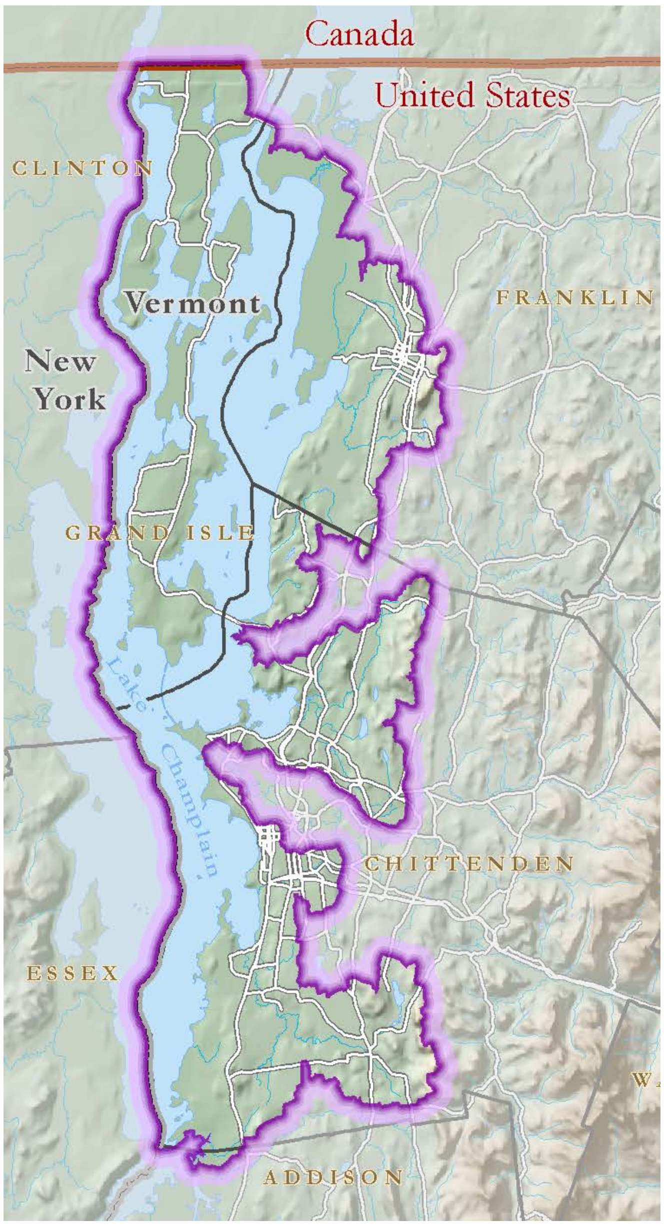
Agency of Natural Resources
Department of Environmental Conservation
Watershed Management Division

Northern Lake Champlain Direct Drainages Tactical Basin Plan Update

Updated December 28th, 2017



Vermont Surface Water Management Strategy

The Northern Lake Champlain Direct Drainages Tactical Basin Plan was prepared in accordance with 10 VSA § 1253(d), the Vermont water quality standards[1], the Federal Clean Water Act and 40 CFR 130.6, and the Vermont Surface Water Management Strategy.

Approved[1]:

8/25/15

Alyssa B. Schuren, Commissioner
Department of Environmental Conservation

Date

8-25-15

Deb Markowitz, Secretary
Agency of Natural Resources

Date

1) Pursuant to Section 1-02 D (5) of the VWQS, Basin Plans shall propose the appropriate Water Management Type of Types for Class B waters based on the exiting water quality and reasonably attainable and desired water quality management goals. ANR has not included proposed Water Management Types in this Basin Plan. ANR is in the process of developing an anti-degradation rule in accordance with 10 VSA 1251a (c) and is re-evaluating whether Water Management Typing is the most effective and efficient method of ensuring that quality of Vermont's waters are maintained and enhanced as required by the VWQS, including the anti-degradation policy. Accordingly, this Basin Plan is being issued by ANR with the acknowledgement that it does not meet the requirements of Section 1-02 D (5) of the VWQS.

Cover Photos: Rugg Brook, LaPlatte River, Thorp Brook Wetland

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Executive Summary

The Northern Lake Champlain Direct Drainages (Basin 5) Tactical Basin Plan provides an overall view of the health of the basin as well as strategies to protect high quality waters and to improve degraded water resources by addressing stressors, (see Surface Water Management Strategy.) This plan also meets U.S. EPA's expectations for the development of the Lake Champlain Phosphorus TMDL Phase II plan (see Appendix F). It will serve as the road map for work in Basin 5 that will eventually lead to achieving the phosphorus allotments established in the Lake Champlain Phosphorus TMDL.

Water resources in Basin 5 provide recreational opportunities, drinking water and support for wildlife habitat and plant communities. Despite the high level of development and agricultural land use that are common in the basin, water quality in most of the surface waters is sufficient to protect these uses. Most of the water quality problems in the Basin that impair, stress or threaten uses include algal blooms, high levels of pathogens or turbidity in the water, high levels of mercury and PCBs, and aquatic invasive species. Pollutants or processes most responsible for the first three conditions include agricultural and urban runoff, and eroding river channels due to a lack of equilibrium in the river system. The basin is also a source of phosphorus pollution to Lake Champlain.

The heart of this plan is the implementation table in Chapter 4, which includes geographically explicit strategies to protect or restore surface waters in the basin. Below are the top priority strategies from this table as well as Chapter 3:

- **Reclassify two A(2) waterbodies to class B waters** to better protect habitat functions.
- **Protect river corridors to increase flood resilience and to allow rivers to reach equilibrium** through conservation easements as well as encouraging towns to adopt appropriate ordinances
- **Increase understanding of water quality conditions** in the basin through the establishment and/or continuation of short-term intensive and long term monitoring programs, including Allen Brook and Malletts Creek in Malletts Bay watershed.
- **Promote implementation of agricultural BMPs in CSAs** (critical source area) that indicate potential for significant phosphorus load to a waterbody.
- **Resolve *E. coli* impairments** in streams with bacteria TMDLs by working with agricultural operators and residential communities and towns, including Smith Hollow Brook and Crooked Creek and Mud Hollow Brook; LaPlatte River, Englesby and Potash Brook.
- **Improve biological condition of stormwater impaired waters**, using tools such as a stormwater master planning, in addition to the required Flow Restoration Plans.

- **Assist with the installation of LID practices in Burlington, South Burlington, St. Albans, and Shelburne**, to reduce stormwater runoff to impaired waters and where present, alleviate combined sewer overflow.
- **Improve littoral zone and wetland habitat** along Lake Champlain, Lake Iroquois and through direct outreach with landowners to encourage participation in the Lake Wise Program and implementation of lakeshore BMPs.
- **Assist towns with management of roads and culverts to reduce erosion and enhance compatibility with river functions**
- **Assist wastewater treatment facilities in meeting TMDL goals** to reduce phosphorus loading to Lake Champlain.

In addition to these top priority actions, the Tactical Basin Plan also includes actions to address aquatic and riparian invasive species, to reduce sediment loading to lakes ponds and streams in the basin, and to reduce oil and contaminants in the Stevens Brook watershed.

The Vermont Agency of Natural Resources has prepared an online mapping tool, the *ANR Natural Resources Atlas*, that allows the reader to identify the locations of many Basin features http://anrmaps.vermont.gov/websites/anra/

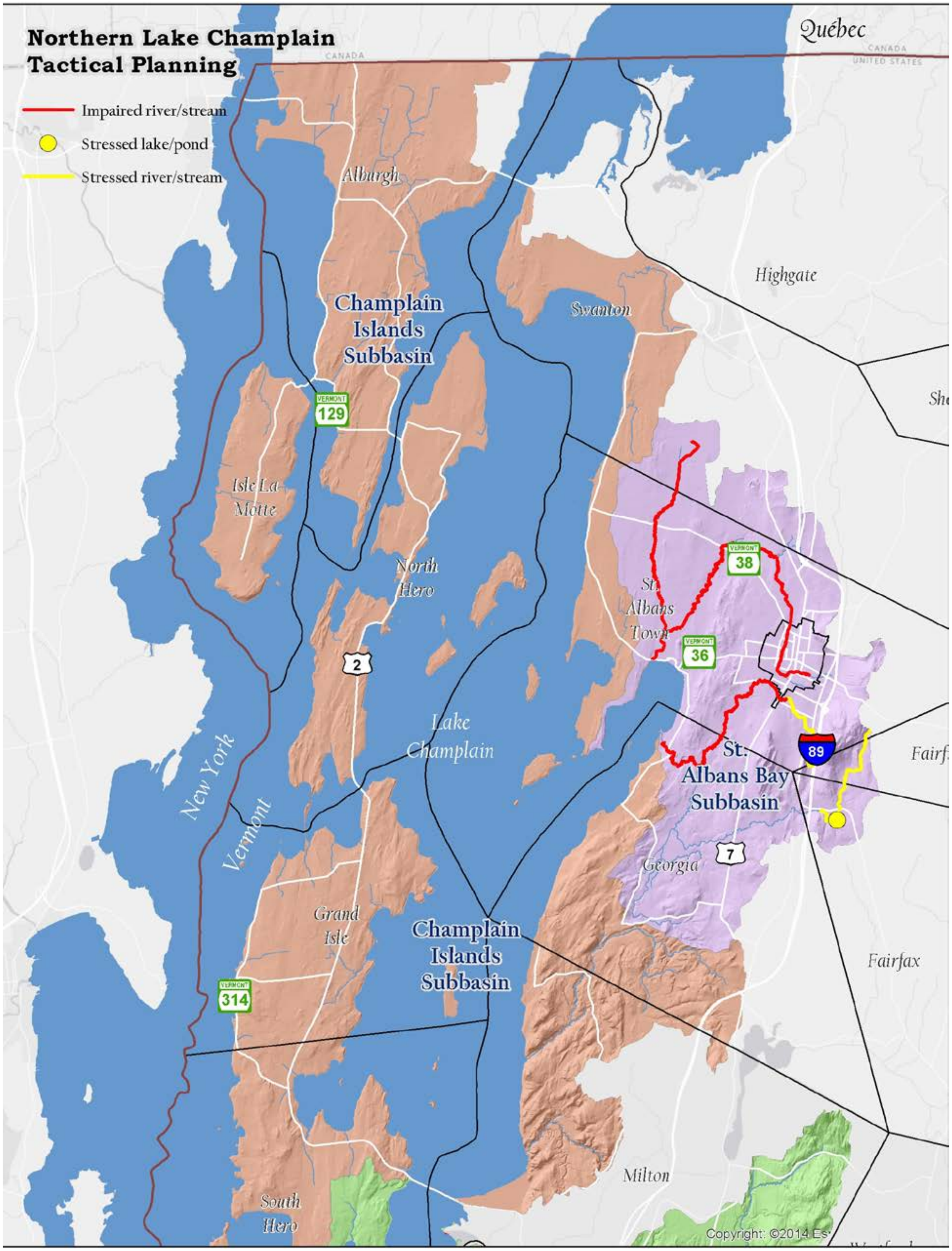

Figure 1. Northern section of Basin 5

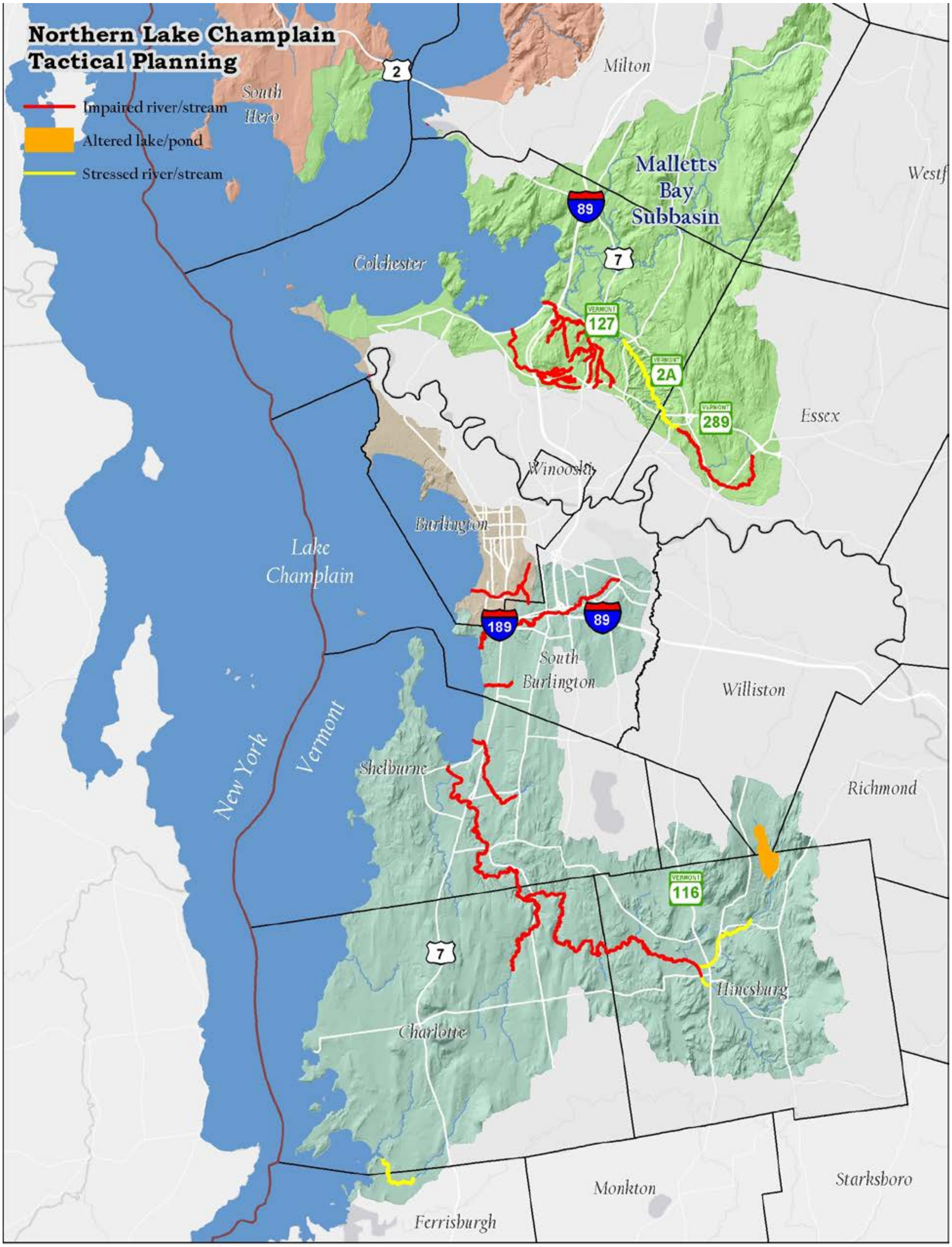

Figure 2 Southern section of Basin 5

Chapter 1 - Introduction

A. Basin Description

The Basin includes the northern section of Lake Champlain, beginning at the Ferrisburgh and Charlotte town line and ending at the Canadian border, and all Vermont surface waters excepting the three-major river watershed that drain directly into this section of the Lake (Figure 1 and 2). The watershed and its sub-watersheds are described in detail in Table 1 and Chapter 2. The Agency of Natural Resources (Agency) has completed separate basin plans for the other three river watersheds, the Lamoille, the Winooski and the Missisquoi.

B. Purpose of the Tactical Plan

Tactical basin plans are developed according to the goals and objectives of the Vermont Surface Water Management Strategy to protect, maintain, enhance, and restore the biological, chemical, and physical integrity, and public use and enjoyment of Vermont's water resources, and to protect public health and safety. This tactical plan is a guide for the Agency as well as State, federal, and local watershed partners and members of the public that work collaboratively to achieve these goals at the basin scale. The tactical planning process is outlined in Chapter 4 of the Surface Water Management Strategy.

The Agency completed a Northern Lake Champlain Direct Drainages watershed plan in 2009 (DEC 2009). That plan contained 68 actions to protect and restore water quality and aquatic habitat in the basin. Many of these recommendations focused on objectives that related to river corridor protection, stormwater management, drinking water protection, aquatic invasive species management, and agricultural practice installation. Through efforts of the Agency and its watershed partners, many of these have been implemented or are in progress. A subsequent tactical basin plan, signed in 2015, builds upon those original plan recommendations by promoting specific, geographically explicit actions in areas of the basin identified for intervention, using on-the-ground monitoring and assessment data. An update to this plan in 2017, by way of the addition of information to Appendix F, allows it to serve as the Phase 2 Implementation Plan for the execution of the Champlain TMDL.

C. Watershed Partners

Partners in the tactical planning process include multiple State and federal agencies. They can play multiple roles, include funder, technical resource (see the appendices in the Vermont Surface Water Management Strategy) or project manager as well as providing guidance during the planning process. These partners are undertaking watershed monitoring, assessment, protection, restoration, and education and outreach projects in Basin 5.

Chittenden County Regional Stormwater Education Program (RSEP)/ Chittenden County Stream Team (CCST) is a project to engage citizens across an eight-town area (Burlington, Essex, Essex Junction, Milton, Shelburne, South Burlington, Williston & Winooski) to implement projects to reduce non-point source pollution and stormwater volume at the local level. The project utilizes social networking tools to form a cadre of concerned citizens and professionals interested in hands-on activities to reduce the harmful effects of stormwater. The project is managed by the Chittenden County Regional Planning Commission, and run by the Winooski Natural Resources Conservation District. Special focus is placed on impaired streams in the eight municipalities as well as three entities, the Burlington International Airport, University of Vermont, Vermont Agency of Transportation, that are subject to the Municipal Separate Storm Sewer Systems (MS-4) permit under Phase 2 of the federal Clean Water Act. The impaired streams are Allen Brook, Bartlett Brook, Centennial Brook, Englesby Brook, Indian Brook, Morehouse Brook, Munroe Brook, Potash Brook and Sunderland Brook

Franklin, Winooski and Grand Isle County Conservation Districts are locally led and operated organization that promotes and supports soil and water conservation. The mission of the Districts is to "help provide conservation assistance to the people living in the area through education programs and partnerships with federal, state, and local entities involved in natural resources management." The Winooski conservation district has been most active of the three, and projects have included water quality sampling with volunteers, tree planting (trees for streams) programs and stormwater management programs for residential landowners.

Friends of Northern Lake Champlain is a non-profit organization dedicated to the rehabilitation and protection of northern Lake Champlain and all the waters that flow into it. The organization works collaboratively with local communities, farmers, government, lake associations, regional planning, and policy developers to reduce polluted land use runoff into Lake Champlain

Lake Champlain Basin Program is a congressionally designated initiative to restore and protect Lake Champlain and its surrounding watershed. The program 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 LCBP 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

Lake Champlain Committee is a bi-state organization that is solely dedicated to protecting Lake Champlain's health and accessibility. The committee uses science-based advocacy, education, and collaborative action to protect and restore water quality, safeguard natural habitats and ensure recreational access. The program is also the home organization for the Lake Champlain Paddlers' Trail, providing a safe, recreational corridor for human-powered craft on the lake. The Lake Champlain Committee also leads citizen- based efforts to conduct blue-green algal surveillance and reporting for Lake Champlain and adjacent waterbodies. These efforts are coordinated with ANR and the VT Department of Health

Lake Champlain International (LCI) is a federally recognized 501(c)(3) non-profit organization actively involved in shaping the future of Lake Champlain's water and fisheries health for the well-being of the people who depend on it today and tomorrow. To protect, restore, and revitalize Lake Champlain and its communities, LCI educates, advocates, and motivates to ensure that Lake Champlain is swimmable, drinkable, and fishable, understanding that healthy water resources are essential for a healthy economy and a healthy community.

Lake Iroquois Association was formed to maintain and enhance healthy ecosystems and appropriate public uses of Lake Iroquois (located in the four towns of Williston, Hinesburg, Richmond, and St. George, Vermont) and those aspects of its watershed which impact on the health and well-being of the lake. The association does this by monitoring, prevention and management initiatives, research, education, advocacy and other actions, involving the co-operative efforts of property owners, town, state, and federal officials and other interested parties.

LaPlatte Watershed Partnership's mission is to protect significant ecological values and natural systems within the LaPlatte watershed for wildlife, plants and human cohabitation. This citizen's group, made up of people from Charlotte, Hinesburg, Shelburne and Williston, works with other organizations to provide resources and information that will facilitate conservation improvement activities in the watershed towns. The water quality monitoring arm of the LWP is the South Chittenden River Watch program.

St. Albans Area Watershed Association was created in 2002 with the primary goal of restoring the water quality of St. Albans Bay and the surrounding watershed. The association is a grassroots group.

Lake Champlain Sea Grant develops and supports research, outreach and education programs to empower communities, businesses and other stakeholders in the Lake Champlain Basin to make informed decisions regarding the management, conservation, utilization and restoration of their aquatic resources for long-term environmental health and sustainable economic development

Watershed Municipalities and the Regional Planning Commissions - The basin includes 21 municipalities (Figure 1, 2) as well as the Chittenden County and Northwest Regional Planning Commissions. The municipalities play an important role in protecting or remediating water resources as prescribed under State and federal law (see Chapter 2, section I). In addition, municipalities also expend resources to treat stormwater from roads, assist watershed groups or municipal conservation commissions in efforts to assess water quality through monitoring programs or implement water resource restoration projects. Often with the assistance of the regional planning commissions, ANR or the Vermont League of Cities and Towns, these municipalities have also adopted zoning or ordinances that further ensure water resource protection.

D. Other Planning Processes

St. Albans Watershed Initiative

The Agency created the St. Albans Bay Watershed Initiative to focus attention on water quality problems that continually plague St. Albans Bay. The Initiative focuses on reducing nutrient and sediment-laden polluted runoff that drains directly into the bay. Sources include polluted runoff from agricultural land, developed lands, and roads, as well as unstable river channels. The initiative is being implemented in close partnership with the Northwest Regional Planning Commission, the City of St. Albans, the University of Vermont Extension System, and the VTrans Better Back Roads Program.

The Northwest Regional Planning Commission received support from ANR Ecosystem Restoration Program (ERP) to help identify water quality improvement projects within the watershed. The work consisted of three parts:

(1) Evaluate previously completed water quality improvement reports for potential projects (Capital Eligible Water Quality Projects, St. Albans Bay Watershed.)

(2) Use GIS overlay mapping techniques to identify potential critical source areas (CSA) in the watershed likely to contribute phosphorus runoff; and (3) identify capital funds-eligible nonpoint source pollution reduction projects concerning: (a) publicly and

privately owned road-related projects, and (b) stormwater retrofit opportunities in areas of the watershed that are not within the boundary of the municipal stormwater permit (i.e., Municipal Separate Storm Sewer System (MS4) permit).

As a first step in addressing stormwater runoff problems, the City of St. Albans received support to develop a flow restoration plan and then worked collaboratively with VTrans to develop the plan for the upper portion of Stevens Brook. The plan, completed in February 2014, identifies a number of publicly and privately-owned sites that could better control stormwater runoff volumes and improve conditions in the upper reaches of the brook.

The University of Vermont (UVM) Extension System also received ERP funds to work with agricultural landowners in the Jewett Brook and lower Stevens Brook watersheds. The purpose of the work is to implement conservation practices at critical source areas. The UVM Extension program is also serving as a 'case manager' to assist landowners with enrollment in U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) cost-share soil and water conservation programs.

The ERP program provided an additional $60,000 in funds to VTrans to implement six priority BBR projects in three towns within the watershed --Swanton, Fairfield and St. Albans.

E. Implementation Process

This Tactical Basin Plan includes targeted actions to achieve the State's water quality goals laid out in the Vermont Surface Water Management Strategy (DEC 2012) (VSWMS) and Chapter 2.

The actions are described in the implementation table (Chapter 4) and will be addressed over the life of the Northern Lake Champlain Direct Drainages Tactical Plan, envisioned as five years. The Tactical Basin Plan will not be a static document. It is expected that the Agency and its partners will have to develop adaptive management techniques as new natural and anthropogenic events present themselves.

Successes and challenges in implementing actions will be reviewed in biannual meetings with watershed partners. In addition, the implementation table will be modified accordingly to best address newly emerging information, unanticipated events, and new requirements such as are anticipated by the Lake Champlain Phosphorus TMDL.

Chapter 2- Water Quality in the Basin

A. Watershed Description

The Northern Lake Champlain Direct Basin is only about 37 percent forested, a much lower percentage than for other basins in Vermont. Historically, the Basin has been heavily farmed and agricultural land still accounts for a substantial portion of the landscape with approximately 35% of the land area in this use. Developed land, including transportation infrastructure, occupies approximately 13%, relatively large compared to other Vermont basins. The remaining 15% includes waterbodies.

The basin's landscape changes dramatically from north to south. Overall, the landscape in the northern half of the Basin (Grand Isle and Franklin counties) is predominantly agricultural, whereas the southern end of the Basin around the LaPlatte River watershed is predominantly forested. In between are the urbanized communities of Burlington, South Burlington, Colchester, Milton, Essex Junction and Shelburne.

For this plan, the entire area is broken down into the following five subwatersheds, shown in Figures 1 and 2: St. Albans, Malletts, Burlington and Shelburne Bays, and the Champlain Islands. The watersheds, their significant streams and adjacent lake sections are identified in Table 1. The Pike and Rock Rivers and the Missisquoi Bay are also Basin 5 waters; however, they have been addressed in the Missisquoi River planning process[1].

Table 1. Subbasins in Basin 5 and their associated streams, towns and lake segments.

Subbasin	Contributing Streams and Ponds	Towns	Adjacent Lake Segment
St. Albans Bay	Jewett, Rugg, Stevens Brook, and Mill River; and St. Albans Reservoirs	St. Albans city and town, Georgia	Northeast Arm
Malletts Bay	Malletts Creek, Allen Brook, Indian Brook, Crooked Creek, Moorings Stream and Milton Pond and Indian Brook Pond	Colchester, Milton, Essex Junction	Main Lake, Northeast Arm
Burlington Bay	Englesby Brook	Burlington	Main Lake
Shelburne Bay (and shoreline south)	Potash, Munroe, Bartlett, Thorp and Kimball Brooks, LaPlatte River, and Lake Iroquois	Shelburne, Charlotte, Hinesburg, South Burlington	Main Lake
Champlain Islands and shoreline of Lake	Stonebridge Creek, Trout Brook, Mud Creek	Alburgh, Isle La Motte, South and North Hero, Grand Isle, Georgia, Milton	Northeast Arm, Main Lake

[1] see http://www.anr.state.vt.us/dec/waterq/planning/htm/pl_missisquoi.htm

B. Assessment of Water-based Resources

The Agency's Watershed Management Division (WSMD) in the Department of Environmental Conservation (DEC) assesses the health of a waterbody using biological, chemical and physical criteria. The Division pulls together all readily available information during the development of each basin's Water Quality and Aquatic Habitat Assessment Report and biennially when the statewide 303(d) List of Impaired Waters and List of Priority Surface Waters Outside the Scope of 303(d) are generated. The list (Table 2) provides preliminary information on responsible pollutant and/or physical alterations to aquatic and riparian habitat and if known, the source. In addition, the Lake Score Card (table 5) shows the conditions of each lake in Vermont based on monitoring and assessment work by the WSMD. Detailed information on the condition of water resources in the basin is in the DEC Basin 5 Water Quality and Aquatic Habitat Assessment Report and the three updated subwatershed reports for St. Albans Bay, Malletts Bay, and Shelburne Bay [2]. The following is a summary of the condition of rivers, lakes and ponds in the basin:

Rivers

Based on river miles, sediment and nutrients are the most prevalent pollutants[3] in streams and rivers except at high elevations. Physical alterations are also present throughout the watershed, ranging from habitat alteration, general stream channel instability and encroachment into the flood hazard zone. Next prevalent as source of impairment or stress are pathogens. More isolated problems specific to particular reaches[4] include, thermal modification, toxic compounds from hazardous waste sites and flow alteration.

Lakes and ponds

The basin encompasses nine lakes or ponds that are above 10 acres in size. Threats to aquatic habitat and water quality in the lakes include shoreline development and flow alterations (i.e., water level fluctuations). Additional problems include sedimentation and increased eutrophication due to nutrient loading. The nutrient loading has resulted

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[2] http://dec.vermont.gov/watershed/map/assessment#Northern Lake Champlain Basins WQ Assessment Reports

[3] Definition of these pollutants can be found in VSWMS http://dec.vermont.gov/sites/dec/files/documents/wsmd_swms_Appendix_B_Pollutants.pdf

[4] The waters and associated problems are listed in the EPA and state lists (see Table 2)

in algal blooms and more recently, cyanobacterial blooms (blue-green algae). Aquatic Invasive Species (AIS) pose a threat to the four of the lakes (see Lakescore card, Table 5).

All the Basin 5 lakes (and all but one in Vermont) are under a Vermont Department of Health Fish Consumption Advisory for exceeding the USEPA mercury limits in fish. Mercury is a chemical that becomes toxic at high concentrations and as bigger fish eat smaller fish, the mercury concentrations increase in the fish tissues, and through this process of bioaccumulation, mercury levels become unsafe for human consumption of the fish.

Despite the threats to the lakes, Basin 5 does include examples of lakes with healthy ecosystems: within Vermont, Milton pond rises to the top 10% for water quality and the top 25% for all criteria assessed for the WSMD Lakescore card (see Table 5).

To learn more about pollutants and stressors discussed above, please see Figure 3.

The following sections provide an explanation of how the Division identifies pollutant sources.

C. Stressors, and Causes and Sources of Impairment

The [Vermont Surface Water Management Strategy](#) (DEC 2012) (VSWMS) lays out the goals and objectives of DEC's Watershed Management Division (Division) for addressing pollutants and stressors that affect the designated uses of Vermont surface waters. The strategy discusses the 10 major stressors (Figure 3) that are managed to protect and improve surface waters. A stressor is defined as a phenomenon with quantifiable damaging effects on surface waters resulting from the delivery of pollutants to a waterbody, or an increased threat to public health and safety. For the most part, stressors result from human activity on the landscape;

Figure 3. Stressors relating to water resource degradation with links to in-depth information.

however, when landscape activities are appropriately managed, stressors are reduced or eliminated.

Figure 3 provides links to the stressor chapters of the VSWMS that describe in detail the stressor, its causes and sources, and DEC's approach to addressing the stressor through monitoring, technical assistance, regulations and funding.

D. Sources of Pollutants and Physical Alterations to Aquatic and Riparian Habitat

Most pollutants enter surface waters either as a point source, a discrete source from a pipe, or as non-point source, carried in precipitation that runs off the landscape (stormwater runoff). The one exception is aquatic invasive species (AIS), plants or animals that are often inadvertently introduced to waterbodies by people. The landuse activities that are responsible for non-point source pollutants, are described in detail in the VSWMS under activities.

Point sources

Point sources are discharges of wastewater and, for the most part, are managed through DEC's National Pollutant Discharge Elimination System (NPDES) permitting process. DEC oversees permitting for pre-treatment and direct discharges of municipal and industrial wastewater treatment facilities and the oversight of concentrated animal feeding operations (CAFOs). Most of the pollutant load from point source enters through the direct discharges of municipal wastewater (see Chapter 2, section C.). The permitting process results in discharges that will ensure that receiving waters meet Vermont water quality standards and comply with specific Total Maximum Daily Load (TMDL) allocations. To ensure continued compliance, and as part of the tactical planning process, DEC assesses monitoring results of effluent and receiving waters, and re-evaluates permit conditions during permit renewals every five years.

Nonpoint sources

The quality and volume of runoff is more complicated to control than point sources because effective nonpoint source pollution control requires land management approaches that are in the purview of a multitude of individuals and groups. The Department of Environmental Conservation (DEC) regulates some activity on the landscape: VSWMS includes a list of regulatory programs focused on surface water protection (see Appendix A). Where landuse activities are not subject to regulations, DEC encourages the community to adopt practices that protect surface waters. To this end, the Agency of Natural Resources (Agency) provides grants, technical assistance, education and outreach to help the community better manage stormwater runoff and protect surface waters. The Implementation Table in Chapter 4 includes strategies for distributing the assistance and encouraging the community members to adopt sustainable behaviors. The strength in the strategies lies in the collaborative approach the Agency has taken with other State, federal, non-profit groups and community members to develop and implement the strategies.

Climate change: increasing pollutant loads and impacts to waterbodies

Climate change predictions for Vermont are expected to lead to increased pollutant loads from the landscape as well as loss of native species. With the predictions including the increased intensity of storms and resulting increase in stormwater flows, management of landscape activities, will in turn, have to intensify to effectively address stressors such as channel and land erosion, nutrient loading and thermal stress. In addition, invasive species will gain a competitive edge as well with warmer temperatures and management strategies must change to better protect native species.

F. Water Quality Assessment Results for Specific Waterbodies

The Department of Environmental Conservation uses monitoring and assessment data to assess individual surface waters in relation to Vermont Water Quality Standards as outlined in the DEC Surface Water Assessment and Listing Methodology and other relevant guidelines (e.g., stream equilibrium standard). Based on assessment results for water quality, degraded surface waters are placed into one of three categories: stressed, altered or impaired, as described below:

Stressed waters support designated uses, but the water quality and/or aquatic biota/ habitat have been disturbed to some degree by point or by nonpoint sources of human origin and the water may require some attention to maintain or restore its high quality. In some instances, stressed waters may have documented disturbances or impacts and the water needs further assessment to confirm impairment.

Altered waters are affected by 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.

Impaired waters are those surface waters where there are chemical, physical and/or biological data collected from quality assured and reliable monitoring efforts that reveal 1) an ongoing violation of one or more of the criteria in the water quality standards and

2) that a pollutant of human origin is the most probable cause of the violation. Impaired waters are those that require pollution control efforts under one or more provisions of the Clean Water Act. The most common mechanism to address an impaired water is the development and promulgation of a Total Maximum Daily Load (TMDL).

Table 2 lists the known stressed, impaired or altered streams in Basin 5 based on the 303(d) and other lists. See Appendix A for biological assessment results of each stream.

The goals of the Tactical Basin Plan include addressing the stressors or pollutants degrading the listed waters in Table 2 through geographically specific actions (see Chapter 4 Implementation Table). The types of actions prescribed are based on the stressor specific practices outlined in the Vermont Surface Water Management Strategy. Additional monitoring and assessment needs are outlined in Table 7.

Table 2 Impaired (I), Altered (A), or Stressed (S) stream conditions in the Northern Lake Champlain Direct Drainages arranged by stressors (DEC 2014a, DEC 2014b,.

Surface Waters Affected by Land Development Activities:

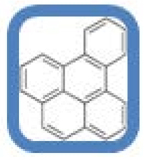
Stream or lake segment	Mileage[5] & Status	Pollutant	Source	Other Info.
Lake Champlain Segments	***Impaired*** - Part D list	Phosphorus	P enrichment	EPA approved Lake Champlain Phosphorus TMDL September 25, 2002. EPA disapproved in 2011. EPA Developing new TMDL expected 2015
Rugg Brook from mouth upstream	3.1 miles ***Impaired***-Part A list	Nutrients, sediment, E. coli	From agricultural runoff	Part of an agricultural TMDL being developed
Jewett Brook	3.5 miles ***Impaired***- Part A list	Nutrients, sediment, E. coli	Agricultural runoff	Part of an agricultural TMDL being developed
Mill River from mouth upstream	1.8 miles ***Impaired***- Part A list	Nutrients, sediment	Agricultural runoff, streambank erosion	Part of an agricultural TMDL being developed
Stevens Brook from mouth upstream	6.8 miles ***Impaired***-Part A list	Nutrients, sediment, E. coli	Agricultural runoff, stream instability	Lower part of Stevens Brook is through ag land but also receives all upstream urban pollutants
Rugg Brook, from rm 3.1 upstream to Route 7	1.6 miles ***Impaired*** Part D list	Stormwater	Stormwater runoff	EPA approved a TMDL 2/19/2009
Stevens Brook from Pearl St (rm 6.5) to rm 9.3	2.5 miles ***Impaired*** Part D list	Stormwater	Stormwater runoff, Erosion/sedimentation, Morphological instability	EPA approved a TMDL 2/19/2009
Mill River upper reaches	3.5 miles ***Stressed*** Part C list	Sediment, nutrient/ org. enrichment, E. coli	Ag & urban runoff, stream-bank erosion	Pollutants and stressors not well defined

[5] Unless otherwise stated, mileage is distance from mouth to end of stream segment

Stream or lake segment	Mileage[5] & Status	Pollutant	Source	Other Info.
Indian Brook – from rm 5.8 to rm 9.8	4 miles **Impaired**-Part D list	Stormwater	Stormwater runoff, land Development, erosion	EPA approved TMDL August 21, 2008.
Direct Smaller Drainages To Inner Malletts Bay - Crooked Creek	3 miles **Impaired**-Part D list	E. coli	Urban runoff, potential failed/failing Septic systems	EPA approved TMDL September 30, 2011
Direct Smaller Drainages To Inner Malletts Bay Smith Hollow Stream	2.7 miles **Impaired** – Part D list	E. coli	Urban runoff, potential failed/failing Septic systems	EPA approved TMDL September 30, 2011
Englesby Brook, Mouth To Rm 1.3	**Impaired** – Part D list	stormwater	Stormwater runoff, Blanchard Beach closure	EPA approved TMDL August 21, 2008.
Englesby Brook	**Impaired** – Part D list	E. coli	Elevated E. coli levels	EPA approved TMDL September 30, 2011
Munroe Brook	2.8 miles ***Impaired***– Part D list	stormwater	Stormwater runoff, erosion, land Development	EPA approved TMDL August 21, 2008.
Bartlett Brook	0.7 miles ***Impaired***– Part D list	stormwater	Stormwater runoff, land Development, erosion	EPA approved TMDL September 30, 2007
Potash Brook	5.2 miles ***Impaired***-Part D list	stormwater	Stormwater runoff, land Development, erosion	EPA approved TMDL December 19, 2006
Potash Brook	***Impaired***– Part D list	E. coli	urban runoff, illicit discharges	EPA approved TMDL Sept 30, 2011.
Mud Hollow Brook	3.0 miles ***Impaired***-Part D list	E. coli	Agricultural runoff, streambank Erosion	EPA approved TMDL Sept 30, 2011.
LaPlatte River – from mouth to Hinesburg	10.5 miles ***Impaired***-Part D list	E. coli	ag runoff	EPA approved TMDL Sept 30, 2011.
LaPlatte River, from mouth to Hinesburg	10.5 miles ***Stressed*** – Part C List	turbidity, sediment, thermal & habitat modifications	streambank erosion, channel instability, land development	See Implementation Table, Chapter 4
Patrick Brook From Laplatte R up to Lower Pond	***Stressed*** – Part C List	physical modification	land development, channelization	See Implementation Table, Chapter 4

Stream or lake segment	Mileage[5] & Status	Pollutant	Source	Other Info.
Kimball Brook, From Town Farm Bay Up 1.1 Miles	1.1 miles ***Stressed* – Part C List**	Turbidity, Nutrients	Pasture, barnyard, lack of riparian vegetation	See Implementation Table, Chapter 4

Surface Waters Affected by Toxics



Stream or Lake Segment	***Mileage/status***	Pollutant	Source	Other info
Lake Champlain segments	***Impaired*-**Part D list	Mercury	Atmospheric deposition	Elevated mercury in walleye; EPA approved a TMDL on 12/20/2007
Lake Champlain segments	***Impaired*-** Part A list	PCBs		Elevated levels of PCBs in lake trout
Stevens Brook, Lasalle St Downstream of 0.5 Mi	***Impaired*-** Part A list	Metals	Sed contamination from St Albans gas and Light haz waste site	Continue monitoring ground and surface waters
St. Albans Reservoir North	***Stressed*-**Part C list	Unknown Copper	Reservoir treated with copper sulfate	Macroinvertebrate assessment indicates potential biological alteration. Copper in sediments above NOAA threshold effects level
Indian Brook - mouth to rm 5.4	5.4 miles **Stressed**-Part C list	Sediment, Toxics, Metals	Potential impacts from landfill leachate, Developed areas, hazardous waste site	Assessment of stream sediments and biota needed. Follow-up needed by DEC Waste Management Division.
Burlington Bay - Lake Champlain - Pine Street Barge Canal	***Impaired*-** Part B list	Priority & Nonpriority Organics, Metals, oil, Grease, PCBs	Contamination from coal tar in sediments of Pine St. Barge canal (site #770042)	The Pine Street Barge Canal Coordinating Council is overseeing implementation of the May 1998 Cleanup Plan. EPA approved Cleanup Plan

Surface Waters Affected by Flow Alteration:

Stream or lake segment	Mileage[5] & Status	Pollutant	Source	Other Info.
				
