and the water quality need to ensure compliance with the AAPs, AAFM has committed to a targeted small farm inspection program, and has already taken steps to start this process. In fall 2013, AAFM hired the first small farm inspector who is focusing outreach and evaluation efforts in the priority watersheds within Franklin County.

AAFM will expand its small farm inspection program with the hiring of three additional inspectors in 2015-2016, and initially will prioritize dairy farms, but will also address any significant livestock farms that are in priority watersheds. Significant livestock farms will be determined based on size, location, proximity to water, and any potential or actual water quality concerns. All small dairies in Missisquoi River basin and St. Albans Bay watershed will be evaluated by the end of 2015 and all small dairies in the South Lake watershed will be evaluated by 2019. All small dairies in other watersheds of Lake Champlain basin will be evaluated by the end of 2020. AAFM will continue to utilize the existing staff that currently perform investigations into suspected AAP violations on non-dairy farms based on internal and external reports as well as new staff hired in 2015.

Vermont recognizes that further reductions of agricultural NPS pollution will necessitate taking additional, aggressive actions pertaining to the AAPs to reduce water pollution and achieve a more consistent and equitable regulatory environment for all farms. In 2015, Act 64 was enacted (aka Vermont Clean Water Act) requiring substantial changes to the AAPs (to become known as the Required Agricultural Practices – RAP). Act 64 also included new authority that strengthened AAFM’s ability to enforce agricultural violations. As an example, agricultural landowners enrolled in Vermont’s Use Value Appraisal (UVA) Program<sup>14</sup> having repeated AAP violations or unresolved ongoing discharges could lose entirely or see reductions in property tax

---

<sup>14</sup> Also known as Vermont’s Current Use Program, a program providing property tax savings for enrolled agricultural or forest landowners. For qualified enrollees, property tax is based on current use versus fair market value.

benefits. AAFM also recognizes the enormous need for education about the current regulations as well as any proposed additional requirements. Consequently, AAFM is working closely with non-regulatory partners who can, and have already taken steps to help with improving and expanding that outreach.

The following actions related to AAPs/RAPs will require rulemaking, a process which will take approximately 12 months, and would be initiated in the fall 2015 with an expected implementation date of 2016. AAFM is committed to rule making for certain activities regardless of whether additional resources are provided (livestock exclusion, buffers, gullies and erosion for example), however other rule changes may be implemented over a longer time frame.

Each of actions below will be effective immediately upon completion of the rulemaking process. Each action will require extensive outreach and education towards implementation of the rules and remediation of water quality problems. Upon completion, AAFM has the immediate authority to enforce any violations, and does not need additional statutory changes to proceed with compliance.

**Table 9.1. AAP Related.**

<b>AAP-related Objectives</b>	<b>Actions by AAFM</b>	<b>Milestones</b>	<b>Schedule (2015 – 2019)</b>
Update AAP rule to become known as RAP	Improve and standardize buffer width requirement along perennial streams. Create buffer width requirement along field ditches. Improve management of field gully erosion. Reduce specified soil losses to "T." Expand/improve restriction affecting livestock exclusion.	Initiate education to agricultural community regarding potential new regulations. Initiate rulemaking. Complete rulemaking. Begin enforcement of new regulations to be known as RAP. Increased livestock exclusion from surface waters throughout Vermont.	2014  2015 – 2016 2016 2016 2016
Begin small farm evaluation/inspection process	Inspect small farms within high priority watersheds.	100% of small dairies evaluated in Missisquoi River basin & St Albans Bay watershed. 100% small dairies evaluated in South Lake watershed. All small dairies evaluated in other watersheds of Lake Champlain drainage (2020). Evaluation of small farms in VT outside Lake Champlain basin.	2015 - 2016  2016 - 2019  2015 - 2019
Create small farm certification of compliance (COC) process	Using partner groups & different outreach media, achieve greater awareness by farmers & VT residents of AAP/RAP existence and associated requirements.	Determine threshold level for COC requirement. Develop online COC process. Conduct E+O process. Require submittal of certifications.	2016  2018 2016 – 2019 2017

	Achieve higher levels of AAP/RAP compliance.		
Create livestock exclusion financial incentive program	Reduce direct and indirect discharges from livestock accessing surface waters. Provide financial assistance tied to early adopters.	Program developed with declining cost share levels.	2016

***Program Activity 2: Permitting of Agricultural Operations***

As per an EPA-approved Memorandum of Understanding (MOU) dating back to April 1993, the Vermont Agency of Agriculture, Food & Markets (AAFM) is the lead agency in Vermont when addressing agricultural NPS pollution. AAFM has several regulatory programs in place to manage NPS pollution and is proposing revisions to these programs in order to more comprehensively address agricultural pollution concerns across Vermont. These proposed revisions embody the vision of AAFM and DEC to meet water quality goals and will be applied to achieve reductions in nutrients, sediment and pathogens.

AAFM also acknowledges that substantial improvements have been made in very recent years that exhibit a lag time between installation and resulting phosphorus reductions. Development of the MFO general permit (2007) generated a significant amount of technical and financial assistance needs resulting in extensive practice implementation throughout the MFO community but due to the nature of the practices and delay in seeing results until the practices become fully functional, there may be a lag time in reductions.

Staffing resources to implement many of these NPS projects were also increased after 2008 and will increase again in 2015 - 2016. The number of partner staff working in Lake Champlain has increased significantly through the VT Association of Conservation Districts’ technical programs, UVM Extension, and NRCS. Partner NGOs were not providing on farm technical assistance and implementation support prior to 2008 and have consistently been doing this type of work every year since then. These staffing increases are providing valuable technical support but the results will not immediately result in nutrient reductions.

Vermont has three permitting programs regulating the management of agricultural wastes to prevent contamination of surface waters – the Medium and Small Farm Operation Rules and supporting Medium Farm Operations (MFO) General Permit and the Small or Medium Farm Individual Permits, the Large Farm Operations (LFO) Rules and Individual Permits. The third permit program, a Concentrated Animal Feeding Operations (CAFO) Permit, is considered to be for managing agricultural point sources and therefore will not be discussed further in this document.

***Medium and small farm permits*** - The Medium and Small Farm Operational Rule, managed by the Vermont AAFM, applies a Vermont state general permit to farms with animal numbers that meet the minimum thresholds, such as dairy farms with 200-699 mature animals, 300-999 cattle or cow/calf pairs, 150-499 horses, 16,500-54,999 turkeys, and 25,000-81,999 laying hens without liquid manure handling system. The rule also provides for an individual permit for small

or medium farms that meet specific criteria, such as utilizing new or innovative technologies or a history of non-compliance.

The Medium and Small Farm Operation Rule prohibits and prevents 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. AAFM is required by law to inspect all farms permitted under these rules at least once every five years (20% annually) and many farms are visited more often, due to permit compliance needs, project management assistance, and practice implementation.

The MFO general permit has been in existence since February 2007 and was revised in 2012. Currently, there are 142 farms under the MFO general permit throughout Vermont. Approximately 104 of these farms (73%) are in the Vermont portion of the Lake Champlain basin.

**Large farm operation (LFO) permit** - The LFO permit program, also managed by the AAFM, applies an individual permit to farms with animal numbers that meet the minimum thresholds, such as having more than 700 mature dairy cows, 1,000 beef cattle or cow/calf pairs, 1,000 young-stock or heifers, 500 horses, 55,000 turkeys, or 82,000 laying hens without a liquid manure handling system. An LFO permit prohibits and prevents 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. An LFO permit also regulates odor, noise, traffic, insects, flies, and other pests, construction siting, and setbacks. AAFM inspects all LFOs throughout Vermont on an annual basis. The LFO Rules have been in effect since 1999 and were updated in 2007. There are 27 permitted LFOs in Vermont, 17 (63%) of which are in the Vermont portion of the Lake Champlain basin.

**MFO and LFO inspections** - There are currently three AAFM inspectors and a supervisor who also assists with inspections and administers MFO and LFO permits. In 2012, AAFM changed the inspection protocol for MFO/LFO inspections to include increased spot checks of field practices. Through this requirement, inspectors visit a minimum of three fields at each inspection, confirming compliance with the farm's mandatory nutrient management plan. In 2014, AAFM has increased nutrient management compliance checks for grants provided for the development or update of NMPs, which includes many MFOs and LFOs. The goal is to review 10 fields on a subset of these farms for adherence to the implementation component of the NMP and follow up would include permit enforcement on farms that are under a MFO or LFO permit.

AAFM will increase the number of inspections, increase time on farms with field checks and accommodate for future size and technology growth of permitted farms. AAFM will coordinate enforcement information to ensure consistent progress and maintain a database to ensure ranking of high priority farms. Act 64 of 2015 mandates that MFO inspections by AAFM will, after a ramp up period, occur once every three years.

AAFM and DEC will continue to prepare annual compliance reports as required in a 2007 MOU to meet the goals outlined below. Compliance reports will contain state-verified information including but not limited to compliance with nutrient management plan requirements and the

nature of any documented discharges. DEC, AAFM and the Vermont Attorney General’s office have also increased regular coordination.

**Enforcement** - The passage of Act 64 of 2015 (aka Vermont Clean Water Act) increased the ability of AAFM to enforce water quality regulations. This new and expanded authority allows AAFM to issue emergency assistance orders to protect water quality, provisions for mandatory corrective actions and the authority for AAFM to require the reduction of livestock in cases where the amount of livestock waste generated exceeds farm capacity and no remediation is possible. The Act provides AAFM with civil enforcement authority to enjoin activities, order corrective actions and levy civil penalties up to \$85,000 for violations. Further, the Vermont Department of Property Valuation and Review can remove agricultural land or farm building(s) from the Vermont Use Value Appraisal Program (aka Current Use Program) if the owner/operator has been identified by AAFM as being out of compliance with water quality requirements or with an enforcement order for an agricultural water quality violation.

**Table 9.2. Agricultural Permitting Related.**

<b>Permitting Objectives</b>	<b>Actions by AAFM unless noted otherwise</b>	<b>Milestones</b>	<b>Schedule (2015 – 2019)</b>
Conduct inspections on all Large Farm Operations annually (AAFM)	Minimize LFO NPS pollution. Ensure LFO permit terms and provisions are being attained.	100% LFOs inspected annually.	Ongoing
Conduct inspections of Medium Farm Operations (AAFM)	Minimize MFO NPS pollution Increase frequency of annual MFO inspections.	20% MFO inspected per year. At least 25% MFO inspected per year.	2015 - 2016 2018 - 2019
Enhance MFO inspection protocols	Improve MFO inspection methods concerning number and scope of field-based inspections.	Modified inspection methods put into place and utilized.	2014
Carry out joint DEC & AAFM inspections	Institute measures or protocol to ensure consistency between DEC and AAFM during farm inspection process.	Ten joint inspections per year starting 2015. Trainings for staff twice per year starting 2015.	2015 - 2019 2015 - 2019
Improve compliance reporting	Increase coordination. Monthly meetings between DEC-WSMD, DEC-CED and AAFM to share current activities. Quarterly meetings to include VAG.	Compliance findings shared among agencies.	2015 - 2019

**Program Activity 3: Nutrient Management**

Nutrient management planning results in the application of nutrients to cropland and pasture lands to ensure that applied nutrients do not exceed crop needs or contribute to water quality

degradation. Substantial work concerning nutrient management planning and plan implementation has been done in Vermont and the Lake Champlain basin to educate farmers about new or different land practices (such as reduced tillage and buffers) and to provide funding for the purchase of equipment that increase retention and crop uptake of nutrients. It is considered essential and of paramount importance to agricultural NPS management that current technical assistance staff working directly with farmers continue in that capacity.

Currently MFOs and LFOs are required through the state permits to develop, update and implement a nutrient management plan (NMP) that meets the USDA/NRCS conservation practice "590" standard. Small farms that have received USDA cost-share funding for a waste management system are also required to have and follow a 590 NMP. Both AAFM and NRCS provide funding to help develop and update these plans. The basic level of required nutrient management according to the AAPs consists of farms needing to base nutrient applications on once every five years field soil testing and maintaining nutrient application records. Once the AAPs are revised (becoming RAPs), NMPs will be required at all small, medium and large farms. AAFM and its partners will expand offerings and trainings about NMP development until the requirement goes into effect. Trainings will continue after the requirement sets in focused on NMP updating.

The basic level of required nutrient management according to the AAPs consists of farms needing to base nutrient applications on once every five years field soil testing and maintaining nutrient application records. A 590 plan includes a nutrient application plan with additional requirements to minimize nutrient runoff into surface waters. The full document includes maps, soil and manure test results, current and planned crop yields, location of sensitive areas, each field tolerable soil loss ("T") and field phosphorus indices (to calculate potential for phosphorus runoff and nitrogen losses). The 590 plan indicates all structural practices that are related to nutrient storage and application and ensures structural practices are installed and maintained to NRCS standards.