Stream or Lake Segment	***Mileage/status***	Pollutant	Source	Other info
Rugg Brook, Upstream From Route 7	***Stressed***	Flow changes, physical channel changes,	Land development, suburban runoff	See Implementation Table Chapter 4.
Surface Waters Affected by Aquatic Invasive Species 				
Stream or Lake Segment	***Mileage/status***	Pollutant	Source	Other info[6]
Lake Champlain	***Altered***-Part E list	Zebra mussels	Spread after introduction	Nearly all suitable substrate covered; Expanding onto soft substrate; native mussels extirpated in these areas
Lake Champlain	***Altered***-Part E list	Eurasian water milfoil	Spread after introduction	Has been some mechanical harvesting; weevils are present in Lake Champlain.
Lake Iroquois	***Altered***-Part E list	Eurasian watermilfoil	Spread after introduction	Weevils augmented 1996-2011; public access greeter program in place.

G. Additional Assessments that Identify Sources of Stressors and Pollutants

DEC also supports assessments that provide additional information relating to stressor and pollutant sources as well as remediation and protection opportunities (see Table 3 for list of assessments). During the tactical basin planning process, the assessments are used to prioritize geographic areas for project development. The assessments also

[6] See http://dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives for further information on current actions supported in the basin to manage or prevent the spread of AIS.

include projects that are considered for inclusion in the basin plan's implementation table (Chapter 4). Additional assessment needs are outlined in Table 3 and 7.

Table 3 Status of assessments for the Northern Lake Champlain Direct Drainages

	Sub-Basin	Geomorphic Assessment	Water Quality Monitor-ing	Stormwater Mapping	Illicit Discharge Detection	Stormwater Master Plan (SMP) or Flow Restoration Plan (FRP)
St. Albans Bay	**Jewett Brook**	PC	U	NA	NA	NA
	Stevens Brook	PC	U	C	C	SMP, FRP - PC
	Rugg Brook	PC	U	C	C	FRP- PC
	Mill Brook	PC	U, X	NA	NA	SMP - C
Lake Champlain Islands and shoreline	**Stone Bridge Brook**	PC	PC	NA	NA	NA
	Thorp, Kimball and Holmes	PC	PC	X	NA	NA
Malletts Bay	**Allen Brook**	C	PC/X	C	C	SMP-X
	Malletts Creek	PC	X	NA	NA	NA
	Crooked Creek	NA	PC/X	NA	C	NA
	Smith Hollow	PC	PC/X	C	C	NA
	Pond Brook	PC	PC/X	C	NA	NA
	Indian Brook	C	X	C	C	FRP-PC
Burlington Bay	**Potash Brook**	PC	U	C	C	FRP-PC
	Englesby Brook	PC	U	C	C	FRP-PC
Shelburne Bay	**LaPlatte River (Mud Hollow)**	C	U/X	C	PC	SMP-PC
	McCabes	C	PC/X	C	C	SMP-PC
	Munroe Brook	PC	U	C	C	FRP-PC

X= proposed in plan C= Completed PC= Partial Completion U=Underway[7] NA=Not Applicable

<u>Biomonitoring assessment site status</u>

Overlaid on both the agricultural erosion potential and road erosion risk maps are the most recent assessment results at DEC biomonitoring sites (also available in Appendix A and on the Vermont Natural Resources Atlas). The point features are color coded to show status based on macroinvertebrate monitoring data that have been accepted and approved by DEC. Original assessment categories were assigned by DEC scientists as "poor", "fair-poor", "fair", "fair-good", "good", "good-very good", "very good", "very

[7] Assessment that are underway also include long-term monitoring efforts taken on by volunteer watershed groups, municipalities or the State.

good-excellent", and no status where not enough data exists. These were then grouped and color-coded on this map as "low", "fair", "good", "high", and "highest". This data only communicates the results of the most recent assessment outcome.

DEC LaRosa Lab Volunteer and other Water Quality Assessments

In addition to WSMD-collected data, assessments also consider stream chemical data collected by volunteer monitoring groups and analyzed by the DEC Larosa lab. The most common parameters include total and dissolved phosphorus, total nitrogen and total suspended solids. In Basin 5, the Southern Chittenden County Riverwatch has collected data on the LaPlatte River, and Munroe, McCabes, Thorp, Holmes and Kimball Brooks. In Basin 5, the Chittenden County Stream Team collects data at one or two sites on Allen, Potash, and Munroe Brook. This data and other volunteer water quality monitoring data is analyzed by the DEC LaRosa lab.

The data was useful in identifying a section of Kimball Brook as stressed (see Table. In addition, the high phosphorus and sediment concentrations in agricultural-dominated subwatersheds of Thorp and Kimball was considered during the agricultural assessment (see below).

In addition, the town of Colchester received an EPA grant to develop an Integrated Water Resources Management Study (Town of Colchester, 2011). The study included water quality sampling along Colchester tributaries. Microbial source tracking was also conducted in two subwatersheds of Malletts Bay.

Stream Geomorphic Assessments

Geomorphic assessments and River Corridor Plans integrate watershed-wide physical stream characteristics from maps, aerial photographs, existing studies, and field data on the geographic, geologic, and hydrologic factors of the stream channel and floodplain characteristics. This information reveals equilibrium departures, ongoing channel adjustments, and provides a detailed characterization of riparian and in-stream habitat, stream-related erosion, and flood hazards for use in watershed planning. Geomorphic assessments generally include a comprehensive assessment of bridge and culverts for both geomorphic and aquatic organism passage (AOP) compatibility.

Assessment of all Vermont streams by DEC's River Management Program has found that 75 percent of Vermont field-assessed stream sections are undergoing channel evolution processes. A stream in this situation lacks access to its floodplains during high frequency floods. The evolution process includes the widening and aggrading of incised streams and results in the development of new floodplains along the rivers. Recent major storms have energized these channelized stream systems with inputs of water and sediment and in so doing have accelerated the process. The physical adjustment process of streams is most commonly observed as stream bank erosion. Erosion results in the meander changes that occur as the channel slope and energy gradient adjust in equilibrium with watershed inputs.

The ongoing adjustment process have degraded water quality in the streams by increasing turbidity and sedimentation associated with erosion. In turn, aquatic habitat has declined due to the increase in sedimentation and absence of riparian vegetation.

The assessed tributaries in Basin 5 experience many of the same stressors and are going through similar processes, including incision and subsequent and ongoing planform adjustments in lower reaches. The causes of the incision differ among these tributaries. Urbanized stream's hydrologic changes are associated with stormwater discharge. In many of the streams in former or current agricultural lands, incision is a result of straightening and encroachment. Most streams have been subject to alterations due to culvert or road crossing, which alter hydrology and sediment loads.

The basin planning process included the review of priority river protection and restoration projects listed in the SGA corridor plans. Projects were included in the implementation table (Chapter 4) based on a number of considerations. These include the ability to enhance a community's flood resiliency, for example, the protection of areas for attenuation and adjustments towards equilibrium where there are current threats from development or other practices that are not prohibited through existing regulations. The prioritization of municipal culvert replacement throughout the Basin that were assessed in an SGA are located separately in Appendix C.

The SGA results were also used to identify areas of concern for landuse activities based on the sediment departure regime. The SGA for the Mill River identifies an area where landuse activity may be the driving force behind changes in sediment movement in the stream, necessitating further investigation by DEC and the AAFM. Geomorphic assessments for Malletts and Allen Creeks also called out areas with high sensitivity for erosion; indicating a need for further assessment of landuse activity as well as water quality monitoring (see Implementation Table, Chapter 4 for strategies).

Table 4 Stream Geomorphic Assessments in Basin 5. Access reports at https://anrweb.vt.gov/DEC/SGA/finalReports.aspx

River	Assessment type	Date completed

Allen and Malletts Creeks	Malletts Creek & Allen (Petty) Brook Phase 1 & Phase 2 Stream Geomorphic Assessment Summary Report	2/23/2011
Direct Drain to Lake Champlain	Direct Drain to Lake Champlain Phase 1 SGA	2/01/2008
Indian Brook	Indian Brook Watershed Departure Analysis and Project Identification	4/14/2008
LaPlatte River	Hinesburg Reaches on the LaPlatte Phase 2 SGA	2/01/2006
LaPlatte River	LaPlatte River and tributaries Corridor Plan	6/01/2007
LaPlatte River	LaPlatte River Corridor Plan Shelburne and Charlotte	4/01/2008
LaPlatte River	LaPlatte River Phase 2 SGA	6/01/2004
LaPlatte River and McCabes Brook	Phase 2 SGA Lower LaPlatte and McCabes Brook	6/01/2007
Stonebridge Brook, Mill River, Rugg Brook, Deer Brook	Stonebridge, Mill River, Rugg Brook Fluvial Erosion Hazard Mapping & Phase 2 Assessment Report	2/01/2008
Pond Brook and Smith Creek	Pond Brook and Smith Creek Phase 1	4/27/2007
Stevens Brook / Rugg Brook / Jewett Brook	Geomorphic Assessment of Stevens, Rugg and Jewett Brooks in Franklin County, Vermont	3/15/2006

Stormwater Master Plans

The Department of Environmental Conservation (DEC) has supported the development of stormwater master plans to identify and address priority areas for stormwater management for the Hinesburg Village, Alburg, St. Albans Town and Georgia (see Table 3 and https://anrweb.vt.gov/DEC/_DEC/SWMapping.aspx?Folder=Town%20Reports%20and%20Maps/). In addition, through DEC's St. Albans Bay Watershed Initiative, the Northwest Regional Planning Commission has identified additional water quality improvement, nonpoint source, projects in the St. Albans Bay watershed (NRPC 2015)

All MS4 entities, including St. Albans City, are required to develop stormwater management plans (see Chapter 2, section I)

The basin planning process considers the inclusion of priority projects from stormwater plans based on significance in comparison to projects throughout the basin and additional information collected relating to the feasibility of a proposed project.

Agricultural Assessment

The Agency of Agriculture, Food and Markets (AAFM) assesses the need for Required Agricultural Practices(RAP)) and Best Management Practices (BMPs) on agricultural sites. In Basin 5, the level of assessment will vary based on intensity of agriculture in the area, see Appendix C of the previous basin plan (DEC 2009) for a general description of agriculture in the Basin and Appendix D of the plan for a list of State and federal resources available to agricultural producers.

In addition, the Agency of Agriculture (AAFM) has established goals for assessing agricultural operations in the basin through the Phase 1 TMDL for Lake Champlain. The assessment goals focus the assessments to the dense agricultural areas in northern Lake Champlain first, then the southern portion of Lake Champlain. The order of farm type is primarily focused on dairy and livestock operations and then other agricultural types. Farms identified as needing additional BMPs or compliance with RAPs will be provided information on how to access technical assistance resources. See Appendix F for additional information.

St. Albans Bay watershed

An intensive effort to assess farms in the Missisquoi and St. Albans Bay watershed is underway. The AAFM and partners have inspected each known livestock farm in the St. Albans Bay watershed. In addition, a specific inspector has been assigned to small farms (SFO) to provide additional assistance to these farms, which in the past have not had as much contact with agricultural staff from either State or federal partners. The work will be aided by the following resources that can help prioritize resources to areas that may provide the highest loadings:

- In St. Albans Bay, Northwest Regional Planning Commission created maps that identify critical sources areas (CSA) for sediment and phosphorus loading from crop (NRPC, 2015)
- DEC created a less detailed CSA map for the entire Basin 5, see Erosion and Sediment risk maps (Fig. 4-8); and

- In St. Albans Bay, AAFM has mapped field ditches, roadside ditches, and streams; mapped cropland fields that have been tiled (conventional or systematic); and is currently working on mapping cropland fields that have high phosphorus-index levels where nutrient management plans are in place.

Additional staff and funds will be available to assist landowners with implementing BMPs, including:

- Landowner assistance with U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) program enrollment
- Cost-share soil and water conservation programs within CSAs (UVM Extension, ERP funds)
- Regional Conservation Partnership Program (RCCP) funds focused on challenged watersheds identified by EPA, NRCS, ANR and other partners. Challenged watersheds in Basin 5 include Jewett and Steven Brook in St. Albans Bay for 2015-2016.
- Additional RCPP funds received by the VT Association of Conservation Districts will provide funding to develop nutrient management plans on small farms in watersheds including Basin 5.
- North Lake Farm Survey initiative-related projects will be developed and implemented with partners including Farmer's Watershed Alliance, Friends of Northern Lake Champlain and the Vermont Association of Conservation Districts.
- Agricultural engineering firms have been placed on retained with the Agency of Agriculture to design and implement structural on farm BMPs.
- Additional AAFM and NRCS engineers to help farmers design projects and oversee the private sector engineering work.

Other sub-watersheds

The other subbasins in Basin 5 support much less agricultural activity. Using stream geomorphic assessment and water quality data, additional areas were identified as priority for further discussion. The potential priority areas that have been discussed by the AAFM supported agricultural resource group, mentioned above, includes sections of the Mill River, Malletts Creek, Pond Brook, the LaPlatte River, and Thorp and Kimball Brooks (also see Implementation Table, Chapter 4). Resources will be directed towards these areas as time and resources permit.

Lake and Pond Assessments

The Vermont Lakes and Ponds Management and Protection Program has created Lake Score Card to show and explain the conditions of each lake in Vermont. A Check List of Lake Protection Actions is included with the Lake Score Card to best direct lake management actions for each individual lake.

The table below is a summary of the Lake Score Card findings for the 10 lakes in Basin 5, with blue signifying good, yellow fair, and red reduced conditions for each of the four categories: Shoreland and Lake Habitat; Invasive Species; Atmospheric Pollution; and Water Quality. Where no color is shown, no data has been collected, and therefore the condition has yet to be assessed.

Table 5. Lakescore card results for Basin 5 lakes (10+ acres). Shoreland score based on 2014 data, all other scores based on 2011 data.

Lake	# of acres	Invasives	Atmospheric	Water Quality	Shoreland
COLCHESTER	186	Blue	Yellow	Blue	Blue
INDIAN BROOK (ESSEX)	50	Red	Yellow	Blue	Blue
IROQUOIS	243	Red	Yellow	Blue	Yellow
LITTLE (FRANLN)	95	Blue	Yellow	Blue	Blue
LONG (MILTON)	47	Blue	Yellow	Blue	Blue
LOST (GEORGA)	10	Blue	Yellow	Blue	White
LOWER (Sunset Lake)	58	Red	Yellow	Blue	White
MILTON	24	Blue	Yellow	Blue	Blue
NORTH ST. ALBANS	35	Blue	Yellow	Blue	White
SOUTH ST. ALBANS	27	Blue	Yellow	Blue	White

Shoreland development is the greatest stressor to Vermont lakes, as recently reported in the National Lake Survey study (USEPA, 2012). It is one of the top three priorities for Vermont lake management, along with controlling and preventing further spread of aquatic invasive species and conducting regular monitoring and assessment on lakes.

Passed by the Vermont legislature in 2014, the Shoreland Protection Act now regulates the creation of cleared area and impervious surface on lakeshores with a surface area of > 10 acre. Development subject to permits may require implementation of best management practices to protect water quality, ensure bank stability and protect shoreland habitat. Education and outreach specific to implementation of shoreland best management practices is being implemented through the Division's shoreland permitting and Lake Wise initiatives (Appendix E). Specific lakes targeted for the Lake Wise initiatives as well as additional project implementation and AIS management efforts are included in the Chapter 4 Implementation Table.

H. Surface waters associated with very high quality ecological integrity, significant natural communities or fisheries.

Biological integrity

DEC assesses ecological integrity in rivers and streams using biological assessments of macroinvertebrate and fish communities, which are assessed on a gradient from "poor" at the most impacted, to "excellent" at the most natural (see Appendix A for Basin 5 biological assessment results). River segments that rate consistently good to excellent include:

- LaPlatte at river mile 5.8
- Allen Brook at river mile 1.3
- Stone Bridge Brook at river mile .1

These segments, however, do not reach the level of high quality biological integrity.

The Trout River and upper LaPlatte River are both potential area for excellent ecological integrity based on surrounding known water quality and landuse. The Agency plans to sample a site on both rivers during the subsequent rounds of biological monitoring in the basin.

Significant Natural Communities and Rare, Threatened and Endangered Species of the Basin

Significant natural communities associated with water resources include the wetlands along the Lake Champlain shoreline. The wetlands depend upon the seasonal water level fluctuations of the Lake and riparian areas for their existence and ability to support wildlife and fish. The largest of these wetlands are often situated on river deltas. Black Creek Marsh, located at the north end of St. Albans Bay where Jewett and Stevens Brooks converge, is one example. This 360-acre wetland complex includes deep rush and cattail marshes and deciduous forested wetland. In a 1988 survey of the area, both the state threatened spiny softshell turtle and the uncommon map turtles were found. Similar wetland complexes are found at the mouth of the Thorp Brook (Charlotte), Mill River (Georgia), LaPlatte River (Shelburne), and Malletts Creek (Colchester).

The clay sediments and low elevation of the Lake Champlain Islands helped create the 33 wetland complexes identified as "priority wetlands" during the Vermont Advanced Wetlands Planning and Protection Project. The largest one, Alburgh's Mud Creek and

Swamp, is a 1500-acre wetland complex that includes softwood and hardwood swamps, shrub swamps, emergent wetlands and shallow open water areas. A number of rare or threatened plants and animals inhabit portions of this wetland complex including nodding trillium, matted spikerush, least bitterns, black-crowned night herons, map turtles, blue-spotted salamander, spiny softshell, sora, pied-billed grebe, black tern, and common moorhen. Although much of the swamp is protected by ANR as a wildlife management area, activity outside the area result in impacts to water quality and the habitat.

The South Alburg Swamp and associated sand beach at the Alburg Dunes is considered "one of Vermont's premier natural areas" by the Advanced Wetland Planning and Protection Project. The swamp consists of a number of wetland types including red maple-green ash swamp, the unusual tamarack-red maple swamp, small areas of white cedar swamp, and a black spruce swamp with open bog, a boreal community out-of-place in the moderate climate of the Champlain Valley. At the southern end of this large and diverse swamp community is a long stretch of sand beach and dunes.

The lower LaPlatte River also provides habitat for rare, endangered, and threatened species. Species include the channel darter, stonecat (a fish), blue-spotted salamander, four-toed salamander, and pocketbook (a mussel). Other rare, endangered, and threatened species in Basin 5 include the northern brook lamprey, blacknose shiner, and mottled sculpin. Additional information about significant natural communities and rare, threatened, and endangered species is contained in the 2013 DEC Basin 5 Water Quality and Assessment Report and in the Shelburne Bay Watershed Updated Assessment Information Report June 2013.

The Watershed Management Division's Wetland Program has identified Colchester Bog, Sandbar Wetlands, and Munsons Flat as potential Class I wetlands. In addition, the LaPlatte River Marsh, Thorp Brook and Mud Creek warrant further study to determine their value as Class I (see Chapter 3).

Fisheries

The fish species within Basin 5 are diverse and many support recreational fisheries. Lake Champlain is a warm water fishery except for portions of the lake where depths are more than 25 feet at Low Lake Level (93 feet NGVD) from June 1, through September 30. These areas support a cold-water fishery. Fishery habitats in the streams range from high velocity riffles with cobble substrate such as in the upper LaPlatte River, to slow moving pools with sand substrate, such as in Indian Brook, to seasonally flooded wetlands adjacent to Lake Champlain. The wetlands with lake influenced hydrology are spawning habitat for yellow perch, brown bull head, pumpkinseed, bowfin, largemouth bass, black crappie, carp, mud minnow and longnose gar.

In addition, spring high water levels inundate upland meadows as well as wetlands, providing additional spawning habitat for fish. Prime spawning habitat for northern pike lies above 98.5 feet (the average annual high is 99.7 feet); however, it is the additional spawning habitat created during the infrequent years with spring lake levels rising above 100 feet that support the abundant population of northern pike (ANR 1978). The high lake levels allow northern pike to swim through flooded fields to spawn on grasses, where eggs and small fry will benefit from the warm temperatures of the shallow water. Carmans Marsh in Swanton and Malletts Creek in Colchester are excellent examples of this environment.

I. Regulatory Programs for Addressing Stressors and Pollutants

Regulatory programs play a significant role in ensuring that pollutants and stressors responsible for degraded water quality are addressed. The Vermont Agency of Natural Resources' (VANR) and the Agency of Agricultural, Food and Markets' regulatory programs that are associated with water resource protection are described in the Vermont Surface Water Management Strategy - Appendix A .

The passing of Act 64 in 2015, resulted in the creation of the State's Clean Water Initiative Program (CWIP). The CWIP has provided additional resources and direction to the Tactical Basin planning process for Basin 5 regarding sediment and phosphorus reduction. The goal of this Initiative is to satisfy the State's legal obligations under both the Vermont Clean Water Act and the federal Clean Water Act. The priorities to achieve this goal include:

1. Implementing agricultural best management practices
2. Reducing and treating stormwater runoff and erosion from developed lands
3. Installing pollution controls on State and municipal roads
4. Restoring and protecting natural infrastructure for flood resiliency and water quality improvements
5. Increasing investments in municipal wastewater treatment infrastructure

The CWIP also strengthens the relationship between VANR and the Regional Planning Commissions, Vermont League of Cities and Towns, and municipalities to strategically identify projects for the Tactical Basin Plans to address the above priorities.

The regulatory processes that will support the priorities include the development of the following permits or regulations:

Regulatory Program or Permit	Application	Issuance Date	Regulated Community
Required Agricultural Practices (RAPs)	Adopt and implement a set of minimum conservation practices to protect water quality	2016	Agricultural operations
Municipal Roads General Permit (MRGP)	Inventory and control stormwater discharges from municipal roads	2018	Municipalities
Municipal Separate Sewer System (MS4) General Permit	Restore stormwater-impaired streams	2018 (Re-issuance)	12 MS4 communities
Operational Three-Acre Permit	Inventory and control stormwater discharges on sites where impervious surfaces exceed 3 acres	2018	Municipalities and Private Land Owners
Transportation Separate Storm Sewer System (TS4) Permit	Inventory and control stormwater discharges from the transportation network and associated transportation facilities	2017	State transportation

See VDEC's Clean Water Initiative webpage for additional information, including timing for permit enactment. The new as well as existing regulations will be an important tool for ensuring that Vermont water quality standards are met. While the implementation table of this plan includes numerous actions that will be implemented on a voluntary basis, actions will also help to facilitate adoption of permit requirements and provide municipalities and landowners with incentives to develop and implement required management plans under the new permits.

Total Maximum Daily Load Implementation Plans

The federal Clean Water Act requires states to establish a Total Maximum Daily Load (TMDL) for polluted waters. A TMDL places a cap on the amount of a pollutant allowed to enter a lake or river, and allocates that maximum amount among the various sources. Vermont develops implementation plans for each waterbody with a TMDL that provides reasonable assurance that the waterbody will meet goals by a specific date. Basin 5 has waters with TMDLs for mercury, bacteria, stormwater and phosphorus (see Table 2). The mercury TMDL will be addressed through EPA's efforts to control emissions from Vermont and other states. The other TMDLs are addressed through implementation plans developed by VANR and approved by EPA. The latter two TMDLs and associated implementation plans are explained in further detail below. The bacterial TMDLs will be met in part by other TMDLs such as the stormwater and phosphorus. In addition, actions listed in Chapter 4's implementation table to address pathogens in the streams with bacteria TMDLs describe the efforts needed to meet goals:

Stormwater TMDLs and Municipal Separate Storm Sewer System (MS4)

Seventeen of Vermont's waters are impaired due to urban stormwater runoff; six of those are in Basin 5. These waters fail to meet the Vermont water quality standards, because they fail to attain biological water quality criteria, based on biological monitoring data.

Act 140, passed by the General Assembly in 2004, requires that the Agency of Natural Resources develop a TMDL or water quality remediation plan for each of these waters. TMDLs have been developed for Vermont's urban stormwater impaired waters. The Stormwater Management Program in DEC's Watershed Management Division has developed an implementation strategy for the TMDLs with input from the Vermont Stormwater Advisory Group (SWAG).

During the interim period prior to implementation of the TMDL through a general permit, projects in the affected watersheds (listed below) will have to comply with a "net zero" pollution standard. The following waterbodies in Basin 5 have USEPA approved TMDLs:

- Bartlett Brook
- Englesby Brook
- Indian Brook

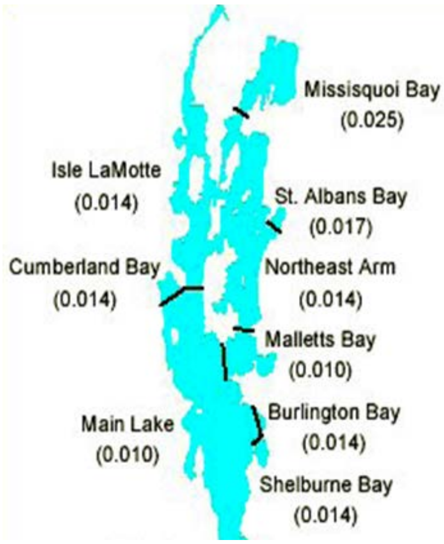


Figure 4. Phosphorus concentrations critera in the Vermont water quality standards for Lake Champlain segments.

- Munroe Brook
- Potash Brook
- Stevens Brook
- Rugg Brook

The DEC's implementation framework for the stormwater TMDLs is supported by USEPA guidance and by case studies of TMDL implementation efforts around the country. The main elements of the DEC's implementation framework are described below.

On December 5, 2012, DEC issued a General Permit (3-9014) for Stormwater Discharges from MS4s. The 2012 permit includes new requirements for MS4 entities including the development of a Flow Restoration Plan (FRP) for each stormwater impaired watershed to which they discharge by no later than October 1, 2016. The FRPs must include the following elements:

- An identification of the suite of necessary stormwater best management practices (BMPs) that will be used to achieve the flow restoration targets. DEC is providing support for the development of these plans using hydrologic modeling software developed by TetraTech, Inc.
- A design and construction schedule not to exceed 20 years from the issuance of the permit.
- A financial plan that estimates the cost of implementing the required controls and a strategy for financing those costs.
- A regulatory analysis that identifies additional authorities that the MS4 entity must adopt to implement the plan.
- An identification of regulatory assistance that the MS4 entity may require of DEC to implement the implementation plan
- Identification of any third parties that are responsible for implementing any portion of the TMDL.

See Appendix G for an example of a draft FRP for Stevens and Rugg Brooks, St. Albans City and Town.

The MS4s must also identify, by October 1, 2015, how they wish to deal with the expired permits in their respective impaired watersheds. There are approximately 125 expired stormwater permits in Basin 5. MS4s have the option of directly including these discharges under their FRP, or requesting that DEC utilize its residual designation authority to require these discharges upgrade to current standards. The MS4s must also implement or otherwise fund a precipitation and flow monitoring program in each impaired water to which the MS4 discharges. Following legislation passed in 2013, DEC has the ability to collect fees from and manage the monitoring program on behalf of the MS4s, and is engaged in a collaborative process with contributing municipalities to facilitate an accurate, reliable and cost-efficient monitoring program."

DEC has also issued NPDES General Permit 3-9030 under its residual designation authority (RDA) to discharges in five of the 12 urban stormwater-impaired waters with BMP implementation requirements. Discharges in these waters were designated that did not discharge into or commingle with runoff from the MS4. DEC plans to issue permits to discharges in the remaining lowland impaired waters in 2015. DEC may exercise additional residual designation authority as necessary to ensure that any private dischargers into the MS4 that are identified as a necessary component of BMP implementation participate in implementation activities.

Lake Champlain Phosphorus TMDL

Phosphorus pollution is the greatest threat to clean water in Lake Champlain. Phosphorus is a nutrient that stimulates excessive growth of algae in the lake, turning the water green and making it unsuitable at times for swimming or drinking. Phosphorus is found in eroded sediment and runoff from farm fields, barnyards, roads, parking lots, and streambanks, and in wastewater discharges.

Vermont has accelerated its efforts to reduce all these sources of phosphorus over the past ten years, but the lake has been slow to recover. The five subwatersheds of Basin 5 are contributors along with the tributaries noted in Table 1 and to a lesser degree areas of Quebec and New York State.

In 2002, the U.S. Environmental Protection Agency (EPA) approved a Lake Champlain Phosphorus TMDL that was prepared by the states of Vermont and New York. In 2011, the EPA concluded that two elements of the TMDL did not comply with EPA regulations and guidance, and thus their approval of the 2002 TMDL was withdrawn. On June 17, 2016, EPA established new phosphorus TMDLs for the twelve Vermont segments of Lake Champlain. Subsequent to the TMDL, he State of Vermont developed a restoration plan for Lake Champlain and its tributaries as Phase I of the TMDL. This 2017 update of the 2015 Basin 5 plan meets U.S. EPA's expectations for the development of the Lake Champlain Phosphorus TMDL Phase II plan. Most of the relevant material is included in Appendix F. The additional information will serve as the road map for work in Basin 5 that will eventually lead to achieving the phosphorus allotments established in the Lake Champlain Phosphorus TMDL following strategies outlined in the Phase I implementation plan.

Bacteria TMDLs

Twenty-one of Vermont's waters are impaired at least in part due to bacterial contamination; six of those are located in Basin 5. These waters fail to meet the Vermont water quality standards, because they fail to attain biological water quality criteria, based on biological monitoring data.

A Vermont Statewide TMDL Report was designed to support bacteria pollution reduction and watershed restoration throughout Vermont. Bacteria data for impaired waterbodies are presented in the report's Appendices 1 through 19 on a watershed basis.

The bacterial impaired watersheds in Basin 5 include:

- Smith Hollow Brook and Crooked Creek (Direct Smaller Drainages to Inner Malletts Bay)
- Englesby Brook
- LaPlatte River from Hinesburg to mouth (10.5 miles);
- Mud Hollow Brook, from mouth to 3 miles upstream
- Potash Brook

Within each watershed, measured bacteria concentrations in each of the impaired waterbodies are used to estimate the percent reduction needed to attain water quality standards.

This statewide report, organized on a watershed basis with site-specific data presented for each impaired waterbody, highlights pollutant sources and provides meaningful implementation actions to mitigate each type of pollutant source. The TMDL provides a framework for the implementation and restoration process a useful format for guiding both remediation and protection efforts in impaired watersheds.

Specific actions in the Chapter 4 Implementation Table for the listed bacterial impaired surface waters above are part of the TMDL implementation plan.

J. Flood Resilience Efforts

In Vermont, the warmer global temperatures resulting from climate change are expected to lead to earlier thawing of Vermont's rivers, lakes and ponds and snowpack in the mountains. In addition, streams flows' yearly averages are expected to continue increasing over the coming decades with high flows occurring more frequently[8]. These events are expected to lead to increased erosion over the landscape, including within river channels. As part of its effort to address climate change, the Agency is working with communities to enhance their flood resiliency. Working towards resilience means both proactively reducing vulnerabilities to flooding and flood damage, and improving response and recovery efforts when flood events do occur, so that communities bounce back quickly from natural resource, social and economic impacts. Reducing vulnerabilities includes efforts to diffuse stormwater flows from buildings, over roads, especially in areas with slope and erodible material.

The importance of flood resilience was highlighted in the aftermath of tropical storm Irene and other recent flooding events across Vermont. Act 16, effective July 2014, requires municipal and regional plans to incorporate a "flood resilience" component or element.

Improving flood resilience requires mapping local flood hazard areas, identifying flood attenuation zones (including floodplains, river corridors, forests and wetlands) and recommending specific actions and policies to towns that will help protect these areas and reduce the risks facing existing development. The DEC Watershed Management Division has developed resources to assist municipalities including publishing statewide maps of river corridors, and included these and other municipal resources to a website: Flood Ready. These efforts will work towards making flood resiliency an integral part of town planning. Figure 15 identifies the towns in the Basin that have adopted municipal river corridor and floodplain protection bylaws as of 2015.

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[8] The Vermont Climate Assessment (VCA)at http://vtclimate.org/

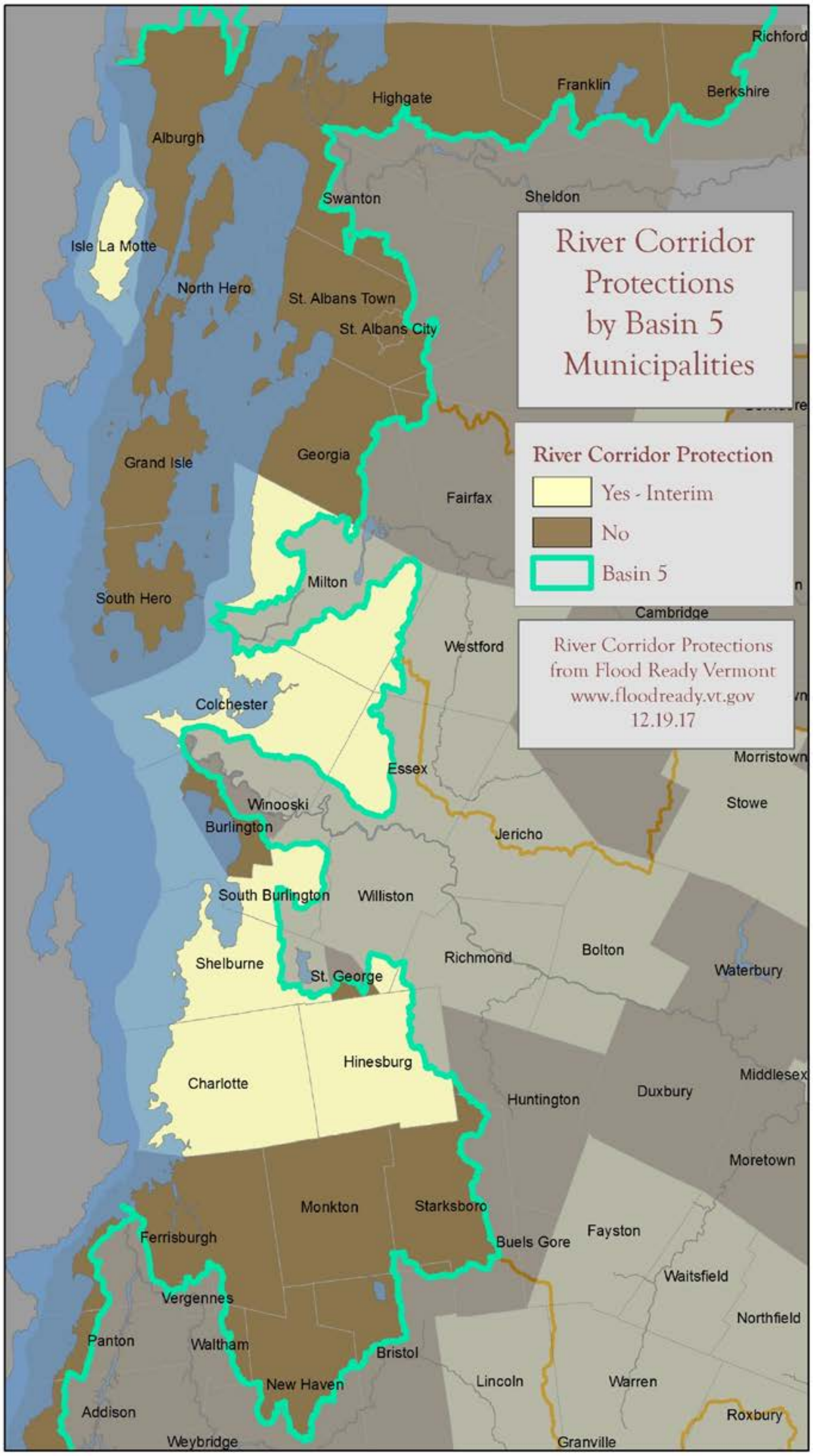

Figure 5. Basin 5 municipalities with river corridor and floodplain protection bylaws

K. Targeted Priorities for this Tactical Basin Plan.

Assessment needs and priorities

In addition to waters identified as needing further assessment in Table 2, Table 7 proposes additional assessment needs based on conclusion from the previously described assessments in this chapter.

Table 6. Additional proposed monitoring and assessment needs in Basin 5 with supporting documents in parentheses.

• Mud Hollow and the Malletts Bay tributaries are a priority for additional assessment for sources of *E. coli* bacteria. The existing bacterial TMDLs for these waters use data from 2004 and 2005 respectively , see http://www.vtwaterquality.org/mapp/htm/mp_tmdl.htm
• Measuring phosphorus and sediment concentrations in streams is important to understanding sources of phosphorus to Lake Champlain. Volunteer water quality monitoring programs focusing in the following areas would allow this to happen.
o Based on geomorphic assessment suggesting high rates of erosion, increased sampling in the Mill River (VEM,2008), especially the southern tributaries and the first 5.4 river miles of Indian Brook would provide information as to impact of erosion on water quality (DEC, 2008).
o Existing water quality data (Colchester, 2011) support additional sampling and assessment of sources on Pond Brook, Moorings Stream, Smith Hollow Brook and Crooked Creek.
o Watersheds with potential for development such as Allen Brook are also important places for additional water quality monitoring.
• Biological monitoring to determine compliance with the Vermont water quality standards based on other assessments include (additional) sections of Allen Brook (LaRosa Lab data collected by CCST volunteers), Pond Brook (Colchester, 2011), Indian Brook (DEC, 2008), Patrick Brook and Thorp Brook (LaRosa Lab data collected by LWP volunteers).
• In addition, assessment of streams to identify waters with excellent biological integrity should also be prioritized (Appendix A). Trout Brook and the upper LaPlatte River are two areas of interest based on site visits by DEC staff.

Implementation Priorities

Based on the above stressors causes and sources of impairment, and VANR'sunderstanding of the water-quality related issues and assessment needs described above, the following watersheds are identified as the focus of this basin plan (see the basin specific reports for descriptions of these streams as well as Table 1-3):

- Jewett, Stevens, and Rugg Brooks
- Southern Branch of Mill River
- Malletts and Allen Creek and Pond Brook
- Crooked Creek and Smith Hollow Brooks
- Burlington Bay and Shelburne Bay stormwater impaired streams (Munroe, Potash, Bartlett, Engelsby) and unnamed tribs
- Patrick Brook, Mud Hollow and the mid section of the LaPlatte River
- McCabes Brook
- Thorp and Kimball Brook

Chapter 3- Management Goals for Waters in the Northern Lake Champlain Direct Drainages

The protection or improvement of water quality and water-related uses can be promoted by establishing specific management goals for particular bodies or stretches of water. The management goals describe the values and uses of the surface water that are to be protected or achieved through appropriate management. In Chapter 2 of this plan, a number of waters were identified as being potential Class I wetlands, and these, as well as other unique areas, may be candidates for establishing alternate management goals or augmented protections through one of the processes that are further described below.

- Opportunities for reclassification of waters.
- Identification of existing uses
- Opportunities for designation of Outstanding Resource Waters.
- Classification of wetlands
- Designation of waters as warm and cold-water fisheries.

The Agency of Natural Resources is responsible for determining the presence of existing uses on a case-by-case basis or through basin planning, and is also responsible for classification or other designations. Once the Agency establishes a management goal, the Agency manages state lands and issues permits to achieve all management goals established for the associated surface water. Before the Agency recommends management goals through a classification or designation action, input from the public on any proposal is required and considered. The public may present a proposal for establishing management goals for Agency consideration at any time. When the public develops proposals regarding management goals, the increased community awareness can lead to protection of uses and values by the community and individuals.