A 590 plan can be quite large depending on farm size. A 590 plan requires a level of knowledge and equipment for certain calculations and can be expensive to develop in spite of cost share assistance. Few small farms voluntarily choose to develop a 590 plan, however, under the current AAPs all small farms are required to have much of the information that would be in a plan available upon inspection.

As part of the AAP/RAP revision, nutrient management plan standards will be developed for all farms. A threshold for small farm certification will be determined during the AAP rulemaking and a nutrient management matrix will be developed that will consider such factors as farm size, number of animals, animal density and proximity to water. Farms above the criteria would be required to create a 590 standard plan. Farms below the criteria would be required to either use a small farm NMP template or meet RAP-specified requirements. AAFM will review standards from other states and identify a NMP requirement that best addressed Vermont's water quality needs.

The matrix will be developed in 2016 in consultation with the agricultural technical service provider community and the so called Ag Working Group. The threshold for NMPs will ideally

coordinate with guidelines for small farm certification of compliance. AAFM and its partners will expand offerings and trainings about NMP development, NMP updates and NMP implementation.

Maintaining or increasing cost sharing or financial assistance for NMP development and implementation will be essential. AAFM will continue to work with NRCS to maintain sufficient funding to support a four-year development and implementation scheme for farms that develop plans to help ensure all farms gain access to resources.

Site specific field practices are critical to the effective implementation of NMPs. Examples of key field practices closely tied to water quality and in need of continued implementation are noted below. The current NRCS-funded “edge-of-field monitoring” research, being conducted across several years on six Vermont farms in the Lake Champlain basin, will help determine the water quality effectiveness of monitored practice implementation. As additional research documenting the reduction values of these practices becomes available, an adaptive management approach will be taken to further commitments to increase implementation and implementation.

**Cover Crops** – Cover cropping is a demonstrated and effective practice for controlling runoff and erosion, for limiting excess nutrients and for improving soil quality. Cover cropping is a challenge on heavy clay soils that require tillage and even on lighter soils when weather does not allow for seeding in a timely manner for adequate fall cover. A new program to re-introduce aerial seeding using helicopters is showing promise and other alternatives such as shorter growing season corn options need continued funding, education and research.

**Reduced tillage** – The Capital Equipment Assistance Program (CEAP) offered by AAFM has provided funding for on-farm purchase of equipment such as no-till planters that are increasing the acreage dedicated to reduced tillage practices which help to reduce soil erosion and provide greater cover to bare fields.

**Manure injection or aeration** – CEAP has also provided funding for the purchase of manure injection equipment. Increased use of this equipment is crucial especially in areas with high slopes and proximity to surface water. More importantly, manure injectors are able to apply nutrients into hay ground versus the typical surface application which can be prone to runoff. This equipment is extremely expensive and CEAP funds will be used to incentivize equipment purchase to the fullest extent possible.

**Improving soil health and quality through reduced compaction** – Improving a soil’s health and quality by decreasing compaction increases the infiltration of water, reducing erosion and nutrient runoff. Lower compaction rates can be attained through changes in land practices such as reduced tillage and precision nutrient management that decreases use of heavy equipment.

**Precision nutrient application** – In addition to improving soil quality, precision nutrient application also allows for site-specific and in-field detailed application of nutrients using GPS technology installed on farm equipment. The technology is initially expensive to install but can more specifically allocate nutrients to decrease any potential for excess runoff.

**Controlled tile drainage** – Tile drains have been and are currently being installed by Vermont farmers to increase productivity. New tile drain is being installed at rates and in places of concern. While well-drained fields are less likely to result in gully erosion, research has shown that tile drain effluent can contain high nutrient levels, especially dissolved phosphorus. Education about control structures as well as appropriate installation and management of tile drainage is necessary.

**Buffers** – Perennially vegetated areas surrounding crop fields and between fields and surface waters have been shown to be effective at filtering and reducing runoff and associated pollutants. The joint federal-state Conservation Reserve Enhancement Program (CREP), currently underutilized, is a voluntary program that could become more widespread.

Implementation of buffers and all these other field or agronomic practices just noted must continue and increase but with limited resources, AAFM will need to prioritize efforts by focusing on potential critical source areas (CSA) that are likely to have a high risk of causing or contributing to pollutant loading, especially phosphorus. CSA mapping has been conducted in some parts of Vermont’s Lake Champlain basin and, with the ongoing acquisition of LiDAR and increased use of the data, mapping will continue for the remainder of the State. AAFM and DEC and other partners will focus to the fullest extent possible on CSAs during inspections and land treatment practice implementation.

**Research** - Implementation of current practices will be encouraged, funded and incentivized, however, additional research is also needed for ongoing improvements in overall nutrient management. While research is not eligible for Section 319 funding, agricultural research-associated activities represent an important component to Vermont’s overall NPS management program. AAFM and DEC, in partnership with USDA and UVM, will continue to encourage and support research initiatives that show promise through funding and collaboration.<sup>15</sup> Some current examples of areas of interest for continued agricultural NPS research include but are not limited to:

- On-farm digesters that not only produce electricity but also increase the use of manure as bedding and provide the ability to transport phosphorus off-farm.
- An evaluation of the P-index to increase its value as a nutrient management tool.
- An evaluation of soil loss tools other than RUSLE that will be more applicable as a water quality measurement.
- Edge of field paired watershed designs measuring the effectiveness of particular practices that are considered fundamental in Vermont’s effort to better manage agricultural NPS pollution.
- Precision nutrient application.
- Tile drain water level management.

---

<sup>15</sup> A vital component is also understanding and applying research in northern climates by groups outside of Vermont.

- An evaluation of different treatment media for reducing phosphorus levels in tile drain outflows.
- Alternative buffers and cover crops that will provide necessary water quality needs but have other potential value.

**Table 9.3. Agricultural Nutrient Management Related.**

<b>Nutrient Management Objectives</b>	<b>Actions by AAFM unless noted otherwise</b>	<b>Milestones</b>	<b>Schedule (2015-2019)</b>
Increase development & implementation of NMP	Promote nutrient management by all agricultural producers. Educate agricultural producers about nutrient management, nutrient management plans & following plan recommendations. Demonstrate NMP successes. Note: all actions above can be assisted by DEC, UVM-EXT, VACD/NRCDs	Develop NMP matrix & SFO template. Expand offerings of small farm NMP development courses/workshops. Provide increased cost sharing for NMP development. Develop & deliver NMP training program for technical service providers and custom manure applicators. Require certification of custom manure applicators. Develop educational courses for farmers.	2016 2017 2018 2017 2016 2016 – 2018
Improve field practice implementation	Identify a network of NMP adopters & practitioners of different farm sizes/types in different watershed settings. Develop articles regarding development & beneficial use of NMP. Expand use of manure injection & cover cropping whether seeded through conventional or aerial means. Note: all actions above can be assisted by UVM-EXT, VACD/NRCDs	Technical & financial assistance supporting AAP and BMP implementation on small farms with emphasis on key supporting practices. Continue & increase targeted NMP outreach & technical assistance. Continue & expand, if funding allows, technical assistance efforts under Agronomy and Conservation Assistance Program (ACAP). Support existing farmer-led groups. Create/establish additional farmer-led groups. Increase participation with CREP via increased enrollment leading up to RAPs for livestock exclusion. Improved accounting of acres cover cropped and manure injected. Article(s) describing NMP related successes.	2015 – 2019  2015 - 2019 2015 - 2019  2015 - 2019 2016  2015 - 2017  2015 – 2019 2017 - 2019
Improve tile drain effluent management	Assess tile drain management efforts underway elsewhere in northeast, USA & Canada. Develop guidance concerning tile install & managing tile effluent.	Bibliographic citations on tile drainage management (output from LCBP). Interim & final reports for VT legislature on recommendations for management of tile drains.	2015 - 2016 2017

	Consider tile drain regulatory provisions to AAPs or farm permits. Develop tile drain install tracking procedures.	Report from USDA-CIG funded evaluation effort concerning tile outflow treatment media effectiveness. RAPs to include requirements for tile drain management.	2017 – 2018  2018
--	--	--	-------------------------

***Program Activity 4: Additional Efforts & Measures in Priority Agricultural Watersheds of Lake Champlain***

High nutrient and sediment loading (and pathogen contributions) from agricultural runoff in a number of large sub-watersheds of Lake Champlain (Missisquoi Bay, St. Albans Bay, South Lake) will dictate that additional land treatment measures be implemented in these areas. Priority will be given to these areas through increased education, outreach and funding opportunities, targeted funding, and higher cost-share opportunities. Specific and key practices are described above.

Implementation in these watershed areas and associated technical assistance activities were enhanced through recent funding award decisions under NRCS’ Regional Conservation Partnership Program (RCPP).<sup>16</sup> Part of Vermont’s RCPP project includes development of an *Environmental Stewardship Program* which will be piloted in these watersheds. Dating back to 2012, Vermont began working with partners and the agricultural community to develop a “certainty / safe harbor” program. Grants from multiple sources, including EPA and NRCS as well as private local foundations, provided funding for a concentrated outreach program with the agricultural community. The Ag Workgroup was the result of this effort. A key deliverable of the funding was to evaluate the feasibility of a certainty program for the State. Hundreds of farmers participated in this discussion as well as many members of the environmental community. AAFM and DEC are intending to develop an incentive-based certainty program that will reward farmers who install additional BMPs above regulatory requirements. This approach was approved by the Ag Workgroup and a draft set of incentives is under development. A pilot of this approach will be implemented in 2016.

In response to commitments for increased funding, NRCS launched in 2014 a strategic watershed planning process to help define particular and priority agricultural watersheds that would receive greater attention regarding technical and financial assistance resulting in ongoing or even accelerated implementation by landowners of soil and water conservation practices.

---

<sup>16</sup> NRCS RCPP funding is for a five year period. NRCS RCPP will affect Vermont agricultural landowners in watersheds of the Lake Champlain basin through two complimentary efforts – one as a national RCPP (AAFM project) and the second as a state RCPP (VACD project). AAFM project focused on land treatment assistance to previously conserved farms and developing improved incentives for wetlands conservation. VACD project focused on expanding use of NMP on small farms. NRCS RCPP funding will also affect some Vermont agricultural landowners located in watersheds draining to the Connecticut River under a national RCPP (CT Council of Soil & Water Conservation project).

NRCS intends to develop strategic watershed plans that would help guide implementation efforts. DEC has assisted with that process and four watersheds in the Lake Champlain drainage have been selected as strategic priority drainages for attention and support. Three of the four watersheds for strategic planning and implementation focus are located in Franklin County (Rock River, Pike River, St Albans Bay) with the fourth located in Addison County (so called McKenzie Brook which includes several small drainages found between Crown Point Bridge and East Creek).

Focusing on high priority needs areas in no way indicates that other areas of concern, especially those with water quality violations or lack of state mandated practices will be ignored. The following additional implementation steps in the paragraphs below are seen as initiatives beyond current programs and practices in recognition of great nutrient reduction needs of these watersheds. AAFM and DEC remain committed to addressing all water quality concerns, violations and needs through ongoing programs and creative, innovative new efforts to the greatest extent possible.

The National Water Quality Initiative (NWQI), a program launched by NRCS in 2012 in collaboration with EPA and state water quality agencies, provides an opportunity to target financial assistance resources with water quality monitoring in order to determine the effectiveness of land treatment in relation to measured water quality improvement. Dating back to 2011, the Rock River watershed found in Franklin County and the Province of Quebec has been designated as Vermont’s sole NWQI watershed. Land treatment within Vermont is being evaluated by four levels or tiers of water quality monitoring (a fifth tier if one include monitoring data collected in Quebec). Vermont watershed landowners along with NRCS and AAFM will continue efforts to install and maintain land treatment practices while DEC monitors water quality in order to assess possible changes arising from implementation.

DEC, in partnership with AAFM, is also evaluating the feasibility of a nutrient trading program through a recent Conservation Innovation Grant awarded by NRCS. This joint effort between AAFM and DEC will evaluate the opportunities and possible frameworks for agricultural NPS nutrient trading and produce guidance for the potential development of such a program in the future.

**Table 9.4. Additional Agricultural Efforts/Measures in Priority Areas.**

<b>Additional Efforts Objectives</b>	<b>Actions</b>	<b>Milestones</b>	<b>Schedule (2015 – 2019)</b>
Achieve higher levels of land treatment implementation in Lake Champlain & CT River basins	Develop protocols and programmatic areas of responsibility for delivering 3 RCPP efforts in an effective manner (AAFM, VACD).	Successful launching of two Lake Champlain related RCPP efforts focused on phosphorus.	2015  2015

		Assist with launch of CT River related RCPP efforts focused on improving nitrogen management. Land treatment & NPS implementation progress documented annually by lead agency responsible for respective RCPP effort.	2016 - 2019
Improve understanding of land treatment & water quality response in conjunction with NWQI (Rock River)	Carry out water quality monitoring efforts & interpret monitoring data (DEC). Acquire non-sensitive information from NRCS regarding land treatment implementation (DEC, AAFM). Develop and provide educational opportunities to inform landowners & interested stakeholders about progress (DEC, AAFM, NRCS).	NWQI progress reports submitted to EPA on annual or biannual basis. Mutually agreed upon process to document the nature & location of treatment. Content & schedule for NWQI educational forums.	2015 - 2019  2016  2017 - 2019
Initiate environmental stewardship program (ESP)	Examine comparable ESP type programs / initiatives elsewhere (AAFM). Define and develop criteria & incentives for ESP (AAFM).	Agricultural certainty/safe harbor program launched as pilot in chosen watershed area(s).	2016

**B. Stormwater Runoff and Transportation NPS Pollution**

*Introduction*

Stormwater runoff from developed land areas is a major source of NPS pollution in Vermont. Actions that will be undertaken to address stormwater runoff from developed lands and transportation are noted in the text appearing below and in Table 9.5.

A modest portion of stormwater runoff from developed land areas is considered point source pollution and is currently regulated through permit programs (e.g. the state’s operational stormwater permit, MS4 permits and the multi-sector general permit (MSGP) under the National Pollutant Discharge Elimination System (NPDES). Vermont is planning to bring more developed land into the regulatory arena by establishing various new permits which will affect several categories of land use associated with existing development. Once these new permits become effective, this will essentially transform NPS runoff to point source runoff, meaning the particular regulated by permit sources will fall outside the scope of the NPS management program. Because this represents a major change in Vermont’s approach, significant detail is provided below on how this conversion will occur through the various new planned permit

programs (refer to “Stormwater runoff from developed lands: Conversion of nonpoint sources to point sources” appearing on page 104).

### ***Program Activity 1: Non-Regulatory Stormwater Management***

#### ***Stormwater master planning & green stormwater infrastructure***

Stormwater Master Planning (SWMP) is an analytical process designed to prevent and reduce stormwater runoff from impervious areas that are not currently regulated by DEC. The process serves as the basis for targeting management actions in areas of the developed landscape thought to be critical areas of NPS pollutants. The process directs a variety of mitigation actions, including Green Stormwater Infrastructure (GSI) and Low Impact Development (LID) approaches, and promotes municipal adoption of the Vermont League of Cities and Town’s model stormwater ordinance to protect water quality and save municipalities money by avoiding the increasing costs of collecting and treating stormwater runoff. Recommended actions identified by a SWMP process are then subsequently integrated into tactical river basin water quality management plans or become applications for projects and assistance with grant funding.

Since 2009, ANR has supported a Green Infrastructure (GI) Coordinator position within DEC through various funding mechanisms. The position plays a critical role in coordination of Vermont’s GSI initiative, a statewide effort that seeks to increase the adoption of LID principles and implementation of GSI practices. The Initiative works to implement strategies identified within the GSI Strategic Plan, which was developed by the Green Infrastructure Roundtable, an ad hoc group of individuals from the public and private sector who came together on a quarterly basis. The Plan targets four key audiences along with major objectives for each:

- Design Professionals: Design professionals (Engineers, Landscape Architects, Architects, Design/Build Contractors) statewide are trained in promoting and utilizing LID principles and GSI practices.
- Municipalities: Help municipalities recognize the impacts from stormwater runoff and work to mitigate the effects.
- Property Owners: Property owners voluntarily implement GSI practices on their property(s).
- State Agencies: State Agencies secure and commit funding to develop policies and programs to support GSI.

The GSI Strategic Plan was followed by the signing of Executive Order 06-12 in March 2012. The Order, in effect for five years, further defines the role of particular State agencies and calls for the creation of an Interagency Green Infrastructure Council which includes the secretaries of particular state agencies (Natural Resources, Transportation, Commerce and Community Development, and the Commissioner of Buildings and General Services). The Council is tasked with identifying opportunities for integration of GSI practices in existing programs; initiating a process for developing GSI technical guidance; establishing a plan for implementing GSI on state properties and projects; identifying agency liaisons; identifying and undertaking GSI

research and monitoring; and identifying sustainable funding sources. Members of the Council are also tasked with developing a GSI implementation work plan for their respective Agency/Department. Work plans were first completed on July 1, 2013 and lay out opportunities and strategies for moving the GSI initiative forward. Progress on initiating or completing work plan items as well as updates to agency work plans have occurred on an annual basis starting in July 2014.

Finding ways to incorporate LID and GSI into the framework of the State's Stormwater Management Manual (VSMM) is identified as a task in ANR's Implementation Work Plan as the present day manual has been seen as somewhat of a barrier to GSI implementation. To overcome that barrier, DEC's Stormwater Program is currently undergoing a process to revise the VSMM which will include but not be limited to: incorporate and incentivize LID and GSI concepts, promote infiltration to reduce runoff volumes and peak flows and to enhance nutrient removal rates. Importantly, the overall strategy and measures in the revised VSMM are deemed consistent with climate change readiness. The revised VSMM will be adopted via rulemaking (see Table 9.5 below).

In addition to NPS management efforts related to SWMP and GSI and practices specified in the VSMM, Class 3 and Class 4 roads represent a subset of municipally managed impervious surfaces that can be a significant source of NPS pollution. DEC has developed remote sensing information for municipalities to initially identify those sections of road that have the potential to be at risk of erosion and may therefore be a source of sediment and phosphorus pollution to surface waters. DEC is currently developing a road erosion inventory methodology. This methodology will further aid municipalities in identifying sections of local roads in need of sediment and erosion control, assess and prioritize the sites, and estimate costs to remediate sites using road BMPs. Sites defined by the methodology will receive higher priority for grant funding.

DEC is using existing authorities to manage these differing aspects of the non-regulatory stormwater program. DEC will develop, employ, and offer trainings for state agencies, municipalities and other partners plus promote and otherwise demonstrate effective stormwater controls when identifying and prioritizing remediation and prevention techniques, practices and actions.

**Table 9.5. Non-Regulated Stormwater Management Related.**

<b>Non-regulated Stormwater Management Objectives</b>	<b>Actions by DEC unless otherwise noted</b>	<b>Milestones</b>	<b>Schedule (2015-2019)</b>
Increased use of stormwater master planning guidance by towns & other interested groups	Promote stormwater master planning (SWMP) guidance document. Develop stormwater management practices handbook for sub-jurisdictional activities.	5% of ERP applications for stormwater projects done in consultation with SWMP guidance. 35% of ERP applications for stormwater projects done in consultation with SWMP guidance. Stormwater management practices handbook for sub-jurisdictional activities produced. Stormwater related trainings provided referencing demonstration sites/projects.	2016  2019  2016  2015 - 2019
Green Stormwater Infrastructure techniques & philosophy become commonly known or accepted	Specified state agencies implement priority actions found in applicable state agency GSI action plans. Utilize findings or recommendations from GSI roundtable when beginning or expanding GSI initiatives. Coordinate efforts with DFPR regarding urban/rural forest canopy cover.	Annual agency plans produced. Plan-defined GSI projects or initiatives undertaken by applicable state agencies. Final adopted VSMM made available for distribution.	2015 – 2019 2016 – 2019  2017
Erosion & runoff reduced from Class 3 & Class 4 roadways	Promote availability of statewide maps defining erosion control priority Class 3+4 road segments. Distribute backroad erosion inventory methodology.	Statewide erosion priority map information at each town and RPC. Priority road segment map information used by applicants seeking road erosion control grant funding. Erosion control methodology finalized. Methodology used in 50% of grant applications. Methodology used in 100% of grant applications.	2015  2016  2015  2017  2019
Strategic planning pertaining to Vermont’s new stormwater permit approach along with revisions to Vermont Stormwater Management Manual (VSMM)	VT NPS Program coordinator and staff will coordinate with Stormwater Program to identify and resolve any issues pertaining to Vermont’s new permit approach for state and municipal roads, new and existing development (see description below, “Stormwater runoff from developed lands:	Joint program meetings to plan Vermont’s new stormwater permit approach. Revised draft VSMM issued for public comment. Final adopted VSMM issued.	2016  2016  2017

	conversion of NPS to point sources”). Incorporate LID/GSI concepts into completed revision to VSMM.		
--	--	--	--

***Stormwater runoff from developed lands: Conversion of nonpoint sources to point sources***

Stormwater runoff from roads and existing developed lands are being addressed in a staged and prioritized manner through a system of watershed-based stormwater permitting using a combination of state law and NPDES-based regulatory authority. DEC has authority under 10 VSA 1264, and 18-302(a)(5) of the Vermont Stormwater Management Rule to require permits from any impervious surface where it has been determined treatment and runoff control is necessary to reduce adverse impacts resulting from the discharge of stormwater from impervious surfaces. DEC may also use its Residual Designation Authority (RDA) to require permits where it is determined the discharge is a significant contributor of pollutants or where it has been determined stormwater controls are necessary based on a wasteload allocation. Finally, DEC may amend its existing MS4 designation criteria to designate additional municipalities as requiring MS4 coverage in order to implement necessary pollutant controls.<sup>17</sup>

DEC anticipates implementing the programs addressing stormwater from existing developed lands, state highways, and municipal roads through the most appropriate authority, or combination of authorities. In all cases, implementation of the authority to regulate stormwater, be it under State law, RDA, or MS4, requires a demonstration of facts linking the discharge to impacts on receiving waters.

***Transportation Separate Storm Sewer System (TS4) for State Roads***

The State highway system will be addressed by means of a to-be-developed TS4 Stormwater General Permit. The TS4 is a NPDES-based Transportation Separate Storm Sewer System General Permit (TS4 GP) designed to regulate stormwater discharges from the entire state-operated transportation system. The program would be implemented as an MS4 program, pursuant to 40 CFR 123.35(b). The TS4 GP would regulate all stormwater discharges from the state owned transportation network and associated transportation facilities by consolidating permit requirements from the existing Municipal Separate Storm Sewer System (MS4), Multi-sector General Permit (MSGP) and post-construction stormwater permits. Implementation of a comprehensive TS4 GP approach could allow for the prioritization of maintenance, upgrade of stormwater infrastructure, and implementation of remediation activities based on environmental benefit. Stormwater management practices will be consistent with the Vermont Stormwater Management Manual, with an emphasis on surface infiltration (where/when feasible) to maximize nutrient reduction (particularly phosphorus). DEC, in cooperation with Vermont Agency of Transportation, is planning to issue and implement TS4 GP program starting

---

<sup>17</sup> Such MS4 action would result in the nonpoint source of stormwater pollution becoming a point source of stormwater pollution. This action would also result in DEC being prohibited from using section 319 funds to control or manage stormwater discharges regulated by an MS4 permit.

in 2015. This set of actions would result in stormwater runoff from state roads no longer being considered as a nonpoint source of pollution.

The schedule to develop this general permit is as follows: prepare TS4 permit (2016); seek public comment (2016); and implement and administer TS4 permit (2017).

### ***General Stormwater Permit for Municipal Roads***

Vermont municipalities maintain approximately 11,000 miles of road; three-quarters of these municipal road miles are believed to need erosion control improvements. Two-thirds of these roads are unpaved gravel or unimproved roads and nearly all require ditches and culverts for water drainage. Stormwater runoff from roads can accumulate and deliver a variety of pollutants to surface waters such as debris, oils, salts and other chemicals, sediment and nutrients. Roads can also affect the volume of runoff being generated, which in turn, can alter the hydrology and ecological health of receiving waters.

It is DEC's intention to issue a stormwater general permit covering municipal roads. The permit will require development of management plans based on local road conditions including road slope, connectivity to receiving waters and other factors, that identify the type and scope of BMPs necessary for the municipality. The management plan will include an implementation schedule informed, where appropriate, by sub-watershed phosphorus reduction priorities. At a minimum, municipal road BMPs shall be as protective as those identified in the 2011 Town Road and Bridge Standards and focused on the prevention of erosion and transport of sediment containing phosphorus. The general permit will adopt these specific BMPs directly, rather than reference the Town Road and Bridge Standards or other standards. DEC will first issue a letter of intent prior to the issuance of the new permit. This set of actions would result in stormwater runoff from town roads no longer being considered as a nonpoint source of pollution.