Public involvement is an essential component to restoring and protecting river and lake ecology. The Vermont water quality standards "Public participation shall be sought to identify and inventory problems, solutions, high quality waters, existing uses and significant resources of high public interest." Emphasis on the identification of values and expectations for future water quality conditions can only be achieved through public contributions to the planning process.

Although Basin 5 provides plenty of opportunities for great boating, fishing and swimming, not many of the rivers and streams, lakes and ponds, and wetlands in the basin currently achieve a very high quality of water and aquatic habitat and are exceptional places to swim, fish, boat, and otherwise enjoy. Where these very high-quality waters exist, there is the opportunity to protect surface waters by identifying and documenting the excellent quality and preserving those excellent conditions or features through various classifications or designations. Several statewide references and reports available with descriptions of the exceptional ecological quality or recreational uses of Vermont surface waters. A major new resource, the Agency's BioFinder, provides a statewide application identifying surface water and riparian areas with a high contribution to biodiversity.

A. Classification, and Recent Revisions to the Vermont Water Quality Standards

Since the 1960s, Vermont has had a classification system for surface waters that establishes management goals and supporting criteria for each use in each class of water (see Table 14). These goals describe the class-specific uses of surface waters that are to be protected or restored through appropriate management practices. The Agency works to implement activities that restore, maintain or protect the management goals.

Pursuant to Act 79 of 2016, the Vermont General Assembly, recognizing the wide range of quality for Class B waters, created a new intermediary water quality class between B and A, now called Class B(1). Act 79 also sets forth the expectation that individual uses of waters (e.g., aquatic biota and wildlife, aquatic habitat, recreation, aesthetics, etc.) may be individually classified, such that a specific lake or stream may have individual uses classified at different levels. Act 79 indicates that uses may be reclassified independently to Class B(1) if the quality of those uses are demonstrably and consistently of higher quality than Class B(2).

Through the tactical planning process, surface waters where one or more uses is of consistently and demonstrably higher quality than Class B(2) are to be identified, and proposed for reclassification to Class B(1) for the use(s) in question. Basin plans may also identify surface waters that merit reclassification to Class A(1).

The Vermont Water Quality Standards have been amended to account for this change. The new Standards feature four classes: A(1), A(2), B(1) and B(2), and have been restructured to clarify which the quality criteria pertaining to each designated use, by class.

With the exception of the waters listed below, all waters in Basin 6 are Class B(2) for all designated uses, pursuant to the proposed new Standards.

A(1)

Waters above 2,500 feet in elevation, are classified A(1) by Vermont statute

No Class A(1) waters exist in the Northern Lake Champlain Direct Drainages. The management objective for A(1) waters is to maintain their natural condition. DEC has not documented any streams in the basin that have the water quality sufficient to be proposed for designation as Class A(1) waters.

Class A(2) to Class B

Waters used as public water supplies are classified A(2). The only class A(2) waters in the Basin 5 that are currently used are the two reservoirs which drain to the Mill River and all waters within their watersheds in the Towns of Fairfax, St. Albans, and Fairfield. The reservoirs are the City of St. Albans water supply.

There following A(2) waters remain classified as public water supplies, but are no longer used as such:

- Milton Pond, Milton: No longer used as a water supply.
- Colchester Pond, Colchester: The Pond has not been used as a water supply since 1974, but may still be reserved for emergency use.

B. Existing Uses

All surface waters in Vermont are managed to support designated uses valued by the public including swimming, boating, and fishing. The degree of protection afforded to these uses is based on the water's class as described above. In specific surface waters, however, the existence of uses is protected absolutely if the Agency of Natural Resources identifies them as existing uses under the anti-degradation policy of the Vermont water quality standards. Specifically, this means that an existing use may not be eliminated by the issuance of a permit or other action where compliance with the Water quality standards is assessed (DEC Anti-Degradation Procedure, 2012). The Agency identifies existing uses of particular waters either during the basin planning process or on a case-by-case basis during application reviews for state or federal permits. During the Northern Lake Champlain Direct Drainages planning effort, DEC has identified:

- The existing use of the waters for swimming;
- The existing use of waters for boating;
- The existing use of the water for water supply, and
- The existing use of water for recreational fishing.

It is DEC's long-standing stipulation that all lakes and ponds in the basin have existing uses of swimming, boating and fishing. Likewise, VDEC recognizes that fishing activities in streams and rivers are widespread throughout the state and can be too numerous to document. The Vermont water quality standards stipulate that existing uses may be documented in any surface water location where that use has occurred since November 28, 1975. Therefore, information presented in Appendix H should be viewed as only a partial accounting of known fishing uses based upon limited criteria and does not change protection under the Clean Water Act or Vermont water quality standards for waters not listed.

C. Outstanding Resource Waters

In 1987, the Vermont Legislature passed Act 67, "An Act Relating to Establishing a Comprehensive State Rivers Policy." A part of Act 67 provides protection to rivers and streams that have "exceptional natural, cultural, recreational or scenic values" through the designation of Outstanding Resource Waters (ORW). Depending on the values for which designation is sought, ORW designation may protect exceptional waters through permits for stream alteration, dams, wastewater discharges, aquatic nuisance controls, solid waste disposal, Act 250 projects and other activities. At the present time, there are no ORW designations in the Northern Lake Champlain Direct Drainages.

D. Other High Quality Waters

The current water quality standards require that all basin plans place Class B waters into one of the three water management types. As consistent with prior plans issued by the Agency, this Plan does not make specific recommendations for water management types. It is the intent of the Agency to provide protections to the very high-quality condition of these surface waters coincident with application of the Agency's Anti-degradation Procedure. The Agency will provide technical assistance to municipalities who are interested in promoting further surface water protections.

E. Class I Wetland Designation

It is policy of the State of Vermont to identify and protect significant wetlands and the values and functions they serve in such a manner that the goal of no net loss of such wetlands and their functions is achieved. Based on an evaluation of the extent to which a wetland provides functions and values it is classified at one of three levels:

Class I: Exceptional or irreplaceable in its contribution to Vermont's natural heritage and therefore, merits the highest level of protection

Class II: Merits protection, either taken alone or in conjunction with other wetlands

Class III: Neither a Class I or Class II wetland

Northshore wetlands adjacent to Lake Champlain in Burlington is the only Class 1 wetlands in Basin 5; however, as part of the development of this tactical basin plan, several surface waters have been identified as prospective candidates for Class I, which are presented below. These wetlands have passed a cursory review by the Vermont Wetlands Program Ecologists. In addition, there are at least three wetlands that warrant study for Class I potential. These wetlands are listed below. As part of the implementation of this tactical basin plan, the Department will develop and implement procedures and documents to enable submission, evaluation, and implementation of petitions to classify wetlands as Class I. Those wetlands that satisfy criteria for designation may be proposed for such designation through Departmental rulemaking authority, and as consistent with the Vermont Wetland Rules.

Prospective candidates in Basin 5 for reclassification to Class I status include:

- Sandbar wetlands (South Hero); Colchester bog; Mallett's Creek/Munson Flats

Wetlands in Basin 5 that warrant further study for Class I potential:

- Mud Creek wetlands (Alburgh); LaPlatte Wetlands (Shelburne); Thorp Brook Wetland (Charlotte)

F. Warm and Cold-Water Fish Habitat designations

The following waters are designated as warm water fish habitat for purposes of the Vermont water quality standards along with the following ponds:

(a) All streams, creeks and brooks lying with Grand Isle County.
(b) Lake Champlain, between the Ferrisburgh-Charlotte town boundary and the Canadian boundary, where depths are less than 25 feet at Low Lake Level (93 feet NGVD) - June 1, through September 30, only.
(c) Holmes Creek, Charlotte
(d) Indian Brook, Colchester from Vermont Routes 2 & 7 to its confluence with Lake Champlain
(e) Lake Iroquois, Hinesburg/Williston
(f) LaPlatte River from its confluence with Patrick Brook in Hinesburg extending downstream to the Spear Street extension bridge in Charlotte annually from the period June 1 through September 30 only.
(g) Long Pond, Milton
(h) Lower Lake, (Lake Sunset), Hinesburg
(i) Malletts Creek, Colchester, from Vermont Routes 2 & 7 to its confluence with Lake Champlain
(j) Milton Pond, Milton
(k) Mud Creek Pond, Alburgh A-3
(l) Murr (Munroe) Brook, Shelburne

(m) Round Pond, Milton
(n) St. Albans Reservoir (N), Fairfax
(o) Stevens Brook, St. Albans
No changes to warm water fish or cold water habitat designations are proposed by this plan.

Chapter 4- Watershed Improvement Actions and the Implementation Table

The tactical plan's implementation table, included as part of the 2015 basin 5 plan, and subsequently identified projects by DEC and partners that are located in the online Watershed Projects Database frame out specific actions to address impairments, altered or stressed waters (Table 2) and waters included as priority areas at the end of Chapter 2. Prioritized assessment and monitoring needs are included in Table 2 and Table 7. Action items reflect many of the primary goals and objectives identified in the Statewide Surface Water Management Strategy with the purpose of remediating or protection waters.

This tactical plan implementation table is a working document that has been updated and will be updated with input from watershed partners every two years. It is envisioned that the action items will be accomplished within the next five years.

A. Examples of Watershed Projects Completed by ANR and/or its Partners

The previous basin plan was completed in 2009. The following are examples of projects that address strategies in the 2009 plan by watershed partners with DEC support.

Low Impact Development supported in Chittenden County

Numerous projects to infiltrate stormwater were installed in both Chittenden and Franklin Counties. Examples of projects in Chittenden County included small projects, such as a rain garden built by Chamberlain School kids and their teacher (Figure 16) as well as installation of 17800 sq ft. of pervious pavement at an apartment complex in Essex Junction by the developer. The Winooski Natural Resource Conservation District *Let it Rain Program* provided the technical assistance and incentive payment with support from the DEC Ecosystem Restoration Program (ERP) funds. In addition, the Lewis Creek Assocation installed a rain garden with ERP funds on Silver Street in Hinesburg to treat 2.6 acres of impervious surface.

In Franklin County, VTrans and ERP funds supported the installation of a gravel wetland where stormwater runoff from impervious surfaces on 1.2 acres of the the Park and Ride and adjacent roadway intersection is collected by catch basins and directed into the gravel wetland by subsurface pipes. Stormwater is filtered through a microberich gravel layer under the soil where contaminants are captured. Excess water is absorbed by the plant roots.

Figure 6. Rain garden built with students at Chamberlin School, South Burlington.

The LaPlatte River and Kimball, Thorp and Holmes Brook Volunteer Water Quality Sampling Project

The LaPlatte Watershed Partnership has supported the Southern Chittenden CountyRiverwatch, a comprehensive volunteer water quality sampling program, including the LaPlatte, McCabes and Munroe over the last 10 years. They have provided extensive reports to town governments. More recently, a group of citizens from Charlotte organized a sampling program with support from DEC to determine the health of small tributaries to Town Farm Bay and the Charlotte Beach. The samping took place over three years with help from the LaPlatte Watershed Partnership. The costs of analysis for both programs was paid for through the DEC LaRosa Partnership Program. The results were provided to the town conservation commission during an educational forum in 2013 and through community newspaper articles.

Collins Perley Daylighting of Rugg Brook

Figure 7. Before and after pictures

The North Tributary to Rugg Brook contributed to flooding problems at the Collins Perley Sports Complex and was a source of sediment and phosphorus pollution into the downstream receiving waters, which ultimately discharge into Lake Champlain. This project was designed to help alleviate flooding problems and improve water quality. The first component involved removing approximately 300 linear feet of culvert and restoring a more natural stream channel for the North Tributary at the northwest corner of the Complex. The project improved conveyance, provided flood storage in a 50 to 75 foot riparian buffer corridor, and filtered surface runoff from adjacent playing fields. The second component enhanced the function and values of the riparian area surrounding the new daylighted stream with shrub and tree plantings. The Ecosystem Restoration Program funded the project. Northwest Regional Planning Commission provided project management and BFA St. Albans is providing ongoing stewardship of the Collins Perley Stream Restoration project.

Figure 8. Stone Bridge Brook

Stone Bridge Brook

Stone Bridge Brook in Georgia (Figure 18), a stream dominated by agriculture in the lower reaches, was identifed as restored in 2011 after previously failing to meet water quality standards. The Vermont Agency of Agriculture, Food and Markets (AAFM) and the DEC worked with farmers in the watershed to address nonpoint source pollution from agricultural areas. As a result of this collaboration, farmers implemented a variety of agricultural BMPs between 2010 and 2011, including one roof runoff/clean water diversion, one silage leachate collection and treatment system, planting of more than 300 acres of winter cover crops and use of no-till planting to reduce sediment runoff from agricultural fields. Additionally, farmers developed and implemented nutrient management plans covering 700 acres. Combined, these actions helped to substantially reduce sediment and nutrient loading to Stone Bridge Brook.

The Vermont AAFM served as a key partner in this effort, providing $102,977 in cost-share assistance for agricultural field BMP implementation and improvements to waste management systems. Several farm producers and two local conservation districts also contributed to this work. DEC provided approximately $1,500 in CWA section 319 funds to support the BMP design engineering work conducted by the Vermont AAFM.

B. The Tactical Basin Plan Implementation Table

The implementation table (next page) lists projects to address the waterbodies that are stressed, altered or impaired (Table 2). Information for each project provides opportunities for all Basin 5 stakeholders to pursue and secure technical and financial support for implementation. The columns include location information, the stressor responsible for the problem, as well as project description, the source of the project if an assessment supports the project, partners that may be interested in implementing the project, potential funding sources as well as level of priority.

The priorities included within these tables were the result of a comprehensive compilation and review effort of both internal ANR monitoring and assessment data, and those of our watershed partner organizations (Chapter 1 and 2). These monitoring and assessment reports include, but are not limited to, stormwater mapping reports, geomorphic assessments, river corridor plans, bridge and culvert assessments, agricultural modeling and assessments, road erosion inventories, TMDL reports, biological and chemical monitoring, lake assessments, fisheries assessments, and natural communities and biological diversity mapping.

The following actions were prioritized as high, medium or low based on following criteria:

- Degree of success in addressing noted stressor;
- listed in a stormwater management plan, or river corridor plan and remains a basin-side priority for addressing a stressor;

- for further investigation, an agricultural or road-related projects located in a critical source area for erosion (or ground truthed and assessed as needing a fix); and
- the action is included in the State Surface Water Management Strategy.

Priorities were not determined based on interest of landowner or complexity of project.

DEC will increase the granularity of the prioritization process in subsequent TBPs, including methods for evaluating success. The Watershed Management Division is finalizing, in draft form, a prioritization process to assist in project identification, prioritization, implementation, and tracking, pursuant to the requirements of Act 64. The framework for prioritization will rely on the "Stage-Gate" model, whereby projects must meet specific criteria to proceed from initial project scoping, thru project design, then to installation, in a step-wise manner. At each "stage," there is a criteria-based "gate" that must be satisfied to move a project to the next level. To that end, the project prioritization process will include the review of projects at all three levels (scope, design and implementation), and the development of a database system to house implementation tables of all tactical basin plans. As articulated in Act 64, Regional Planning Commissions will assist in further prioritization using the stage-gate framework.

Implementation Table Objectives

The overall objectives of the tactical plan can be broken down into three broad categories: identifying waters in need of further monitoring and assessment, protecting high quality waters, and restoring altered, stressed and other high priority waters. Watershed outreach and education opportunities cut across all of these priority categories. The Implementation Table covers protection and restoration actions. Table 7 includes monitoring and assessment needs.

It is the Agency's goal to prioritize staff time and direct internal and external grant funding opportunities towards these recommended Actions. These Actions include all water media within the basin and all the spectrums of land use that could potentially impact water quality and aquatic habitat. It is our hope that these tables outline priorities that are realistic to implement over a five-year period, noting that there are many unforeseen variables, like landowner willingness and funding availability.

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
Town Farm Bay and Charlotte shoreline	Charlotte	All waters	Land erosion, nutrients, channel erosion	Identify and implement needed agricultural BMPs for areas identified as significant pollutant sources based on risk for erosion, water quality data and agriculture inspections.	DEC, AAFM	DEC, UVM extension, NRCS, NRCD	CREP, NRCS, AAFM	High
Town Farm Bay and Charlotte shoreline	Charlotte	All waters	Land erosion,	Identify and implement needed Better Backroads BMPs for roads identified in Appendix B	DEC	Municipality	BBR, ERP	High
Town Farm Bay and Charlotte shoreline	Charlotte	All waters	Land erosion	Develop and implement stormwater management plan for private and public roads. Use town road assessments and map points of stormwater inputs to ditches to assist in project prioritization	Charlotte	Town of Charlotte, DEC,	BBR, ERP, LCBP, Watershed Grants	Medium
Town Farm Bay and Charlotte shoreline	Charlotte	All waters	Pathogens, nutrients	Identify need for improved pump out facilities for boats and apply for funding	DFW		Federal Clean Vessel Act Funds	Medium
Town Farm Bay and Charlotte shoreline	Charlotte	All waters	Land erosion, channel erosion	Support geomorphic assessments Phase 2 light to identify opportunities for regaining floodplain connection and potential gully remediation.	DEC	Town of Charlotte, LCA, DEC	ERP, LCBP, Watershed Grants	Medium
Town Farm Bay and Charlotte shoreline	Charlotte	All waters	Aquatic Invasive Species	Support community's efforts to control aquatic invasive plants (e.g. yellow flag iris, purple loosestrife, European frogbit)	LCA	DEC, Town of Charlotte, LCA	AIS grant in aid program	Medium
Kimball Brook	Ferrisburgh	At railroad crossing	Pathogens, nutrients, land erosion	Manage Kimball Brook cow crossing under railroad	SCRW, 2010	Landowners, Local Implementation Teams, VTrans, Vermont Rail	AAFM, ERP	Medium
Kimball Brook	Charlotte	T8.s2.01	Land erosion, Encroachment	Manage stormwater and replace culvert on townline road	SCRW, 2010	Town of Charlotte, SCRW	BBR	Medium

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
Holmes Brook	Charlotte	T3 S4.01 T3-05 to T3-07, and all tributaries	Pathogens, nutrients, land erosion	Install riparian buffers and enhance nutrient management on agricultural land	DEC	NRCS, UVM extension	CREP, NRCS	High
Shelburne Bay	Williston, St. George, Hinesburg, Charlotte, Shelburne	All waters	Land erosion, nutrients	Identify and implement needed BMPs for agricultural fields identified as at moderate to high risk for erosion.	DEC	UVM extension	CREP, NRCS	High
Shelburne Bay	Williston, St. George, Hinesburg, Charlotte, Shelburne	All waters	Land erosion,	Identify and implement needed Better Backroads BMPs for roads identified in Appendix B as at moderate to high risk for erosion	DEC	Municipalities	BBR, ERP	High
Shelburne Bay	Williston, St. George, Hinesburg, Charlotte, Shelburne, S. Burlington	All waters	Land erosion, Nutrients, channel erosion	Continue to support volunteer water quality monitoring in the LaPlatte, McCabes, Munroe, Potash and Lake Iroquois as well as the lay monitors on Lake Iroquois.	DEC	SCRW, LIA, Chittenden County Stream team, DEC	DEC LaRosa Lab, volunteer group municipal donations and volunteer labor	High
Shelburne Bay	Williston, St. George, Hinesburg, Charlotte, Shelburne, S. Burlington	All waters	Encroachment, channel erosion	Replace geomorphologically incompatible culvert and bridges : At least 8 priority replacements in subbasin, see Appendix C	DEC	municipalities, RPC, VTrans,	federal hazard mitigation funds, Municipalities, VTrans	High
Shelburne Bay	Shelburne	Munroe Brook	Channel erosion, Flow alteration, nutrients, land erosion	Finalize and implement Flow Restoration Plan for stormwater-impaired waters in Shelburne pursuant to MS4 permit.	FRP	Shelburne	Municipal, SRF, ERP, State and Fed. Highway funds	High
Shelburne Bay	Burlington	Bartlett Brook	Channel erosion, Flow alteration, nutrients, land erosion	Finalize and implement Flow Restoration Plan for stormwater-impaired waters in Burlington pursuant to MS4 permit.	FRP	Burlington	Municipal, SRF, ERP, State and Fed. Highway funds	High

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
Shelburne Bay	South Burlington	Potash Brook	Channel erosion, Flow alteration, nutrients, land erosion	Finalize and implement Flow Restoration Plan for stormwater-impaired waters in South Burlington pursuant to MS4 permit.	FRP	South Burlington	Municipal, SRF, ERP, State and Fed. Highway funds	High
Shelburne Bay	Williston, St. George, Hinesburg, Charlotte, Shelburne, South Burlington	All waters	Channel erosion, Flow alteration, nutrients, land erosion	Manage stormwater runoff from private and town roads (see Appendix B)	DEC	Towns	BBR	High
Shelburne Bay	Hinesburg, Charlotte, Shelburne	All waters	Land erosion, Nutrients, channel erosion	Discussion w/ agricultural producers about SCRW water quality sampling results	UVM extension	Champlain Valley farmer coalition, UVM Extension, DEC, SCRW	UVM extension	Medium
LaPlatte River	Williston, St. George, Hinesburg	Lake Iroquois subwatershed	land erosion, channel erosion	Manage stormwater runoff from private and town roads, including Dynamite Hill and Mt. Prichard Roads.	LIA, 2013	DEC, landowners	BBR	High
LaPlatte River	Williston, Hinesburg	Lake Iroquois subwatershed	Land erosion, nutrients, thermal modification	promote the Lake Wise Program and associated Lake Leaders training sessions to encourage lake-friendly shoreline property maintenance (Appendix E)	LIA, 2013, DEC	LIA, DEC	LCBP, Watershed Grants	High
LaPlatte River	Williston, Hinesburg	Lake Iroquois subwatershed	Aquatic Nuisance Species	Support community's efforts to control aquatic invasive plants (e.g. European frogbit),	LIA	LIA, DEC	AIS grant-in-aid program	High
LaPlatte River	Williston, Hinesburg	Lake Iroquois subwatershed	Land erosion, Nutrients, channel erosion	Assist development of a bluegreen algae volunteer monitoring program develop a plan for response and communication for cyanobacteria blooms	DEC	DEC, VDH, LIA	DEC, VDH staff time	High
LaPlatte River	Williston, Hinesburg	Lake Iroquois subwatershed	Land erosion, Nutrients, channel erosion	Assist in analyzing data collected on the Lake Iroquois tributaries by the LIA,	LIA, DEC	DEC, LIA	Staff time	High

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
LaPlatte River	Hinesburg	Beecher Brook T5.01D	land erosion, channel erosion, encroachment	Relocating town garage, old access road and sand pile to divert runoff away from town gravel pit, reducing stormwater runoff to river	LWP, 2007	Town, DEC	ERP, LCBP, Watershed Grants	Medium
LaPlatte River	Hinesburg	Beecher Brook T5.01B, C	Encroachment	Protect River corridor, FEMA buyout potential	LWP, 2007	Town, DEC	FEMA	Medium
LaPlatte River	Hinesburg	M17	channel erosion, encroachment	Replace geomorphologically incompatible culvert at crossing used for agriculture and silviculture	LWP, 2007	Town forest committee, DEC	NRCS	Medium
LaPlatte River	Hinesburg	M16	Encroachment	Investigate potential for berm removal.	LWP, 2007	LCA	ERP, LCBP, Watershed Grants	Low
LaPlatte River	Hinesburg	M16	Land erosion, channel erosion	Swale improvement at gas station/Lyman Meadows	LWP, 2010	LCA, town	ERP, LCBP, Watershed Grants	Medium
LaPlatte River	Hinesburg	M16-M12	Channel erosion, land erosion	Work with town to review flood resiliency status and improve stormwater infrastructure planning and regulation	LWP, 2007	DEC, LCA, Town	DEC staff time	High
LaPlatte River	Hinesburg	M15S2.02 and upstream	Channel erosion, nutrients	Assess adequacy of CVU field drainage practices to protect stream	LWP, 2007 (Silver street rain garden report)	DEC, LCA, CVU	ERP, LCBP, Watershed Grants	High
LaPlatte River	Hinesburg	Patrick Brook M15 S2.01	channel erosion	Protect stream corridor to allow for passive geomorphic restoration	LCA	LCA	ERP, LCBP	Medium
LaPlatte River	Hinesburg	Patrick Brook M15 S2.01	land erosion, channel erosion	Detain stormwater on south side of Route 116	LWP, 2010	LCA, town	ERP, LCBP, Watershed Grants,	High
LaPlatte River	Hinesburg	Patrick Brook M15 S2.01	Flow alteration;	Support a collaborative town led process in developing a management plan for Patrick Canal, incorporating local knowledge and river science.	LWP, 2007	Town, landowners, DEC	ERP, LCBP, Watershed Grants	High
LaPlatte River	Hinesburg	Patrick Brook T4.03	land erosion	Allow lawn area to naturalize and function as wetland at entrance road to cemetery	LWP, 2010	Town	n/a	High
LaPlatte River	Hinesburg	Patrick Brook T4.03, T4.04 and T4.06	encroachment	Investigate removal of old mill footings and partial dams. Bedrock may provide more flow restriction than dams.	LWP, 2007	DEC	n/a	Low

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
LaPlatte River	Hinesburg	M15	Channel erosion, Land erosion, nutrient loading	Continue to identify and implement GSI stormwater management projects for village. Encourage centralized stormwater treatment system where dense development exists. Also choose treatment areas based on locations of soils with high infiltration potential	LWP, 2010; Hinesburg, 2010	LCA, town	ERP, LCBP, Watershed Grants	High
LaPlatte River	Hinesburg	M15	Channel erosion, Land erosion, nutrient loading	Plant riparian area with woody vegetation and fence out cattle on M15A, and improve management of pastures	LWP, 2007	UVM extension	CREP, NRCS	High
LaPlatte River	Hinesburg	M15	Channel erosion, Land erosion, nutrient loading	Investigate active stream restoration especially if predicted channel adjustment towards WWTF requires active protection	LWP, 2007	Town, DEC	ERP	Low (Clay Soils)
LaPlatte River	Hinesburg	T3.01 and T3.02	Channel erosion, land erosion, nutrient	Fence out livestock and plant riparian buffer	LWP, 2007	NRCS, UVM Extension	CREP, NRCS	High
LaPlatte River	Hinesburg	M12, 13, 14	Channel erosion, Land erosion,	Protect undeveloped stream corridor to allow for continued flow and sediment attenuation and to improve water and habitat quality.	LWP, 2007	LCA, VLT	ERP, LCBP, Watershed Grants	High
LaPlatte River	Hinesburg	M13	Channel erosion, Land erosion,	Plant riparian area with woody vegetation	LWP, 2007	LCA	CREP, NRCS	High
LaPlatte River	Hinesburg	M12, 13, 14	land erosion, nutrient loading, pathogens	Encourage Agricultural BMPs for grazing in flood plain, pasture management, and surface water drainage practices	DEC	NRCS, UVM Extension	CREP, NRCS	High
LaPlatte River	Hinesburg	M12	Land erosion, nutrient loading	Plant woody riparian buffer and investigate wetland restoration of agric. ditches to stream	LWP, 2007	LCA, DEC, USFWS	ERP, USFWS	High
LaPlatte River	Hinesburg	M12	Encroachment, land erosion	Floodwaters crossing road is community concern. Develop alternatives for managing flooding over Leavensworth Rd that includes allowing flows to cross over road	LWP, 2007	LCA, town, engineer	BBR	Medium

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
LaPlatte River	Charlotte	M9a	land erosion	Riparian plantings near Habitat for Humanity property	LWP, 2008	LCA	ERP	Medium
LaPlatte River	Charlotte	M08-01	(protection)	Protect river corridor to allow for passive restoration	LWP, 2008	LCA, DEC, VLT, Town of Charlotte	ERP	Medium
LaPlatte River	Shelburne	M06-4	land erosion, channel erosion	Restore incised reach and address stormwater inputs with GSI practices	LWP, 2008	SCRW, DEC, Town of Shelburne	ERP, LCBP, Watershed Grants	High
LaPlatte River	Shelburne	M01-M02	(protection)	Assist with petition for Class I designation for LaPlatte wetland	DEC	TNC, Shelburne NRC	n/a	Medium
LaPlatte River	Shelburne	M06-M01	Land erosion, Nutrients, channel erosion	Complete stormwater management planning, including Gardenside Condo area	DEC	SCRW, DEC, Town of Shelburne	ERP	High
LaPlatte River	Shelburne	M01	Aquatic Invasive species	support community efforts to control aquatic invasive plants (e.g., European frogbit)	DEC	DEC	AIS grant-in-aid program	Medium
Bingham Brook	Charlotte	head waters of T2	Land erosion, nutrients, channel erosion, pathogens	Wetland restoration or riparian buffer	LCA	USFWS, DEC,	WRE, CREP	High
Bingham Brook and Mud Hollow	Charlotte	T2	pathogens, land erosion, nutrients, channel erosion	ID sources of pathogens from farms - Conduct agricultural assessment on SFO's to determine unmet resource needs. Pursue funding for high priority SFO BMPs	E. coli TMDL	NRCD; UVM Extension	AAFM - BMP, ERP, LCBP, Watershed Grants, NRCS where appropriate	High
McCabes Brook	Shelburne	T1	land erosion, nutrients, pathogens	Identify highest priority resource concerns and implement BMP practices	DEC	NRCD (ARS), NRCS, ANR	AAFM - BMP, ERP, LCBP, Watershed Grants, NRCS where appropriate	High
McCabes Brook	Shelburne	T1.08	Flow alteration;	Remove partially breached dam	LWP, 2013	SCRW, Town of Shelburne, residents	ERP, LCBP	Medium
McCabes Brook	Shelburne	T1.08	land erosion	Protect wetland and river corridor	LWP, 2013	SCRW, Town of Shelburne, residents	ERP	Medium

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
McCabes Brook	Shelburne	T1.07B/A T1.06B	land erosion	Work with landowners to secure specific protections for the forested river corridor. VLT has easement	LWP, 2013	SCRW, Town of Shelburne, residents	n/a	Medium
McCabes Brook	Shelburne	T1.05B/A	Channel erosion, land erosion	Determine benefit of increasing floodplain and stabilizing mass failure for benefit of protecting Route 7	LWP, 2013	VTrans	State and federal	Medium
McCabes Brook	Shelburne	T1.05	channel erosion, land erosion	Divert stormwater from running over bank failure south of vineyard.	DEC	VTrans	VTrans	Medium
McCabes Brook	Shelburne	T1	channel encroachment	Investigate landowner interest in removing private bridge over brook	DEC	SCRW	LCBP, Watershed Grants	Medium
McCabes Brook	Shelburne	T1	channel encroachment	Day light and restore tributary on community school play fields	DEC	SCRW, Town of Shelburne, residents	ERP, LCBP, Watershed grants	High
McCabes Brook	Shelburne	T1	land erosion, channel erosion	Address stormwater related issues at school street neighborhood, include work with residential home owners to implement GSI	DEC	SCRW, Town of Shelburne, residents	ERP, LCBP, Watershed Grants	High
McCabes Brook	Shelburne	T1.04B	Land erosion, channel erosion	Protect corridor to allow the river to reach equilibrium and become attenuation asset.	LWP, 2013	SCRW	ERP, LCBP, Watershed Grants	Medium
McCabes Brook	Shelburne	T1.03	Land erosion, channel erosion	review LWP stormwater study projects and identify treatment options, expand village stormwater management plan/hydrologic study to protect McCabe from Impairment status	LWP, 2010	SCRW, Municipal Planning Grant, ACCD	ERP, LCBP	High
McCabes Brook	Shelburne	T1.03	Land erosion, channel erosion	Plant stream buffer/restore flood plain at the Shelburne Town Garage and Wastewater Treatment Facility on Turtle Lane	LWP, 2013	SCRW	ERP, LCBP	Medium
McCabes Brook	Shelburne	T1.03	nutrients, land erosion,	Assess agricultural BMP needs for diverse farmstead north of Harbor Rd	DEC	SCRW, NRCS, UVM extension	AAFM, NRCS, CREP	Medium

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
Munroe Brook	Shelburne	T1.02 Upstream	land erosion, channel erosion	address 136-foot eroding grass swale on Brook Lane replace w/ perforated pipe, add infiltration trench and a raingarden	LWP, 2013	SCRW, Town	ERP, LCBP, Watershed Grant	High
Burlington Bay	Burlington	Englesby Brook	land erosion, channel erosion	Burlington is developing a flow restoration plan (FRP) for Englesby, due October 2016	DEC	Burlington	Municipal funds, SRF, ERP	High
Burlington Bay	Burlington	As applicable	Encroachment	Replace geomorphologically incompatible culvert and bridges : at least 5 priority replacement in basin, see Appendix C	DEC	City of Burlington, RPC, VTrans	federal hazard mitigation funds, Municipality, VTrans	Medium
Burlington Bay	Burlington	As applicable	pathogens, nutrients	Reduce stormwater to Combined Sewer (CSO) using GSI practices	DEC	Burlington	ERP, LCBP	Medium
Small directs to lake	Burlington, South Burlington	All waters	land erosion, channel erosion,	Manage stormwater using GSI practices	DEC	Municipalities, DEC	ERP, LCBP, Watershed grants	Medium
Small directs to lake	South Burlington	Nesti Brook	land erosion, channel erosion,	Stabilize Nesti Brook, create gravel wetland to treat Rt 7 stormwater	DEC	DEC	ERP, Vtrans Enhanceme nt grant	High
Malletts Bay	Colchester/ Milton, Essex	All waters	Land erosion,	Identify and implement needed Better Backroads BMPs for roads identified in Appendix B	DEC	Municipalities	BBR, ERP	High
Malletts Bay	Colchester, Essex Junction	All	Encroachment	Replace geomorphologically incompatible culvert and bridges: at least 1 priority replacement in basin, see Appendix C	DEC	municipalities, RPC, Vtrans,	Federal hazard mitigation funds, Municipalitie s, VTrans	High
Malletts Bay	Colchester	Bay	Pathogens, nutrients	If need determined for improved pump out facilities for boats, apply for funding to address	DFW	Marinas	Federal Clean Vessel Act Funds	Medium
Malletts Bay	Colchester	All	Pathogen	Continue sampling of shoreline and enhance program to gage degree of contribution of pathogens from shoreline wastewater systems	DEC	Municipality, DEC	Staff time	High

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
Malletts Bay	Colchester	All	Pathogen	Develop and implement sampling program to better understand sources of bacteria from natural source	DEC	DEC, municipality	Staff time	Medium
Malletts Bay	Colchester	Inner Bay,	Pathogens	Consider a sewer line along the inner bay, supported by the state revolving funds if project meets criteria used by DEC Facilities Engineering Division. Provide technical assistance to support application.	DEC	DEC, municipality	State revolving funds	High
Malletts Bay	Colchester	Smith Hollow Brook	Pathogens, nutrients	Develop sampling plan to target stormwater catch basins for optical brightener testing during high groundwater levels in neighborhoods along Williams Road and Blakeley Road	DEC,	DEC, Municipality,	Staff time	High
Malletts Bay	Colchester	Smith Hollow Brook M03	Pathogens, nutrients	Provide small farms, including horse farms, with resources to reduce nutrient and pathogens, including opportunities to compost animal waste	E. coli TMDL	WNRCD, DEC	ERP	High
Malletts Bay	Colchester	Crooked Creek adjacent and downstream of Rte. 7	land erosion, channel erosion,	address runoff to the multiple (10) gullies and stabilize erosion from hayfields and Route 7 stormwater runoff	DEC	DEC, VTrans, NRCS	ERP, VTrans, NRCS	High
Malletts Bay	Colchester	Crooked Creek (west of I-89)	land erosion, channel erosion,	Address erosion associated with stormwater runoff to small culverted tributary by addressing private camp road management and stormwater management off campground.	DEC	Municipality, DEC	ERP, BBR	High
Malletts Bay	Colchester	Crooked Creek, Pond Brook and Smith Hollow Brook	Pathogens	Manage residential stormwater through education and outreach include dog waste reduction strategies	E. coli TMDL	Municipality, DEC, LCC	LCBP, Watershed Grant	High
Malletts Bay	Colchester	Crooked Creek, Pond Brook and Smith Hollow Brook	Pathogens, land erosion, channel erosion	Implement GSI practices with goal of diverting runoff to streams	DEC, Colchester, 2011, E. coli TMDL	Municipality, DEC, WNRCD, UVM Sea Grant	ERP, LCBP, Watershed Grant	High

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
Malletts Bay	Colchester	Pond Brook M02 to M06	Land erosion, nutrients	Provide small farms, including horse farms, with resources, including opportunities to compost animal waste	DEC	WNRCD, UVM extension	ERP, CREP, NRCS	High
Malletts Bay	Colchester	Pond Brook M05	pathogens, nutrients, land erosion	Develop sampling plan to further investigate pathogen sources in village neighborhoods in Pond Brook watershed. Consider targeting stormwater catch basins for optical brightener testing during high groundwater levels.	Colchester, 2011	Municipalities, DEC	State low interest loans for onsite septic	High
Malletts Bay	Colchester	Indian Brook	Channel erosion, Encroachment	Assess potential for dam removal at Mill Pond Road	Vermont Dam Task Force	VNRC, The Nature Conservancy, USFWS, DFW DEC.	ERP, USFWS and private funds.	Medium
Malletts Bay	Colchester	Indian Brook M01-1 and M02-1	Channel erosion	Develop river corridor conservation easements for parcel occupying entire reach	DEC, 2008	WNRCD,	ERP	Medium
Malletts Bay	Essex Junction	Indian Brook M09-A-1	land erosion, channel erosion,	Develop conservation easements for parcels occupying entire reach	DEC, 2008	WNRCD,	ERP	Low
Malletts Bay	Essex Junction	Indian Brook M10-A-2	Encroachment	Remove derelict structure associated with old crossing	DEC, 2008	WNRCD,	LCBP,	Medium
Malletts Bay Indian Brook	Essex Junction	Indian Brook M11	land erosion, channel erosion,	Plant stream buffer along right bank south of the intersection with Grove St. and Educational Drive.	DEC, 2008	WNRCD,	ERP	Medium
Malletts Bay	Essex Junction	Indian Brook M11-A	land erosion, channel erosion,	Restore incised reach to reestablish meanders and create equilibrium profile and geometry along section adjacent to school.	DEC, 2008	Municipality, DEC	ERP	Medium
Malletts Bay	Essex Junction	Indian Brook M11-B	land erosion, channel erosion,	Plant stream buffer along right bank east of the Route 15 crossing.	DEC, 2008	WNRCD, municipality	ERP	High
Malletts Bay	Essex Junction	Indian Brook M11-C	land erosion, channel erosion,	Develop conservation easements for parcels occupying river corridor.	DEC, 2008	Municipality, DEC	ERP	High

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
Malletts Bay	Essex Junction	Indian Brook	land erosion, channel erosion,	Essex Junction is developing a flow restoration plan (FRP) for Indian Brook, due October 2016	DEC	Essex Junction	Municipal, SRF, ERP, State and Fed. Highway funds	High
Malletts Bay	Essex Junction	Indian Brook reservoir	Land erosion	Continue to support water quality monitoring in the lake through the Lay Monitoring program	DEC	citizens	State	High
Malletts Bay	Colchester, , Milton	Malletts Creek, Allen Brook	Land erosion Channel erosion	Provide education and outreach to encourage the use of the portable skidder bridge housed at Cyr lumber for silvicultural activity	DFPR	WNRCD, DEC, CYR Lumber	ERP	Medium
Malletts Bay	Colchester/ Milton	Malletts Creek M04-M13	Land erosion, nutrients	Identify and implement needed BMPs for agricultural fields identified as at moderate to high risk for erosion.	DEC	Local Implementation Teams, UVM extension	CREP, NRCS	Medium
Malletts Bay	all	all	Land erosion,	Identify and implement needed Better Backroads BMPs for roads identified in Appendix B		Municipalities	BBR, ERP	High
Malletts Bay	Colchester	Malletts Creek M01	(protection)	reclassify Munson's Flats wetland to Class 1	DEC	Community group, DEC	DEC	Medium
Malletts Bay	Milton/Colchester	Malletts Creek M14-M17, T6	land erosion, channel erosion	Prioritize and Implement projects identified in corridor plan for upper watershed;	CCRPC, 2013	Municipalities, DEC	ERP	Medium
Malletts Bay	Milton	Malletts Creek M15-B #1	channel erosion, land erosion	plant woody riparian buffer	CCRPC, 2013	Local Implementation Teams, UVM extension	CREP, ERP, LCBP, Watershed Grant	High
Malletts Bay	Milton	Malletts Creek M17-A	Channel erosion	Investigate corridor protection	CCRPC, 2013	Municipality	ERP	Medium
Malletts Bay	Milton	Milton Pond	Flow alteration	Follow the recommendations of the past inspection reports and retain an engineer to help with either the repair or removal of the dam.	Town of Milton, DEC	Town of Milton	ERP, LCBP, Watershed Grant	Medium
Malletts Bay	Milton	Malletts Creek T6.01	Channel erosion	Investigate corridor protection and plant woody riparian buffer	CCRPC, 2013	WNRCD	CREP, ERP, LCBP, Watershed Grant	Medium