The schedule to develop this general permit is as follows: prepare town and road permit (2016); issue letter of intent to affected towns (2017); provide guidance and technical assistance (2016); issue and administer general permit (2018) and receive town-based management plans (2019).

### ***Permits for Existing Developed Lands***

Stormwater runoff from existing developed land, exclusive of surfaces regulated under the State or municipal roads stormwater programs, will be addressed in a staged and prioritized manner through a system of watershed-based stormwater permitting using a combination of state law and NPDES-based regulatory authority.

The first stage of implementation will require permit coverage for all stormwater discharges on sites where impervious surfaces exceed 3 acres. Additionally, impervious surfaces discharging to municipal stormwater systems where such impervious surfaces exceed 15 acres, in aggregate, and the density of impervious surface is greater than 7% shall be addressed by a stormwater permit, issued to the municipality and requiring implementation of a stormwater management and phosphorus control plan. These are preliminary criteria that may need to be adjusted or refined in the future.

Existing facilities with greater than 3 acres of impervious surface permitted prior to the adoption of the 2002 Vermont Stormwater Management Manual will be subjected to feasibility-based upgrade requirements during their next permit renewal cycle which ranges out to 10 years. Stormwater management practices will be consistent with the Manual with an emphasis on surface infiltration, where feasible, to maximize pollutant reduction.

Existing facilities discharging within a regulated Municipal Separate Storm Sewer System (MS4) are required to develop Flow Restoration Plans for stormwater-impaired waters in accordance with the MS4 General Permit. The extensive deployment of stormwater-management infrastructure associated with this requirement will contribute substantially to phosphorus reduction in Lake Champlain. Further, regulated MS4 municipalities are required to track phosphorus reductions associated with the deployment of BMPs. Finally, following issuance of a completed TMDL for Lake Champlain, DEC will re-issue the MS4 General Permit such that the TMDL is considered an “approved TMDL” under section IV.C.1.a of the MS4 General Permit. This will require MS4 permittees to develop and implement a plan to control discharges consistent with the assumptions and requirements of the wasteload allocation. This set of actions would result in stormwater runoff from qualifying existing developed lands no longer being considered as a nonpoint source of pollution.

The schedule of quantifying permit coverage is as follows: determine number, location, extent of sites equal to or greater than 3 acres (2015); determine number, location, extent of sites equal to or greater than 15 acres (2015); issue state stormwater permit to affected sites (2017).

#### ***Post-construction Permits for New Development***

DEC’s Stormwater Program administers a post-construction stormwater permit program pursuant to state statute. Regulated projects are required to implement BMPs in accordance with the Vermont Stormwater Management Manual (VSMM). The VSMM is currently undergoing revision to increase the use of green stormwater infrastructure practices and increase the required levels of phosphorus removal in approved practices. The process is primarily focused on revising Water Quality Volume, Groundwater Recharge, and Channel Protection criteria and to increase the use of distributed highly effective pollutant removal practices. Criteria associated with preventing increases in peak flows associated with larger storms (i.e. the Qp10 and Qp100 standards) are likely to be retained. Precipitation volumes used for the various criteria will be revised based on best-available local data, including the past 10 years of record to account for changes in precipitation volumes, regional variability and anticipated changes in climate and precipitation patterns. The final revised VSMM will then be adopted via state rulemaking process. The final adopted VSMM will employ state-of-the-art stormwater BMPs designed to maximize phosphorus removal. These practices, combined with Vermont’s regulatory program requiring permits for all new and redevelopment projects with over one acre of impervious surface as well as expansions greater than 5,000 square feet, will prevent substantial pollutant loading and reflect climate readiness standards or specifications.

## C. Hydromodification (River Channel Stability)

### *Program Activity 1: Minimizing River Corridor and Floodplain Encroachments and Restoring Riparian Buffers*

Managing rivers and floodplains to attain and maintain dynamic equilibrium conditions (i.e., vertically stable banks and least erosive conditions achieved when there is a balance between erosion and deposition processes) accomplishes three surface water resource objectives: provide greater flood resilience and public safety; reduce NPS sediment and nutrient pollution; protect aquatic and riparian habitat. Removing old dams that no longer serve any useful purpose along with avoiding new buildings, utilities, or public infrastructure in river corridors and floodplains and maintaining vegetated buffers (native plants) are essential to attaining and maintaining equilibrium conditions. Avoiding new encroachments decreases adverse river channel modifications and increases the capacity of valley landforms to store floodwaters and NPS pollutants such as sediment and nutrients. Floodplains, wetlands, and meanders with vegetated buffers: (a) dampen flood energy and soil erosion by moderating stream flow velocities when floodwaters spill onto them; (b) allow for sediment deposition on floodplains during floods, which account for the greatest volumes of sediment over time; and (c) moderate streambank failures due to the root strength, root depth, and root density of the vegetated buffer.

Minimizing river corridor and floodplain encroachments will not only serve to limit future increases in NPS pollutant loadings, but is the most effective form of stream and riparian restoration to reduce present day NPS pollutant loadings. River dynamics ensures that, given the proper space, rivers and streams will eventually evolve under their own power to the least erosive form and arrive at equilibrium conditions. Minimizing river corridor and floodplain encroachments also represents an effective short and long-term strategy for managing or avoiding impacts that arise from more frequent extreme weather events brought about by climate change.

DEC will use existing statutory authority to manage the channel stability program including the development of Flood Hazard Area and River Corridor Rules, Protection Procedures and General Permits and, Inter-Agency Floodplain and River Corridor Management MOUs. Post-disaster flood recovery incentives through Vermont's Emergency Response Assistance Fund (ERAF) are available to towns adopting river corridor protection ordinances. DEC's interest is to have as many towns as possible take steps to protect river corridors from encroachment in order to receive the highest 17.5% ERAF reimbursement rate.<sup>18</sup>

The Vermont Agency of Natural Resources (ANR) and the three departments therein (DEC, Fish and Wildlife and Forests, Parks and Recreation) own and manage about 350,000 acres of land across Vermont. ANR also has easements on an additional 150,000 acres of land. The management of riparian zones across these acreages, that reflects different categories or types

---

<sup>18</sup> As of July 15, 2015 and based on a working list of 295 communities (towns, villages, cities, gores) 36 communities have highest 17.5% ERAF reimbursement rate, 90 communities have 12.5% ERAF rate and 169 communities have default 7.5% rate.

of water resources (i.e. ephemeral streams, intermittent and small perennial streams, wetlands, vernal pools, lakes and ponds, perennial streams/rivers with narrow or broad floodplains), assists in reducing or avoiding NPS pollution as well as serve to showcase sound land use management by the State.

The Vermont LiDAR Initiative (VTLI)<sup>19</sup>, a partnership of federal, state, non-profit and academic entities, has developed a collaborative plan to guide the continuing development of a statewide high resolution digital elevation model (DEM) that is based on acquisition of LiDAR imagery. The extent of storm and flooding damage caused by Tropical Storm Irene (August 2011) underscored the critical need for an accurate DEM to proactively manage future flood risks. Erosion, runoff and landslide hazards within Vermont are expected to increase along with anticipated changes in climate and precipitation. FEMA has recommended that Vermont acquire a statewide model to support development of accurate FEMA digital floodplain risk maps and flood insurance program equity to address inundation and erosion hazards. Since Irene, the State of Vermont has initiated substantial flood and climate resilience efforts, initiatives that are hampered by inadequate topographic data. A broad range of stakeholders throughout Vermont have called for a statewide high resolution DEM.

Vermont currently has 63% state LiDAR coverage to support high resolution elevation data needs with 9.25 - 18.5cm vertical accuracy and surface contours of 1 – 2 feet. These accuracy levels reflect quality levels “QL2” and “QL3” as defined by the National Digital Elevation Program (NDEP). With support of the 3D Elevation Program (3DEP), Vermont has proposed to complete the acquisition of statewide LiDAR by focusing on 3,520 square miles of eastern Vermont where extensive damage occurred during Tropical Storm Irene and where the current topography (with 20 foot contour intervals) has been inadequate to portray and prepare for climate-aggravated flood, erosion and landslide risks. Vermont’s proposal is for LiDAR acquisition for eastern Vermont (37% of Vermont’s area) at the “QL2” accuracy threshold.

The Connecticut River Basin includes 3DEP LiDAR acquisition priorities for portions of three states (VT, NH and MA). The CT River basin has the distinction of being the nation’s first “National Blueway,” a designation created in May 2012 under America’s Great Outdoors Rivers Initiative. Acquiring data at the sub-basin level within the basin would simultaneously serve rivers-related planning needs of multiple states, the Connecticut River Watershed Council and the Connecticut River Joint Commissions.

---

<sup>19</sup> LiDAR means Light Detection and Ranging. LiDAR uses ultraviolet, visible, or near infrared light to image objects targeting a wide range of materials, including non-metallic objects, rocks, rain, chemical compounds, aerosols, clouds and even single molecules. A narrow laser-beam can map physical features with very high resolution.

**Table 9.7. Encroachments & Buffers Related.**

<b>Encroachments &amp; Buffers Objectives</b>	<b>Actions by DEC unless otherwise noted</b>	<b>Milestones</b>	<b>Schedule (2015-2019)</b>
Establish state floodplain rules that set a standard of no adverse impact in floodplains and river corridors and address all developments exempt from municipal regulation.	Adopt Flood Hazard Area and River Corridor Protection Procedures to regulate Act 250 developments and establish map amendment and revision procedures and river corridor BMPs such as those concerning establishment and maintenance of riparian buffers. Establish MOUs with other state agencies to regulate developments within their purview to be consistent with the new state floodplain rule. In conjunction with Dams Task Force, remove old non-functional dams as opportunities arise.	Original procedures prepared & adopted (2014). Amendment/revision procedures finalized. MOUs drafted and in effect. Changes to dam removal inventory list.	2016 2016 2015 - 2016
Regulate municipally exempt activities and Act 250 developments to the higher standards established in Goal above and review all development proposals (under state and municipal jurisdiction) on floodplains.	Establish general permits and a regional Certified Floodplain Technician Program to also increase the regulatory and technical assistance capacity for floodplain protection. Program would also provide technical assistance to a greater number of communities each year to actively restore floodplains and riparian areas and secure the municipal adoption of enhanced model floodplain and river corridor protection bylaws that exceed the NFIP minimum requirements.	Create/ establish general permit. Initiation of certified technician program. Outreach provided to towns and RPCs regarding floodplain and river corridor protection methods. Create/modify spatially referenced catalog of river corridor conservation easements.	2015 2016 2015 – 2019 2016 - 2019
Obtain LiDAR data where needed to modernize inundation and river corridor mapping statewide for streams and lakeshores.	Secure funding for LiDAR. Acquire data on statewide basis. Distribute data.	Create proposal for securing LiDAR data for eastern Vermont. Secure funding needed to acquire LiDAR imagery. LiDAR data used to develop DEM for eastern Vermont.	2015 2016 2017
Implement a statewide river corridor and floodplain mapping center to develop and maintain inundation, erosion hazard and riparian buffer maps as per the adopted Flood Hazard Area and River Corridor Protection Procedures.	Working with VCGI, promote creation of Center as LiDAR data acquisition gains momentum and coverage.	Establishment of mapping Center. Update Center with new data as it becomes available.	2015 2015 - 2019

Increase the role of land conservation in river corridor and floodplain protection and restoration (i.e., securing river corridor, channel management, and riparian buffer provisions in land conservation projects).	Target priority areas for conservation. Secure river corridor, channel management and or buffer provisions during new land conservation projects. Target previously conserved lands where corridor, channel or riparian provisions could be added. Develop riparian zone management policy and guidelines affecting riparian areas owned and managed by ANR. Strategic river corridor project identification.	Conservation targeting applied through river corridor planning process. Adopt ANR Riparian Zone Management policy & guidelines. Integrate field assessment data, river corridor plans and statewide river corridor mapping in support of town flood resiliency plans, road erosion assessments, basin plans and project identification in state, regional, local hazard mitigation plans.	2015 – 2019  2015  2015 - 2019
Establish/Enhance Flood Resilient Communities Program with funding and technical assistance incentives for municipalities to adopt regulations for floodplains, river corridors, and riparian buffers.	Track municipalities where enhanced river corridor and floodplain bylaws have been adopted. Provide increased state cost share recovery under the Vermont Emergency Relief and Assistance Fund (ERAF) to those municipalities with enhanced bylaws.	Municipal bylaw tracking system developed & in use. ERAF program in effect with an increase in towns taking advantage of 12.5% or 17.5% ERAF reimbursement incentives.	2015 – 2019  2015 - 2019
Establish/Enhance a “Flood Ready” web page to promote cross-agency, flood resiliency planning authorized by Act 16.	Offer peer-to-peer learning and community progress barometers in the Flood Resilient Communities Program. Increase municipal adoption of enhanced floodplain, river corridor, and riparian buffer protection bylaws and other mitigation measures to minimize flood risks and maximize floodplain function.	Creation of ‘flood ready’ web page. River corridor/ERAF protection incentives tracked and promoted. Assistance offered by the State to increase adoption by municipalities.	2015  2015 – 2019  2015 - 2019

### ***Program Activity 2: Preventing Adverse River Channel Modifications***

Widespread and historic stream channelization (entrenchment from dredging, berming, straightening and armoring practices) in many Vermont rivers and streams has led to increased erosion and increased sediment and nutrient loading. Land drainage activities and structural controls such as rip-rap may prevent flooding and erosion at one site, but increase erosion downstream and contribute to destabilizing the stream system. These activities increase the power of floods thereby increasing NPS stream bed and bank erosion, property damages, and risks to public safety.

Valley streams and rivers in the Lake Champlain drainage and in Vermont’s other drainages were, by nature, evolving to a least erosive, equilibrium condition where sediment erosion and

deposition (storage) are in balance. Now, due to past channelization, these same streams and rivers function primarily as transport (or non-storage) streams. The floodplain deposition of fine sediment, so critical to NPS nutrient retention, has been drastically reduced (>50%) throughout the Lake Champlain basin. It is estimated that comparable reductions in floodplain deposition are true for Vermont’s three other regional drainages. Stream alteration activities that result in conditions which depart from or impede the attainment of an equilibrium condition need to be limited or better managed.

DEC will use existing statutory authority to manage the channel modification program, including implementation of Stream Alteration Rules and General Permits, River Management training programs and MOUs regarding inter-agency coordination during flood response periods.

**Table 9.8. River Channel Modification Related.**

<b>Channel modification objectives</b>	<b>Actions by DEC</b>	<b>Milestones</b>	<b>Schedule (2015-2019)</b>
Provide technical and regulatory assistance for stream alterations, including emergency and next-flood protective measures to maximize equilibrium conditions.	Develop stream alteration rules and general permit regulating stream alterations and measures during emergency response.	Rules & general permit in place (2014). Enforcement of rules & general permit. Assessment of response actions following future emergencies.	2015 – 2019  2016 – 2019  2016 - 2019
Establish agricultural streambank stabilization practices.	Work with AAFM and NRCS to establish practices consistent with ANR policies for minimizing fluvial erosion hazards as per revisions to 10 VSA section 1021.	Create stabilization practices work group in order to define and reach agreement on practices.	2015 - 2017
Establish and maintain a River Operations Center within an ANR Incident Command System (ICS).	Enable ICS to manage and authorize emergency measures in large scale flood disasters (i.e., when most modern-day channelization occurs). Center to include a network of river scientists, engineers, and habitat restoration specialists. Center to assist VTrans and municipalities as resident experts on larger disaster recovery sites.	Development of ICS for DEC-WSMD. Deputy river management engineers trained as part of ICS river operations. Coordination meetings with VTrans and VT Emergency Management.	2015  2016  2015 - 2019
In concert with DEC river scientists, capitalize on opportunities to implement projects involving the removal of river, river corridor, and floodplain encroachments (e.g., floodplain fills, undersized	Target restoration and protection funds to high priority critical source areas identified in tactical river basin water quality management plans or river corridor plans, recognizing that restoration measures will	Restoration & protection projects targeted and identified. Coordination of critical source, river corridor and river basin planning. Link encroachment removal efforts with	2015 – 2019  2015 – 2019  2015 - 2019

stream crossings, flood-damaged structures, or dams).	vary from avoidance-based to active interventions to restore stream equilibrium conditions, including riparian buffers, depending on site characteristics, plan recommendations, and willing landowners.	climate readiness outreach activities.	
Adopt State Stream Alteration Rules and a General Permit establishing equilibrium and connectivity standards as well as standard practices for next-flood and emergency protective measures.	Develop and continually edit standard river management principles and practices (SRMPP) to maximize equilibrium conditions when managing conflicts between human activities and the dynamic nature of rivers, taking into account anticipated changes in climate. Achieve FEMA recognition of state adopted river management and stream crossing codes and standards for conducting emergency protective measures and promote the municipal adoption of these codes and standards (e.g., with the VTrans Road and Bridge Standards).	Publish SRMPP manual. Update SRMPP manual as new techniques are developed in the field. Achieve recognition of SRMPP by FEMA.	2014 2016 – 2019  2017
Develop and implement a 3-tiered outreach and training program by offering courses to VTrans Operations Technicians, municipal roads workers, contractors, and other river technicians.	Develop 3 tiers of information for river channel outreach & training. Deliver coordinated trainings to maximize attendance.	Tier 1 & 2 trainings developed (2014) & provided on ongoing basis. Develop Tier 3 trainings. Annual 3-tiered trainings made available.	2015 – 2019  2016 - 2017 2017 - 2019
Conduct outreach and train municipalities and contractors in the use of the SRMPP and authorizations under the new ANR Stream Alteration Rules and General Permit that contain equilibrium-based performance standards.	Assess logistical and practical aspects of delivering trainings and relationship(s) to 3-tiered approach above.	Integrate into Tier 2 trainings. Create separate training program for towns regarding how to conduct & authorize Emergency Protective Measures.	2015 - 2019  2016 – 2019

## D. Forest Management

### *Program Activity 1: Acceptable Management Practices (AMP)*

The “Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont” became effective August 15, 1987 and were adopted under the authority of Chapter 47 of Title 10 of the Vermont Statutes Annotated, Water Pollution Control (10 V.S.A. §1259). The AMPs are intended to prevent discharges of sediment, petroleum products, logging slash and other hazardous materials associated with logging from entering streams and other bodies of water, to control soil erosion and to maintain natural water temperature.

Discharges of wastes into the waters of the State, through any means or activities, are violations of the State Water Pollution Control Act, 10 V.S.A. §1259, and the Vermont Water Quality Standards, regulations established pursuant to this statute. The AMPs relieve a person from the obligation of getting a permit for discharges (associated with logging operations) into waters of the state. Discharges of wastes into waters of the State that result from logging operations where the AMPs are not implemented can result in enforcement action and assessment of penalties.

A water quality violation can occur when there is a discharge of waste to waters of the State that occurs as a result of activities associated with a logging operation. Sediment, petroleum products, logging slash and other hazardous materials associated with logging are wastes under the water quality statutes, water quality regulations, and AMP regulations. If the AMPs are not correctly implemented and a discharge occurs, there is a violation of the AMPs, and therefore a water quality violation. In such situations, penalties may be assessed for the water quality violation as well as the AMPs that are not implemented. If no discharge occurs, the logger or landowner cannot be fined or prosecuted for not implementing the AMPs. If the AMPs are correctly implemented, there is a presumption that the logging operation is complying with the State water quality statutes and the Vermont Water Quality Standards even if a discharge occurs as a result of logging. However, this presumption may be overcome if a water quality analysis demonstrates that there is a discharge of wastes into waters of the State due to logging, and thus, a violation of 10 V.S.A. §1259 and the Water Quality Standards (Vermont Water Quality Standards Section 2-03B.1) has occurred. Therefore, although implementation of the AMPs cannot guarantee that a discharge (and a water quality violation) will not occur, the AMPs constitute the best practices available to prevent discharges on logging operations. When correctly implemented, the AMPs provide a level of protection for the landowner and/or logger against enforcement of water quality violations.

FPR has begun the process of updating the AMPs. The revised and finalized AMP manual and rule promulgation are slated for completion in 2016. Key modifications to the AMPs include:

Require compliance with standards set forth in DEC Rivers Program's stream alteration general permit and rule for permanent stream crossing structures on perennial streams.

Strengthen standards pertaining to stream crossing practices including:

- Better management of ditch water on approaches to stream crossings. Proposal is to prohibit drainage ditches along truck roads from terminating directly into streams and to specify a minimum distance for installing turn-outs. Drainage ditches approaching stream crossings must be turned out into the buffer strip a minimum of 25 feet away from the stream channel, as measured from the top of the bank.
- Better management of surface water runoff from skid trails and truck roads on approaches to stream crossings. Proposal is to prevent surface runoff from entering the stream at stream crossings from skid trails and truck roads and to specify a minimum distance for installing surface water diversion practices, such as drainage dips. Surface runoff is to be diverted into the buffer strip at a minimum distance of 25 feet from the stream channel, as measured from the top of the bank.
- Better management of stream crossings after logging. Proposal is to prevent erosion and to specify a minimum distance from the stream for diverting runoff. Upon removal of the temporary stream crossing structures, the site is to contain water bars 25 feet from the stream channel on approaches to the stream crossing to divert runoff into the buffer and capture sediment before entering the stream. Additionally, all exposed soil, at a minimum of 50 feet on each side of the crossing, to be stabilized with seed and mulch according to existing application rates.
- Include a new proposed AMP to address the management of petroleum products and other hazardous materials on logging operations: Petroleum products and other hazardous materials as necessary for logging shall be stored only on log landings, be placed outside a forest buffer and shall be removed when logging is completed.
- Enhanced stream buffer guidance in the AMPs. Metrics have been included for desirable residual stand density, stand structure and crown cover.
- Enhanced options and guidance with metrics provided for soil stabilization to establish temporary and permanent ground cover.
- Better clarification provided for selection and spacing of water diversions on skid trails and truck roads during logging operations and immediately after cessation of logging.
- Increased seeding/mulching of exposed soil adjacent to streams and other waterbodies from 25 feet to 50 feet.
- Enhanced guidance for selecting the appropriate type of temporary stream crossing structure based upon stream characteristics.
- Temporary brushed-in stream crossings will only be allowed on intermittent streams and when ground is frozen.

The initiation of USDA's RCPP program in 2015 will help forest landowners located within the Lake Champlain basin to take advantage of NRCS cost share assistance when accelerating implementation of practices to better manage NPS pollution. Practices of interest for implementation under RCPP include erosion control on active forest trails and landings,

installation of bridges, fords and culverts at stream crossings, restoring forest riparian areas and mulching.

**Table 9.9. AMP Related.**

AMP Objectives	Actions by DFPR	Milestones	Schedule (2015-2019)
Update AMPs	Revise/update technical aspects of AMPs especially to require compliance with standards set forth in DEC stream alteration general permit and rule affecting permanent stream crossing structures on perennial streams.	Improved/updated AMPs promulgated as rules.	2016
Reporting of AMP enforcement & compliance activities	Refine AMP reporting protocol.	Initiate annual AMP enforcement reporting under revised AMPs.	2017
Increase implementation of forestry related NRCS cost share practices in Lake Champlain basin through RCPP	Initiate effort in all watersheds draining to Lake Champlain to boost enrollment/adoption of priority forestry runoff practices. Target practice implementation efforts in priority watersheds of Missisquoi River & South Lake.	Agreement between NRCS & DFPR regarding cost share arrangements. Quantify forest acres treated by practice by watershed.	2015 – 2016  2015 - 2019

***Program Activity 2: Healthy Forest Cover – Enhancing Urban Forest Canopy***

Forests have been documented to produce the cleanest water of any land use. Research indicates that on a watershed scale and for riparian forest buffers, water quality impacts can be seen when forest cover extent becomes less than 65% and 70%, respectively. Vermont’s land cover is presently about 75% forested with variations between watersheds and from site to site. A forest cover strategy of **no net forest cover loss** supports the creation of a system to promote forest cover goals in priority zones, including riparian and developed areas, coupled with mechanisms to ensure the health, maintenance and conservation of existing cover. Healthy forests, one form of green infrastructure (GI), translate into functional ecosystems that prevent additional NPS runoff. Given that 86% of Vermont forests are privately owned and managed, successfully achieving a no net forest cover loss relies on landowners reaping some financial benefits from their forestlands. Economic incentives for forest products, therefore, become an integral part of keeping and maintaining healthy forestland and healthy forest cover.

Climate change poses a significant amount of uncertainty with respect to understanding forest response to disturbance and effectiveness in meeting forest management goals. Temperature, heavy precipitation events, mild winters, and extreme wind and ice storms are predicted to increase. The best risk management associated with minimizing forestland or logging related NPS pollution in light of anticipated climate change is to manage forests to be more resilient to a variety of weather conditions and to build forest harvest plans that account for anticipated extreme weather influences.

As noted previously, NPS pollution resulting from stormwater runoff associated with developed lands is one of the leading causes of water quality impairment in Vermont. The Division of Forests within DFPR is leading an effort to promote green approaches, including urban forest enhancement and other green stormwater infrastructure (GSI) practices that intercept and infiltrate rainwater across the landscape. Healthy trees and forests translate into functional ecosystems that bind phosphorus and water, preventing additional runoff while providing other benefits. Opportunities exist to absorb stormwater by improving current infrastructure within the public road right-of-ways and make the integration of trees and other GSI practices standard components of the roadway system.