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
Malletts Bay	Milton/Colchester	Allen Brook	Land erosion,	Identify and implement needed Better Backroads BMPs for roads identified in Appendix B	DEC	Municipalities	BBR, ERP	High
Malletts Bay	Milton	Allen Brook T1.1 - T1.08	land erosion, channel erosion	Develop a stormwater management plan that includes stormwater infrastructure drainage	DEC	DEC, Milton	ERP	High
Malletts Bay	Milton	Allen Brook T1..07	land erosion, channel erosion	Assess water quality below village with additional biomonitoring sites and water quality sampling sites	DEC	DEC, Milton	ERP	High
Malletts Bay	Milton	Allen Brook T1.02 and T1.03	Channel erosion	Investigate corridor protection	CCRPC, 2013	Municipality	ERP	High
Malletts Bay	Milton	Allen Brook T1.04	Land erosion	Stabilize gully near the outfall to Allen Brook with additional stone	CCRPC, 2013	Municipality, DEC	ERP, LCBP, Watershed Grant	Medium
Malletts Bay	Milton	Allen Brook T1.06-B	Land erosion	plant woody riparian buffer	CCRPC, 2013	WNRCD	ERP, CREP, NRCS	Medium
Inland Sea	Georgia	Champlain shoreline / Georgia	Land erosion, thermal modification	Support Lake Wise practices (Appendix E)	DEC	FNLC, Georgia Conservation commission	ERP, LCBP, Watershed Grant	Medium
Inland Sea	Georgia	Stonebridge Brook	Land erosion, Channel erosion	Address residential stormwater runoff	Georiga Stormwater Master Plan	Municipality, FNLC	ERP, LCBP, Watershed Grant	Medium
St. Albans Bay	St. Albans city/town/Georgia	all waters	all	Increase awareness of water resource issues and promote adoption of residential, business and agricultural BMPs	St. Albans Bay partners	FNLC, FWA, NRPC, UVM Sea Gant; SAAWA, St. Albans city and Towns	LCBP, Watershed grants	Medium
St. Albans Bay	St. Albans Town and City	Stevens Brook	Land erosion, channel erosion	St. Albans City and Town and VTrans will implement a flow restoration plan	DEC	Municipalities and VTrans	Municipal, SRF, ERP, State and Fed. Highway funds	High
St. Albans Bay	St. Albans Town and City	Rugg Brook	Land erosion, channel erosion	St. Albans City and Town and VTrans are developing a flow restoration plan, due October 2016.	DEC	Municipalities, VTrans	Municipal, SRF, ERP, State and Fed. Highway funds	High

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
St. Albans Bay	St. Albans Town and City	all waters	Encroachment	Replace geomorphologically incompatible culvert and bridges : at least 2 priority replacements in basin, see Appendix C	DEC	Municipalities, RPC, VTrans,	federal hazard mitigation funds, Municipalities, VTrans	High
St. Albans Bay	St. Albans town, Georgia,	Lake Champlain shoreline	Pathogens, nutrients	Inspect and maintain (and where needed, replace) on-site septic systems. Consider a feasibility study for alternative onsite treatment if needed.	DEC	DEC, FED	DEC FED loan program, SRF	Medium
St. Albans Bay	St. Albans Town, City	all waters	Toxins, nutrients	Encourage use of salt brine instead of salt to reduce overall use of salt and sand	NRPC, 2014	NRPC	LCBP	High
St. Albans Bay	St. Albans Town	all waters	Aquatic nuisance and invasive species	Support community's efforts to control aquatic nuisance plants and Eurasian Water Milfoil	Franklin Watershed Initiative	SAAWA, St. Albans Town	AIS grant-in-aid program	High
St. Albans Bay	all	all waters	Pathogens, nutrients, land erosion	Review agricultural practices on every farm and identify AAP and BMPs needs. Use CSA maps (NRCS, 2015) and EPA scenario tool	Franklin Watershed Initiative	AAFM, UVM extension	CREP, RCPP (Appendix D) NRCS	High
St. Albans Bay	all	all waters	Pathogens, nutrients, land erosion	Develop a plan and identify partners to work with agricultural producers to ensure implementation of needed practices	NRCS RCPP	NRCS, DEC, AAFM, FNLC, VACD, FNRCD, USFWS, UVM extension	NRCS, CREP	High
St. Albans Bay	all	Mill Brook	Land erosion	Identify and implement needed Better Backroads BMPs for roads identified in Appendix B	DEC	Municipalities	BBR, ERP	High
St. Albans Bay	Georgia	Mill Brook M2T2.2S1;M2T2.06; M03-M06	pathogens, nutrients, land erosion, channel erosion	Identify BMP needs for fields in priority CSA and where geomorphic assessment identifies sediment regime departure	Map; NRPC, 2008;	Local Implementation Teams, FNLC, UVM extension	NRCS RCPP NRCS, CREP	High
St. Albans Bay	Georgia	Mill Brook M2T2.2S1.3S3.01	Land erosion, channel erosion	Identify and address source of channel erosion including channel adjustment, stormwater and sediment inputs	Georgia Stormwater Master Plan, DEC	DEC, conservation commission,	ERP	High

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
St. Albans Bay	Georgia	Mill Brook M2T2.2S1.03	land erosion, channel erosion	At elementary school manage stormwater discharge to streams using infiltration at source where possible	DEC	Town, school, DEC	ERP, LCBP, Watershed grants	High
St. Albans Bay	Georgia	Mill Brook	Land erosion, channel erosion	Assist towns in defining appropriate slope failure risks for future development, and map	NRPC	NRPC, municipalities, DEC - Geology	Emergency Managemen t funds	Medium
St. Albans Bay	St. Albans Town	Rugg Brook	Land erosion, nutrients	Identify and implement needed BMPs for production areas as well as agricultural fields identified as at moderate to high risk for erosion.	DEC	AAFM, UVM extension	CREP, NRCS, RCPP	High
St. Albans Bay	St. Albans Town	Rugg Brook	land erosion, channel erosion	Identify and implement needed stormwater management for roads identified in Appendix B.	DEC	Municipality	BBR, ERP	High
St. Albans Bay	St. Albans Town	Rugg and Stevens Brooks	land erosion, channel erosion	Prioritize and implement needed stormwater management identified in the St. Albans Town stormwater master plan and NRPC NPS project list	St. Albans Town Stormwater Master Plan, 2015; NRPC 2015	Municipality	ERP, SRF	High
St. Albans Bay	St. Albans Town	Rugg Brook	channel erosion	When landowner interested investigate 2-tiered channel off Bronson Road and river corridor easement	DEC	DEC, NRCS	ERP, USDA	Medium
St. Albans Bay	St. Albans Town	Stevens Brook	Land erosion, nutrients	Identify and implement needed BMPs for production areas as well as agricultural fields identified in CSA map as moderate to high risk for erosion.	NRPC CSA erosion risk maps (2014), NRCS Gap watershed for 2015-2016	AAFM, UVM extension	CREP, NRCS, RCPP (Appendix D)	High
St. Albans Bay	St. Albans Town	Stevens Brook	Land erosion	Identify and implement needed Better Backroads BMPs for roads identified in town road assessments, Appendix B or NRPC Road erosion risk maps and in St. Albans Town stormwater master plan	NRPC Road erosion risk maps, St. Albans Town, 2015	Municipalities	BBR, ERP	High
St. Albans Bay	St. Albans City	Stevens Brook 1	Encroachment	protect flood plain and wetlands between city limits and mouth	Gaddis, 2007	USFWS, Watershed groups	USDA-WRE	High

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
St. Albans Bay	St. Albans City	Stevens Brook 3	Channel erosion, land erosion	Reduce stormwater flow into Weldon street CSO with GSI practices	DEC	Municipality	Municipal, SRF, ERP	High
St. Albans Bay	St. Albans City	Stevens Brook	Channel erosion	Daylight section of stream and install stormwater best management practices	NRPC, 2014	Municipality	ERP, SRF	Medium
St. Albans Bay	St. Albans Town	Stevens Brook (tributary 7)	Flow alteration, channel erosion, land erosion	Provide golf course with technical assistance to achieve ANR "Green Links" certification	DEC	DEC	DEC	Medium
St. Albans Bay	St. Albans Town	Stevens Brook (tributary 7)	Land erosion, Channel erosion, nutrients	Develop and implement a stormwater management plan for watershed urban area along Route 7	DEC	DEC, municipality, FNLC	ERP	High
St. Albans Bay	St. Albans Town	Jewett Brook	Non-erosion nutrients	Identify locations for tile drainage BMP's based on AAFM survey of 2015	AAFM	AAFM, LCBP, FNLC	CREP, NRCS, NRCS-CIG	High
St. Albans Bay	St. Albans Town	Jewett Brook	Land erosion, nutrients	Identify and implement needed BMPs for production areas as well as agricultural fields identified as moderate to high risk for erosion.	NRPC CSA erosion risk maps (2014)	AAFM, UVM extension	CREP, NRCS, RCPP (Appendix D)	High
St. Albans Bay	St. Albans Town	Jewett Brook	Land erosion,	Identify and implement needed Better Backroads BMPs for roads identified in town road assessments, Appendix B, and NRPC Road erosion risk maps	NRPC Road erosion risk maps (2014)	Municipality	BBR, ERP	High
Islands	all	All waters	land erosion	Identify and implement needed Better Backroads BMPs for roads identified in Appendix B	DEC	Municipalities	BBR, ERP	High
Islands	Alburgh	All waters	Pathogens, nutrients	Conduct sanitary survey on Cedar drive and East shore road	citizen complaint, DEC	DEC	DEC	High
Islands	Alburgh	All waters	(protection)	reclassify Mud Creek Marsh to Class 1	DEC	Community group, DEC	DEC	Medium
Islands	Alburgh	All waters	Land erosion, Channel erosion, nutrients	Prioritize and implement projects in the Alburgh Stormwater Master Plan	DEC	Municipalities; landowners; Grand Island NRCD	ERP, LCBP	High
Islands	All	All waters	Aquatic Invasive species	Determine effectiveness of a fire district for shoreline owners to fund AIS management projects.	DEC	Shoreline assn, DEC	604b funding to RPCs	Medium

Subbasin	Town	Stream segment	Stressor addressed	Project Description	Source	Potential Partners	Funding source	Priority
Entire Basin	All	All waters	Aquatic Invasive specific	Incorporate materials specific to spiny water flea into signs, greeter program. Place spiny water flea spread prevention information at all lake accesses (see Appendix I)	DEC	DEC	DEC, LCBP	High
Entire Basin	All	All waters	Aquatic Invasive specific	Develop a pilot network of hot water power wash stations at selected high priority Lake Champlain accesses to assist boaters with decontamination of watercraft and gear	DEC	LCBP greeter stewards	DEC, staff time	High
Entire Basin	All	All waters	nutrients, land erosion, channel erosion	Identify potential wetland restoration sites based on Lake Champlain wetland restoration map	DEC	DEC, USFWS	USDA – WRE, RCPP	Medium
Entire Basin	All	All waters	Pathogens, nutrients, land erosion	Update RAP brochure and distribute during animal vaccinations	AAFM	AAFM, UVM extension, veterinarians	AAFM	High
Entire Basin	All	All waters	Pathogens, nutrients	Assist wastewater treatment facilities in meeting TMDL goals to reduce phosphorus loading to Lake Champlain	DEC FED	municipalities	State Revolving Fund	High
Entire Basin	See Figure 16 for specific towns	All waters	Channel erosion, encroachment	Protect river corridors to increase flood resilience and to allow rivers to reach equilibrium by assisting towns to adopt appropriate ordinances	DEC	Municipalities, RPCs, DEC	604b funding to RPCs; DEC staff time	High
Entire Basin	See Table 7	All waters	Nutrients, land erosion, channel erosion, pathogens	Monitor and assess surface waters to gain better understanding of condition and potential sources	DEC	DEC, watershed groups, CCST	DEC including LaRosa Partnership Program,	High

List of Acronyms

319 -Federal Clean Water Act, Section 319
604(b) -Federal Clean Water Act, Section 604b
A(1) – Vermont Class A(1) water
A(2) – Vermont Class A(2) water
AAP -Accepted Agricultural Practice
AEM -Agricultural Environmental Management
ANR -Vermont Agency of Natural Resources
AIS -Aquatic invasive species
AOP -Aquatic Organism Passage
ARS -Agricultural Resource Specialist
BBR -Better Backroads grant
BMP -Best Management Practice
CWSRF -Clean Water State Revolving Fund
CREP -Conservation Reserve Enhancement Program
CWA-Federal Clean Water Act
DEC - Vermont Department of Environmental Conservation
DFPR -Vermont Department of Forests, Parks and Recreation
DFW Vermont Fish and Wildlife Department
DWSRF -Drinking Water State Revolving Fund
ERP – Ecosystem Restoration Program grant
EQIP -Environmental Quality Incentive Program
EU -Existing Use
FEH -Fluvial Erosion Hazard
FNLC – Friends of Northern Lake Champlain
GSI- Green Stormwater Infrastructure
IDDE – Illicit Discharge Detection and Elimination
LCA – Lewis Creek Association
LIA – Lake Iroquois Association
LID -Low Impact Development
LWP – LaPlatte Watershed Partnership
MAPP -Monitoring, Assessment and Planning Program
NPDES -National Pollution Discharge Elimination System
NPS -Non-point source pollution
NRCD -Natural Resource Conservation District
NRCS -Natural Resources Conservation Service
ORW -Outstanding Resource Water
PDM -Pre-Disaster Mitigation
RAP – Required Agricultural Practices
RCP -River Corridor Plan
RCPP – NRCS Regional Conservation Partnership Program
RMP -River Management Program
RPC -Regional Planning Commission
SCRW – South Chittenden River Watch
SGA -Stream Geomorphic Assessment
SRF – State Revolving Fund
TMDL -Total Maximum Daily Load
USDA -United States Department of Agriculture
USEPA -United States Environmental Protection Agency
USFWS -United States Fish and Wildlife Service
UVM -University of Vermont
VAAFM -Vermont Agency of Agriculture, Food and Markets
VTrans -Vermont Agency of Transportation
VDH -Vermont Department of Health
VGS Vermont Geological Survey
VIP -Vermont Invasive Patrollers
VLCT -Vermont League of Cities and Towns

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Glossary

10 V.S.A., Chapter 47 - Title 10 of the Vermont Statutes Annotated, Chapter 47, Water Pollution Control, which is Vermont's basic water pollution control legislation.

Acceptable Management Practices (AMP) - methods of silvicultural activity generally approved by regulatory authorities and practitioners as acceptable and common to that type of operation. AMPs may not be the best methods, but are acceptable.

Aquatic biota - all organisms that, as part of their natural life cycle, live in or on waters.

Basin - one of fifteen planning units in Vermont. Some basins include only one major watershed after which it is named such as the Lamoille River Basin. Other Basins include two or major watersheds such as the Poultney/ Mettawee Basin.

Best Management Practices (BMP) - a practice or combination of practices that may be necessary, in addition to any applicable Accepted Agricultural or Silvicultural Practices, to prevent or reduce pollution from nonpoint source pollution to a level consistent with State regulations and statutes. Regulatory authorities and practitioners generally establish these methods as the best manner of operation. BMPs may not be established for all industries or in agency regulations, but are often listed by professional associations and regulatory agencies as the best manner of operation for a particular industry practice.

Classification - a method of designating the waters of the State into categories with more or less stringent standards above a minimum standard as described in the Vermont water quality standards.

Designated use - any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water as set forth in §§ 3-02 (A), 3-03(A), and 3-04(A) of the Vermont water quality standards.

Existing use - a use that has actually occurred on or after November 28, 1975, in or on waters, whether or not the use is included in the standard for classification of the waters, and whether or not the use is presently occurring

Fluvial geomorphology - a science that seeks to explain the physical interrelationships of flowing water and sediment in varying land forms

Impaired water - a water that has documentation and data to show a violation of one or more criteria in the Vermont water quality standards for the water's class or management type.

Natural condition - the condition representing chemical, physical, and biological characteristics that occur naturally with only minimal effects from human influences.

Nonpoint source pollution - waste that reaches waters in a diffuse manner from any source other than a point source including, but not limited to, overland runoff from construction sites, or as a result of agricultural or silvicultural activities.

pH - a measure of the hydrogen ion concentration in water on an inverse logarithmic scale ranging from 0 to 14. A pH under 7 indicates more hydrogen ions and therefore more acidic solutions. A pH greater than 7 indicates a more alkaline solution. A pH of 7.0 is considered neutral, neither acidic nor alkaline.

Point source - any discernible, confined and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which either a pollutant or waste is or may be discharged.

Reference condition - the range of chemical, physical, and biological characteristics of waters minimally affected by human influences. In the context of an evaluation of biological indices, or where necessary to perform other evaluations of water quality, the reference condition establishes attainable chemical, physical, and biological conditions for specific water body types against which the condition of waters of similar water body type is evaluated.

Required Agricultural Practices(RAP) - land management practices adopted by the Secretary of Agriculture, Food and Markets in accordance with applicable State law.

Riparian vegetation - the native or natural vegetation growing adjacent to lakes, rivers, streams.

Sedimentation - the sinking of soil, sand, silt, algae, and other particles and their deposition frequently on the bottom of rivers, streams, lakes, ponds, or wetlands.

Thermal modification - the change in water temperature

Turbidity - the capacity of materials suspended in water to scatter light usually measured in Jackson Turbidity Units (JTU). Highly turbid waters appear dark and "muddy."

Water Quality Standards - the minimum or maximum limits specified for certain water quality parameters at specific locations for the purpose of managing waters to support their designated uses. In Vermont, water quality standards include both Water Classification Orders and the Regulations Governing Water Classification and Control of Quality.

Waters - all rivers, streams, creeks, brooks, reservoirs, ponds, lakes, springs and all bodies of surface waters, artificial or natural, which are contained within, flow through or border upon the State or any portion of it.

Watershed - all the land draining to a common waterbody (river, stream, lake pond or wetland).

Appendix A – Biological Assessments in Basin 5

Bold Blue = class A condition/ *Bue italics= potential Class A(1) water* **/** **Bold Green= Either macroinvertibrate or Fish indicate Very high quality water/** *Italics Green = Either macroinvertebrate or Fish suggest potential very high quality water* **/** ***Orange Bold italics = potential issues*** **/ Grey highlight = impaired /** Red blanks indicate where macro community assessment is forthcoming.

Stream station	Date	Macro community Assessment	Fish community assessment	Comments
Stevens Brook 3.2	9/30/1992	Fair		Nutrient, sediment, E. Coli impairment (303(d) List - Part A)
Stevens Brook 4.2	9/28/2011	Fair	Poor	
Stevens Brook 4.2	10/5/2009	F-Poor	Fair	
Stevens Brook 4.2	10/6/2004	G-Fair		
Stevens Brook 4.2	10/20/1998	Fair		
Stevens Brook 4.2	10/18/1993	Fair		
Stevens Brook 4.2	9/29/1992		Poor	
Stevens Brook 4.2	9/5/1991	Poor	Poor	
Stevens Brook 4.2	7/31/1990	Poor		
Stevens Brook 4.2	10/17/1989	Fair	Poor	
Stevens Brook 4.2	8/12/1988	Poor	Poor	
Stevens Brook 4.2	8/18/1987	Poor	Fair	
Stevens Brook 4.2	10/7/1986	Poor	Poor	
Stevens Brook 4.7	10/13/2004	Fair	Poor	
Stevens Brook 4.7	10/1/2003	F-Poor	Poor	
Stevens Brook 6.5	9/28/2011		Poor	Stormwater impairment (List of Priority Surface Waters - Part D)
Stevens Brook 6.5	10/16/2009	Poor		
Stevens Brook 6.5	10/17/1989	Poor		
Stevens Brook 6.6	10/1/2003	Poor	Poor	
Stevens Brook 6.6	9/30/1992	Poor		
Stevens Brook 6.6	10/4/1991	Poor		
Stevens Brook 6.6	10/17/1989	Poor		
Stevens Brook 6.7	9/30/1992	Poor		
Stevens Brook 6.8	10/4/1991	Poor		
Stevens Brook 6.8	10/17/1989	Poor		
Stevens Brook 7.5	9/28/2011	Poor	Poor	
Stevens Brook 7.5	10/6/2004	Fair		
Stevens Brook 7.5	10/17/1989	Poor	Poor	
Stevens Brook 9.0	10/20/1998	F-Poor		
Jewett Brook 3.2	9/30/1992	Poor		Nutrient, sediment, E. Coli impairment
Stevens Brook Trib 7 0.2	10/7/2008	Fair	Poor	

Stream station	Date	Macro community Assessment	Fish community assessment	Comments
Mill River 0.7	10/19/2009	Fair	Poor	Nutrient, sediment impairment (303(d) List - Part A)
Mill River 0.7	10/17/2006		Poor	
Mill River 0.7	10/5/2004	Good		
Mill River 0.7	10/15/2002	Fair		
Mill River 0.7	10/21/1999	Fair		
Mill River 0.7	10/20/1998	Good	Poor	
Mill River 0.7	9/30/1992		Fair	
Mill River 0.7	9/5/1991	Poor		
Mill River 0.7	9/18/1990	Vgood		
Mill River 0.7	7/31/1990	G-Fair		
Mill River 0.7	10/18/1989	Good		
Mill River 5.1	10/16/2009	Vg-Good		
Mill River 8.7	10/13/2006	VGood	Poor	
Mill River 8.7	10/15/2002	Vg-Good	Poor	
Rugg Brook 0.5	10/8/2012	G-Fair	Fair	Nutrients, sediment, E. Coli impairment (303(d) List - Part A)
Rugg Brook 0.5	10/20/2009	Vg-Good		
Rugg Brook 0.5	10/5/2004	Fair		
Rugg Brook 0.5	10/21/1999	Fair		
Rugg Brook 4.3	9/28/2011	Fair	Fair	Stormwater impairment (List of Priority Surface Waters - Part D)
Rugg Brook 4.3	10/14/2009	Poor	Poor	
Rugg Brook 4.3	10/4/2000		Poor	
Rugg Brook 4.3	10/6/1999		Poor	
Rugg Brook 4.4	10/5/2004	Fair		
Rugg Brook 4.4	10/15/2002	Poor		
Rugg Brook 5.3	10/8/2012	Fair		
Rugg Brook 5.3	9/28/2011	Good		
Rugg Brook 5.3	10/13/2009	G-Fair		
Stone Bridge Brook 0.1	7/24/1991		Excellent	
Stone Bridge Brook 0.2	9/22/2011	Vg-Good		
Stone Bridge Brook 0.2	10/9/2009	VGood		
Stone Bridge Brook 0.2	9/29/2004	G-Fair	Very Good	
Stone Bridge Brook 0.2	10/12/1999	G-Fair		
Stone Bridge Brook 0.2	10/8/1997	Fair	Good	
Stone Bridge Brook 5.5	9/22/2003	Fair		
Stone Bridge Brook 5.5	9/18/1990			
Malletts Creek 2.2	9/29/1992	Fair		
Malletts Creek 2.4	*10/9/2009*	*Exc*		*Macroinvertebrate community assessments suggest potential very high quality water*
Malletts Creek 2.4	*10/12/1999*	*Vgood*		

Stream station	Date	Macro community Assessment	Fish community assessment	Comments
Malletts Creek 3.5	10/7/1999		Fair	
Malletts Creek 3.5	8/10/1987	Fair		
Allen Brook 0.9	10/20/2003			
Allen Brook 1.3	10/20/1998			
Allen Brook 1.3	9/5/1992	Good		
Allen Brook 2.2	9/22/2011			
Allen Brook 2.2	10/13/2009			
Pond Brook 1.4	10/12/1999	Fair		
Pond Brook 1.5	10/12/1999	Fair		
Pond Brook 1.6	9/21/2011			
Malletts Creek Trib 8 0.2	***10/9/2009***	***Ex-Vgood***		***Macroinvertebrate community assessments suggest potential very high quality water***
Malletts Creek Trib 8 0.2	***10/8/2004***	***Ex-Vgood***		
Malletts Creek Trib 8 0.2	***10/17/2003***	***Vg-Good***		
Indian Brook 3.1	***10/1/2004***	***G-Fair***		***Stressed (Sediment, toxics, metals)***
Indian Brook 3.1	***10/14/2003***	***Fair***		
Indian Brook 3.1	***8/8/1989***		***Good***	
Indian Brook 5.8	9/20/2011	Fair	Fair	Stormwater impairment (List of Priority Surface Waters - Part D)
Indian Brook 5.8	10/6/2008	Fair	Fair	
Indian Brook 5.8	10/1/2004	F-Poor		
Indian Brook 5.8	9/15/2003	Poor		
Indian Brook 5.8	10/12/1999	Fair	Good	
Indian Brook 5.8	9/23/1994		Fair	
Indian Brook 5.8	9/29/1993	F-Poor	Good	
Indian Brook 5.8	9/29/1992	F-Poor	Fair	
Indian Brook 5.8	8/8/1989		Good	
Indian Brook 7.0	9/20/2011	Fair		
Indian Brook 7.0	10/4/2006			
Indian Brook 8.5	9/20/2011	F-Poor		
Indian Brook 8.5	10/13/2009	Poor	Good	
Indian Brook 8.5	10/8/2002	F-Poor	Good	
Indian Brook 8.5	9/30/1993	F-Poor		
Indian Brook 8.5	10/16/1992		Fair	
Indian Brook 9.0	10/7/2004	G-Fair		
Indian Brook 9.0	9/15/2003	Fair		
Indian Brook 9.0	10/8/2002	G-Fair		
Indian Brook 9.5	9/20/2011	Fair		
Indian Brook 9.5	10/1/1996	G-Fair		
Indian Brook 9.5	10/12/1995	Exc		
Indian Brook 9.8	9/30/1993	Poor		

Stream station	Date	Macro community Assessment	Fish community assessment	Comments
Potash Brook 0.7	10/3/2012	Poor		Stormwater, E. Coli impairment (List of Priority Surface Waters - Part D)
Potash Brook 0.7	9/15/2011	F-Poor		
Potash Brook 0.7	10/4/2010	Fair		
Potash Brook 0.7	9/30/2009	F-Poor	Good	
Potash Brook 0.7	10/6/2008	Fair		
Potash Brook 0.7	10/11/2007	F-Poor		
Potash Brook 0.7	10/21/2005	F-Poor		
Potash Brook 0.7	9/22/2004	Poor		
Potash Brook 0.7	10/10/2001	Poor	Good	
Potash Brook 0.7	9/30/1993	Poor		
Potash Brook 1.0	10/12/2004		Good	
Potash Brook 1.0	10/5/2001	Poor		
Potash Brook 1.0	9/30/1993	F-Poor	Good	
Potash Brook 1.0	10/15/1992	Fair	Good	
Potash Brook 1.0	9/30/1991	Fair	Good	
Potash Brook 1.0	7/31/1990	F-Poor		
Potash Brook 1.0	10/18/1989	Fair		
Potash Brook 1.0	10/19/1988	Poor		
Potash Brook 1.0	10/26/1987	Poor		
Potash Brook 1.3	8/26/1994		Good	
Potash Brook 1.8	9/15/2011	Poor		
Potash Brook 1.8	10/1/2009		Fair	
Potash Brook 1.8	9/22/1997	Fair		
Potash Brook 1.8	10/13/1994	G-Fair		
Potash Brook 1.8	10/18/1989	Good	Good	
Potash Brook 1.8	8/10/1988		Good	
Potash Brook 1.9	10/17/2001		Good	
Potash Brook 2.1	10/5/2011	Good		
Potash Brook 2.1	9/21/2004	Fair		
Potash Brook 4.3	10/26/1987	Poor		
Potash Brook Trib 3 0.3	10/6/2008			
Potash Brook Trib 3 0.3	10/13/1994	Poor	Poor	
Potash Brook Trib 7 0.1	10/13/1994	G-Fair		
Munroe Brook 0.3	9/22/2011	Fair		Stormwater impairment (List of Priority Surface Waters - Part D)
Munroe Brook 0.3	9/30/2009	Fair		
Munroe Brook 0.3	10/4/2006	Poor	Poor	
Munroe Brook 0.3	10/21/2005	Fair		
Munroe Brook 0.3	10/8/2004	Fair	Poor	
Munroe Brook 0.4	10/12/1999	Poor	Poor	
Munroe Brook 0.4	10/9/1991	Poor		

Stream station	Date	Macro community Assessment	Fish community assessment	Comments
Munroe Brook 2.8	9/21/2011	Good		
Munroe Brook 2.8	10/6/2009	Good		
Munroe Brook 2.8	10/10/2002	Fair		
Munroe Brook North Trib 0.8	9/22/2011	Fair		
Munroe Brook North Trib 0.8	10/21/2005	Fair		
Munroe Brook North Trib 0.8	10/8/2004	F-Poor		
Munroe Brook North Trib 0.8	10/10/2002	F-Poor		
Laplatte River 3.4	10/6/2009	Exc		E. Coli impairment (List of Priority Surface Waters - Part D)
LaPlatte River 5.8	*9/21/2011*	*VGood*		*Macroinvertebrate and fish community assessments suggest potential very high quality water*
LaPlatte River 5.8	*10/6/2009*	*Exc*		
LaPlatte River 5.8	*10/20/1998*	*Vg-Good*		
LaPlatte River 5.8	*7/26/1995*		*Very Good*	
LaPlatte River 8.6	9/24/1991	Poor		
Laplatte River 12.0	10/6/2009			
Laplatte River 12.5	10/6/2009			
Laplatte River 12.5	8/18/1988		Poor	
Laplatte River 14.9	9/21/2011		Fair	
Laplatte River 14.9	9/16/2003	G-Fair	Good	
McCabes Brook 1.2	10/8/2012	F-Poor	Poor	
McCabes Brook 1.2	9/16/2011	Fair	Good	
McCabes Brook 1.2	10/13/2006	G-Fair	Good	
McCabes Brook 1.4	9/16/2011	Good	Good	
McCabes Brook 2.6	10/9/1991	Poor		
Mud Hollow Brook 0.1	9/23/2009	Good		E. Coli impairment (List of Priority Surface Waters - Part D)
Patrick Brook 0.8	*8/27/2004*	*F-Poor*	*Good*	*Stressed (sediment, physical alterations)*
Thorpe Brook 0.4	8/27/2004		Very Good	
Thorpe Brook 0.5	10/5/2011			
Holmes Creek 2.7	9/22/2011			
Bartlett Brook 0.2	10/8/2012	F-Poor	Good	Stormwater impairment (List of Priority Surface Waters - Part D)
Bartlett Brook 0.2	9/15/2011	Poor		
Bartlett Brook 0.2	10/6/2008		Good	
Bartlett Brook 0.2	10/21/2005	Poor		
Bartlett Brook 0.2	10/8/2004	Poor	Good	
Bartlett Brook 0.2	10/9/2003	Poor	Poor	
Bartlett Brook 0.2	9/20/2001		Fair	
Bartlett Brook 0.2	10/12/1999	F-Poor		
Bartlett Brook 0.2	9/22/1997		Very Good	
Bartlett Brook 0.2	8/29/1994		Fair	

Stream station	Date	Macro community Assessment	Fish community assessment	Comments
Bartlett Brook 0.2	9/30/1993	Poor	Good	
Bartlett Brook 0.3	9/30/2002		Fair	
Bartlett Brook 0.4	10/5/2009	Fair	Poor	
Bartlett Brook 0.4	9/30/2002		Fair	
Bartlett Brook 0.4	10/12/1995		Poor	
Bartlett Brook 0.7	10/13/1994	F-Poor		
Englesby Brook 0.1	6/10/1994		Very Good	Stormwater, E. Coli impairment (List of Priority Surface Waters - Part D)
Englesby Brook 0.5	10/7/2004	Poor		
Englesby Brook 0.5	9/30/2002		Poor	
Englesby Brook 0.6	10/3/2012	Poor		
Englesby Brook 0.6	10/13/2009	Poor		
Englesby Brook 0.6	10/4/2006	Poor	Poor	
Englesby Brook 0.6	9/10/1998		Poor	
Englesby Brook 0.6	9/22/1997	Poor		
Englesby Brook 0.6	10/1/1996	Poor		
Englesby Brook 0.6	10/12/1995	Poor		
Englesby Brook 0.6	10/28/1994	Poor	Poor	
Englesby Brook 1.3	10/20/1998	Poor		
Englesby Brook 1.3	9/30/1993	Poor		
Rocky Brook 0.1	10/20/1993	G-Fair	Good	
Crooked Brook 1.0	9/27/2011			E. coli impairment (List of Priority Surface Waters - Part D)
Crooked Brook 1.0	10/2/2006			
Crooked Brook 1.0	10/12/2005			
Crooked Brook 1.0	10/20/2004			
Crooked Brook Trib 3 0.1	10/20/2004			
Crooked Brook Trib 3 0.1	10/20/2003			
Trout Brook 0.1	9/15/1995	Good		
Trout Brook 0.1	9/5/1995	Good		
Trout Brook 0.7	10/9/2009	VGood		
Trout Brook 0.7	9/10/1991	Good		
Trout Brook 0.8	9/27/2011		Good	
Trout Brook Trib 2 0.3	9/29/1992	Good		
Trout Brook Trib 2 0.3	9/10/1991	Exc		

Appendix B - Road segments scoring moderate or higher for erosion risk. See Road Erosion Risk Ranking on ANR Environmental Atlas

Town	Road Name	Risk Category	Centroid Lat. (dec. deg.)	Controid Long. (dec. deg.)
ALBURGH	Driveway	Moderate	44.86425	-73.29459
ALBURGH	Driveway	Moderate	44.93063	-73.27138
ALBURGH	Driveway	Moderate	44.93065	-73.27251
ALBURGH	Driveway	Moderate	44.96545	-73.2905
ALBURGH	Driveway	Moderate	44.98555	-73.22562
ALBURGH	Driveway	Moderate	44.98701	-73.22532
ALBURGH	Driveway	Moderate	45.00167	-73.30373
ALBURGH	Driveway	Moderate	45.00059	-73.29667
ALBURGH	Driveway	Moderate	45.00053	-73.2999
ALBURGH	MIDDLE RD EXT	High	44.93038	-73.27925
ALBURGH	MIDDLE RD EXT	Moderate	44.93045	-73.28173
ALBURGH	OLD RT 2	Moderate	44.9913	-73.29733
ALBURGH	SUMMIT RD	Moderate	44.903	-73.30334
ALBURGH	SUMMIT RD	Moderate	44.90396	-73.30212
ALBURGH	TH 26	Moderate	44.96535	-73.29043
ALBURGH	TOWN HWY 19	Moderate	44.99259	-73.22267
BURLINGTON	Driveway	Moderate	44.49017	-73.22199
BURLINGTON	NORTH AV	Moderate	44.52778	-73.26836
CHARLOTTE	BINGHAM BROOK RD	Moderate	44.29844	-73.18498
CHARLOTTE	CARPENTER RD	High	44.34158	-73.18414
CHARLOTTE	CARPENTER RD	Moderate	44.33962	-73.1893
CHARLOTTE	CARPENTER RD	Moderate	44.33949	-73.19054
CHARLOTTE	CONVERSE BAY RD	Moderate	44.29427	-73.27682
CHARLOTTE	DORSET ST	Moderate	44.33868	-73.17119
CHARLOTTE	Driveway	Moderate	44.27281	-73.21509
CHARLOTTE	Driveway	Moderate	44.2721	-73.21543
CHARLOTTE	Driveway	Moderate	44.27816	-73.21985
CHARLOTTE	Driveway	Moderate	44.2802	-73.21817
CHARLOTTE	Driveway	Moderate	44.27768	-73.21111
CHARLOTTE	Driveway	Moderate	44.27807	-73.21298
CHARLOTTE	Driveway	Moderate	44.27835	-73.21402
CHARLOTTE	Driveway	Moderate	44.27821	-73.21489
CHARLOTTE	Driveway	Moderate	44.27781	-73.21471
CHARLOTTE	Driveway	Moderate	44.27767	-73.21273
CHARLOTTE	Driveway	Moderate	44.27685	-73.21529
CHARLOTTE	Driveway	Moderate	44.27903	-73.19743
CHARLOTTE	Driveway	Moderate	44.28083	-73.1946
CHARLOTTE	Driveway	Moderate	44.27903	-73.19522
CHARLOTTE	Driveway	High	44.27873	-73.1964
CHARLOTTE	Driveway	Moderate	44.28506	-73.2322
CHARLOTTE	Driveway	Moderate	44.29529	-73.18843
CHARLOTTE	Driveway	Moderate	44.30719	-73.18366
CHARLOTTE	Driveway	Moderate	44.31306	-73.24274
CHARLOTTE	Driveway	Moderate	44.311	-73.24282
CHARLOTTE	Driveway	Moderate	44.31182	-73.24318

CHARLOTTE	Driveway	Moderate	44.31785	-73.2729
CHARLOTTE	Driveway	Moderate	44.32201	-73.24631
CHARLOTTE	Driveway	Moderate	44.32183	-73.24712
CHARLOTTE	Driveway	Moderate	44.3226	-73.24539
CHARLOTTE	Driveway	Moderate	44.32015	-73.24507
CHARLOTTE	Driveway	Moderate	44.32215	-73.24431
CHARLOTTE	Driveway	Moderate	44.3226	-73.24475
CHARLOTTE	Driveway	Moderate	44.3253	-73.1647
CHARLOTTE	Driveway	Moderate	44.32452	-73.1641
CHARLOTTE	Driveway	Moderate	44.33512	-73.24796
CHARLOTTE	Driveway	Moderate	44.33516	-73.24915
CHARLOTTE	Driveway	Moderate	44.33473	-73.25265
CHARLOTTE	Driveway	Moderate	44.35498	-73.2136
CHARLOTTE	Driveway	Moderate	44.35728	-73.1769
CHARLOTTE	Driveway	Moderate	44.35816	-73.17515
CHARLOTTE	Driveway	Moderate	44.35783	-73.17556
CHARLOTTE	E THOMPSON PT RD	High	44.2817	-73.25347
CHARLOTTE	HIGBEE RD	High	44.29208	-73.23786
CHARLOTTE	HIGBEE RD	Moderate	44.29199	-73.23911
CHARLOTTE	LIME KILN RD	Moderate	44.34986	-73.21276
CHARLOTTE	LIME KILN RD	High	44.34975	-73.214
CHARLOTTE	ONE MILE RD	Moderate	44.28739	-73.22112
CHARLOTTE	PRINDLE RD	Moderate	44.30249	-73.18439
CHARLOTTE	TH 20	Moderate	44.3107	-73.24506
CHARLOTTE	TH 20	Moderate	44.31046	-73.24558
CHARLOTTE	WHALLEY RD	Moderate	44.31583	-73.28915
COLCHESTER	BRIGHAM HILL RD	Moderate	44.56899	-73.10062
COLCHESTER	BRIGHAM HILL RD	Moderate	44.56932	-73.10104
COLCHESTER	COLCHESTER POND RD	Moderate	44.54906	-73.12489
COLCHESTER	COLCHESTER POND RD	Moderate	44.54929	-73.12537
COLCHESTER	COLCHESTER POND RD	High	44.54898	-73.12481
COLCHESTER	COON HILL RD	Moderate	44.57764	-73.15791
COLCHESTER	COON HILL RD	High	44.57869	-73.15714
COLCHESTER	CREEK FARM RD	High	44.56023	-73.17989
COLCHESTER	CURVE HILL RD	Moderate	44.54219	-73.12129
COLCHESTER	Driveway	High	44.51738	-73.20155
COLCHESTER	Driveway	High	44.51779	-73.20078
COLCHESTER	Driveway	Moderate	44.5373	-73.131
COLCHESTER	Driveway	Moderate	44.53642	-73.13069
COLCHESTER	Driveway	Moderate	44.53555	-73.13042
COLCHESTER	Driveway	Moderate	44.5349	-73.12695
COLCHESTER	Driveway	Moderate	44.53781	-73.17731
COLCHESTER	Driveway	Moderate	44.57092	-73.14336
COLCHESTER	Driveway	Moderate	44.57095	-73.14221
COLCHESTER	Driveway	Moderate	44.57288	-73.12479
COLCHESTER	Driveway	Moderate	44.57262	-73.12407
COLCHESTER	GALVIN HILL RD	Moderate	44.58725	-73.14777
COLCHESTER	MACRAE RD	Moderate	44.52499	-73.23384

COLCHESTER	MACRAE RD	Moderate	44.52748	-73.23807
COLCHESTER	MIDDLE RD	High	44.58424	-73.1401
COLCHESTER	MIDDLE RD	Moderate	44.56928	-73.14208
COLCHESTER	MIDDLE RD	High	44.56856	-73.14246
COLCHESTER	MIDDLE RD	High	44.5658	-73.14371
COLCHESTER	MIDDLE RD	High	44.56549	-73.14403
COLCHESTER	MIDDLE RD	High	44.56514	-73.14441
COLCHESTER	MIDDLE RD	Moderate	44.56047	-73.14977
COLCHESTER	MIDDLE RD	Moderate	44.55654	-73.15281
COLCHESTER	MUNSON RD	Moderate	44.54833	-73.16618
COLCHESTER	PINE ISLAND RD	Moderate	44.51672	-73.20388
COLCHESTER	POOR FARM RD	Moderate	44.54167	-73.16874
ESSEX	BRIGHAM HILL LN	Moderate	44.55672	-73.09576
ESSEX	BRIGHAM HILL RD	Moderate	44.54861	-73.08073
ESSEX	DISCOVERY RD	High	44.52616	-73.11883
ESSEX	DISCOVERY RD	Moderate	44.52631	-73.1176
ESSEX	Driveway	Moderate	44.50288	-73.11532
ESSEX	Driveway	High	44.50341	-73.11725
ESSEX	Driveway	Moderate	44.50297	-73.11613
ESSEX	Driveway	Moderate	44.50959	-73.09471
ESSEX	Driveway	Moderate	44.50778	-73.09497
ESSEX	Driveway	Moderate	44.52127	-73.11953
ESSEX	Driveway	Moderate	44.52089	-73.11915
ESSEX	Driveway	Moderate	44.51874	-73.11768
ESSEX	Driveway	Moderate	44.52564	-73.10774
ESSEX	Driveway	Moderate	44.52768	-73.11244
ESSEX	Driveway	Moderate	44.5385	-73.08947
ESSEX	Driveway	Moderate	44.53823	-73.08729
ESSEX	Driveway	High	44.53895	-73.08504
ESSEX	Driveway	Moderate	44.53902	-73.08379
ESSEX	Driveway	Moderate	44.56325	-73.08368
ESSEX	Driveway	Moderate	44.5629	-73.084
ESSEX	INDIAN BROOK RD	Moderate	44.51801	-73.08671
ESSEX	INDIAN BROOK RD	Moderate	44.51716	-73.0845
ESSEX	LAMORE RD	Moderate	44.52977	-73.11794
ESSEX	LOST NATION RD	High	44.51663	-73.09428
FAIRFAX	BESSETTE RD	Moderate	44.76137	-73.05921
FAIRFAX	Driveway	Moderate	44.759	-73.07436
FAIRFAX	Driveway	High	44.76025	-73.07564
FAIRFAX	Driveway	High	44.75947	-73.07508
FAIRFAX	Driveway	High	44.75423	-73.06888
FAIRFAX	Driveway	High	44.75509	-73.06544
FAIRFAX	NICHOLS RD	Moderate	44.75863	-73.0692
FAIRFAX	NICHOLS RD	High	44.75235	-73.06918
FAIRFAX	NICHOLS RD	High	44.75146	-73.06895
FAIRFAX	PILON RD	Moderate	44.76313	-73.0575
FAIRFIELD	GILLIN RD	Moderate	44.77314	-73.05626
FAIRFIELD	GILLIN RD	Moderate	44.77281	-73.05667

FAIRFIELD	GILLIN RD	Moderate	44.77472	-73.04611
GEORGIA	BATES RD	Moderate	44.70665	-73.15317
GEORGIA	BRADLEY HILL RD	High	44.7233	-73.1798
GEORGIA	BRADLEY HILL RD	Moderate	44.72273	-73.17881
GEORGIA	BRADLEY HILL RD	High	44.72025	-73.17371
GEORGIA	DECKER RD	Moderate	44.71546	-73.13959
GEORGIA	DECKER RD	Moderate	44.71517	-73.1384
GEORGIA	Driveway	High	44.68903	-73.12829
GEORGIA	Driveway	Moderate	44.68995	-73.12801
GEORGIA	Driveway	Moderate	44.69081	-73.12786
GEORGIA	Driveway	Moderate	44.69864	-73.08898
GEORGIA	Driveway	Moderate	44.6979	-73.08944
GEORGIA	Driveway	Moderate	44.70148	-73.15617
GEORGIA	Driveway	Moderate	44.70189	-73.10041
GEORGIA	Driveway	Moderate	44.71571	-73.13884
GEORGIA	Driveway	Moderate	44.72124	-73.11479
GEORGIA	Driveway	Moderate	44.72418	-73.20121
GEORGIA	Driveway	Moderate	44.73038	-73.1425
GEORGIA	Driveway	High	44.74509	-73.09029
GEORGIA	Driveway	Moderate	44.74553	-73.08945
GEORGIA	Driveway	High	44.75069	-73.0873
GEORGIA	Driveway	Moderate	44.75095	-73.08675
GEORGIA	FALLS RD	Moderate	44.77618	-73.13199
GEORGIA	FALLS RD	Moderate	44.77671	-73.13146
GEORGIA	HORSESHOE BARN RD	Moderate	44.7618	-73.11798
GEORGIA	MONTCALM RD	Moderate	44.73779	-73.15945
GEORGIA	PATTEE HILL RD	High	44.73264	-73.1581
GEORGIA	PATTEE HILL RD	Moderate	44.73047	-73.14326
GEORGIA	REYNOLDS RD	Moderate	44.74108	-73.14716
GEORGIA	REYNOLDS RD	Moderate	44.73895	-73.12989
GEORGIA	TH 15	Moderate	44.74565	-73.10516
GEORGIA	TH 15	Moderate	44.74402	-73.09171
GEORGIA	TH 15	Moderate	44.74407	-73.09422
GEORGIA	TH 45	Moderate	44.72508	-73.08912
GRAND ISLE	Driveway	Moderate	44.68657	-73.30811
GRAND ISLE	Driveway	Moderate	44.73969	-73.32488
GRAND ISLE	Driveway	Moderate	44.74344	-73.26099
GRAND ISLE	Driveway	Moderate	44.74192	-73.26369
GRAND ISLE	EAST SHORE N	High	44.76134	-73.2752
GRAND ISLE	EAST SHORE N	Moderate	44.76122	-73.27495
HIGHGATE	Driveway	Moderate	44.93631	-73.11149
HIGHGATE	Driveway	Moderate	44.94006	-73.10997
HIGHGATE	Driveway	Moderate	44.93987	-73.11169
HINESBURG	BALDWIN RD	Moderate	44.28866	-73.13137
HINESBURG	BEECHER HILL RD	Moderate	44.31744	-73.08372
HINESBURG	BEECHER HILL RD	High	44.31669	-73.08442
HINESBURG	BOUTIN RD	Moderate	44.34966	-73.15154
HINESBURG	BUCK HILL RD E	Moderate	44.32769	-73.08196

HINESBURG	BUCK HILL RD W	Moderate	44.32737	-73.08426
HINESBURG	BURRITT RD	Moderate	44.30728	-73.15226
HINESBURG	BURRITT RD	High	44.30768	-73.15162
HINESBURG	DRINKWATER RD	Moderate	44.29324	-73.13544
HINESBURG	Driveway	Moderate	44.28809	-73.08961
HINESBURG	Driveway	Moderate	44.31662	-73.11539
HINESBURG	Driveway	Moderate	44.32656	-73.06561
HINESBURG	Driveway	Moderate	44.32634	-73.06577
HINESBURG	Driveway	Moderate	44.32598	-73.06596
HINESBURG	Driveway	Moderate	44.32578	-73.06588
HINESBURG	Driveway	Moderate	44.32615	-73.05582
HINESBURG	Driveway	Moderate	44.33768	-73.13519
HINESBURG	Driveway	Moderate	44.3378	-73.13461
HINESBURG	Driveway	Moderate	44.33955	-73.13397
HINESBURG	Driveway	Moderate	44.34058	-73.10584
HINESBURG	Driveway	Moderate	44.34084	-73.10544
HINESBURG	Driveway	Moderate	44.34063	-73.10553
HINESBURG	Driveway	Moderate	44.34129	-73.10315
HINESBURG	Driveway	Moderate	44.34089	-73.10353
HINESBURG	Driveway	Moderate	44.34072	-73.10474
HINESBURG	Driveway	Moderate	44.34151	-73.10281
HINESBURG	Driveway	Moderate	44.34175	-73.10213
HINESBURG	Driveway	Moderate	44.34221	-73.10233
HINESBURG	Driveway	Moderate	44.34204	-73.10197
HINESBURG	Driveway	High	44.34237	-73.10251
HINESBURG	Driveway	High	44.34221	-73.10297
HINESBURG	Driveway	Moderate	44.34208	-73.10157
HINESBURG	Driveway	Moderate	44.34204	-73.10173
HINESBURG	Driveway	High	44.34205	-73.10151
HINESBURG	Driveway	High	44.34174	-73.10143
HINESBURG	Driveway	High	44.34278	-73.09499
HINESBURG	Driveway	Moderate	44.34154	-73.0953
HINESBURG	Driveway	Moderate	44.34143	-73.09406
HINESBURG	Driveway	Moderate	44.34272	-73.09424
HINESBURG	Driveway	Moderate	44.3475	-73.05595
HINESBURG	Driveway	Moderate	44.34978	-73.05675
HINESBURG	Driveway	Moderate	44.34802	-73.05619
HINESBURG	Driveway	Moderate	44.35439	-73.10924
HINESBURG	Driveway	Moderate	44.35394	-73.10873
HINESBURG	Driveway	Moderate	44.36185	-73.14942
HINESBURG	GILMAN RD	Moderate	44.30529	-73.0901
HINESBURG	HAYDEN HILL RD W	High	44.32909	-73.07268
HINESBURG	HAYDEN HILL RD W	Moderate	44.3271	-73.06012
HINESBURG	ISHAM RD	High	44.29228	-73.10855
HINESBURG	ISHAM RD	Moderate	44.29183	-73.11854
HINESBURG	LAVIGNE HILL RD	Moderate	44.32719	-73.0932
HINESBURG	LEAVENSWORTH RD	Moderate	44.33134	-73.14151
HINESBURG	LEWIS CREEK RD	Moderate	44.28657	-73.09332

HINESBURG	LINCOLN HILL RD	High	44.32141	-73.06376
HINESBURG	LINCOLN HILL RD	Moderate	44.32178	-73.06492
HINESBURG	LINCOLN HILL RD	Moderate	44.30891	-73.04272
HINESBURG	MAGEE HILL RD	Moderate	44.3689	-73.05524
HINESBURG	OLD ROUTE 116	Moderate	44.29808	-73.07278
HINESBURG	ONEIL RD	High	44.34201	-73.16012
HINESBURG	ONEIL RD	Moderate	44.34184	-73.15906
HINESBURG	PARTRIDGE HILL	Moderate	44.34361	-73.10299
HINESBURG	POND BROOK RD	Moderate	44.35965	-73.08064
HINESBURG	SENECA CREEK RD	High	44.34824	-73.05343
HINESBURG	SENECA CREEK RD	Moderate	44.34908	-73.05315
HINESBURG	SHERMAN HOLLOW RD	Moderate	44.36562	-73.04414
HINESBURG	SHERMAN HOLLOW RD	Moderate	44.36558	-73.04495
HINESBURG	TEXAS HILL RD	High	44.34257	-73.04266
HINESBURG	TEXAS HILL RD	Moderate	44.34267	-73.0415
HINESBURG	TH 19	Moderate	44.333	-73.0405
HINESBURG	TH 19	Moderate	44.33367	-73.03962
HINESBURG	TH 19	Moderate	44.33375	-73.03887
HINESBURG	TH 21	Moderate	44.33431	-73.09432
HINESBURG	TH 27	Moderate	44.29106	-73.12666
HINESBURG	TH 42	Moderate	44.34254	-73.15005
HINESBURG	TURKEY LN	Moderate	44.28782	-73.10267
MILTON	BEEBE HILL RD	Moderate	44.70394	-73.18932
MILTON	BEEBE HILL RD	High	44.66402	-73.19791
MILTON	BULLOCK RD	Moderate	44.70416	-73.19328
MILTON	CADREACT RD	High	44.65348	-73.19446
MILTON	CADREACT RD	Moderate	44.65648	-73.19504
MILTON	DEVINO RD	Moderate	44.61355	-73.08068
MILTON	DEVINO RD	High	44.60275	-73.07597
MILTON	Driveway	Moderate	44.58665	-73.13414
MILTON	Driveway	Moderate	44.60052	-73.13715
MILTON	Driveway	Moderate	44.60494	-73.07331
MILTON	Driveway	Moderate	44.60585	-73.1006
MILTON	Driveway	Moderate	44.60809	-73.10743
MILTON	Driveway	Moderate	44.60537	-73.10886
MILTON	Driveway	Moderate	44.60788	-73.07912
MILTON	Driveway	High	44.61351	-73.08436
MILTON	Driveway	Moderate	44.61562	-73.06947
MILTON	Driveway	Moderate	44.61629	-73.06992
MILTON	Driveway	Moderate	44.61673	-73.07079
MILTON	Driveway	Moderate	44.61633	-73.07175
MILTON	Driveway	Moderate	44.62185	-73.20969
MILTON	Driveway	Moderate	44.62869	-73.17579
MILTON	Driveway	Moderate	44.62555	-73.15907
MILTON	Driveway	Moderate	44.62736	-73.15321
MILTON	Driveway	Moderate	44.63279	-73.05732
MILTON	Driveway	Moderate	44.63688	-73.05597
MILTON	Driveway	Moderate	44.63639	-73.05614

MILTON	Driveway	Moderate	44.63597	-73.05634
MILTON	Driveway	High	44.63429	-73.05695
MILTON	Driveway	Moderate	44.63346	-73.05737
MILTON	Driveway	High	44.63628	-73.1189
MILTON	Driveway	Moderate	44.63761	-73.10807
MILTON	Driveway	Moderate	44.63761	-73.10784
MILTON	Driveway	Moderate	44.64188	-73.08054
MILTON	Driveway	Moderate	44.63861	-73.05107
MILTON	Driveway	Moderate	44.64018	-73.05025
MILTON	Driveway	High	44.64589	-73.18633
MILTON	Driveway	Moderate	44.65233	-73.07047
MILTON	Driveway	Moderate	44.65893	-73.07213
MILTON	Driveway	Moderate	44.65545	-73.07213
MILTON	Driveway	Moderate	44.65671	-73.15591
MILTON	Driveway	Moderate	44.65719	-73.15697
MILTON	Driveway	Moderate	44.70487	-73.20061
MILTON	EAGLE MOUNTAIN HARBOR RD	Moderate	44.67626	-73.20963
MILTON	HARDSCRABBLE RD	Moderate	44.61488	-73.07792
MILTON	HOWARD DR	Moderate	44.63987	-73.11565
MILTON	KINGSBURY CRSG	Moderate	44.62337	-73.10459
MILTON	LAKE RD	Moderate	44.68839	-73.17458
MILTON	LAMPHERE RD	Moderate	44.63553	-73.17137
MILTON	MARCOUX RD	Moderate	44.6613	-73.1666
MILTON	MEARS RD	Moderate	44.65518	-73.17319
MILTON	PETTY BROOK RD	High	44.604	-73.14951
MILTON	TH 11	Moderate	44.68816	-73.17397
MILTON	TH 11	High	44.68335	-73.16692
MILTON	TH 56	Moderate	44.6031	-73.18153
NORTH HERO	Driveway	Moderate	44.81985	-73.28966
NORTH HERO	Driveway	Moderate	44.82088	-73.29456
NORTH HERO	Driveway	Moderate	44.8208	-73.29393
NORTH HERO	Driveway	Moderate	44.82049	-73.29191
RICHMOND	PALMER RD	Moderate	44.37686	-73.04474
SHELBURNE	Driveway	Moderate	44.36401	-73.1473
SHELBURNE	Driveway	Moderate	44.36349	-73.14826
SHELBURNE	Driveway	Moderate	44.3637	-73.14917
SHELBURNE	Driveway	Moderate	44.37482	-73.13651
SHELBURNE	Driveway	Moderate	44.37563	-73.22668
SHELBURNE	Driveway	Moderate	44.37515	-73.22652
SHELBURNE	Driveway	Moderate	44.39869	-73.21847
SHELBURNE	Driveway	Moderate	44.40766	-73.22165
SHELBURNE	POND RD	Moderate	44.37167	-73.18063
SOUTH BURLINGTON	Driveway	Moderate	44.42651	-73.17664
SOUTH BURLINGTON	Driveway	Moderate	44.43665	-73.21349

SOUTH BURLINGTON	Driveway	High	44.43638	-73.2146
SOUTH BURLINGTON	Driveway	Moderate	44.43669	-73.21671
SOUTH BURLINGTON	Driveway	Moderate	44.43647	-73.21724
SOUTH BURLINGTON	Driveway	Moderate	44.43352	-73.21591
SOUTH BURLINGTON	Driveway	Moderate	44.44182	-73.13717
SOUTH BURLINGTON	Driveway	Moderate	44.44031	-73.14136
SOUTH BURLINGTON	RIVER COVE RD	High	44.47275	-73.13493
SOUTH HERO	Driveway	Moderate	44.64227	-73.27839
SOUTH HERO	Driveway	Moderate	44.66189	-73.32955
SOUTH HERO	EAST SHORE RD	Moderate	44.61374	-73.29003
SOUTH HERO	EAST SHORE RD	Moderate	44.62633	-73.28387
SOUTH HERO	SUNSET VIEW RD	High	44.65143	-73.32653
SOUTH HERO	WEST SHORE RD	Moderate	44.66898	-73.34619
SOUTH HERO	WEST SHORE RD	Moderate	44.65318	-73.3459
SOUTH HERO	WHIPPLE RD	Moderate	44.61989	-73.28566
SOUTH HERO	WHIPPLE RD	Moderate	44.61943	-73.28938
SOUTH HERO	WHIPPLE RD	High	44.61928	-73.29062
SOUTH HERO	WHIPPLE RD	High	44.61917	-73.29187
ST. ALBANS CITY	Driveway	Moderate	44.80209	-73.0817
ST. ALBANS TOWN	Driveway	Moderate	44.78035	-73.09209
ST. ALBANS TOWN	Driveway	Moderate	44.78674	-73.07468
ST. ALBANS TOWN	Driveway	High	44.79437	-73.04485
ST. ALBANS TOWN	Driveway	Moderate	44.79374	-73.04404
ST. ALBANS TOWN	Driveway	Moderate	44.8097	-73.0372
ST. ALBANS TOWN	Driveway	Moderate	44.80921	-73.03819
ST. ALBANS TOWN	Driveway	Moderate	44.80769	-73.03819
ST. ALBANS TOWN	Driveway	Moderate	44.8073	-73.03811
ST. ALBANS TOWN	Driveway	Moderate	44.82337	-73.07224
ST. ALBANS TOWN	Driveway	Moderate	44.82326	-73.07156
ST. ALBANS TOWN	Driveway	Moderate	44.82373	-73.12457
ST. ALBANS TOWN	PAQUETTE RD	Moderate	44.81492	-73.02055
ST. GEORGE	Driveway	Moderate	44.37224	-73.09589
ST. GEORGE	Driveway	Moderate	44.3763	-73.12714
ST. GEORGE	Driveway	Moderate	44.3762	-73.12808
ST. GEORGE	Driveway	Moderate	44.38118	-73.11288
SWANTON	Driveway	Moderate	44.83154	-73.0376
SWANTON	Driveway	High	44.8682	-73.09035
SWANTON	Driveway	Moderate	44.94687	-73.21523
WESTFORD	Driveway	Moderate	44.57584	-73.06569
WESTFORD	Driveway	High	44.60824	-73.06783
WESTFORD	Driveway	Moderate	44.61478	-73.05959

WESTFORD	ROGERS RD	Moderate	44.60804	-73.06662
WESTFORD	ROLLIN IRISH RD	Moderate	44.57841	-73.08401
WESTFORD	ROLLIN IRISH RD	High	44.57695	-73.07558
WESTFORD	ROLLIN IRISH RD	Moderate	44.57639	-73.06706
WESTFORD	TH 25	Moderate	44.61411	-73.05936
WESTFORD	TH 36	High	44.608	-73.06719
WESTFORD	TH 36	Moderate	44.60825	-73.0679
WILLISTON	BUTTERNUT RD	Moderate	44.39907	-73.11063
WILLISTON	Driveway	Moderate	44.39429	-73.07948
WILLISTON	ST HILAIRE LN	Moderate	44.40081	-73.08833
WILLISTON	WILLOW BROOK LN	Moderate	44.38501	-73.10563

Appendix C- Assessed Northern Lake Champlain Direct Drainages Culverts mostly or completely incompatible with stream geomorphology

Table 7 From VANR culvert assessments: Culverts Mostly to Completely Incompatible with Geomorphology of named Stream in Shelburne and Burlington Bay Watersheds : 0-5 Completely and 5-10 mostly. Aquatic Organism passage legend: (VANR stream database 2013)

StreamName	Town	Geomorhic Compatablitly Score	AOP Course Screen	Latitude	Longitude
Englesby Brook	Burlington	4	Red	44.45695	-73.2078
LaPlatte River	Hinesburg	4	Red	44.29784	-73.0726
Munroe Brook	Shelburne	5	Red	44.40934	-73.1977
Englesby Brook	Burlington	6	Red	44.45955	-73.2008
LaPlatte River	Hinesburg	6	Gray	44.30083	-73.0739
Mill River	Georgia	6	Gray	44.74181	-73.1525
Mill River	Georgia	6	Gray	44.76059	-73.0851
Munroe Brook	Shelburne	6	Gray	44.3899	-73.2007
Bartlett Brook	South Burlington	7	Red	44.42654	-73.2061
Englesby Brook	Burlington	7	Red	44.46095	-73.2
Englesby Brook	Burlington	7	Red	44.46628	-73.1973
LaPlatte River	Hinesburg	7	Gray	44.34052	-73.1161
Trout Brook	Milton	7	Orange	44.65311	-73.1944
Kimball Brook	Ferrisburg	8	Red	44.25911	-73.2488
LaPlatte River	Hinesburg	8	Orange	44.32827	-73.1285
LaPlatte River	Hinesburg	8	Red	44.35814	-73.1226
Allen (Petty) Brook	Colchester	8	Gray	44.57854	-73.1572
Munroe Brook	Shelburne	8	Green	44.39641	-73.2175

Culvert replacement incurs a substantial cost for a town or the state, yet the replacement with suitable sizes helps with supporting the stream geomorphic stability and fish passage to additional habitat (the aquatic organism passage). The additional functions that the culvert provides can be useful in finding grants that are based on improving the health of the river or fisheries. The chart can be used by towns to help prioritize culvert replacements, suitable replacement size as well as appropriate funding sources. The RPC transportation planner often works with the towns and may be able to use the chart during their discussions. See Stream Geomorphic Assessment DMS for additional culvert and bridge informational that may be helpful when looking at the towns

Appendix D – USDA NRCS/Vermont State Funding Summary - January, 2015

Lake Champlain Funding Sources	Lake Champlain Initiative Announced by Vilsack	Regional Conservation Partnership (RCPP) National – Lake Champlain – Ag, Forestry, Conservation Easements and Wetlands Restoration	RCPP State – Nutrient Management Planning
Lead Project Partner	Funded through NRCS Programs using typical process in consultation with State Technical Committee	Vermont Agency of Agriculture and Agency of Natural Resources	Vermont Association of Conservation Districts
Total Funds Available	$45 Million over five years -Almost all FA directly to farmers	$16 Million (FA and TA) -Note: 10% of EQIP funds will be targeted to New York	$710,980 - 800,000 (FA and TA)
Time Frame	FY 2015 – 2019	FY 2015 - 2019	FY 2015 - 2018
Programs	EQIP only – ~$8M/year solely for Lake Champlain Basin	EQIP – 1.8M/year (FA) ACEP-ALE – 750,000 - $1M/year (FA) ACEP- WRE – 230,000/year	EQIP – about $175,000/yr
Primary Practices	All water quality practices including waste management, infrastructure, field agronomic practices, forestry, and wetlands	Cropland – All Agronomic Practices, with limited focus on Farmsteads; Feed Management; Forestry – Forest Trails and Landings, Stream Crossings, Skidder Bridges	Collection of Data Needed to Develop Land Treatment and Nutrient Management Plans
Restrictions		***Funds cannot be used for admin or outreach*** Requires substantial match including: VHCB – $840,000/year DEC - $389,500/year (staff, lab, wetlands contractor) AAFM - $1,998,294/year (staff, FAP, BMP $)	

Lake Champlain Funding Sources	Lake Champlain Initiative Announced by Vilsack	Regional Conservation Partnership (RCPP) National – Lake Champlain – Ag, Forestry, Conservation Easements and Wetlands Restoration	RCPP State – Nutrient Management Planning
Priority Locations	FY 2015 – basin wide, but with priorities for Missisquoi, St. Albans Bay, and South Lake FY 2016 – basin wide, but will prioritize Rock River, Lake Carmi/Pike River, St. Albans Bay, and Mackenzie Brook.Future will coordinate with DEC Tactical Basin Planning process	Small Farms in the Missisquoi Bay, St. Albans Bay, and South Lake watersheds (both VT and NY); Critical Source Areas will prioritized in those three priority basins Feed Management, forestry and wetlands restoration – basin wide, Land Conservation - Lake Champlain basin	Lake Champlain, with an option to expand beyond the watershed Small farm nutrient management planning in coordination with UVM Extension NMP development class.
Estimated Number of Participants **NOTE - RCPP Numbers Subject to Change due to reduced funding**	On average – 300 participants/year in the Lake Champlain watershed	Total Estimated Small Farms – 120-140 Forestry – 100 Wetland Restoration – 20-30 Conservation Easements - 35	Small Farms - 40 per year for a total of 160
Priority Resource Concern	Water Quality	Water Quality, Land Conservation	Water Quality

Program	Total Commitment	Annual Allocation directly to farmers
NRCS	$45,000,000	$8-9,000,000
RCPP – State of Vermont – EQIP	$7,170,000	$1,792,500
RCPP – State of Vermont – ACEP-ALE	$3,890,000	$970,000 first year, $730,000 following years
RCPP – State of Vermont – ACEP-WRE	$924,000	$230,000
RCPP – VACD – Nutrient Management Plans	$800,000	Approx. $175,000
VT Agency of Agriculture – BMP funds		$1,400,000
VT Agency of Agriculture – FAP/NMP funds		$569,544
Total		**~$14M/year average**

Acronyms

RCPP – Regional Conservation Partnership Program

NRCS – Natural Resources Conservation Service

EQIP – Environmental Quality Incentives Program - Field practices, barnyard improvement, waste management

ACEP-ALE – Agricultural Conservation Easement Program/Ag land easement

ACEP – WRE – Wetlands Restoration Easements

FA – financial assistance – payments directly to farmers for projects

TA – technical assistance – people to help design, implement projects for farmers

VACD – VT Association of Conservation District

BMP – Best management practices

FAP – Farm Agronomic Practices

NMP – Nutrient Management Plans

Appendix E - Lakes and Ponds Actions in the Northern Lake Champlain Direct Drainages. "X" indicates high priority items.

Lake	Town	Acres	Lakeshore Assessment	LakeWise	AIS Spread Prevention
Champlain – Burlington Bay					LTM
Champlain – Isle LaMotte				X	LTM
Champlain – Main Lake					LTM
Champlain – Malletts Bay					LTM
Champlain – Northeast Arm				Locate BMP demo site	VIPs, LTM
Champlain – Shelburne Bay					LTM
Champlain – St. Albans Bay					LTM
Colchester	Colchester	186	X		
Fairfield			X	X	LTM
Indian Brook	Essex	50			
Iroquois	Williston/ Hinesburg	243		X	VIPs, Vermont Public Access Greeter Program, LTM
Long	Milton	47	X		
Lost	Georgia	10	X		
Lower (Sunset)	Hinesburg	58	X		
Milton	Milton	24	X		
North St. Albans	St. Albans	35	X		
South St. Albans	St. Albans	27	X		

The Vermont Lake Wise Program

The Lake Wise Program is offered through the Vermont Lakes and Ponds Program to provide trainings on lake-friendly shoreland management. Recent data from Vermont and the nation has shown that shoreline development can pose a significant threat to lake water quality. Through Lake Wise, lake property is assessed in four categories of property management– shoreland , recreation area, driveway, and septic /structures. Technical assistance then helps property owners identify locations where the use of best management practices can control run-off and prevent erosion. Properties that meet all Lake Wise criteria receive the Lake Wise award and accompanying sign designating their property as lake-friendly. Lake Associations are also eligible for the "Gold Award" if they assist 15% of their fellow lake residents to participate in Lake Wise.

For more information, contact Amy Picotte at amy.picotte@vermont.gov or (802) 490-6128

Vermont Invasive Patrollers (VIPs)

VIPs are local volunteers who monitor a waterbody for new invasive species. They are trained to distinguish between native and invasive aquatic plants and animals during routine systematic surveys. These individuals provide a vital line of defense in Vermont's efforts to protect lake ecology and recreation. Finding an invasive organism before it becomes well established in a lake or pond increases management options and may make eradication possible.

For more information, contact Kimberly Jensen at Kimberly.Jensen@vermont.gov

The Vermont Public Access Greeter Program

The Lakes and Pond Program partners with local watershed associations to operate greeter programs at lake access points. Public access greeters educate lake visitors about invasive species, provide courtesy watercraft inspections and STOP introductions while providing needed data on the ways invasive organisms hitch rides on equipment. In 2014, greeters intercepted and removed aquatic invasive species 361 times, more than half of the recorded intercepts for the year.

For more information, contact Josh Mulhollem at josh.mulhollem@vermont.gov or (802)490-6121

The Lay Monitoring Program (LMP)

For more than 35 years, the Lakes and Ponds Program has provided technical training and support for local water quality monitors around the state. Following a rigorously documented and quality assured method, these volunteers track changes in chlorophyll, phosphorus and lake transparency. The data support protection and restoration activities around the lake and in the watershed. Currently, there are monitors on approximately 55 inland lakes and 15 locations on Lake Champlain.

For more information, contact Mark Mitchell at Mark.Mitchell@vermont.gov

The Champlain Long-Term Water Quality and Biological Monitoring Program (LTM)

Since 1992, the Lakes and Ponds Program has collected water quality and biological data from Lake Champlain in support of the TMDL plan. In conjunction with the New York Department of Environmental Conservation, staff conduct routine monitoring at 15 lake stations and 21 tributaries during the ice-free months.

Cyanobacteria Monitoring in Vermont

In conjunction with the Vermont Department of Health and the Lake Champlain Committee, program staff track cyanobacteria (aka blue-green algae) at 15 locations on Lake Champlain during the summer recreation months. Data are shared through an on-line tracking map for use by lake residents and visitors. In 2014, more than 1400 reports were provided to the tracking map by Lakes staff and citizen volunteers.

Appendix F – Northern Lake Champlain Direct Drainages Phase II Plan for the Lake Champlain Phosphorus TMDL

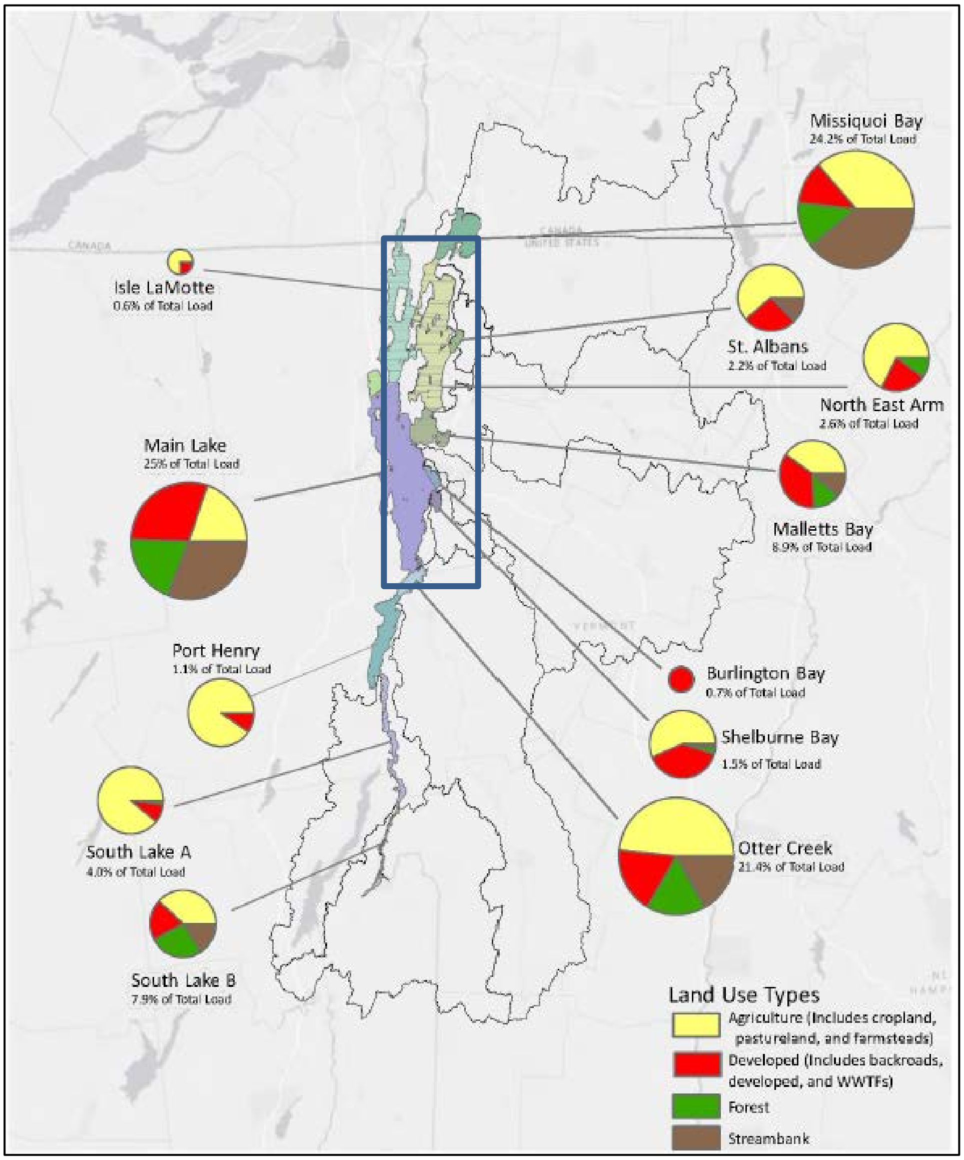
The Basics

A total maximum daily load or TMDL is the amount of a pollutant a waterbody can safely absorb and still meet water quality standards. The maximum pollutant load is divided among the various pollutant sources and locations. In the case of Lake Champlain, there are proposed TMDLs outlining the phosphorus reductions for each of the twelve lake segments required to restore the Lake and meet Vermont's Water Quality Standards. The Northern Lake Champlain Direct Drainages (North Lake Basin) inputs into numerous Lake Champlain segments.

In 2002, the U.S. Environmental Protection Agency (EPA) approved a Lake Champlain Phosphorus TMDL that was prepared by the States of Vermont and New York. In 2011, the EPA concluded that two elements of the TMDL did not comply with EPA regulations and guidance, and thus their approval of the 2002 TMDL was withdrawn. The EPA approved the Vermont Lake Champlain Phosphorus TMDL Phase 1 Implementation Plan in September 2016 and the State of Vermont is finalizing a new aggressive restoration plan for Lake Champlain and its tributaries. The approved proposal addresses all major sources of phosphorus to Lake Champlain and involve new and increased efforts from nearly every sector of society, including state government, municipalities, farmers, developers, and homeowners.

Priority actions have been identified to address surface water stressors (and attendant sources and causes of pollutants) and have been incorporated into the Northern Lake Champlain Basin Implementation table (Chapter 4), and specific projects to implement related actions are identified in DEC's online Watershed Projects Database. In addition, a list of highest priority catchments (i.e., also called catchment basin, drainage area, drainage basin, and is defined as the area of land bounded by watersheds draining into a river, basin, or reservoir), identified through the downscaled Soil and Water Assessment Tool, or "SWAT" modeling analysis which allows geographic targeting as the highest priority for project ("BMPs" or best management practices) implementation, and the prospective locations for practices in a general sense (see Figure 9, 10, 12, 14, 14, and 16). Specific BMPs will be identified through ongoing land use sector assessments to leverage funding and target project development in these highest priority catchments, and will be the focus on ongoing coordination efforts with partners to maximize project implementation over the next 5 years, and in future iterations of Tactical Basin Plans concurrent with VTDEC's Accountability Framework.

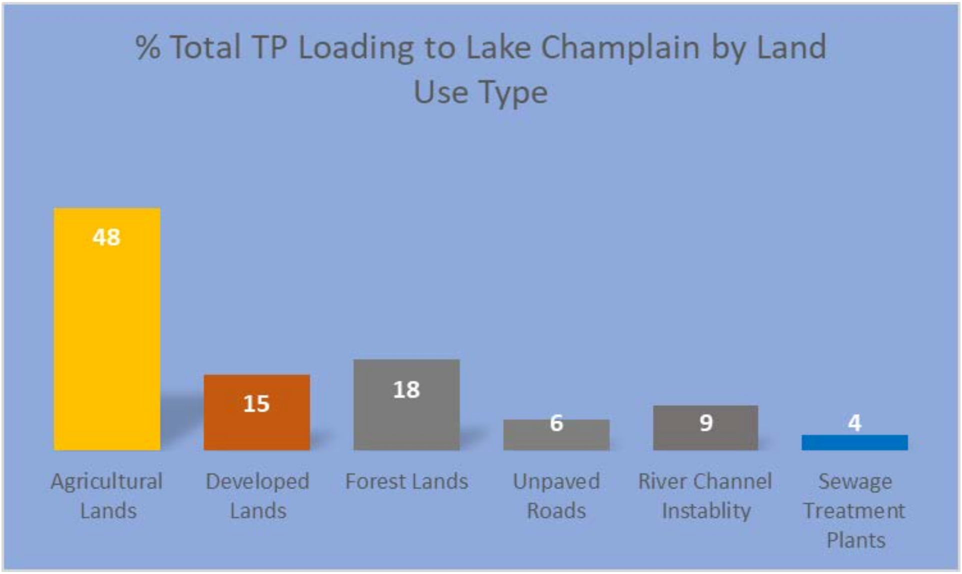
Figure 1. Vermont sources of phosphorus loading to Lake Champlain segments, by land use; annual average of 2001-2010. The approximate North Lake Basin extent is highlighted in the blue box **(Source: US Environmental Protection Agency, 2016**).