**Table 9.10. Forest Cover Related.**

<b>Forest Cover Objectives</b>	<b>Actions by DFPR</b>	<b>Milestones</b>	<b>Schedule (2015 – 2019)</b>
Enhance urban forest canopy cover	Identify high priority communities for targeted technical & financial assistance to protect urban tree canopies and implement GSI practices. Update applicable technical resources. Deliver forest canopy cover outreach presentations to varying audiences. Assist high priority urban & rural towns conduct GI assessments. Develop GI & forest canopy implementation plans.	Data analyzed with map showing high priority urban and rural areas.	2015
		<i>Landscape Guide for VT Roadways</i> and <i>Better backroads Manual</i> updated to include GSI practices.	2016
		30 training events in different contexts (10 state/regional, 10 urban, 10 rural).	2017
		20 towns with completed GI inventories.	2018
		Plans completed for 10 urban areas and 10 rural towns.	2019

***Program Activity 3: Forestry Actions – State Lands***

Two separate and recent initiatives being undertaken by Vermont ANR on state lands will further NPS pollution management within Vermont and in watersheds draining to Lake Champlain. These initiatives include improving flood resiliency and enhanced protection of

riparian areas. State lands are predominantly located in forested headwaters and are managed by foresters with the Department of Forests, Parks and Recreation giving land managers an opportunity to address NPS runoff and sediment production at the source. There are 475,650 acres of state forest land in Vermont (186,570 acres in the Lake Champlain Basin) and another 50,630 acres in Vermont conserved through the Forest Legacy Program (11,570 acres in Lake Champlain basin) where recommendations adopted through these two initiatives would be implemented.

The **Flood Resiliency Initiative** will provide a suite of planning, policy and practice recommendations to achieve greater flood resiliency on state lands. Actions to be implemented would include disconnecting forest roads and trails from stream networks and replacing undersized culverts that may result in streambank erosion and scouring.

The **Riparian Management Initiative** will provide for a greater level of protection of stream and lakeshore buffers on state lands than what is currently in place now. Currently, buffer widths as prescribed in the AMPs (minimum buffer width of 50 feet) are the default for forestry practices on state lands. Timber management is currently allowed within stream buffers. Proposed riparian management guidelines prescribe a minimum buffer width of 100 feet for streams greater than 0.5 square mile drainage area, 50 feet for streams less than 0.5 square mile drainage area and 100 feet for all lakes and ponds. Protection of ephemeral streams is also addressed and 100 foot buffers are proposed for wetlands, a provision exceeding the 50 foot buffer requirement under the Vermont Wetland Rules. Proposed management strategies for buffers will enhance and restore riparian values and functions.

Both initiatives noted above, however, have yet to be reviewed and agreed to by agency stewardship staff or leadership. Consequently, no table is provided outlining objectives, actions, milestones and schedule over the 2015 – 2019 period. While specific details are subject to change prior to final adoption, it is assumed these initiatives and their proposed actions will provide for increased sediment control and nutrient retention thus benefitting NPS management throughout Vermont.

## **E. NPS Program Partnerships and Funding Strategies**

Vermont's NPS Management Program will continue to develop partnerships (when needed) and strengthen existing partnerships at the program and project levels for the purpose of maximizing effective NPS management and control efforts. These partnerships will be fostered and strengthened by:

- Coordinating with DEC basin planners to meet once a year to report on NPS implementation progress arising out of tactical river basin plans.
- Maintaining involvement with NRCS State Technical Committee and with certain NRCS program sub-committees.

- Continue working with EPA and NRCS to carry out the National Water Quality Initiative (NWQI). DEC will continue to emphasize the Rock River (Franklin County) as the sole NWQI within Vermont to evaluate the success of the agricultural NPS reduction work in the watershed in addressing the stream’s impairment.
- Maintaining involvement with the NPS Work Group coordinated by the New England Interstate Water Pollution Control Commission.
- Continue looking for opportunities to better manage or avoid NPS pollution along river corridors and within floodplains.
- Continue collaboration with Watersheds United Vermont (WUV) as a way to bring together watershed professionals across Vermont to share information, network and apply lessons learned.
- Coordinate with ground water and drinking water programs to further protect water supply sources from NPS contamination.
- Continue to work with other government agencies to address areas of environmental concern such as priority impaired and threatened waters, proposing changes to NPS-related rules, BMP tracking and BMP effectiveness monitoring.
- Participating with Clean Water Fund Board affecting decisions regarding distribution of Clean Water Funds between state agencies and qualifying priority NPS projects.

**Table 9.11. NPS Partnerships & NPS Funding Related.**

<b>Partnerships and NPS funding objectives</b>	<b>Actions by DEC</b>	<b>Milestones</b>	<b>Schedule (2015 – 2019)</b>
Restore competitive 319 pass through grants program	Determine amount and source of state funds needed in order to pass through 319 watershed funds (ie 50% of 319 award).	Annually evaluate the possibility of restoring 319 pass through program. Continue to use state funded projects (ERP) for ‘319 leveraging’ if annual evaluation reveals 319 pass through program not feasible. Sufficient state funding provided for NPS personnel needs enabling DEC to award at least 50% of 319 award (ie watershed funds) as pass through grant funds for NPS projects.	2015 - 2019  2015 – 2019  TBD
Utilize to a higher degree US Army Corps’ Watershed Environmental Assistance Program (WEAP) within Lake Champlain Basin	Define qualifying and eligible projects for WEAP. Identify and prioritize NPS projects for WEAP that address nutrient and/or sediment loading.	Ranked NPS-WEAP priority project listing. Process created for selecting one or more projects to undertake. At least 3 NPS projects initiated under WEAP.	2017  2018  2018 - 2019

Explore benefits & need of expanding CWSRF for NPS control	Assess the need (or value) of expanding CWSRF for certain NPS pollution sources beyond those currently authorized. Award CWSRF to certain qualifying NPS efforts.	At least 5 stormwater or LID projects awarded CWSRF dollars. Additional NPS pollution sources made eligible for CWSRF dollars under VT's Intended Use Plan.	2018  2019
For NWQI, create annual information sharing process concerning agricultural NPS implementation & water quality monitoring results.	Work with NRCS and AAFM to develop reporting out process of watershed land treatment activities. Define water quality monitoring parameters of greatest interest, data analysis methods and report out frequency and methods.	Initiate NWQI annual reporting to EPA. Agreement reached between NRCS (VT), AAFM and DEC concerning process and metrics concerning land treatment and water quality reporting.	2015  2016
Assist with allocation & funding decisions concerning VT Clean Water Fund	Participate with Clean Water Fund Board. Help guide decisions regarding allocation & distribution of funds. Define priority NPS efforts to receive Clean Water Funds.	Clean Water Funds directed to priority NPS restoration & protection projects.	2016 - 2019

## F. NPS Program Administration and Oversight

### *Education and Outreach*

DEC will continue to build public understanding and awareness of NPS issues and opportunities using a broad array of available communication media and awareness provided by various partners. DEC aims to provide program partners and citizens with skills and expertise to advocate for or implement the most effective BMPs to avoid or reduce NPS pollution. DEC also relies on its partners to bring research findings or other information to its attention in order to modify programs and practices. Actions include:

- Providing examples highlighting successful implementation of outreach efforts identified in water quality plans, state or federally funded efforts, research findings and efforts by key partners.
- Working with partners to develop and deliver effective outreach strategies such as social marketing to cause or result in behavior change or willingness to adopt BMPs.
- Require grant recipients to provide an article for entry onto a 'blog site' to better publicize completed grant funded activities or implementation projects.
- Provide technical transfer, training opportunities, site visits and certification programs to innovators and key audiences.
- Develop and promote DEC on-line training to serve municipal NPS education and assistance needs.
- Account for situations where water quality has improved or been restored and develop 'NPS success stories.'

### *NPS Technical Assistance*

DEC will provide technical assistance to support watershed groups, conservation districts, regional planning commissions, municipalities, landowners and businesses about techniques and methods to identify and control NPS pollution. Such support will be provided through on-going work including:

- Assist volunteer training and provide technical assistance for watershed, stream or lakeshore surveys, assessments, planning and implementation.
- Provide water quality and NPS program information to municipalities and regional planning commissions that are revising town plans or regional plans.
- Promotion of long-term, ongoing watershed awareness and land stewardship through the use NPS project and BMP tracking methods.
- Provide a range of printed materials (technical and lay user friendly) plus other information in downloadable formats accessed from the internet concerning grant opportunities and other NPS management resources.

**Table 9.12. NPS Program Administration & Oversight Related.**

<b>Program administration/oversight Objectives</b>	<b>Actions by DEC</b>	<b>Milestones</b>	<b>Schedule (2015 – 2019)</b>
Better define priority NPS threatened waters	Refine criteria & process to define priority NPS threatened waters.	NPS threatened waters throughout Vermont identified as part of NPS Management Program plan. Define criteria for priority NPS threat & apply to candidate waters. Updated priority NPS threatened waters list.	2015  2016  2018
Evaluate the possibility of higher level of GRTS use by grant recipients	In consultation with EPA Region 1, assess the merits & QA-related concerns behind GRTS data entry by grant recipients.	Meet with EPA to determine the feasibility and practicality of 3 <sup>rd</sup> party GRTS data entry. Depending on outcome, plan next steps for potentially enabling data entry of mandated elements into GRTS by willing/capable NPS grant project partners.	2017  2018
Partial or full restoration of NPS impaired waters	Through reliable water quality monitoring efforts, document NPS impaired situations where water quality is fully or partially restored.	At least two Vermont NPS success stories submitted and made part of EPA's NPS Success Stories web page.	2015 - 2019

	Prepare & submit to EPA Region 1 applicable NPS success stories consistent with EPA requirements (under measure WQ-10).		
Continue to manage & implement NPS program to meet goals while working towards addressing Vermont's NPS water quality problems effectively & expeditiously	Employ appropriate programmatic & financial systems that ensure 319 dollars are used efficiently & consistent with fiscal and legal obligations. In keeping with Section 319(h)8 & 11, provide EPA with sufficient information/reports/data about VT 319 program to allow EPA to determine progress & whether meeting or exceeding all elements in EPA's Satisfactory Progress Determination (SPD) checklist.	Vermont NPS Program continues to receive SPDs on an annual basis in a timely fashion.	2015 - 2019
Preparation & submittal of annual NPS program reports consistent with EPA guidance	Assemble pertinent material reporting on Vermont's progress meeting program milestones noted in NPS Management Program plan. When information is available, report estimated reductions in NPS pollutant loading & other improvements in water quality arising from program implementation. Provide draft annual program report to EPA for review. Submit annual report.	Draft & final annual NPS program reports.	2015 - 2019
Revised NPS Management Program plan	Track the status of actions, milestones & accomplishments found in current 2015–2019 NPS Management Program plan. Prepare revised & updated NPS Management Program	EPA-approved Vermont NPS Management Program plan (2020-2024) in place by 10/1/2019.	2019

	plan for 2020-2024 period with submittal to EPA for review/approval prior to effective date.		
Revised DEC strategic plan	Link results based accountability (RBA) with planning effort.	RBA measure(s) defined for NPS program level. Measure(s) fed into DEC-WSMD plan. WSMD measure(s) linked to DEC plan.	2015  2016  2016 - 2017
Within 250 feet of lakeshore lines, improved management of lakeshore development activities by property owners	Launch lakeshore development permit regulatory program (2014). Assess lakeshore development permit activities on selected candidate lakes 25 acres or larger.	Status ratings of lakeshore development on lakes 25 acres or larger showing how improved surface runoff control achieved.	2019
Enhanced NPS management arising out of permit application decision processes	Achieve better levels of coordination between certain permit programs involving NPS pollution management.	Create strategies or outreach information for internal and contractor audiences to flag conditions in which the applicant and DEC permit writer need to be aware of other permits. Implement strategies/outreach delivered affecting river corridors, flood hazard areas, land disturbance 1 acre or more or within 250' of lakeshore.	2015 – 2017          2018

## Chapter 10. Measuring Environmental Progress & Evaluating Vermont's NPS Management Program

### A. Measuring Environmental Conditions, Progress & Success

#### *Water Quality Core and Supplemental Indicators*

In order to put NPS related monitoring and program evaluation efforts into context, it is useful to first provide an overview of Vermont's water quality core and supplemental indicators. The Vermont Water Quality Standards (WQS) are the foundation for Vermont's surface water pollution control and surface water quality management efforts. The WQS, now promulgated by DEC (formerly done by the Water Resources Panel under the Vermont Natural Resources Board) provide the specific criteria and policies for the management and protection of Vermont's surface waters. The classification of rivers, streams, lakes and ponds establishes the management goals to be attained, maintained and therein codified as "designated uses" for each class of water. The current Vermont WQS became effective October 30, 2014. Wetlands are managed under the Vermont Wetland Rules, effective August 1, 2010.

The WQS establish narrative and numeric criteria to support existing and designated uses. Existing uses of waters and the level of water quality necessary to protect those uses is to be maintained and protected regardless of the water's classification. A determination of what may constitute an existing water use on a particular waterbody is made during the basin planning process or by the Secretary of ANR during the consideration of an application, in conjunction with the Anti-degradation Procedure.

All surface waters in Vermont are presently classified as Class A1, Class A2, or Class B. Waters designated as Class A1 are Ecological Waters to be managed to maintain an essentially natural condition. Surface waters designated as Class A2 are Public Water Supplies. In this class, there may be a change from the reference condition of a natural waterbody due to fluctuations in reservoir water level and in reduction in stream flow resulting from water withdrawals for water supply purposes. However, this shall not result in natural flows being diminished by more than a minimal amount provided that all uses are fully supported. Class B are all other high quality waters. Class B waters comprise approximately 97% of all surface waters in Vermont. Class B waters are managed to achieve and maintain a level of quality that is compatible with designated uses.

Designated uses, as established in Sections 3-02(A), 3-03(A) and 3-04(A) of the WQS, mean any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water. Table 10.1 appearing on the following page indicates applicable designated uses.

**Table 10.1. Designated Uses Associated with Water Classifications.**

Designated uses	Water management type Class A waters		Water management type Class B waters
	A1 – ecological waters	A2 – public water supplies	B1, B2, B3
Aquatic biota, wildlife & aquatic habitat	√	√	√
Aesthetics	√	√	√
Swimming & other primary contact recreation	√	√	√
Boating, fishing & other recreation uses	√	√	√
Public water supplies		√	√
Irrigation of crops & other agricultural uses			√

Table 10.2 below presents the types of monitoring conducted or authorized by DEC to measure whether a waterbody is meeting the uses identified in the WQS.

**Table 10.2. Types of Monitoring Assessments by Designated Use to Determine Attainability.**

Designated uses	Assessment type conducted to measure attainment of WQS		
	Lakes, ponds, reservoirs	Rivers, streams	Wetlands
Aquatic biota, wildlife & aquatic habitat	<u>Biological</u> -phytoplankton -aquatic plants* -macroinvertebrates -Invasive species* <u>Chemical</u> -Water clarity* -water chemistry* <u>Physical</u> -Littoral habitat assessment*	<u>Biological</u> -nongame fish* -macroinvertebrates* <u>Chemical</u> -water chemistry* <u>Physical</u> -Modified pebble count* -Semi-quantitative habitat assessment*	<u>Biological</u> -aquatic plants* -macroinvertebrates -Invasive species* <u>Chemical</u> -water chemistry* <u>Physical</u> -connectivity -soils -hydrology
Aesthetics	<u>Physical</u> -Observational evaluation	<u>Physical</u> -Semi-quantitative observational evaluation*	<u>Physical</u> -Observational evaluation
Swimming & other primary contact recreation	Bacteria (public beaches, as resources permit)	Bacteria (public beaches, as resources permit)	Not applicable
Boating, fishing & other recreation uses	<u>Biological</u> -Invasive Species* <u>Physical</u> -Lake water level fluctuation	<u>Biological</u> -Invasive Species* -Fishery condition	Not applicable
Public water supplies	<u>Chemical (as needed)</u> -Water clarity -water chemistry	<u>Chemical</u> -water chemistry*	Not monitored by DEC
Irrigation of crops & other agricultural uses	Compliance with this use is presumed when compliance with other uses is achieved.		

\*Core indicators

Table 10.3 below includes core and supplemental indicators not expressly stated in the WQS according to other water quality indicator endpoints.

**Table 10.3. Core & Supplemental Indicators of Water Quality.**

Water quality indicator endpoint	Metric or parameter
Water clarity	Secchi transparency* Chlorophyll-a*
Water chemistry	Total nitrogen** Total silica Conductivity* Oxidation-reduction potential Salinity Base cations and anions* Iron, manganese, sulfides* Organic carbon, dissolved Mercury, total and methyl Pesticides, current use
Sediment quality	Acid volatile sulfides Metals, priority Organics, priority volatile and semi-volatile Pesticides, current use Loss on ignition
Recreational suitability	E. coli bacteria*
Biological integrity	Macrophyte cover* Fish tissue contaminants: mercury; PCBs; TCDD/TCDFs; PBDEs Fish kills and/or gamefish abnormalities Fish Index of Biological Integrity* Diatoms Phytoplankton Zooplankton Macroinvertebrate community* Fishery condition (from VT Fish & Wildlife Department)
Habitat integrity	Modified Pebble Count* Semi quantitative habitat condition assessment* Littoral habitat (in-lake)*
Physical integrity	Stream geomorphic condition Land use type and land use conversion Lake shoreline condition Lake level fluctuation Shoreline development density

\*Core indicators

\*\*Total nitrogen water quality criteria under development (2014).

## B. Introduction to Water Quality Monitoring

As noted in the Vermont Water Quality Monitoring Strategy (2011), there are numerous reasons to monitor the quality of Vermont’s water resources. Principally, the Clean Water Act and the Safe Drinking Water Act require states to characterize the baseline quality or status of waters, understand the trends or directions in which this baseline is moving and determine

what factors, stressors or pollution sources may be influencing that movement. These are critical components to proper and effective management of any water and its quality. Since NPS pollution is such a prevalent problem affecting Vermont's water resources, monitoring and monitoring programs to assess the changing degree of NPS impact are vital to effective problem understanding and decision making. In Vermont, significant emphasis has been and continues to be placed on determining whether waters are in compliance with applicable WQS and criteria. Such decisions carry significant regulatory repercussions, hence the need for a robust, transparent and scientifically defensible framework that describe the various steps of monitoring, assessment, remediation, and protection processes.

The term "monitoring" is intended to address measurement or estimation of ambient physical, chemical and biological water quality status and conditions. This includes physical stream or river geomorphic assessments. The term "assessment" refers to the determination of physical, chemical or biological condition from monitoring data and information. It also refers to the determination of whether various surface water uses are supported by the condition. The assessment process is further described in the Vermont Surface Water Assessment and Listing Methodology (2014) which can be inspected on the internet at this location:

[http://www.watershedmanagement.vt.gov/mapp/docs/mp\\_assessmethod.pdf](http://www.watershedmanagement.vt.gov/mapp/docs/mp_assessmethod.pdf)

The process of assessment begins with the three components noted above: status, trend, and causality. Estimating the status and trends of waters, with known and quantifiable precision, is the first step in assessing standards attainment. In cases where a waterbody is determined to not attain standards, then determining the extent of the water quality impact caused by any number of stressors with known and quantifiable precision is the first step toward understanding and remediating a problem.

While the current water quality management climate forces scientists and managers to think about monitoring in the framework of use support, listings and de-listings of waters and TMDL preparation, there are other, equally important goals that must be met by monitoring activities. Chief among these are the understanding of the current condition of a waterbody and the understanding of how the water responds to one or more management actions. These two objectives provide for protection and efficient remediation of waters. An important corollary objective is that monitoring provides avenues for citizens and organizations within Vermont to contribute in a meaningful way to the assessment of conditions and to the protection and/or improvement of Vermont's water resources – whether surface water (rivers, streams, lakes, ponds, wetlands) or ground water.

Regarding NPS pollution control, management actions may appear in a variety of forms (e.g. structural, non-structural, vegetative) and management actions may be applied singularly or in combination with one or more other actions. Management actions for NPS management are often times referred to as Best Management Practices (BMP). Water quality monitoring in conjunction with BMP implementation, often times done using an experimental design (e.g. a paired watershed or above/below comparisons), has been an efficient approach deployed in Vermont to determine the effectiveness of the practice(s) when controlling or reducing NPS pollutant contributions.

### *Monitoring Strategy Goals & Objectives*

DEC's Water Quality Monitoring Strategy contains two broad goals and twelve associated objectives that are provided below. These goals and objectives create the framework and approach behind Vermont's monitoring design.

**Goal 1** – To monitor and assess the physical, chemical and biological condition of Vermont's surface waters to maintain, protect, enhance and restore their integrity and uses.

Objectives:

- A. Determine the status and trends in the condition of Vermont's waterbodies.
- B. Determine if surface waters are meeting the Vermont Water Quality Standards.
- C. Use probability assessments to provide an understanding of statewide surface water conditions.
- D. Learn what stressors threaten the integrity and uses of Vermont waters.
- E. Adapt monitoring efforts to identify and track pollutants in addition to emerging stressors.
- F. Respond to public complaints and emergency situations regarding Vermont surface waters.
- G. Evaluate the effectiveness of management actions and mitigation activities in achieving water quality goals.
- H. Integrate monitoring and assessment with management actions.
- I. Integrate volunteer monitoring efforts with current departmental needs

**Goal 2** – To interpret, analyze and communicate monitoring and assessment results within ANR and outside groups to maximize good management decisions.

Objectives:

- A. Expand accessibility and use of water quality assessments within the ANR, by other state and federal entities, and by the general public.
- B. Provide information to support and evaluate Agency and Department planning, management and regulatory programs, including the development of environmental indicators.
- C. Communicate, collaborate and coordinate on a regular basis with organizations, agencies, municipalities, and the general public to assure complementary monitoring programs.

### *Monitoring Design*

The monitoring design describes the what, why and how components for the approaches chosen to best serve DEC's water quality monitoring objectives. In addition, how DEC monitors Vermont surface waters and ground waters should answer or address certain objectives from the Clean Water Act or Safe Drinking Water Act:

What is the overall quality of waters in Vermont?

To what extent is water quality changing over time?

What are the problem areas and areas needing protection?

What level of protection is needed?

How effective are clean water projects and programs?

Vermont uses three distinct monitoring design approaches to meet Monitoring Strategy goals and objectives. The three design approaches are: (1) targeted fixed stations; (2) randomly selected probability based stations; and (3) river/stream geomorphology assessments. Integrating the information gained from these design approaches is a major aim of the Monitoring Strategy and provides information about point source and NPS pollution, watershed processes and the overall condition of Vermont waters.

Targeted sites with fixed stations are chosen for a specific reason, such as a stream section with problematic erosion or discharge, or on a pond with increasing nutrients or a known nuisance or invasive species problem. Other targeted sites serve as reference sites for a class of stream, wetland or pond to assess longer term changes or trends. Probability-based sites are randomly selected by EPA to give an unbiased assessment of water quality conditions statewide. This approach is useful in determining the overall status of waterbodies and identifying overall threats to those resources. Probability-based assessment can help water quality management agencies direct resources based on intensity and distribution of threats in a quantifiable manner. River/stream geomorphic assessments identify physically unstable or 'out-of-equilibrium' areas and river corridors in need of protection from a watershed perspective. Through these three design approaches, Goal 1 and all its objectives are met.

### *Targeted Fixed Station Sites*

The design approach for targeted fixed station monitoring sites consists of three types of distinct monitoring effort, each of which is intended to better understand and manage NPS pollution. The types of targeted fixed station monitoring efforts are outlined below.

#### **1A. Rotational River Basin Assessment**

For the purposes of assessing and reporting water quality information, Vermont has been divided into fifteen major drainage basins. Each basin contains four to twenty-two river sub-basins or main stem segments. The major river basins drain into one of four larger regional drainages: Lake Champlain, Connecticut River, Lake Memphremagog or the Hudson River.

In order to more comprehensively and regularly assess the State's waters, DEC has designed a rotational watershed assessment process such that lakes and rivers within each of the 15 major basins are evaluated once every five years. To the extent possible, wetland assessments also follow this rotation schedule and as do geomorphology assessments starting in 2011. By focusing evaluations on selected watersheds each year, DEC believes more systematic and intensive efforts can be made to evaluate not only status and trends but also characterize and understand NPS impacts. A focus on a limited number of watersheds also provides the opportunity to determine the best characteristics of the river system to: use as indicators of

improving water quality and aquatic habitat; potentially reveal water quality trends; involve the general public; and, provide interagency coordination. The current planned schedule for each basin assessment are shown in the table below.