Phosphorus in the Lake comes primarily from nonpoint sources (Figure 1). Nonpoint sources deliver phosphorus from the land to our waterways by rain or snowmelt. Nonpoint sources of phosphorus come from roads, parking lots, lawns, agricultural and logging operations, and eroding stream channels. Point source discharges of phosphorus include regulated stormwater discharges, including agricultural production areas, and sewage treatment plants.

Measuring the phosphorus content of water that comes out of a pipe (point source) is less complicated than measuring phosphorus content of water flowing over land surfaces (non-point source). As a result, determining phosphorus loading of non-point sources requires environmental modeling based on long-term field measurements and land use information from satellite imagery and LiDAR data. The overall sources of phosphorus loading to Lake Champlain are given in Figure 2. More information on how phosphorus loading was projected in the Lake Champlain Basin can be found in Chapter 5 of the Phosphorus TMDLs for Vermont Segments of Lake Champlain.

Figure 9. Source of phosphorus loading to Lake Champlain by land use. (Source: Tetra Tech Inc., 2016)



Understanding the relationship between phosphorus and land use is important because phosphorus pollution is a significant threat to clean water in the North Lake Basin and Lake Champlain, which are both important for recreational and drinking water uses, as well as aquatic life and habitat function. Addressing phosphorus pollution through actions on the landscape will also lead to reductions in other pollutants in the watershed.

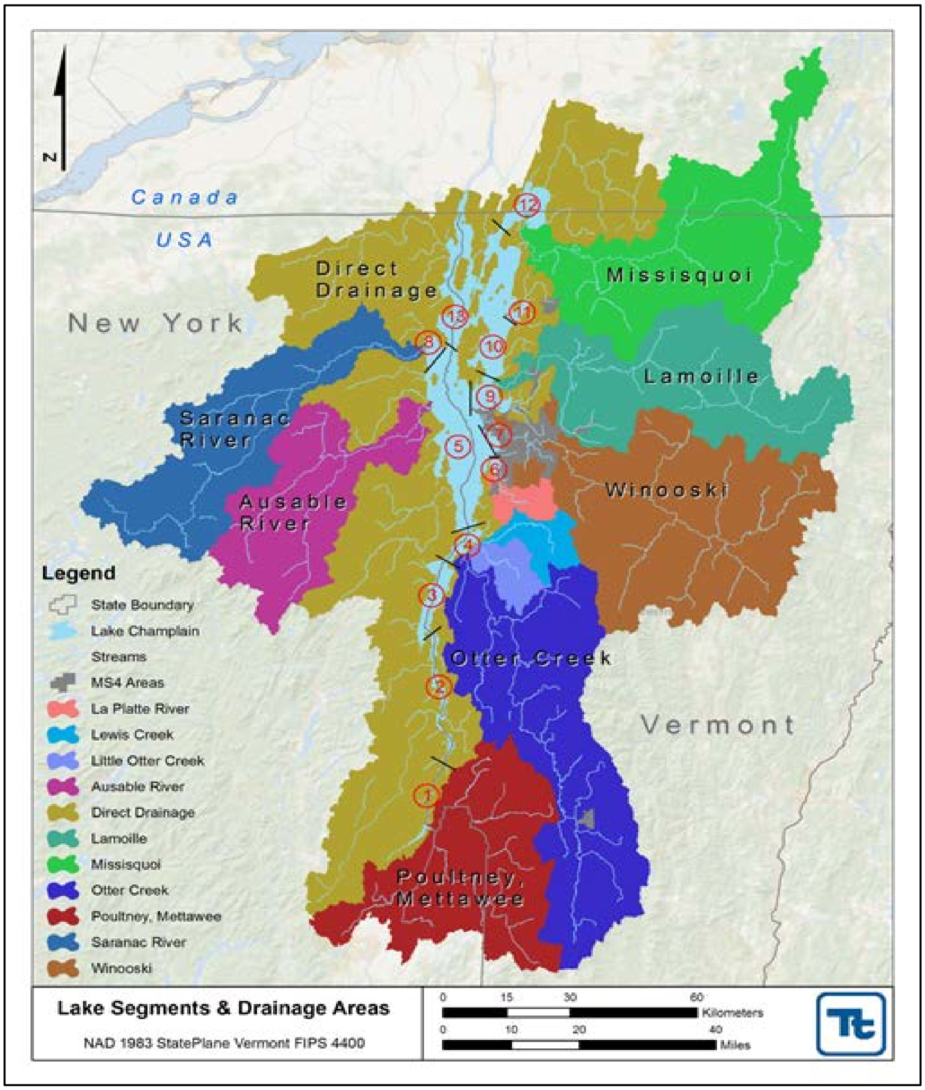
Investments in a clean Lake Champlain will support local and regional economies, enhance tourism and recreation-based businesses, support property values, help local communities reduce future flood damage risk, support the viability of public infrastructure, and improve the ecological functions within the watershed.

The North Lake Tactical Basin Plan will report actions to reduce phosphorus loading per land use type in sub-watersheds and catchments within the basin. However, the reduction of phosphorus to Lake Champlain could take decades in some areas. Accomplishing all the necessary phosphorus reduction actions on the land that drains to the Lake will require many phases of action. Progress will be tracked incrementally through internal tracking systems and a portion of the progress will be tracked in the tactical basin plan implementation table database, which is an electronic extension of the implementation tables included in past tactical basin plans.

The North Lake Basin and the Lake Champlain Phosphorus TMDL

The Lake Champlain basin is divided into numerous drainage areas located in Vermont, New York State and Quebec, as depicted in Figure 3.

Figure 1.. Lake segments and drainage areas of the Lake Champlain basin.

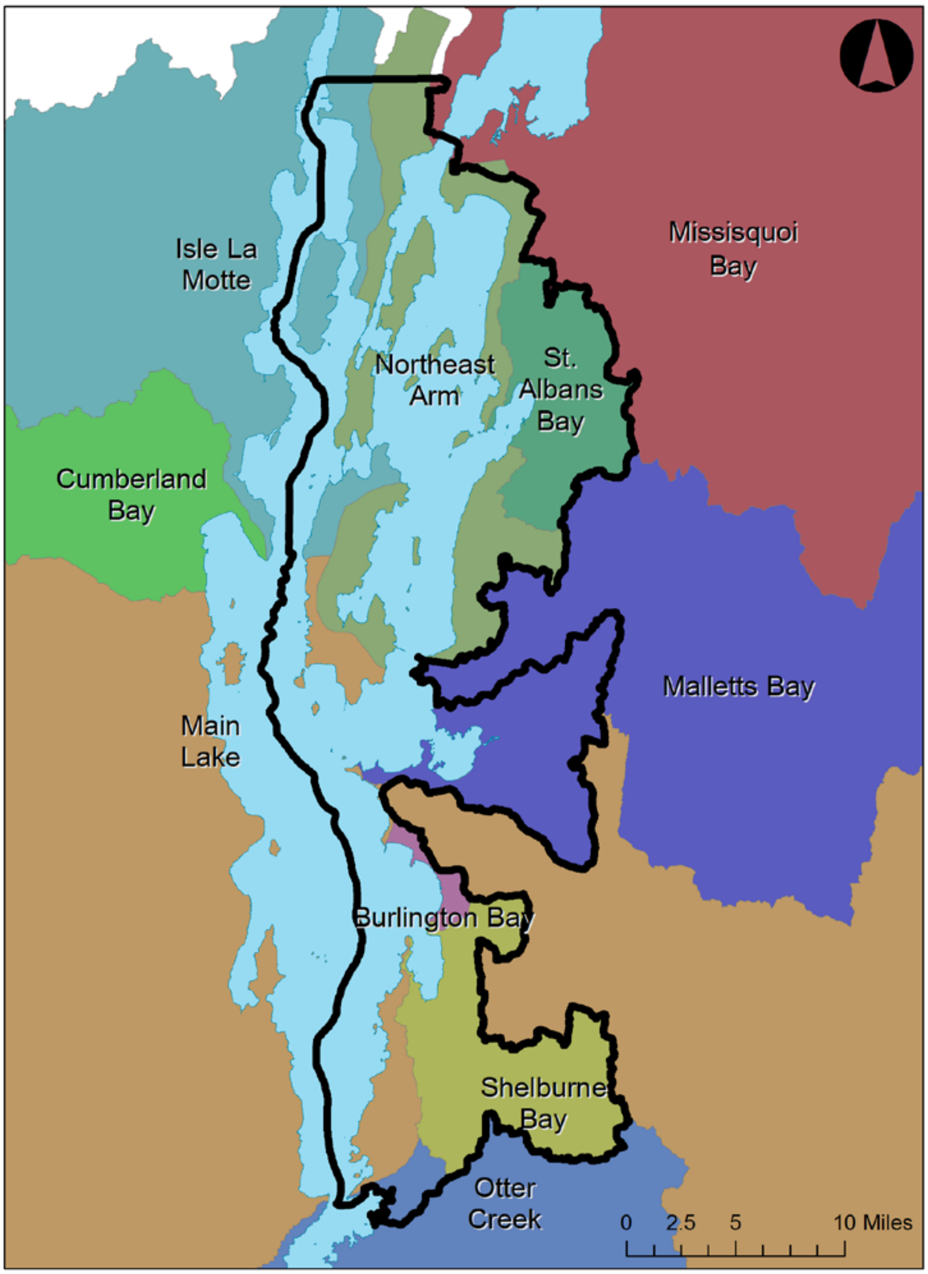


The North Lake Basin is comprised of several Lake Champlain segment drainages, some of which are wholly contained within the planning basin and some of which are only partially represented. These are identified below in Table 1 and shown in Figure 4.

Table 1. Relationship of Lake Champlain drainage areas to North Lake Basin.

Wholly contained in North Lake Basin	Partially contained in North Lake Basin
Isle La Motte	Mallets Bay
Northeast Arm	Main Lake
St Albans Bay	Otter Creek
Shelburne Bay	
Burlington Bay	

Figure 10. North Lake Champlain planning basin relative to Lake Champlain TMDL lake segment drainages.



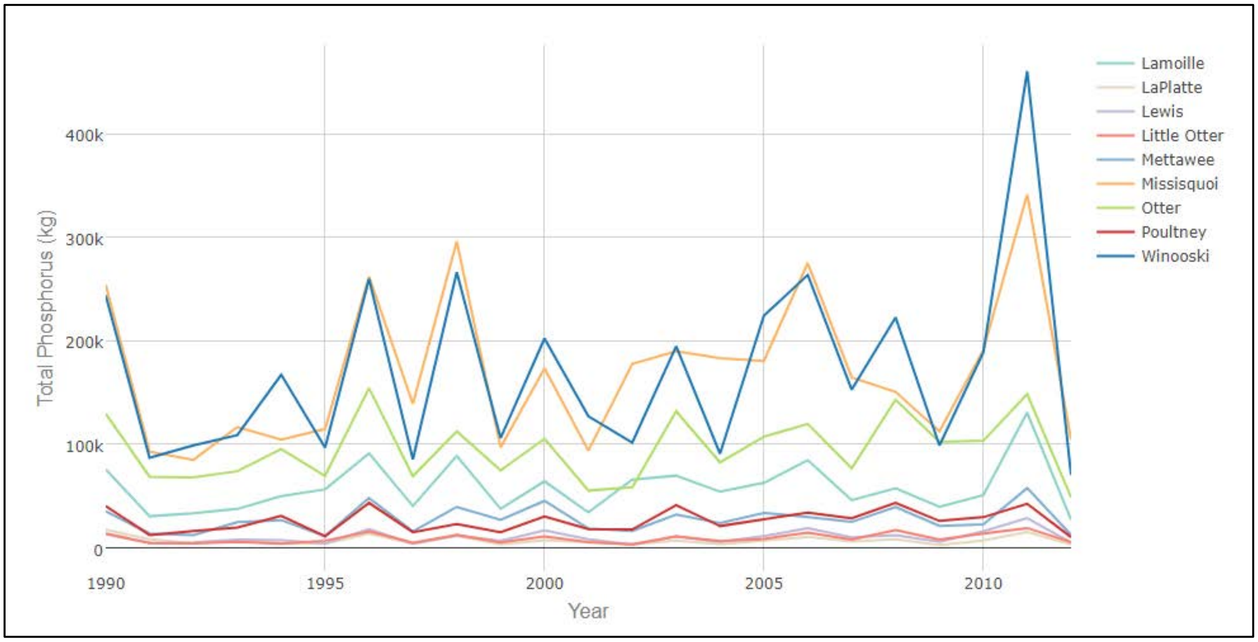
Vermont contributes about 69 percent (630.6 MT/yr) of the total phosphorus load per year to Lake Champlain in comparison to Quebec at 9 percent (77 MT/yr) and New York at 23 percent (213.8 MT/yr). Regarding the North Lake Basin, the loading relative to each drainage is shown in Table 2.

Table 2. Relative phosphorus loading from each lake drainage area in the North Lake Basin. (MT= metric tons)

Drainages wholly contained in North Lake Basin	MT P /yr.	Drainages partially contained in North Lake Basin	MT P /yr.
Isle La Motte	4.1	Mallets Bay	4.3
Northeast Arm	17.8	Main Lake	6.0
St Albans Bay	13.9	Otter Creek	4.7
Shelburne Bay	10.2		
Burlington Bay	4.5		

Based on estimates provided in the 2016 Lake Champlain TMDL, the North Lake Basin contributes approximately 10% of the average total phosphorus delivered from the Vermont portion of the Lake Champlain in a given year. However, total annual total phosphorus (TP) loading varies from year to year based on flow and on-going land use. Measured TP loading from the major river basins in the Lake Champlain basin is shown in Figure 5.

Figure 11. Total phosphorus annual flux as measured at monitoring stations on the major tributaries of Lake Champlain



To meet the Lake Champlain Phosphorus TMDL expectations, total annual TP loading from the North Lake Basin will be significant. The following sections will address how these requirements can be met across all sectors within the North Lake Basin including regulatory and non-regulatory actions.

Lake Champlain Phosphorus TMDL Phase II Plan

The Lake Champlain Phosphorus Total Maximum Daily Load (LC TMDL) establishes the allowable phosphorus loadings, or allocations, from the watershed for the lake water quality to meet established standards. These allocations represent phosphorus loading reductions that are apportioned both by land use sector (developed land, agriculture, etc.) and by lake watershed basin (South Lake, Otter Creek, etc.). Due to the large size of the Lake Champlain watershed in Vermont, the modeling techniques used to estimate loading were implemented at a coarse scale. For example, the modeled loading at the mouth of the major river basins is based on monitoring data and represents the collective inputs from the various land uses and physical features of the watershed. Overall, this is useful to estimate the necessary level of phosphorus-reducing Best Management Practices (BMPs). However, when looking at smaller scale areas such as a municipality, a particular farm or a local road network, it's necessary to complete a detailed on-the-ground analysis to determine appropriate actions for the particular area.

As part of the LC TMDL development, EPA developed a "Reasonable Assurance" analysis at the major-basin scale to determine if it was theoretically possible to obtain the necessary phosphorus reductions. By using modeling results for the entire Champlain Basin, the TMDL showed that through a concerted effort across all phosphorus sources, it appeared possible to reach the lake loading targets with appropriate application of BMPs. However, because this exercise was conducted at the major-basin scale, there is no specific prescription as to where BMPs should be applied. It is through the development of the Tactical Basin Plans that more precise opportunities for BMPs can be identified and prioritized for implementation.

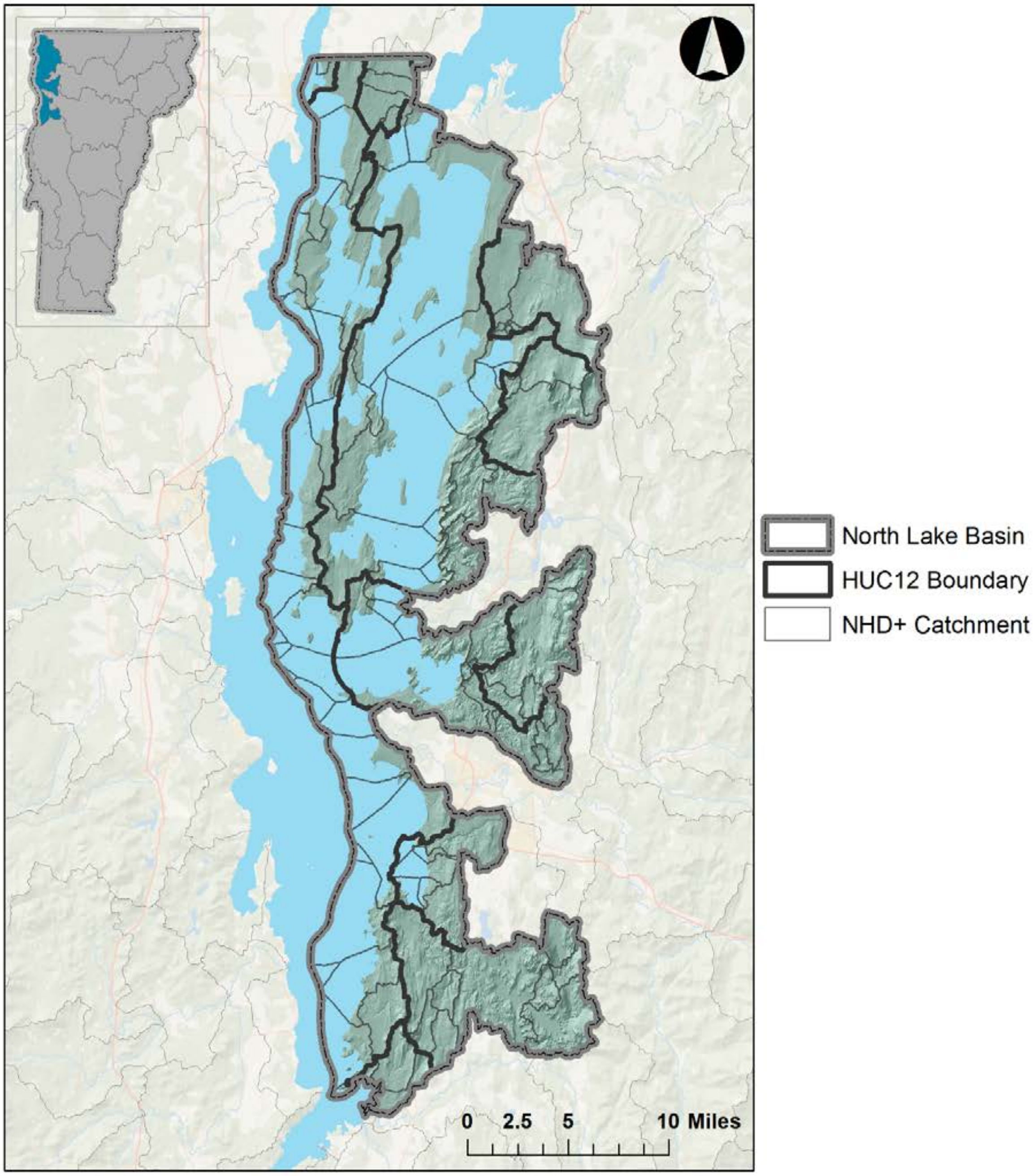
The LC TMDL will be implemented through a series of permit programs as well as identification of site specific BMPs outside the scope of specific programs, many guided by the content of the Tactical Basin Plans. While many programs will be "self-implementing", in many instances applications will proceed in a two-step process of first knowing "where to look" for opportunities followed secondly by "what to do." Many of the phosphorus reduction programs require an initial "assessment" phase to identify what BMPs may already exist on the landscape and where others need to be placed. In some instances, the Tactical Basin Plans can aid prioritization of where to look first, such as expected high phosphorus producing areas. After the assessment phase, BMP implementation can be prioritized and carried forward. Additionally, the Tactical Basin Plans can identify known beneficial projects, the "what to do", prioritize them for funding so that implementation can be expedited and tracked transparently.

The LC TMDL also incorporates an "Accountability Framework" that aims to ensure that phosphorus reduction actions are being implemented at a sufficient pace to see results in the lake. While the specific timeline for lake improvement is not specified by the TMDL, an estimate of the predicted phosphorus reduction needs to be identified within each Tactical Basin Plan on a 5-year rotating basis. Estimating the potential phosphorus reductions expected from site specific actions is one way of determining if the level of effort is sufficient compared to the overall TMDL goals. This portion of the Tactical Basin Plan attempts to provide that estimate of phosphorus reduction reasonably expected from actions taken in specific areas across the basin, specific to source types and regulatory program.

In conjunction with Tactical Basin Planning is a project implementation tracking system that VDEC is also developing. This system intends to track implementation of projects across all sectors and apply an expected phosphorus reduction estimate to each. Over time, as projects are continually implemented, a more precise estimate of cumulative **actual** phosphorus reductions can be reported rather than relying on estimates of **potential** actions.

Several useful modeling products were used to spatially represent where LC TMDL reductions will be most effectively targeted to implement the TMDL. The underlying data from which many of the following analyses originate is the EPA SWAT model (Soil and Water Assessment Tool). This model was developed to estimate phosphorus loading from the Lake Champlain watershed from various land use sectors for development of the TMDL. Discrete SWAT models were calibrated and validated for each of the Hydrologic Unit Code – level 8 (HUC8) watersheds as well as for direct drainages to the lake. Three additional tools were developed from the SWAT modeling results: the HUC – level 12 (HUC12) Tool, the BMP Scenario Tool, and the Clean Water Roadmap which downscales the SWAT modeling from the HUC12 scale to the catchment level. In the analyses that follow, varying geographic scales are used, depending on the source sector; Figure 6 displays these geographic scales. In order of decreasing size, they are the HUC8, HUC12, and catchment scales.

Figure 12. Comparison of HUC12 and catchment watershed scales within the North Lake Basin.



HUC12 Tool

The HUC12 Tool (Figure 7) is a Microsoft Excel spreadsheet that displays SWAT estimates of total phosphorus (TP) loading at a HUC12 scale for each lake segment. TP loading estimates (kg/yr) in the HUC12 Tool are summarized by general land use category for each HUC12 in a lake segment basin (Table 3). In addition, detailed annual load (kg/yr) and areal loading rate (kg/ha/yr) estimates can be displayed by land use for each HUC12 watershed. This more detailed information includes the minimum, maximum, mean, median, 25th percentile, and 75th percentile loading rates per hectare for each land use category. In this way, TP loading magnitudes can be compared across all HUC12 watersheds in a lake segment basin as well as different land use categories within a HUC12.

Figure 13. Screenshot of HUC12 Tool display for Shelburne Bay lake segment. The LaPlatte River HUC12 is highlighted with resultant TP loading information.

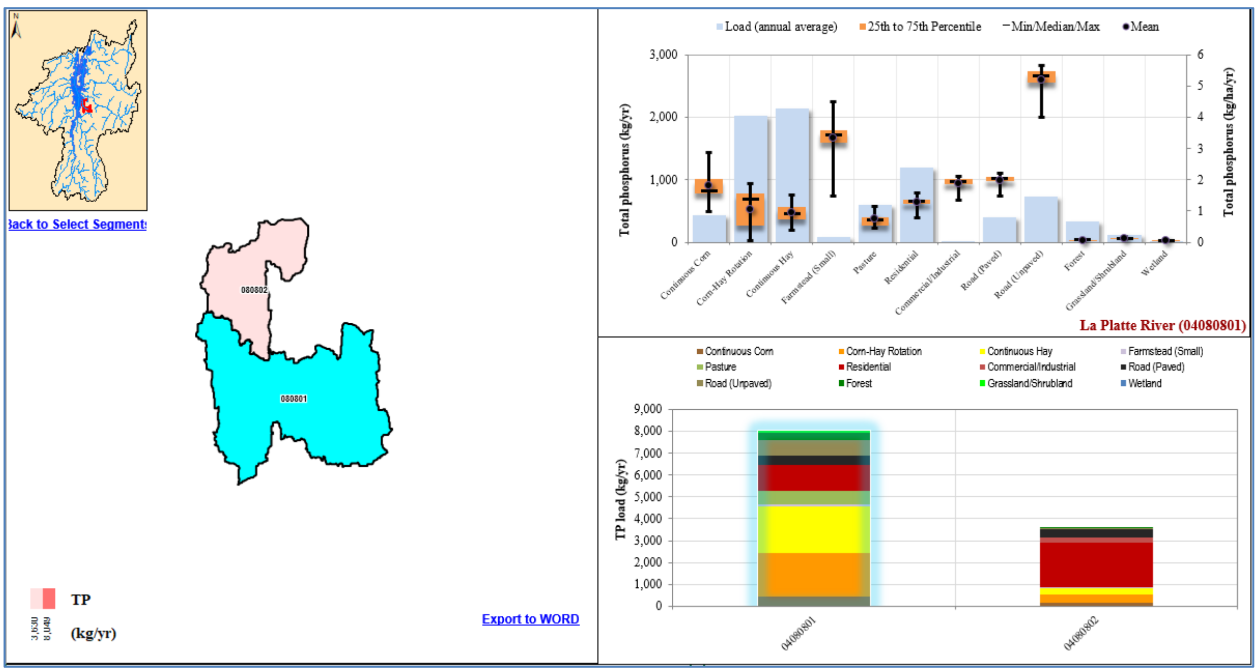


Table 3. General land use categories represented in the HUC12 Tool

HUC12 Tool Land Use Categories	
Continuous Corn	Residential
Corn-Hay Rotation	Commercial/Industrial
Continuous Hay	Road (Paved)
Farmstead (Med/Large)	Road (Unpaved)
Farmstead (Small)	Forest

Pasture	Wetland

BMP Scenario Tool

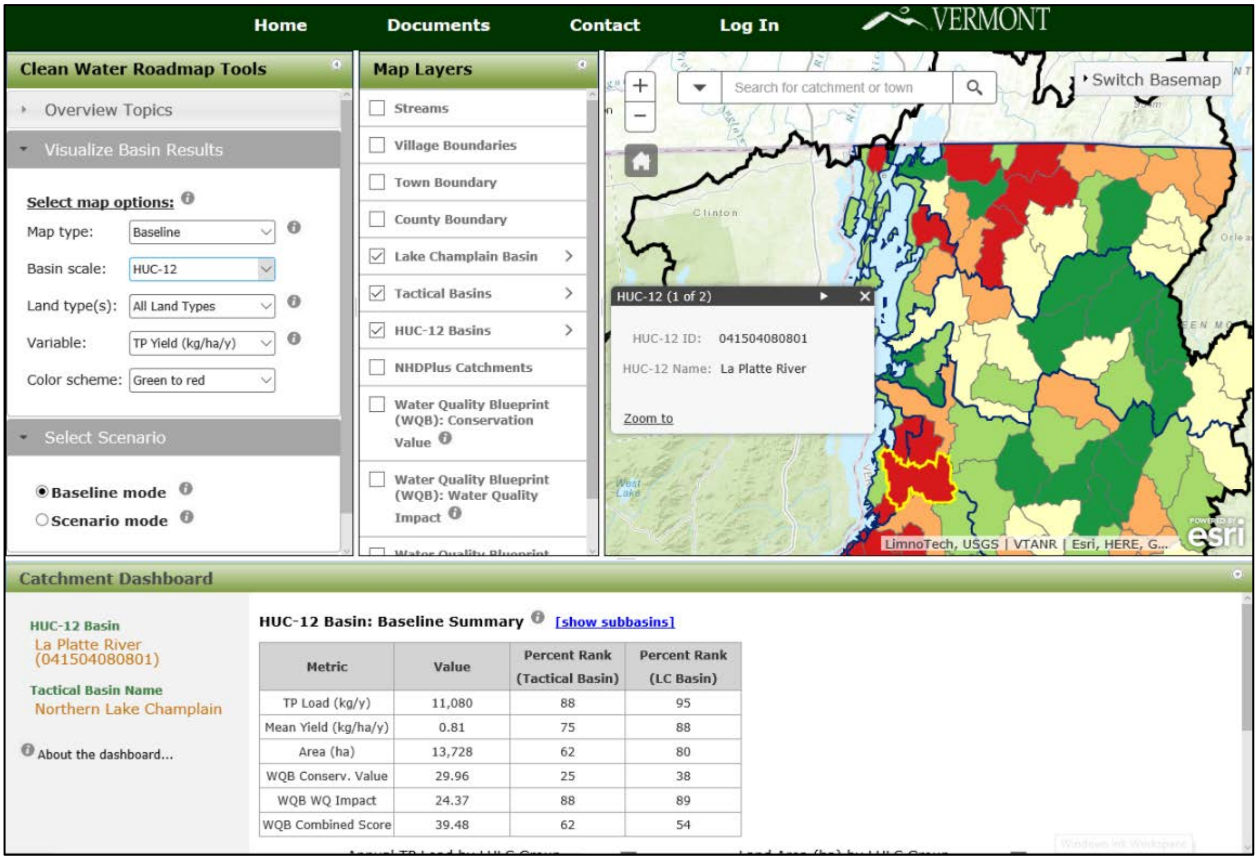
This Microsoft Excel based tool allows users to apply BMP scenarios at the lake segment basin scale to evaluate the phosphorus load reduction potential of various management actions. The Scenario Tool uses SWAT model results and estimates of BMP efficiencies to answer questions such as: "what is the expected phosphorus reduction if this BMP is applied to 60% of the applicable area in a lake segment basin?" BMP suitability in a basin is based on SWAT model inputs such as land use, soil type, and slope. Multiple BMPs can be 'applied' in a basin, and BMP scenarios can be evaluated for a range of loading sources: developed lands, forests, agricultural lands, unpaved roads, and streambank erosion. This functionality allows users to evaluate whether a specific management plan has the potential to meet the TMDL loading targets for Lake Champlain. Stored scenarios can be compared with tabular and visual summaries. The tool also contains extensive summary tables and figures of TMDL targets and existing source loads.

Clean Water Roadmap Tool

The Clean Water Roadmap Tool (CWR) is a partnership between VDEC, Keurig-Green Mountain Coffee Roasters, the Nature Conservancy (TNC), and other stakeholders. The overall goal of the CWR is to 'map' the results of the Lake Champlain SWAT model and associated follow-on products, especially EPA's BMP Scenario Tool, along with management actions contained in VDEC's Tactical Basin Plan implementation tables and tracking systems. The CWR provides a description of *one way* the LC TMDL phosphorus reductions can be achieved, largely based on EPA's reasonable assurance scenario.

The CWR is a map-based application that allows users to click on a specified watershed and receive a summary report of relevant best management practices (BMPs). BMP suitability is assessed using the landscape criteria in SWAT and EPA's Scenario Tool, while implementation table activity locations can be based on data in VDEC's BMP tracking database. The summary data also includes estimated phosphorus loadings based on SWAT modeling. Additional relevant spatial information, such as township boundaries, partner data (TNC's Conservation Blueprint for Water Quality), hydrologically connected backroads, etc., has also be included. The CWR can be used by regional planners, the public, and VDEC staff to identify priority areas and actions for Lake Champlain phosphorus reductions.

Figure 14. Screen shot of the Clean Water Roadmap highlighting TP loading from the LaPlatte HUC12 watershed.



What follows below - through a series of discussions, tables, and graphics - is an expression of the TMDL reductions required in as a site-specific manner as currently possible. Many of these expressions rely on modeled information that are limited by certain spatial extents even though some sector analyses may be more developed based on the currently available data. Because of this, the summing of loading results across different sectors may not "add up" to overall basin loading estimates but are sufficient for planning-level analyses. In some instances, this information will aid the "where to look" aspect of planning while other instances provide the "what to do". Over time, additional assessment information will more accurately inform the identification of BMP opportunities and it is the goal of the Tactical Basin Plans to present the most up-to-date information available to facilitate implementing the LC TMDL.

TMDL allocations for the Lake Champlain segments included within the North Lake planning basin

Table 4 below provides the final phosphorus allocations and the resulting reductions required for the North Lake segments of Lake Champlain. These values are taken directly from the final LC TMDL and the Phase I Implementation Plan (2015). Table 5 indicates how the major land use phosphorus sources are broken down into more specific categories that are addressed using specific approaches as well as how each source is allocated under the TMDL. The "Analysis" column identifies more detailed sector-specific analyses found later in this section

Table 4. Percent reductions needed to meet TMDL allocations from lake segments within the North lake planning basin (adapted from 2016 Phosphorus TMDLs for Vermont Segments of Lake Champlain, Table 8)

Lake Segment	Total Overall	Waste-water[1]	CSO	Developed Land[2]	Agricultural Production Areas	Forest	Streams	Agricultural Nonpoint
Burlington Bay*	31.2%	66.7%	11.8%	24.2%	0.0%	0.0%	-	0.0%
Isle La Motte*	11.7%	0.0%	-	8.9%	80.0%	5.0%	-	20.0%
Main Lake	20.5%	61.1%	-	20.2%%	80.0%	5.0%	28.9%	46.9%
Mallets Bay	17.6%	0.2%	-	20.5%	80.0%	5.0%	44.9%	28.6%
Northeast Arm*	12.5%	-	-	7.2%	80.0%	5.0%	-	20.0%
Otter Creek	23.6%	0.0%	-	15.0%	80.0%	5.0%	40.1%	46.9%
Shelburne Bay*	11.6%	64.1%	-	20.2%	80.0%	5.0%	55.0%	20.0%
St. Albans Bay*	24.5%	59.4%	-	21.7%	80.0%	5.0%	55.0%	34.5%

[1]Percent change from pre-TMDL permitted loads
[2]Includes reductions needed to offset future growth
*Lake Champlain segment drainage completely within North Lake Basin

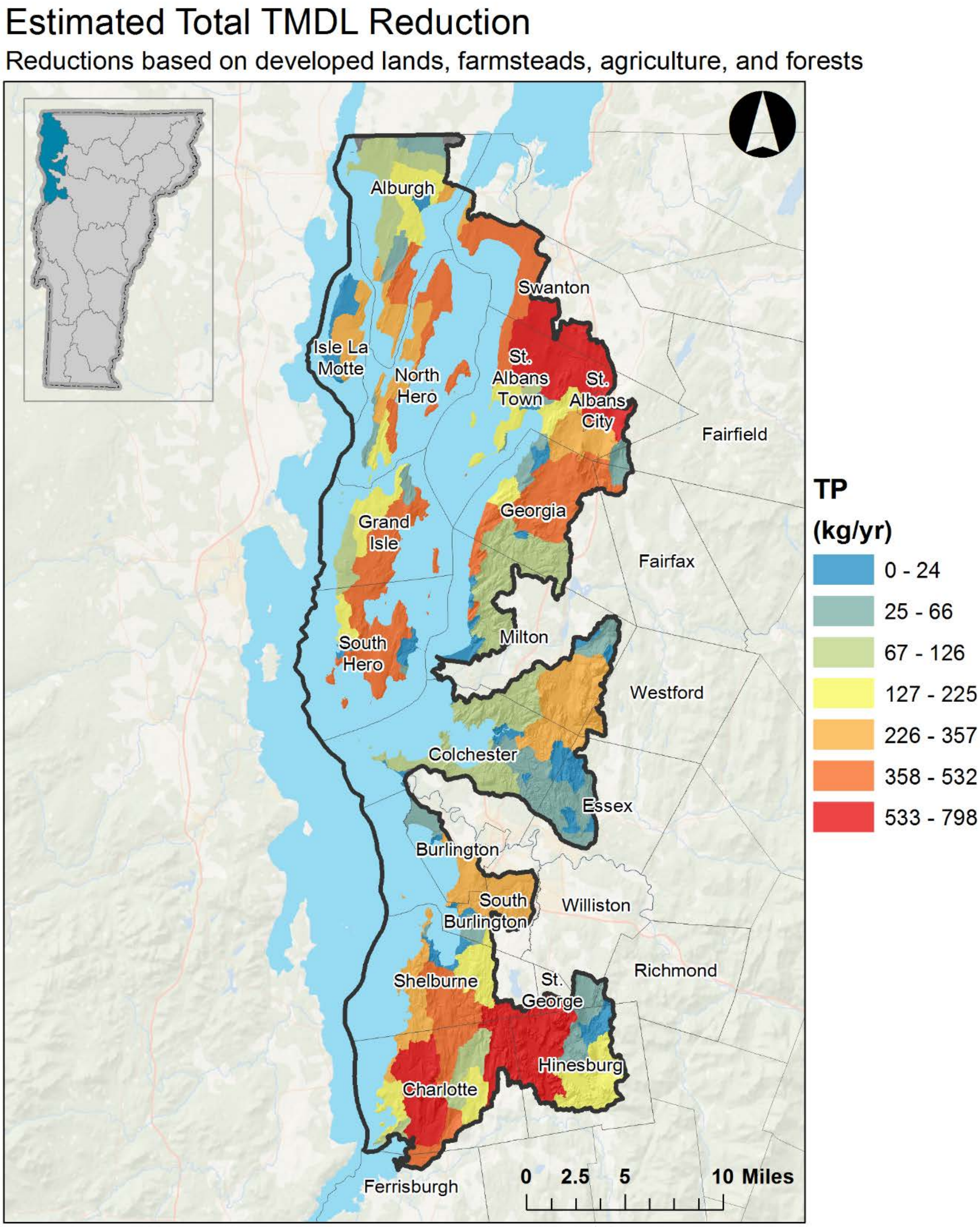
Table 5. Summary table of TMDL allocation categories for the North Lake Basin.

Source	Category	Allocation category	Analysis
Forest	All lands	Load	
Stream Channels	All streams	Load	
Agriculture	Fields/pastures	Load	
	Production Areas	Wasteload	
Developed Land	Summary		
	VTrans owned roads and developed lands	Wasteload	

Source	Category	Allocation category	Analysis
	Roads MRGP	Wasteload	
	MS4	Wasteload	
	Larger unregulated parcels	Wasteload	
Wastewater	WWTF discharges	Wasteload	
	CSO discharges	Wasteload	

Figure 9 below illustrates the required level of TP reductions identified in Table 4 at the catchment-scale. The transition from blue to red indicates a greater level of TP reduction across all catchments, as prescribed for all land use sectors across the basin. For example, for any given catchment, the TMDL reduction percentage is applied to each appropriate land use sector, based on the TMDL reductions required for that sector (Table 5). Then, all reductions are summed for the catchment and displayed on a relative loading scale. It should be noted that this representation accounts for the varying reduction target percentages based on the TMDL allocations for that lake segment.

Figure 15. Estimated total TMDL reductions from all land uses at the catchment scale



Within the basin, the top 20 catchments with the greatest overall identified TP reductions are identified in Table 6. The catchments are located by the primary town they occur in and primary waterbody they discharge to. The total TMDL reduction is broken down by each land use sector. If the total required LC TMDL reductions were applied to these top 20 catchments, which make up ~20% of the total number of catchments, then 69% of the overall needed basin reduction would be realized. For context, there are 104 total individual catchments in the North Lake Basin.

Table 6. Catchments with the greatest overall TP reductions as identified in the TMDL.

Catchment ID	Town name	Primary receiving waterbody (HUC12)	Ag lands reduction (kg/yr)	Developed lands reduction (kg/yr)	Farmstead reduction (kg/yr)	Forest reduction (kg/yr)	Potential TP reduction
4587092	St. Albans Town	Jewett Brook	767.7	20.0	10.6	0.2	798
4578778	Charlotte	Lake Champlain	762.1	13.0	7.5	2.1	785
4587096	St. Albans Town	Jewett Brook	501.6	187.0	6.9	2.7	698
4578820	Hinesburg	La Platte River	611.3	40.6	32.8	12.1	697
4578882	Charlotte	Hoisington Brook-Lake Champlain	580.4	12.8	13.1	2.9	609
4587310	North Hero	St Albans Bay-Lake Champlain	475.2	23.3	25.1	8.4	532
4587208	Georgia	Mill River	454.6	54.0	17.9	4.6	531
4578822	Charlotte	Hoisington Brook-Lake Champlain	502.0	5.5	12.4	1.1	521
4578818	Shelburne	La Platte River	382.6	61.7	10.8	4.6	460
4587314	Grand Isle	St Albans Bay-Lake Champlain	357.4	14.0	11.9	8.9	392
4587320	South Hero	St Albans Bay-Lake Champlain	352.4	15.0	19.2	5.4	392
4588714	South Hero	Malletts Bay	366.7	14.1	3.1	2.8	387
4578878	Charlotte	Lake Champlain	347.5	3.7	4.1	1.4	357
4578758	South Burlington	Munroe Brook-Shelburne Bay	105.1	222.6	3.5	0.8	332
932010376	Swanton	Ruiss Coslett-Riviere Aux Brochets	267.3	19.1	21.7	8.4	316
4587336	North Hero	Lake Champlain	256.2	17.7	7.3	5.0	286
4587148	Milton	Malletts Creek	222.0	39.1	13.5	4.9	280
4587098	St. Albans Town	Mill River	190.5	73.6	3.0	1.1	268
25020530	Shelburne	Lake Champlain	246.7	0.0	1.7	1.2	250
25020520	Burlington	Lake Champlain	0.0	248.4	0.0	0.0	248
	Percent of total TP reduction if all sector allocations are applied to these catchments						**69%**

Limiting Phosphorus Losses from Managed Forest

Vermont adopted rules in 1987 for Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont. The AMPs are intended and designed to prevent any mud, petroleum products and woody debris (logging slash) from entering the waters of the State and to otherwise minimize the risks to water quality. The AMPs are scientifically proven methods for loggers and landowners to follow for maintaining water quality and minimizing erosion.

The Vermont Department of Forests, Parks, and Recreation (FPR) updated the AMPs effective as of October, 22, 2016. Key modifications include:

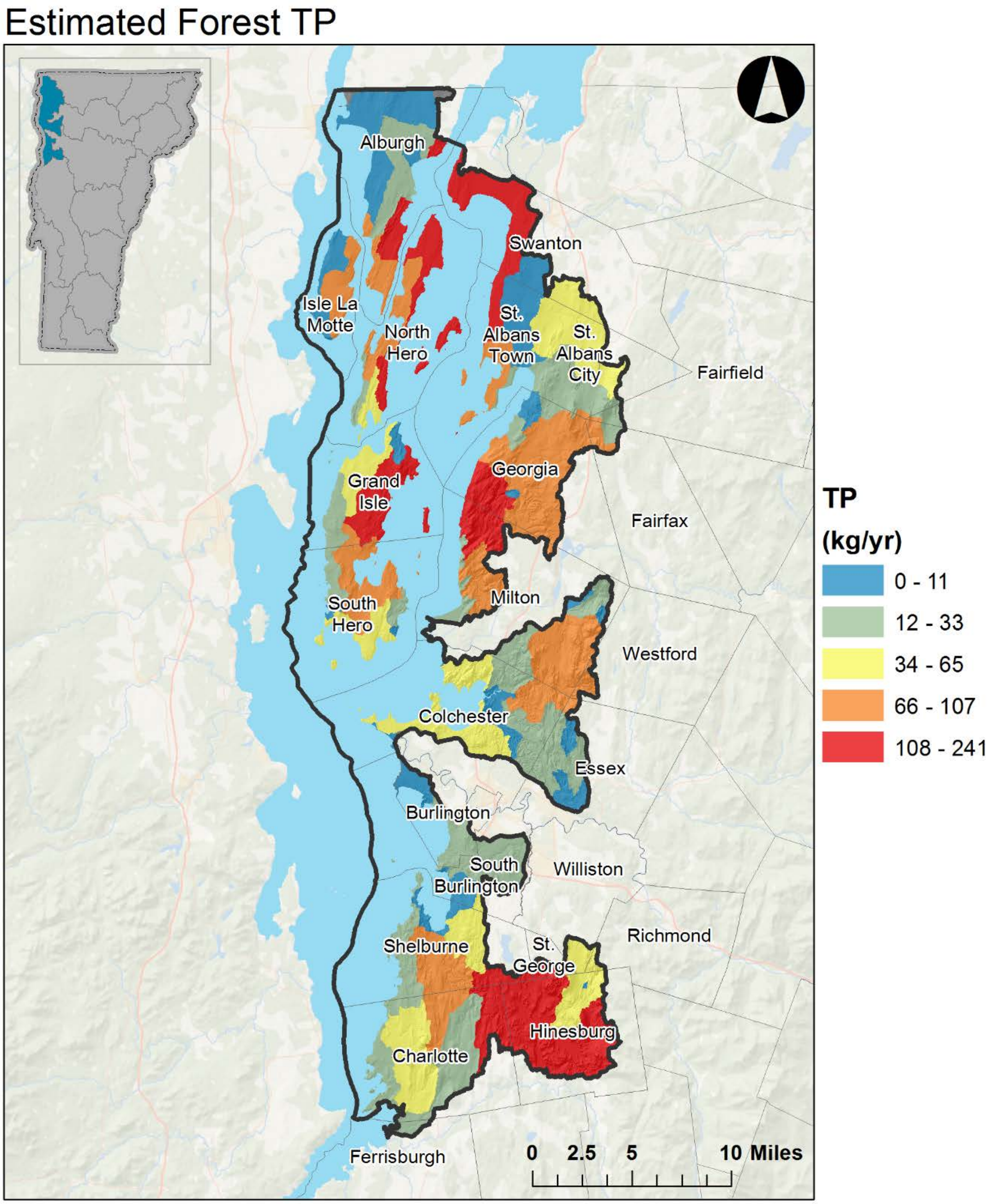
- Require compliance with standards set forth in the VDEC Stream Alteration General Permit for actions including the installation and sizing of permanent stream crossing structures on perennial streams.
- Strengthen standards pertaining to temporary stream crossing practices on logging operations. The proposed standards include:
    - <u>Better management of ditch water on approaches to stream crossings.</u> The 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.
    - <u>Better management of surface water runoff from skid trails, truck roads and temporary stream crossings on logging operations.</u> The 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.
    - <u>Better management of stream crossings after logging.</u> The 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 downhill approaches to the stream crossing to divert runoff into the buffer to capture sediment before entering the stream. Additionally, all exposed soil, at a minimum of 50 feet on each side of the crossing, must be stabilized with seed and mulch according to application rates specified in the AMPs.

- Include a new AMP to address the management of petroleum products and other hazardous materials on logging operations. Such materials must be stored in leak-proof containers, place outside of buffer strips, and must be removed when logging is completed.
- Enhanced stream buffer guidance in the AMPs and established metrics for minimum 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 both during and immediately after logging.
- Increased seeding/mulching of exposed soil adjacent to streams and other bodies of water from 25 feet to 50 feet.

For lake segments in the North Lake Basin, an overall TP reduction target of 5% has been allocated to all forest lands, except for the Burlington Bay segment which is allocated a 0% reduction. Based on documentation that the primary sources of phosphorus from forested areas are forest roads and harvest areas, and that AMPs are being revised to address better management of road erosion and harvest areas to avoid water quality impacts, EPA suggests the 5% reduction called for in the Reasonable Assurance scenario is easily supported.

Based on watershed modeling in support of the TMDL, the catchments are displayed in Figure 10 in order of increasing TP export – from blue to red. While TP loading rates are generally low in forested areas, there are situations which could exacerbate loading. Gleaned from the modeling input data, areas of steep slopes and thin soils could be most problematic for forest road building and harvest activity. It is these areas that could receive the most activity oversight to control erosion.

Figure 16. Estimated forest TP loading for the North Lake Basin at the catchment scale



The mapped catchment TP export is also shown in Table 7 which identifies the highest-loading catchments from Figure 10 by town and lists the forest load as well as the potential phosphorus load reduction if the respective lake segment reduction targets were applied. If allocated reductions were completely applied to these top catchments, approximately 60% of the necessary reductions from forest land could be realized.

Table 7. The top 14 modeled catchments for forest load export (correspond to orange and red catchments in Figure 10)

Catchment ID	Town Name	Primary Receiving Waterbody (HUC12)	Forest TP (kg/yr)	Potential TP Reduction (kg/yr)
4578820	Hinesburg	LaPlatte River	241	12
4578784	Hinesburg	LaPlatte River	205	10
4587314	Grand Isle	Northern Lake Champlain	178	9
4587310	North Hero	Northern Lake Champlain	168	8
932010376	Swanton	Northern Lake Champlain	168	8
4587112	Milton	Northern Lake Champlain	165	8
4587320	South Hero	Northern Lake Champlain	107	5
4587336	North Hero	Lake Champlain	100	5
4587148	Milton	Malletts Creek	98	5
4587122	Milton	Northern Lake Champlain	96	5
4578818	Shelburne	LaPlatte River	91	5
4587208	Georgia	Mill River	91	5
4588718	St. Albans Town	St Albans Bay-LC	73	4
4587104	Georgia	St Albans Bay-LC	72	4
Percent of total TP reduction if sector allocations are applied to these catchments				**60%**

Reducing Phosphorus Attributable to Unstable Stream Channels

The Lake Champlain Phase I Implementation Plan recognizes that we will never achieve the load reduction targets for unstable streams if we focus entirely on restoration (manipulation-type) activities. If the river corridors along our incised and straightened stream channels are not protected from encroachment, they will be developed, and the potential for restoration would be lost forever. River corridor and floodplain protection ensure that the desired channel evolution, stream equilibrium, and natural floodplain function can take place whether it be from restoration activities or through the natural channel forming processes that occur during floods. Further, the estimation of precise subwatershed phosphorus loadings from stream channels would be a scientifically tenuous proposition at any scale smaller than that established by the TMDL. As such, this Tactical Basin Plan relies on the identification of high-priority subwatersheds where Stream Geomorphic Assessments indicate the highest likelihood for phosphorus reductions thru the pursuit of dynamic stream equilibrium. These are shown in Chapter 2 of this Plan, in the Implementation Table summary in Chapter 4, and also in the online Watershed Projects database.

VDEC has developed a methodology to document long-term achievement of the TMDL allocation for stream channels. This methodology serves as a surrogate for long-term physical-chemical monitoring that would be required for each restorative practice type were it possible to isolate cause and effect at this functional level of assessment—which it is not. This tracking approach follows the methodology used by Tetra-Tech to develop the load and load-reduction calculations for unstable streams by evaluating how different practices affect the evolution of Vermont's incised streams to an idealized condition where stream equilibrium is achieved, and the stream has access to its floodplain at the (~2-yr) channel forming flow. Is has been documented that under these ideal geomorphic and hydraulic conditions we see significant capture and storage of fine sediment and phosphorus.

The Stream Equilibrium (SE) Tracking Method starts by establishing a total watershed deficit where the existing condition is subtracted from the ideal condition and a total watershed sum is derived by adding the deficit that is calculated for each reach in the watershed. The deficit for each reach is comprised of two components, one to track restoration activities and another to track corridor and floodplain protection activities. This is a novel approach because most tracking tools focus entirely on activities that manipulate the environment to achieve restoration. The total watershed deficit is envisioned to be calculated as follows:

$$\sum_{\text{All Reaches}} \frac{\text{Channel Width} \times \text{Reach Length} \times \text{Confinement Deficit (ideal – existing)} \times \text{Channel Evolution Deficit (ideal – existing)}}{\text{Reach Sensitivity Value}}$$

Plus

$$\sum_{\text{All Reaches}} \frac{\text{Channel Width} \times \text{Reach Length} \times \text{Reach Protection Deficit (ideal – existing)}}{\text{Reach Sensitivity Value}}$$

The SE tracking method includes spatial and temporal factors that recognize the value of larger floodplains along lower gradient reaches and the influence that erodibility (as a function of channel boundary and bed load characteristics) has on the time frame at which floodplain accessibility might be achieved. For deficit reduction associated with active restoration there is the opportunity to evaluate projects that remove encroachments, thereby changing the stream confinement ratio (so essential to the achievement of an equilibrium channel slope) and the evaluation of projects that directly affect channel dimensions, roughness, channel evolution stage and slope. The deficit reduction associated with reach protection projects is evaluated for the strength (standards and longevity) of the land use and channel management restrictions that are put into place.

Data to support the scoring is largely available in the Vermont Stream Geomorphic Assessment database. The land protection scoring will be developed from different existing GIS data layers, and finally, a restoration practice scoring matrix will be developed to be able to score each type of project pursued on the ground by the VANR and its partners.

Controlling Phosphorus from Agriculture

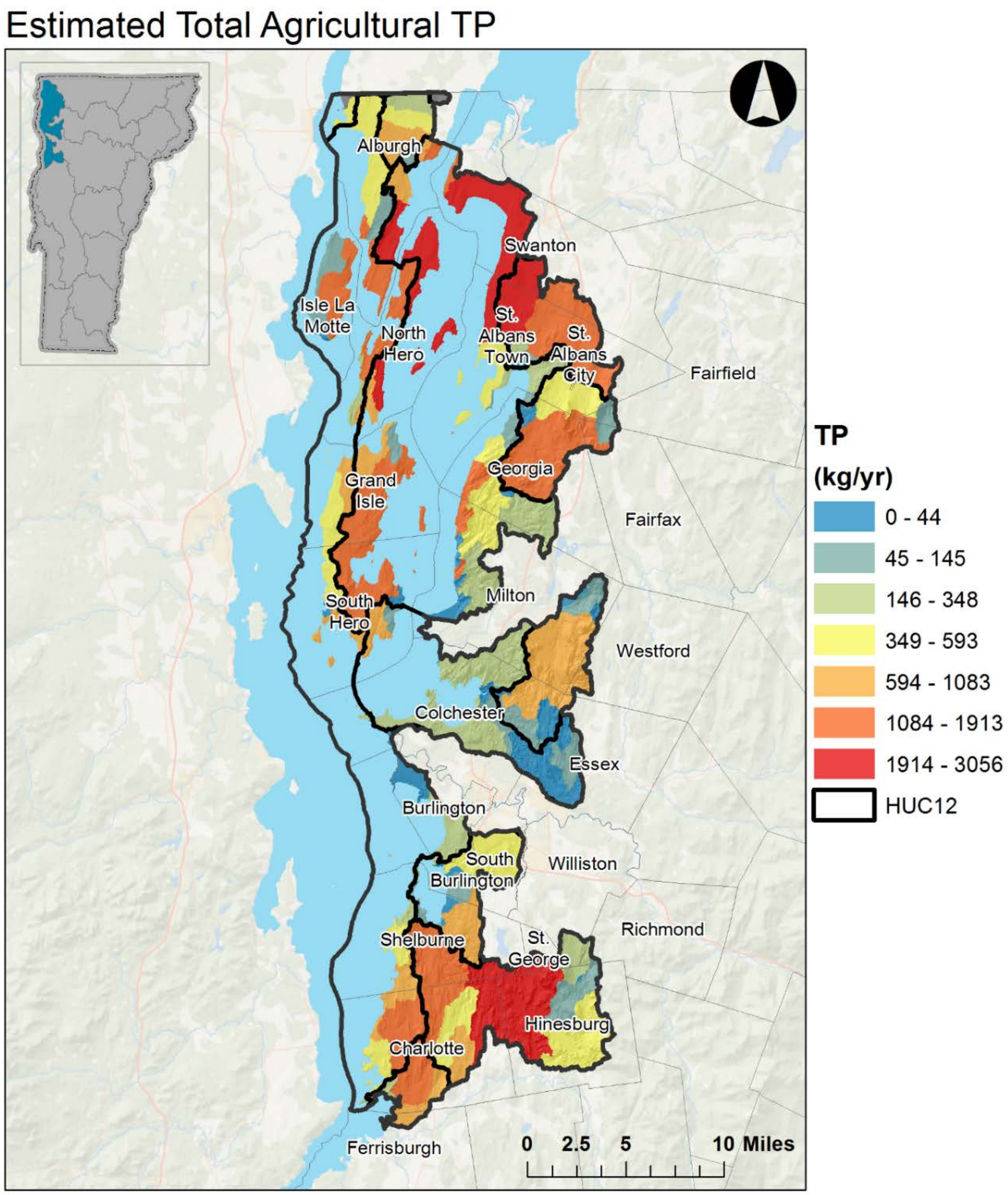
Load Allocation

In the Lake Champlain TMDLs, all permissible nonpoint source agricultural land phosphorus loads are considered part of the load allocation. As such, this section describes the estimated phosphorus loading areas in the basin, potential reductions based on the Reasonable Assurance Scenario, as well as the regulatory programs or provisions that are part of the load allocation for agricultural lands. The latter includes the Required Agricultural Practices for regulated Small Farms; Large and Medium Farm Permits; and lessons learned from the North Lake (Champlain) Farm Survey. Additionally, other, non-regulatory activities that are aimed at reducing phosphorus loading from the agriculture sector will be discussed in this section as well.

Estimated Phosphorus Loading

Estimated modeled phosphorus loading from agricultural land uses is given in Figure 12 at both the catchment and HUC-12 scales.

Figure 17. Estimated agricultural TP export by catchment.



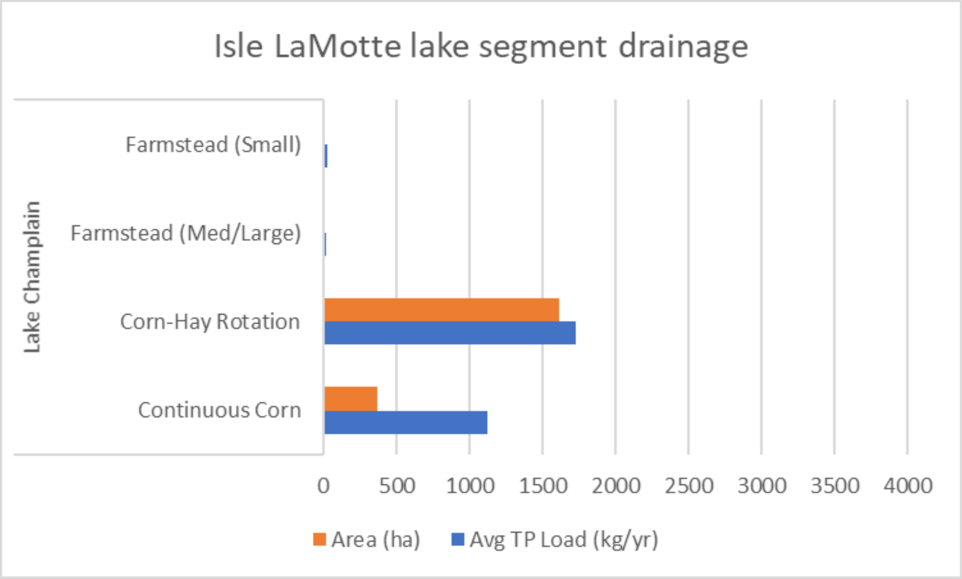
Another representation of the modeled TP export map is given in Table 8 below. The top TP export catchments are listed and are associated with the town in which they occur. The TP reduction amount is simply calculated by applying the appropriate agricultural nonpoint reduction allocation according to the lake segment in which the catchment resides. This ranking provides the general reduction opportunities as they exist across the landscape but actual practice implementation will vary across catchments as practical assessment information is obtained.

Table 8. Catchments with the highest estimated TP export from agricultural land uses (non-farmstead). These catchments correspond to the red and dark orange catchments mapped in Figure 11 above.

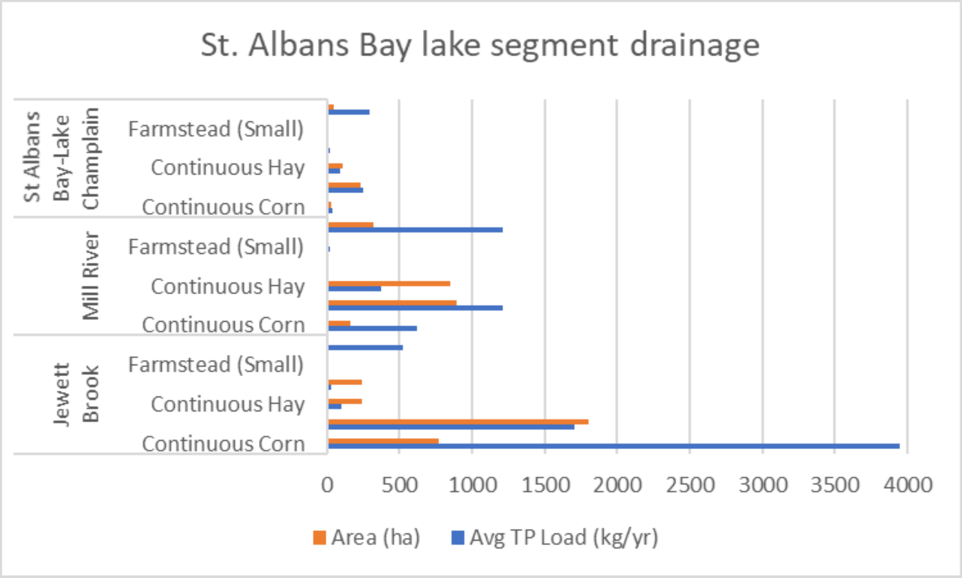
Catchment ID	Town Name	Primary Receiving Waterbody (HUC12)	Ag TP (kg/yr)	Potential TP Reduction (kg/yr)
4578820	Hinesburg	La Platte River	3056	611
4587310	North Hero	St Albans Bay-Lake Champlain	2376	475
4587092	St. Albans Town	Jewett Brook	2225	768
4578818	Shelburne	La Platte River	1913	383
4587314	Grand Isle	St Albans Bay-Lake Champlain	1787	357
4587320	South Hero	St Albans Bay-Lake Champlain	1762	352
4578778	Charlotte	La Platte River	1625	762
4587096	St. Albans Town	Jewett Brook	1454	502
932010376	Swanton	Ruiss Coslett-Riviere Aux Brochets	1336	267
4587208	Georgia	Mill River	1318	455
4587336	North Hero	Lake Champlain	1281	256
4578882	Charlotte	Hoisington Brook-Lake Champlain	1238	580
4578786	Charlotte	La Platte River	1083	217
Percent of total TP reduction if sector allocations are applied to these catchments				54%

Figure 13 (parts A-G) presents the total phosphorus load from various agricultural land uses relative to the area of each land use within a given HUC12 watershed. The North Lake Basin is broken down into its representative lake drainage segments (A-G). Each lake drainage segment is further broken down into its representative HUC12 watersheds, either in part or whole. This identifies land use and location combinations that may be more likely to export more TP per unit area than others. It should be noted that data presented here at the HUC12 level does not precisely follow the absolute HUC12 watershed boundaries in all cases but does represent the portion of the HUC12 that resides in the North Lake Basin (Table 8).

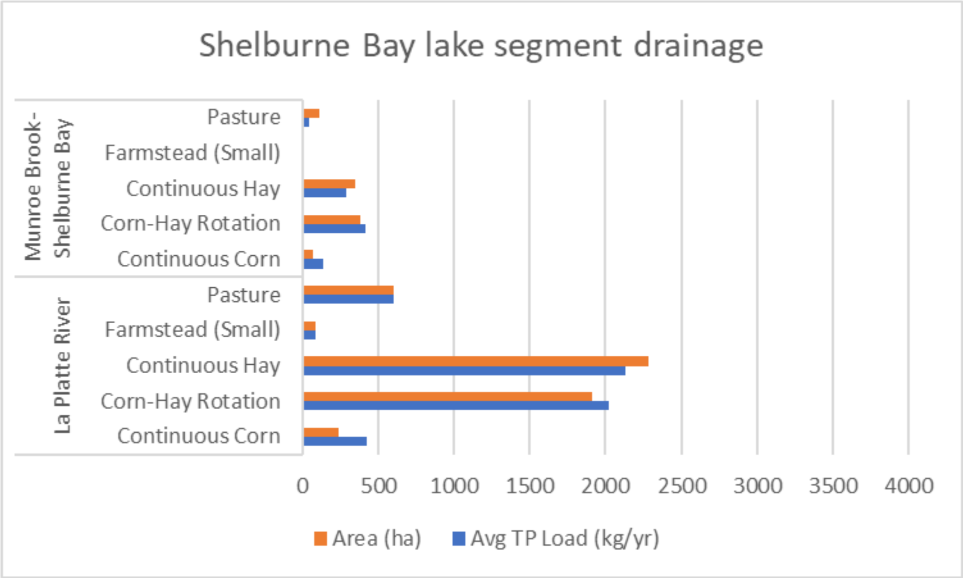
Figure 18 (A-G). SWAT loading estimates and corresponding land areas in the North Lake Basin.



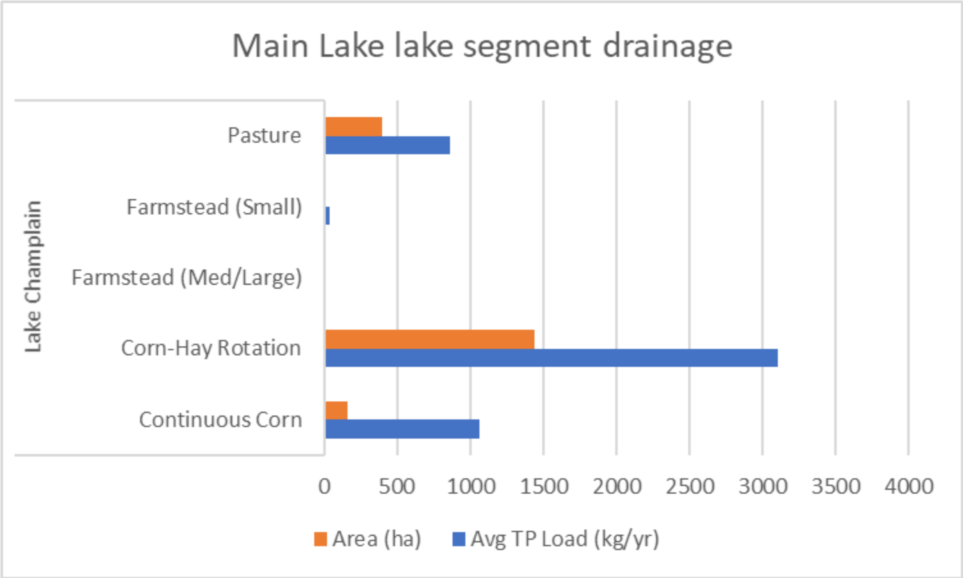
A



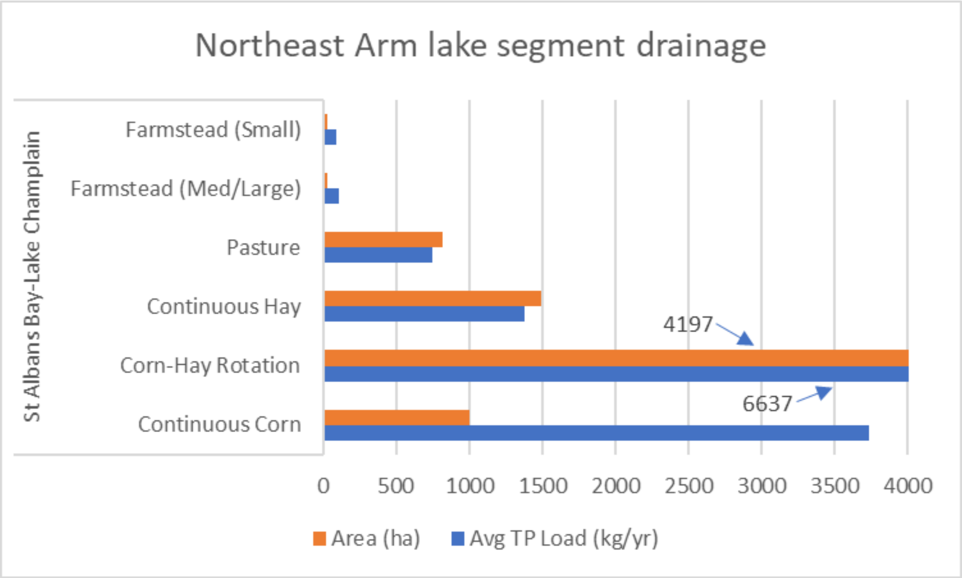
B


Shelburne Bay lake segment drainage
Munroe Brook-Shelburne Bay
La Platte River
Pasture
Farmstead (Small)
Continuous Hay
Corn-Hay Rotation
Continuous Corn
Pasture
Farmstead (Small)
Continuous Hay
Corn-Hay Rotation
Continuous Corn
0
500
1000
1500
2000
2500
3000
3500
4000
Area (ha)
Avg TP Load (kg/yr)

C

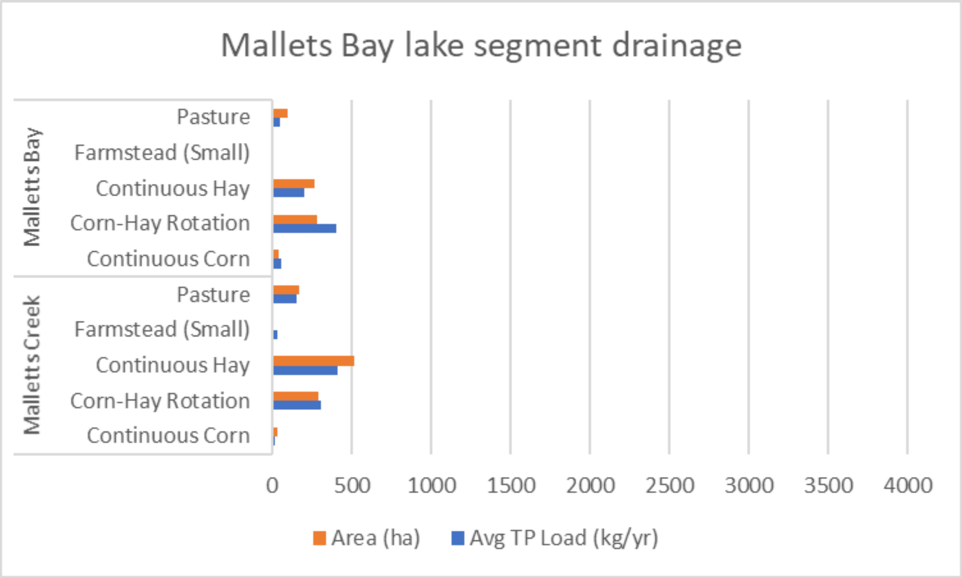

Main Lake lake segment drainage
Lake Champlain
Pasture
Farmstead (Small)
Farmstead (Med/Large)
Corn-Hay Rotation
Continuous Corn
0
500
1000
1500
2000
2500
3000
3500
4000
Area (ha)
Avg TP Load (kg/yr)

D



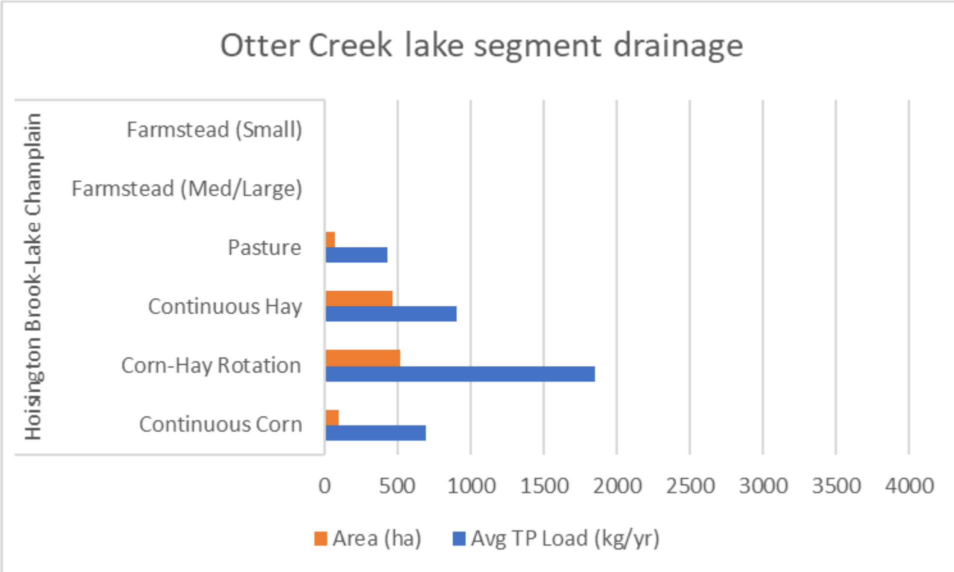
Northeast Arm lake segment drainage
St Albans Bay-Lake Champlain
Farmstead (Small)
Farmstead (Med/Large)
Pasture
Continuous Hay
Corn-Hay Rotation
Continuous Corn
4197
6637
0
500
1000
1500
2000
2500
3000
3500
4000
Area (ha)
Avg TP Load (kg/yr)

E



Mallets Bay lake segment drainage
Malletts Bay
Pasture
Farmstead (Small)
Continuous Hay
Corn-Hay Rotation
Continuous Corn
Malletts Creek
Pasture
Farmstead (Small)
Continuous Hay
Corn-Hay Rotation
Continuous Corn
0
500
1000
1500
2000
2500
3000
3500
4000
Area (ha)
Avg TP Load (kg/yr)

F



G

Table 9 provides information regarding agricultural practice efficiencies that were used to estimate the necessary TMDL reductions as presented in the Scenario Tool.

Table 9. TP reduction efficiencies associated with BMPs as represented in the SWAT-based Scenario Tool

BMP Type	Minimum % Efficiency	Maximum % Efficiency	Average % Efficiency	Efficiency Source
Barnyard Management *	80.00	80.00	80.00	Literature
Change in crop rotation	19.49	28.11	25.26	SWAT
Conservation tillage	10.00	50.00	27.50	SWAT
Cover crop	25.00	30.00	28.33	SWAT
Crop to Hay	0.00	80.00	64.17	SWAT
Ditch buffer	51.00	51.00	51.00	Literature
Fencing/livestock exclusion without riparian buffer	55.00	55.00	55.00	SWAT
Fencing/livestock exclusion with riparian buffer	73.45	73.45	73.45	SWAT
Grassed Waterways	20.00	68.20	38.95	SWAT
Reduced P manure	0.30	17.79	4.95	SWAT
Riparian buffer	41.00	41.00	41.00	SWAT

* Barnyard management addresses runoff considered part of the Wasteload Allocation but its efficiencies are listed here with the remaining BMPs that address runoff related to the Load Allocation.

Required Agricultural Practices and Permit Programs

The Required Agricultural Practices (RAPs) and existing Medium and Large farm permit programs set baseline farm management practices to ensure environmental protection. Medium and Large farm permits have been in place for nearly 10 years, but the RAPs (formally the Accepted Agricultural Practices) have been in place as the current regulatory standard since 2006, and were revised on December 5th, 2016. This revision is expected to result in a significant increase in conservation practice implementation over the next few years. The changes to the RAPs that are expected to result in the greatest impact include:

- Nutrient Management Planning and Implementation on All Farms (New Requirement for Small Farms)
- Creation of Small Farm Certification Program
- Stabilization of Ephemeral Gullies
- 10 ft. grassed filter strips on all field ditches
- Increase in grassed filter strip and manure spreading setback width from 10ft to 25ft on surface waters for small farms (already 25ft requirement for Medium and Large Farms)
- Establishment of cover crops on fields containing frequently flooded soils
- Increased manure spreading ban duration on fields containing frequently flooded soils
- Increase in grassed filter strip and manure spreading setback from 25ft to 100ft on surface waters adjacent to fields with a slope greater than 10%
- Reduction in maximum soil erosion rates by ½ on small farms
- Increased setbacks for construction of waste storage facilities from surface water (50' to 200')
- Increase setbacks for unimproved stacking of ag wastes from surface water (100' to 200')
- Livestock exclusion from production areas
- Partial livestock exclusion in pastures

It is impossible for us to estimate the exact impact that these rules will have, because doing so would require a detailed understanding of the current management on all farms. However, we are confident that as a result of this rule we will see a dramatic increase in the implementation of Nutrient Management Plans, Cover Crops, Grassed Waterways, and Grassed Filter Strips and Riparian Buffers. Any of these practices that are implemented as part of the many existing financial assistance programs will be tracked and reported on in the next planning cycle. Finally, through the creation of the Small Farm Certification program, inspections will be conducted on every small farm that meets the certification thresholds over the next seven years at minimum. Act 64 shortened the inspection cycle on medium farms from 5 to 3 years, and with the additional staffing the Agency received last year has allowed the Agency to perform more comprehensive inspections on medium and large farm facilities. The Agency will continue to perform annual inspections on large farm operations and the regulatory inspections on small and medium farms, all of which will result in a significant increase in compliance with the management practices set forth in the permit programs and the RAPs.

Lessons Learned from the North Lake Farm Survey

A North Lake Farm Survey (NLFS) was conducted in 2015 and 2016 in the Missisquoi and St. Alban's Bay watersheds. An analysis using this data from the Missisquoi Bay watershed revealed the types of compliance challenges many farms are facing. While the Agency has not conducted a full assessment of all farms in the North Lake Basin, we expect that the larger trends found NLFS would apply to farms in the North Lake Basin. Therefore, we imagine that roughly 45% of the farms in the North Lake Basin will need at least one production area fix, while 41% will have at least one land management issue.

Vermont Environmental Stewardship Program

Starting in 2017, the Agency of Agriculture will pilot a Vermont Environmental Stewardship Program that will recognize and certify farmers who achieve high standards pertaining to sediment and nutrient management, pasture condition, and soil health. This program is designed to increase the recognition of farms that manage their lands in a way that provides environmental benefits, with the goal of fostering a shift toward more ecologically based farm management in the agricultural community. The pilot is expected to launch in in 2017 with 10-12 farms, with the full program starting in 2019.

Ag Clean Water Initiative Program

A new grant program was started in 2016 as a result of Vermont's clean water act. This grant program makes funds available for farmers and technical service organizations to help with education and outreach, project scoping and implementation, and enhancing organizational capacity. The goal of this program is to both increase compliance with the RAPs, as well as to implement projects that go above and beyond these baseline regulations.

Wasteload Allocation

In this section, a description of the applicable agricultural phosphorus runoff control regulations will be provided. In this instance, the only separable-applicable regulatory program is the NPDES Confined Animal Feeding Operation permit. As this program at present does not provide coverage for any Vermont facilities, the tabular representation will provide information regarding the numbers of LFO and MFO permitted farms. As mentioned earlier, a small farm certification program is being created that will bring many farms into a permitted program, but the exact number of farms for each watershed has not been estimated at this point. Table 10 shows the number of LFO and MFO permitted facilities in the North Lake Basin by HUC12.

Table 10. Total number of facilities associated with permitted LFOs and MFOs in the North Lake Basin by HUC12.

HUC12 Number	HUC12 Name	MFOs	LFOs
041504080902	Malletts Bay	0	0
041504081201	Jewett Brook	2	4
041504081604	Lake Champlain	1	0
041504080801	La Platte River	1	0
041504081202	Mill River	1	0
041504081203	Mud Creek	3	0
041504081204	St Albans Bay-Lake Champlain	8	10
041504080802	Munroe Brook-Shelburne Bay	0	0
041504080901	Malletts Creek	0	0
	Total:	16	14

Table 11 shows the estimated TP farmstead export for each HUC-12. It is important to note that the farms counted are the primary facilities, and that other facilities are often associated with the primary facilities but are captured under the same permit.