**Table 10.4. Monitoring & Assessment Schedule by River Basin.**

Basin ID #	Basin Name	Monitoring Year	Assessment Year
1	Batten Kill, Hoosic, Wallomsac Rivers	2018	2019
2	Poultney-Mettowee Rivers	2015	2016
3	Otter Creek, Little Otter, Lewis Creek	2016	2017
4	Lower (southern) Direct Lake Champlain Drainages	2015	2016
5	Upper (northern) Direct Lake Champlain Drainages	2016	2017
6	Missisquoi River	2018	2019
7	Lamoille River	2018	2019
8	Winooski River	2015	2016
9	White River	2019	2020
10	Black, Ottauquechee Rivers	2019	2020
11	Saxtons, West, Williams Rivers	2017	2018
12	Deerfield River	2017	2018
13	Lower (southern) Direct Connecticut River, Mill	2016	2017
14	Stevens, Waits, Wells, Ompompanoosuc Rivers	2017	2018
15	Passumpsic River	2015	2016
16	Upper (northern) Direct Connecticut River, Nulhegan, Willard, Paul Stream	2017	2018
17	Lake Memphremagog, Barton, Black and Clyde Rivers	2019	2020

The rotational assessment approach, which meets the objectives under Monitoring Goal 1 and Goal 2 above, results in the periodic production of river basin-specific assessment reports. Each assessment report characterizes the causes and sources affecting use support and is a valuable tool when focusing NPS pollution management efforts – whether for protection or restoration purposes. Individual river basin assessment reports are updated on a recurring five year basis.

**1B. Long term projects**

DEC coordinates a large number of fixed-station monitoring projects, incorporating river, stream and lake water quality projects. Fixed station, long-term, recurring projects are those that DEC has operated (or intends to operate) for several years. Some of these projects, such as the Ambient Biomonitoring Network and Lake Assessment Programs (both of which incorporate several individual monitoring projects and studies) achieve dense statewide spatial coverage. The total number of stream and lake stations established under these two programs alone exceeds 1,700 and 700, respectively. These monitoring networks are designed to assess status and detect trends, and therefore meet Objectives 1A, 1B, 1D, and 1G of the Strategy.

One of Vermont's major lake monitoring programs is a fixed-station, volunteer-based initiative that meets Objective 1I. Stations are added as needed to achieve more comprehensive and complete coverage. In addition, the existing fixed stations can serve as pre-established monitoring locations for random-probability based projects allowing for hybridization of fixed and probability surveys, while maintaining consistency in monitoring location coverage.

DEC also conducts or assists with monitoring in conjunction with edge-of-field type projects intended to understand and quantify BMP effectiveness. The paired watershed type monitoring design was been utilized in a number of agricultural settings as part of Vermont's NPS management efforts dating back to the 1980s.

Monitoring data and other information from the long term stations are of considerable use when documenting the nature and extent of NPS impacts, detecting possible changes in water quality resulting from NPS management or control actions and when determining the water quality effectiveness of particular NPS control actions, measures or BMPs.

### ***1C. Special and TMDL-Related Studies***

DEC undertakes special and TMDL-related monitoring studies as needed, in response to compelling data and information supplied under fixed-station and probability-based projects. Special and TMDL-related monitoring studies meet Objectives 1E and 1F. The number and nature of special studies is dictated by the nature of issues and problems that are predominantly of NPS origin. Certain special monitoring studies may be linked to waters being reported in Vermont's biennial Priority Waters Listings or those waters on the Stressed Waters list. Such waters are typically those where additional information is necessary to make an informed impairment decision. These types of fixed station studies include detailed sampling to assess use support or standards violations, diagnostic-feasibility studies, watershed-based surveys and evaluations and enhanced monitoring of stormwater-impaired watersheds. Special monitoring studies would also include water quality effectiveness evaluations for specific BMPs or particular NPS controls.

Under Section 303d of the Clean Water Act, certain waters found to not meet state WQS (so called impaired waters) are to have a Total Maximum Daily Load (TMDL) determination prepared. TMDL-related monitoring studies are scheduled as needed consistent with the timeline established in Vermont's impaired waters/303d listings and depending on available resources. DEC has prepared and received EPA approval on a significant number of TMDLs dating back to 2001. For more information about the number, pollutant type and location of completed and approved TMDLs, the reader is referred to the following web site:

[http://www.watershedmanagement.vt.gov/mapp/htm/mp\\_tmdl.htm](http://www.watershedmanagement.vt.gov/mapp/htm/mp_tmdl.htm)

### ***Probability-Based Monitoring***

Probability monitoring surveys are useful for determining the extent and intensity of statewide water quality conditions by waterbody type. Additionally, these surveys can provide information on the extent and severity of new environmental or public health concerns. These surveys provide statistically defensible estimates on stressors and use attainment statewide or

basin-wide and meet Objectives 1A, 1C and 1D of the Monitoring Strategy. EPA works with DEC to conduct the probability surveys through the National Aquatic Resource Survey (NARS).

Results from NARS aid in the allocation of resources and can guide overall water quality management activities on a larger basis. DEC strives to maximize the benefits of probability-based surveys by actively supporting or designing projects in which a predictive system can be part of the outcome. DEC has undertaken probability-based projects in collaboration with EPA-Region 1 for rivers, lakes and wetlands. A schedule of surveys completed or underway is presented in Table 10.5 with an indication of additional benefits to DEC and the Vermont NPS Program.

**Table 10.5. NARS Monitoring Schedule.**

<b>Waterbody type</b>	<b>Monitoring year</b>	<b>Benefits to DEC &amp; NPS Program</b>
National Wetland Condition Assessment	2011	Wetland bio-criteria developed
National Lake Assessment	2012	Lake bio-criteria implemented
National Rivers Assessment	2013	Methods for determining biological condition on large rivers provided
Wadeable Streams Assessment	2014	Identify & prioritize statewide stressors

NARS probabilistic surveys also help to identify and prioritize the importance of statewide stressors due to an ‘overdraw’ of probability sites in Vermont. To achieve this, DEC monitoring staff have routinely worked with EPA-ORD personnel to build sample draws that provide such coverage. Sample ‘overdraws’ leverage the Environmental Monitoring and Assessment Program (EMAP) algorithms for site selection, are statistically robust and provide estimates of the target attainment condition with a 90+ % confidence level. Overdraws provide Vermont with enough sites to determine a statewide assessment in addition to the regional assessment determined by EPA. A complete description of Vermont’s probability based projects is located in Appendix B of the Monitoring Strategy.

### *River/Stream Geomorphic Assessments*

Unlike targeted sites or probabilistic-based monitoring efforts describe above, geomorphic assessments measure and assess the physical dynamics of an entire watershed or collection of river reaches. These assessments meet Monitoring Strategy Objectives 1D and 1H. While these assessments are not strictly monitoring in the sense that stream sites are re-measured on a regular ongoing basis, geomorphological assessments result in the collection of data and other information essential to identifying and remediating watershed stressors and protecting Vermont’s flowing waters. Physical aspects of river/stream dynamics are assessed according to one of three sequentially-based phases: using maps, existing data and windshield surveys (Phase 1); using field observation and simple measurements (Phase 2); and using surveying techniques and quantitative analysis (Phase 3). Geomorphic assessments have been completed in each of the 15 river basins in Vermont and often provide a strong foundation for NPS restoration and protection efforts affecting stream channels, streambanks, riparian and

floodplain areas in riverine systems. Appropriate river/stream channel and corridor related management activity guidance is provided through DEC's 2010 *River Corridor Planning Guide*.

### C. Vermont NPS Program Evaluation

In addition to documenting the status and trends of water quality conditions, the nature of NPS pollution and being able to track or quantify progress with restoration and protection goals, DEC will conduct other NPS program evaluations on an ongoing basis as required by current or relevant EPA Section 319 guidance. The following eight evaluation approaches should be of help to Vermont and to EPA in assessing the effectiveness of the Vermont NPS Program as well as in measuring Vermont's progress in meeting or addressing various objectives, actions and milestones.

1. Priorities and Commitments (P&C) - DEC will continue to work with EPA when defining and accounting for NPS-related P&Cs established under Performance Partnership Grant and Performance Partnership Agreement negotiations. Updates on P&C progress will continue to be submitted to EPA on semi-annual basis.
2. Annual NPS Report – DEC will develop and submit an annual NPS Program Report as a means to describe significant Vermont NPS program activities, completed grant projects and documented water quality improvements. The report will also make reference to completed goals, objectives and milestones described in this Plan.
3. NPS Success Stories – As of March 2015, Vermont has documented 11 NPS success stories, the most of any New England state. Vermont's NPS success stories, which describe full or partial restoration of 13 previously impaired waterbodies, meet EPA's critical national water quality measure (WQ-10). DEC will continue its close collaboration with the regional office of EPA when documenting and describing particular NPS impacted waters that may fall into one of three categories regarding water quality improvement.
4. Grant Reporting and Tracking System (GRTS) database – On an annual basis and before the February data entry deadline, DEC will continue to enter into GRTS the mandated elements concerning 319 program and project information. Pollutant loading reduction estimates resulting from certain completed projects will be entered as appropriate.
5. Satisfactory Progress Determination – Upon request, DEC will provide to EPA other 319 or NPS information not reported in 1-4 above. EPA is responsible for conducting an annual progress and performance review of the State's program as specified under Section 319(h)(8).
6. Updates to Vermont NPS Management Program Plan – Vermont's NPS Management Program Plan will be updated on a recurring five year interval. The next EPA-approved Vermont NPS Management Program Plan will be updated in 2019 and will include milestones for the 2020 - 2024 period.
7. Quality Assurance Project Plan – On a periodic basis, DEC will revise and submit for approval its Section 319 Program Quality Assurance Project Plan. DEC's current 319 Program QAPP was last approved by EPA in October 2011.

8. Federal Financial and Performance Reports – Annual financial and performance reports will be completed by the DEC business office as required by 40 CFR 31.40(b)(1) and 40 CFR 31.41(b).

Importantly, and concerning subrecipient monitoring, DEC will continue to monitor subrecipients receiving Section 319 or other federal funds using established standard business operating practices or procedures including office visits and site visits to certain selected construction/implementation projects. DEC continues to issue performance-based grant agreements to every subrecipient, regardless of grant funding source.

## Conclusion

The State of Vermont, towns, environmental groups and the many landowners across the state have made considerable progress in their collective efforts to understand and manage NPS pollution. Beginning with efforts dating back to the late 1970s and areawide planning under Section 208 of the Clean Water Act and continuing to present day under authorities of federal and state laws, Vermont has been an active leader at applying and refining the important aspects concerning NPS management: water quality assessment and planning; prioritization of problems; targeting resources and watersheds; providing effective outreach and education; assessing the effectiveness of BMPs and other NPS controls; and, documenting successful programs and control efforts. In spite of these accomplishments, significant challenges remain in every corner of Vermont regarding the avoidance, generation and control of NPS pollution and the manner in which government and landowners can choose to apply lessons learned and manage NPS pollution. Anticipated changes in climate are likely to add another dimension to meeting those challenges.

For these reasons, Vermont's NPS Management Program is simultaneously increasing the regulatory oversight of NPS pollution control through laws, rules and other program requirements plus increasing investments for technical assistance, grants and loans.

Vermont is considered to have an effective overall NPS management program built on a variety of source or runoff specific programs and practices. The delivery of Vermont's overall NPS management program relies on collaboration and is enhanced by the wide variety of constantly evolving partnerships. Education along with technical and financial assistance and regulatory and non-regulatory approaches will remain as vital pillars of Vermont's NPS program into the foreseeable future.

To meet the challenges ahead, Vermont's NPS Management Program has identified several dozen actions and milestones for the 2015 – 2019 time period. While one measure of overall program success can be linked to the degree these actions and milestones are accomplished, other equally if not more valuable measures of overall program success will be tied to ongoing implementation of BMPs intended to protect and improve the quality of surface waters and groundwaters and the data collected through water quality monitoring efforts indicating the degree to which NPS pollutant contributions have been lessened and problems have been avoided and degraded waters restored.

The various chapters describing the Vermont NPS Management Program represent an acknowledgement of continued application of successful approaches from the past plus the integration of new initiatives to address particular shortcomings regarding NPS control. The combination of previous successes and new efforts provide a high degree of optimism that meaningful and measurable reductions in NPS pollution control progress will be achieved throughout Vermont in each river basin.

## Appendices

- A. Elements of Effective NPS Management Programs (taken from EPA guidance)**
- B. Stressors that Affect Goals and Strategies for Surface and Ground Waters**
- C. Dam Removals – Completed and Active**
- D. NPS Impaired Waters in Need of Restoration**
- E. NPS Threatened Waters in Need of Protection**
- F. Examples of Noteworthy Section 319 Funded Projects (1990 – 2011)**
- G. Act 64 of 2015 (aka Vermont Clean Water Act) Section by Section Summary**