Table 11. SWAT estimated farmstead loading for the North Lake Basin (all estimates are kg/yr)

Lake segment drainage	HUC12 name	HUC12 number	Farmstead (Med/Large)	Farmstead (Small)	Total	Overall 80% TMDL Reduction
Isle La Motte	Lake Champlain	04081604	20	33	53	42
St Albans Bay	Jewett Brook	04081201	31	11	42	34
	Mill River	04081202	15	24	39	31

	St Albans Bay-Lake Champlain	04081204	19	12	31	25
Burlington Bay	Lake Champlain	04081604	-	-	-	-
Shelburne Bay	La Platte River	04080801	-	84	84	67
	Munroe Brook-Shelburne Bay	04080802	-	6	6	5
Main Lake	Lake Champlain	04081604	12	42	54	43
Northeast Arm	St Albans Bay-Lake Champlain	04081204	105	92	197	158
Malletts Bay	Malletts Creek	04080901	31	-	31	25
	Malletts Bay	04080902	10	-	10	8
Otter Creek	Hoisington Brook-Lake Champlain	4080602	14	13	27	22
		Totals	**257**	**317**	**574**	**460**

Controlling Phosphorus from Developed Lands

In the LC TMDLs, all permissible developed land phosphorus loads are considered part of the wasteload allocation. As such, this section describes the four regulatory programs identified to address phosphorus and other impairment pollutant discharges from developed lands. They are the: Transportation Separate Storm Sewer System Permit (TS4); Municipal Roads General Permit; Municipal Separate Storm Sewer Permit; and, the so-called Operational Three-acre Impervious Surface Permit.

As a generalized summary, Table 12. indicates which regulatory program applies to which jurisdiction and the estimated modeled load for that jurisdiction where it is able to be determined.

Table 12. Total Load and the Regulatory Programs applicable in each jurisdiction

Jurisdiction	Load reduction target (%)	Applicable Regulatory Program to address Phosphorus			
		TS4	MRGP	MS4	Three-acre designation
VTrans/State highways	Variable by lake segment. See Table 4 for specifics	✓			
MS4 municipalities				✓	✓
All other non-MS4 municipalities			✓		✓

Prior to discussing the permitting regulatory authorities and their specific areas of application, modeled loading across the entire basin can be visualized in Figure 14. This map represents estimated annual phosphorus loading at the catchment scale with municipal boundaries overlain. This estimate includes loading from all areas of developed lands including roads and low and high-density development. These areas are further described in the following Table 13, whereby the top 20 TP loading catchments are presented. The last column shows the amount of TP reduced if the respective lake segment developed lands TMDL allocation (Table 4) were applied to each of these catchments. Summarized at the bottom is the percentage, 78%, of total TP reduction from developed lands identified in the TMDL that could be realized if the respective lake segment allocations were applied

Figure 19. Estimated TP export from developed land uses including roads (paved and unpaved)

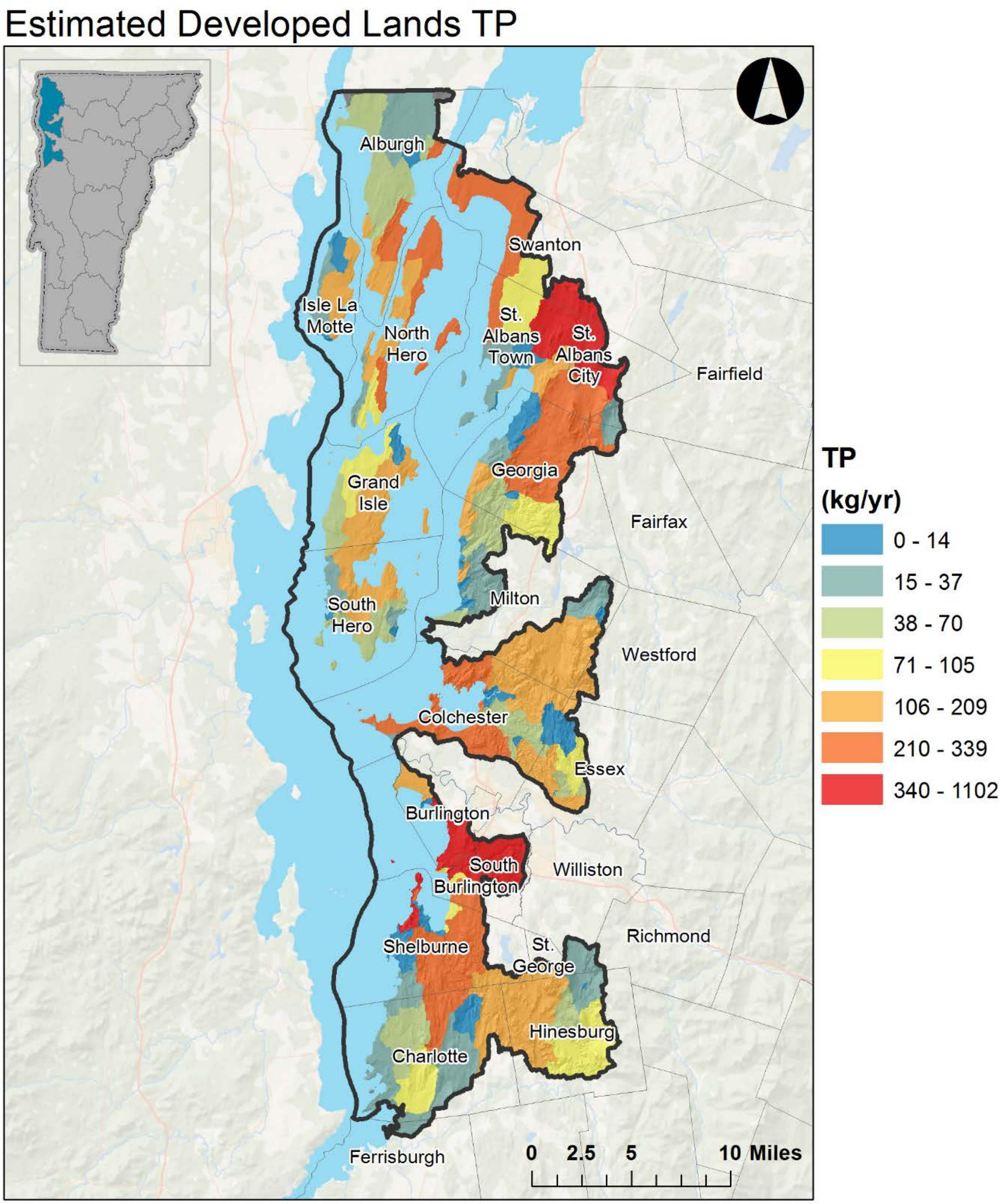


Table 13. Catchments with the highest estimated TP developed lands export. Catchments are associated with individual towns if most of the area of that catchment occurs within a given town boundary.

Town name	Lake basin drainage	Catchment ID	HUC12 name	Developed lands TP load (kg/yr)	Developed lands TP reduction (kg/yr) (% reduction specific to each lake segment)
South Burlington	Shelburne Bay	4578758	Munroe Brook-Shelburne Bay	1102	223
Burlington	Burlington Bay	25020520	Lake Champlain	1026	248
St. Albans Town	St Albans Bay	4587096	Jewett Brook	862	187
St. Albans Town	St Albans Bay	4587098	Mill River	339	74
North Hero	Northeast Arm	4587310	St Albans Bay-Lake Champlain	323	23
Shelburne	Shelburne Bay	4578818	La Platte River	305	62
Swanton	Northeast Arm	932010376	Ruiss Coslett-Riviere Aux Brochets	265	19
South Burlington	Shelburne Bay	4578876	Munroe Brook-Shelburne Bay	252	51
Georgia	St Albans Bay	4587208	Mill River	249	54
Colchester	St Albans Bay	4587304	Malletts Bay	247	51
Shelburne	Shelburne Bay	4578768	Munroe Brook-Shelburne Bay	238	48
South Hero	Northeast Arm	4587320	St Albans Bay-Lake Champlain	209	15
Hinesburg	Shelburne Bay	4578820	La Platte River	201	41

Town name	Lake basin drainage	Catchment ID	HUC12 name	Developed lands TP load (kg/yr)	Developed lands TP reduction (kg/yr) (% reduction specific to each lake segment)
North Hero	Isle LaMotte	4587336	Lake Champlain	199	18
Grand Isle	Northeast Arm	4587314	St Albans Bay-Lake Champlain	194	14
Milton	Malletts Bay	4587148	Malletts Creek	191	39
South Burlington	Burlington Bay	25020524	Lake Champlain	183	44
St. Albans Town	St Albans Bay	4587306	St Albans Bay-Lake Champlain	163	35
Essex	Malletts Bay	4588042	Malletts Bay	157	32
Essex	Malletts Bay	4587164	Malletts Bay	152	31
Percent of total sector TP reduction if necessary sector allocations are applied to these catchments					78%

Phosphorus Loading from Roads

Currently, TP loading estimates for roads only exist from the SWAT model which distinguishes only between paved and unpaved roads. Unfortunately, two of the primary phosphorus reduction regulatory programs related to roads, the MRGP and the TS4, are defined by more narrow parameters than just paved and unpaved. For example, the MRGP will apply to municipally managed roads, and require applicable practices to be applied to all roads that are "hydrologically-connected" to waterbodies, while the TS4 permit will only apply to state-managed roads.

Derived directly from the SWAT loading estimates, Figure 15 identifies the range of catchment TP loading from roads, both paved and unpaved, across the North Lake Basin. A further breakdown of loading estimates is presented in Tables 14 and 15 whereby the top twenty highest roads loading catchments, paved and unpaved, are shown respectively. Also shown are the overall percent reductions achievable if the respective lake segment allocations are realized. However, for each catchment or municipality, these are not actual allocations but rather opportunities. Actual reductions will be accounted for as the essential roads permits are implemented.

Figure 20. Estimated SWAT loading from all paved and unpaved roads in the North Lake Basin at the catchment scale.

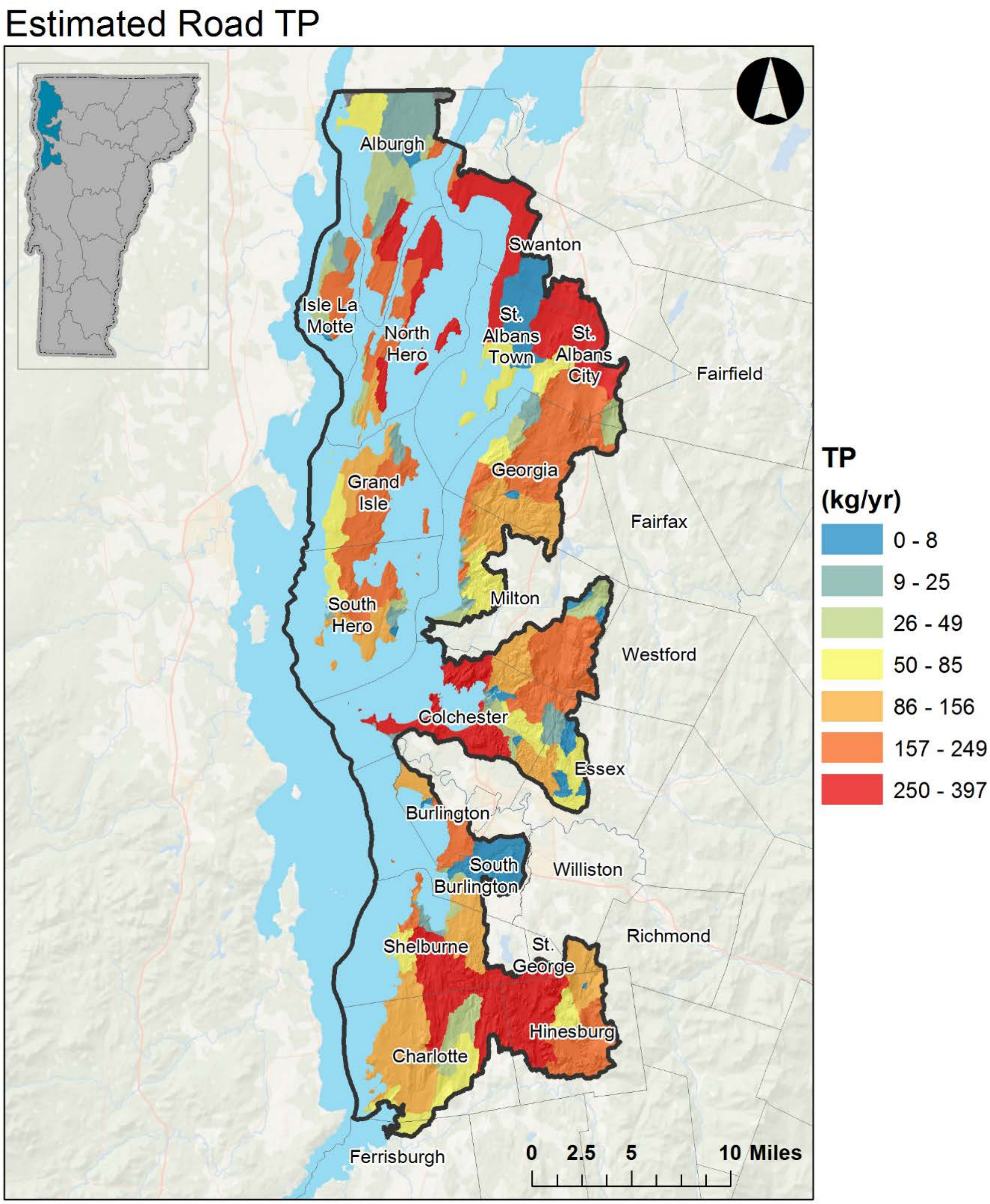


Table 14. Catchments with the highest estimated TP export from paved roads.

Town name	Lake basin drainage	Catchment ID	HUC12 name	Paved roads TP load (kg/yr)	Paved roads TP reduction (kg/yr) (% reduction specific to each lake segment)
St. Albans Town	St Albans Bay	4587096	Jewett Brook	256	56
Colchester	Malletts Bay	4587304	Malletts Bay	214	44
South Burlington	Shelburne Bay	4578758	Munroe Brook-Shelburne Bay	189	38
North Hero	Northeast Arm	4587310	St Albans Bay-Lake Champlain	176	13
Hinesburg	Shelburne Bay	4578820	La Platte River	167	34
Shelburne	Shelburne Bay	4578818	La Platte River	165	33
Burlington	Burlington Bay	25020520	Lake Champlain	158	38
North Hero	Isle LaMotte	4587336	Lake Champlain	142	13
Swanton	Northeast Arm	932010376	Ruiss Coslett-Riviere Aux Brochets	137	10
Grand Isle	Northeast Arm	4587314	St Albans Bay-Lake Champlain	136	10
Milton	Malletts Bay	4587148	Malletts Creek	129	26
Georgia	St Albans Bay	4587208	Mill River	128	28
St. Albans Town	St Albans Bay	4587098	Mill River	114	25
South Hero	Northeast Arm	4587320	St Albans Bay-Lake Champlain	103	7
Hinesburg	Shelburne Bay	4578784	La Platte River	97	20
Shelburne	Shelburne Bay	4578768	Munroe Brook-Shelburne Bay	79	16

Town name	Lake basin drainage	Catchment ID	HUC12 name	Paved roads TP load (kg/yr)	Paved roads TP reduction (kg/yr) (% reduction specific to each lake segment)
South Burlington	Burlington Bay	25020524	Lake Champlain	76	18
Georgia	Northeast Arm	4587104	St Albans Bay-Lake Champlain	75	5
Milton	Malletts Bay	4587138	Malletts Bay	72	15
Grand Isle	Northeast Arm	4588724	St Albans Bay-Lake Champlain	67	5
Percent of total sector TP reduction if necessary sector allocations are applied to these catchments					**64%**

Table 15. Catchments with the highest estimated TP export from unpaved roads.

Town name	Lake basin drainage	Catchment ID	HUC12 name	Unpaved roads TP load (kg/yr)	Unpaved roads TP reduction (kg/yr) (% reduction specific to each lake segment)
Hinesburg	Shelburne Bay	4578820	La Platte River	58	12
Hinesburg	Shelburne Bay	4578784	La Platte River	43	9
Colchester	Malletts Bay	4587304	Malletts Bay	41	8
Swanton	Northeast Arm	932010376	Ruiss Coslett-Riviere Aux Brochets	35	3
Shelburne	Shelburne Bay	4578818	La Platte River	33	7
South Hero	Northeast Arm	4587320	St Albans Bay-Lake Champlain	29	2
Hinesburg	Shelburne Bay	4578864	La Platte River	25	5
Grand Isle	Northeast Arm	4587314	St Albans Bay-Lake Champlain	24	2

Town name	Lake basin drainage	Catchment ID	HUC12 name	Unpaved roads TP load (kg/yr)	Unpaved roads TP reduction (kg/yr) (% reduction specific to each lake segment)
Williston	Shelburne Bay	4578870	La Platte River	23	5
Milton	Northeast Arm	4587122	St Albans Bay-Lake Champlain	20	1
Georgia	St Albans Bay	4587208	Mill River	19	4
Charlotte	Main Lake	25020534	Lake Champlain	19	4
Charlotte	Main Lake	4578878	Lake Champlain	17	4
Charlotte	Otter Creek	4578882	Hoisington Brook-Lake Champlain	17	3
Milton	Malletts Bay	4587148	Malletts Creek	17	3
South Hero	Main Lake	4588714	Malletts Bay	16	3
Milton	Northeast Arm	4587112	St Albans Bay-Lake Champlain	16	1
Shelburne	Main Lake	25020530	Lake Champlain	15	3
North Hero	Isle LaMotte	4587336	Lake Champlain	15	1
St. Albans Town	Northeast Arm	4588718	St Albans Bay-Lake Champlain	14	1
Percent of total sector TP reduction if necessary sector allocations are applied to these catchments					**65%**

To derive more detailed loading source estimates than those given above, it was necessary to apply a secondary analysis to the initial SWAT loading estimates. To further break down the SWAT loading data for paved and unpaved roads, the extent of VTrans-managed and municipal-managed paved roads was derived from a more detailed GIS analysis than that used in the model. Through this analysis, the estimated load was apportioned at a somewhat finer level. Although, when combining the separate data sources to estimate loads, there are unavoidable inconsistencies that become apparent. For example, there is not an exact fit between the input roads data for the two methods and therefore results don't necessarily align. Currently with the tools available, these issues are inherent in the analysis. However, it's believed that they provide good planning level information when considered across the entire basin.

State Managed Roads (Transportation Separate Storm Sewer System General Permit – TS4)

The TS4 is a new stormwater permit for all VTrans owned and controlled infrastructure. As part of the permit, VTrans will develop comprehensive Phosphorus Control Plans (PCPs) for their developed land in each lake segment. This includes state roads, garages, park and rides, welcome centers, airports and sand and gravel operations. The plans will require inventories of all regulated surfaces, establishment of baseline phosphorus loading per lake segment, and a prioritized schedule for implementation of BMPs to achieve the lake segment percent phosphorus reductions.

To begin this assessment, VDEC estimated the miles of state roads per HUC12 in the North Lake Basin, given in Figure 16, and which is also reflected in Table 16. To provide some estimate of the overall basin loading at the bottom of the table, the hybrid analysis mentioned above was utilized with all the inherent inconsistencies. The noted load provides a reasonable planning level loading estimate. As the TS4 permit evolves, VTrans will further delineate the number, location, and condition of drainage from state roads along with other non-road infrastructure.

Figure 21. Estimated mileage of state managed roads summarized by HUC12 in the North Lake Basin.

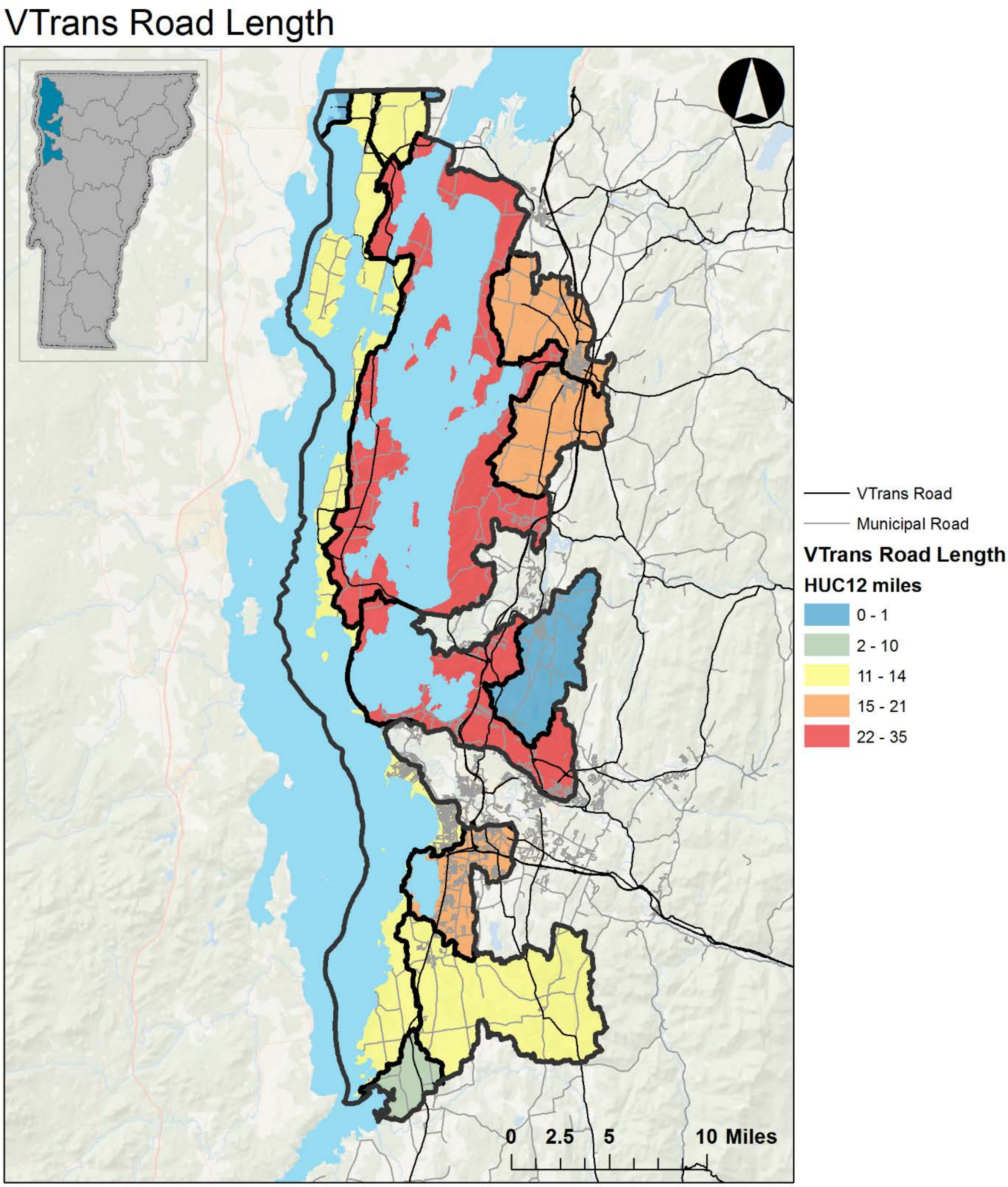


Table 16. Estimated miles for State-managed highways (this does not include other VTrans owned and controlled infrastructure)

HUC12	HUC12 watershed name	State managed road miles
41504081203	Mud Creek	12.2
41504080602	Hoisington Brook-Lake Champlain	9.7
41504081604	Lake Champlain	14.3
41504080801	La Platte River	12.1
41504080802	Munroe Brook-Shelburne Bay	21.0
41504080901	Malletts Creek	1.5
41504080902	Malletts Bay	33.2
41504081201	Jewett Brook	21.0
41504081202	Mill River	19.6
41504081204	St Albans Bay-Lake Champlain	35.2
	Total **miles** VTrans managed roads	179.9
	Estimated TP **loading** from State managed highways (kg/yr)	849

Municipal Managed Roads (Municipal Roads General Permit)

The Municipal Roads General Permit is a new stormwater permit for all non-MS4 Vermont cities and towns that is intended to achieve significant reductions in stormwater-related erosion from municipal roads, both paved and unpaved. The permit will require each municipality to develop a road stormwater management plan to bring road drainage systems up to basic maintenance standards to stabilize conveyances and reduce erosion. The road management plan will require an inventory of municipal roads and current conditions, an identification of potential road best management practices (BMPs), and a prioritized implementation schedule to achieve the road standards.

The following maps and tables were developed to assist municipalities in setting priorities through the road management planning process. To break some of the basin roads loading data down to a town scale, the sum of loading from the catchments within that town needs to be calculated. Figure 17 shows the primary watershed catchments within each town. For these calculations, a given catchment is associated to any given town if most of that catchment falls within that town. While not a perfect fit, it does provide a reasonable estimate of the modeled TP load for any given municipality. Based on this association of catchments related to towns, VDEC estimated the TP load coming from both paved and unpaved roads in each of the towns, shown in Table 17. As towns implement road management plans and stabilize road networks, VDEC will be able to use this data to estimate the reductions in TP loading and confirm progress in meeting the LC TMDL.

Figure 22. Association of catchments to towns in the North Lake Basin

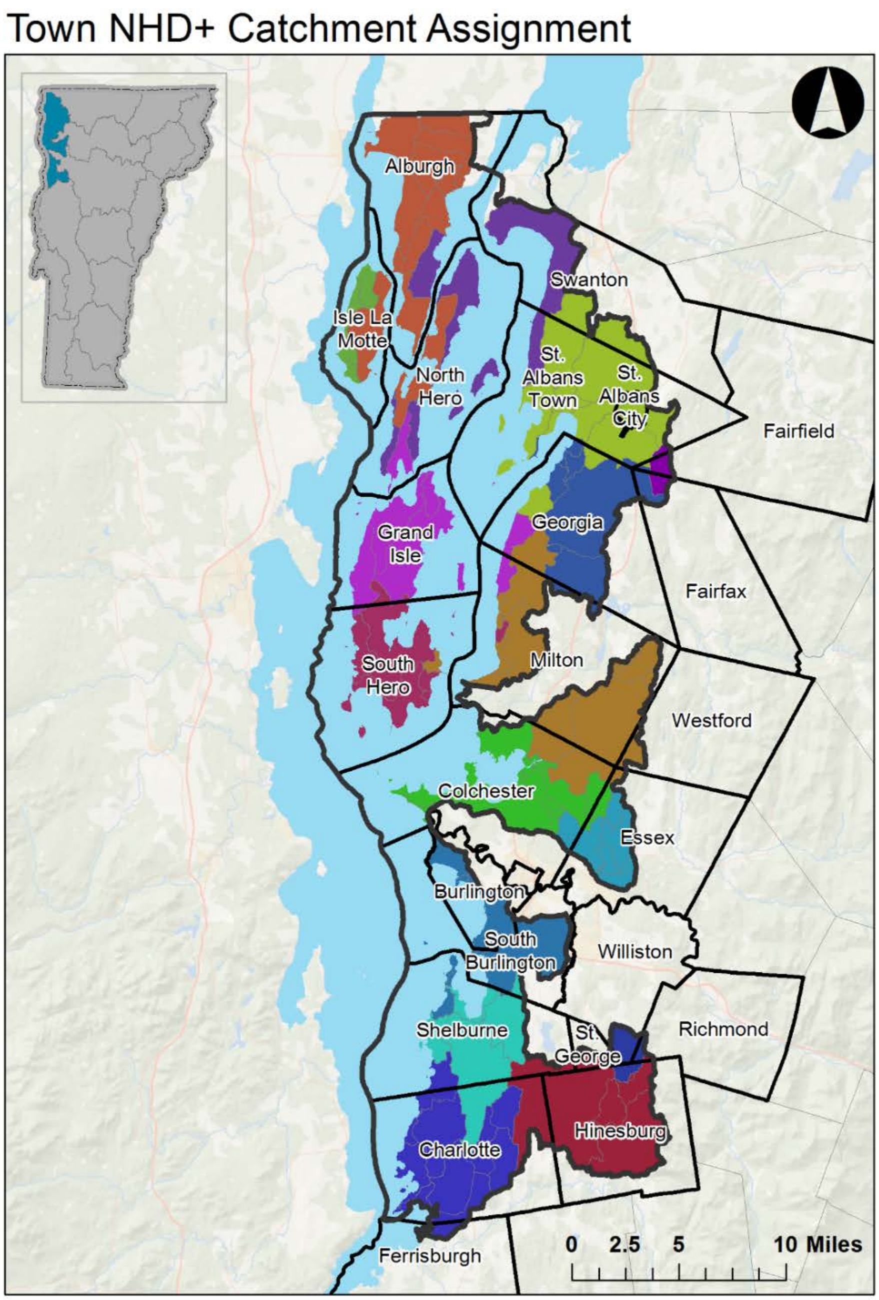


Table 17. Estimated loading for all non-VTrans managed roads occurring in each non_MS4 municipality

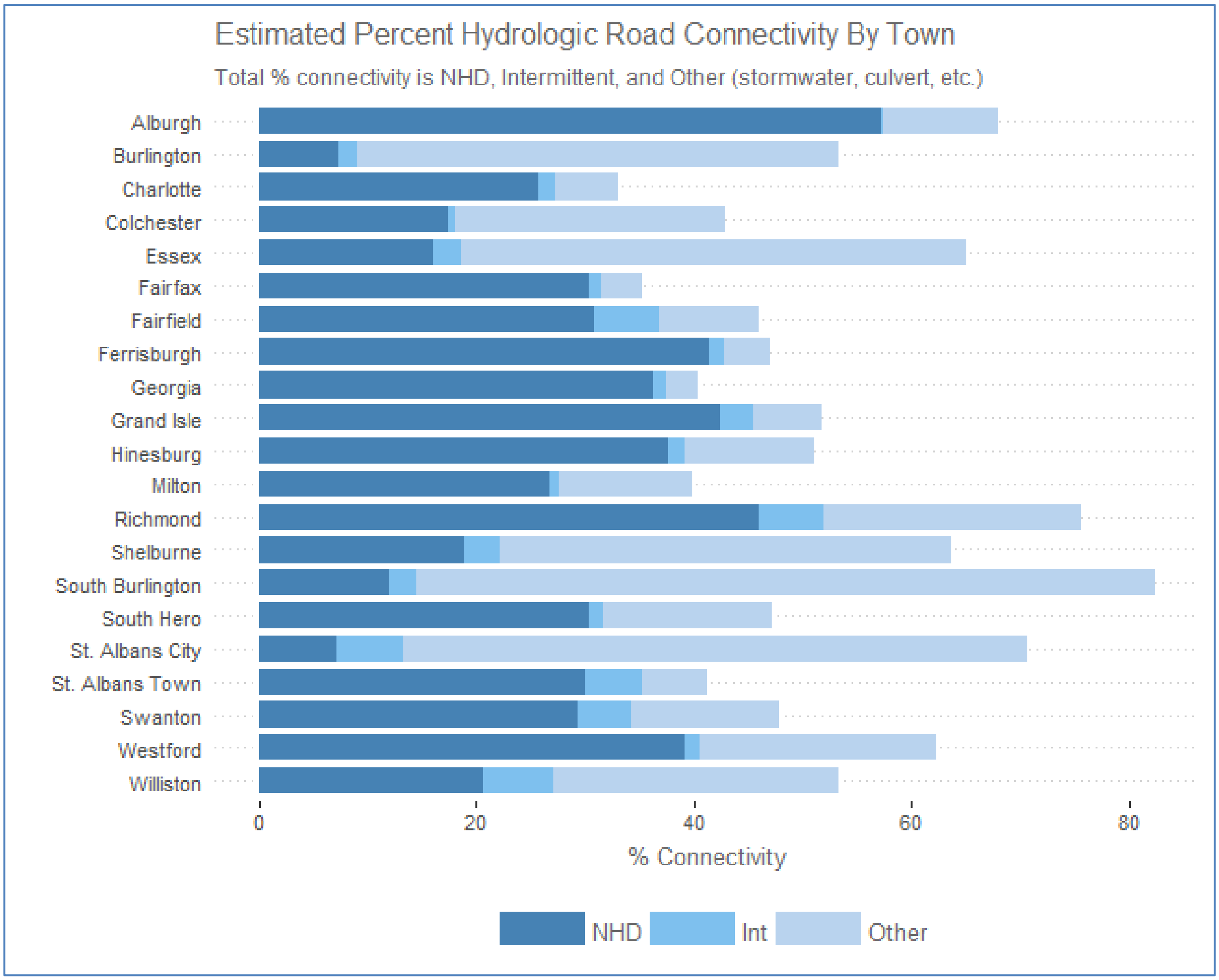
Town	Municipal paved and unpaved roads (kg/yr)
Alburgh	78
Charlotte	174
Fairfield	10
Georgia	178
Grand Isle	181
Hinesburg	247
Isle La Motte	34
North Hero	252
South Hero	120
Total	1275

DEC developed remote sensing information for municipalities to initially identify hydrologically-connected road segments that have the potential to be at risk of erosion and may be a source of sediment and phosphorus pollution to surface waters. This estimated mileage, along with more detailed town maps, will help municipalities establish initial town road inventories and prioritize improvements. Results of this analysis are given in Table 18. It should be noted that mileages are given for the entirety of each town, whether or not the whole town or just a part of it is in the North Lake Basin. Figure 17 breaks down the percent of hydrologic road connectivity by the type of receiving water.

Table 18. Estimated mileage of hydrologically connected municipal road miles by town. These do not include state managed or private roads.

Town	Hydrologically connected municipal road miles		Town	Hydrologically connected municipal road miles
Alburgh	31.2		Milton	45.5
Burlington	57.4		Richmond	39.5
Charlotte	25.0		Shelburne	35.3
Colchester	42.6		South Burlington	74.4
Essex	80.8		South Hero	10.7
Fairfax	24.6		St. Albans City	19.8
Fairfield	50.0		St. Albans Town	23.4
Ferrisburgh	38.0		Swanton	35.7
Georgia	29.4		Westford	26.2
Grand Isle	14.4		Williston	42.8
Hinesburg	30.9			

Figure 23. Estimated percent hydrologic road connectivity by Town.



Municipal Separate Storm Sewer Systems (MS4)

The Municipal Separate Storm Sewer System permit is a permit for municipalities with census designated urbanized areas and stormwater impaired watersheds. Under the MS4 permit, those designated municipalities will be required to develop a comprehensive phosphorus control plans (PCP) to achieve the percent phosphorus reduction for their respective lake segment, on all developed land within the municipality. These municipalities will not need separate permit coverage under the Municipal Roads General Permit or the "3-acre designation," (see below) as these requirements will be incorporated into the phosphorus control planning within the municipality. The PCPs will include requirements to inventory all developed land within the municipality, estimate phosphorus loading from developed land, and identify BMPs and an implementation schedule to achieve the required reductions. VTDEC has developed initial estimated TP loads from developed land within each MS4 municipality, as shown below in Table 19.

Table 19. Estimated loading from developed land categories for MS4 communities. Loading only represents portions of the municipality that drain to the North Lake Basin.

MS4 Municipality	Paved road (excluding VTrans managed roads) (kg/yr)	Unpaved roads (kg/yr)	Other developed lands (kg/yr)
Burlington	151.7	12.3	1026.3
Colchester	216.3	60.3	402.2
Essex + Essex Junction	100.8	16.3	499.5
Milton	282.2	68.1	521.5
Shelburne	206.1	64.1	661.6
South Burlington	245.7	6.6	1620.9
St. Albans City + Town	355.8	27.5	1501.1
Williston	40.7	23.3	23.8
Total	1599	279	6257

Operational three-acre impervious surface permit program

The Stormwater Program will issue a general permit by January 2018 that will include a schedule by which owners of three or more acres of impervious surface will need to obtain permit coverage. Following issuance of the general permit, the Program will identify and notify affected owners. An impervious surface will require coverage under the three-acre permit if it is not covered under a permit that incorporates the requirements of the 2002 Vermont Stormwater Management Manual (VSMM).

It is anticipated that the "three-acre impervious surface" program will address the developed lands phosphorus reductions necessary to achieve the TMDL that are not addressed by other developed lands programs. Ongoing tracking of implementation will be used to verify this projection. If additional reductions in phosphorus are required to implement the TMDL, developed lands permitting requirements may be adjusted accordingly, including requiring projects with less than three acres of impervious surface to obtain permit coverage.

An initial estimate of parcels containing three or more acres of impervious was completed by TetraTech, Inc. with funding from EPA (Table 20).

Table 20. Estimated three-acre parcels and associated impervious cover for North Lake Basin towns.

Town	Estimated # of 3+ acre parcels	Impervious acres
Alburgh	2	8.6
Burlington	53	235.3
Charlotte	2	11.5
Colchester	19	82.1
Essex	22	112.4
Georgia	3	11.2
Grand Isle	3	12.9
Hinesburg	7	43.8
Isle Lamotte	1	3.4
Milton	9	50.5
Saint Albans City	17	96.1
Saint Albans Town	21	139.7
Saint George	3	11.3
Shelburne	19	117.6
South Burlington	43	348.5
South Hero	3	26.4
Swanton	3	20.4
Total	230	1331.8

The initial estimate of the three-acre parcel coverage will require additional screening by VDEC prior to notification of the affected parties. The analysis does not yet identify which impervious surfaces have permit coverage that incorporates the requirements of the 2002 VSMM. VDEC will also identify eligible impervious surfaces from existing permits that were not identified in the TetraTech analysis because the impervious surface is located on more than one parcel.

Controlling Phosphorus from Wastewater Treatment Facilities and Other Industrial Discharges

Controlling Phosphorus from Wastewater Treatment Facilities and Other Industrial Discharges

This section of the Phase II statement in each tactical basin plan is intended to provide additional information to readers regarding wastewater treatment facilities in the Lake Champlain Basin.

As of the issuance of this Plan, all facilities are presently operating under administrative continuance of existing permits, which were issued in conformance with the allocations in place under the remanded 2002 LC TMDL. The 2016 LC TMDL altered the allowable phosphorus discharge loads from several WWTFs that discharge to the North Lake Basin and are outlined below in Table 21.

As part of a necessary refinement of the facility-specific phosphorus wasteload allocations, WSMD, with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions for phosphorus, and determine the "reasonable potential" that WWTP's have to cause or contribute to downstream water quality impairment. In addition, the approved 2016 LC TMDL presents a wasteload allocation for phosphorus loads, to which each facility in the basin will adhere (Table 21).

Table 21. Summary of permit requirements for the wastewater treatment facilities in the North Lake Basin.

Facility (permit ID)	Permit expiration date	Planned permit re-issuance year	Design flow MGD	IWC* 7Q10 /LMM	Pre-TMDL permitted load (MT P/yr)	TMDL WLA (MT P/yr)	9/1/2016 – 8/31/2017 Flow (MGD) / Percent of Design Flow	Treatment type	# of CSOs	Receiving water
Alburg 3-1180	12/31/2009	2017	0.130	N/A	0.108	0.108	0.1624 MGD 125%	Aerated lagoon	0	Lake Champlain
St Albans City 3-1279	9/30/2013	10/1/2017	4.000	N/A	2.762	1.105	2.7556 MGD 68%	Rotating biological contactor	1	Wetlands contiguous with Lake Champlain
St Albans Northwest Correctiona l 3-1260	12/31/2010	10/1/2017	0.040	0.024/ 0.014	0.028	0.028	0.0242 MGD 60% *data from 8-1-16 to 7-31-17*	Tertiary treatment	0	Stevens Brook
VT Fish & Wildlife - Ed Weed Fish Culture Station 3-1312	9/30/2010	2017	11.500	N/A	0.914	0.914	3.8275 MGD 33%	Clarifier w/ alum	0	Lake Champlain
Burlington Main 3-1331	6/30/2010	12/31/201 9	5.300	N/A	4.392	1.464	3.7 MGD 70%	Activated sludge	3	Lake Champlain
South Burlington - Bartlett Bay 3-1284	12/31/2010	10/1/2017	1.250	N/A	0.878	0.345	0.616 MGD 49%	Extended aeration	0	Shelburne Bay
Shelburne 1 (Crown Rd) 3-1289	3/31/2012	10/1/2017	0.440	N/A	0.348	0.122	0.258 MGD 58%	Sequencin g batch reactor	0	Shelburne Bay
Shelburne 2 (Harbor Rd) 3-1304	12/31/2009	12/1/2017	0.660	0.897/ 0.576	0.497	0.182	0.35 MGD 53%	Sequencin g batch reactor	0	McCabes Brook
Hinesburg 3-1172	9/30/2010	Early 2018	0.250	0.554/ 0.162	0.276	0.069	0.209 MGD 84%	Aerated lagoon	0	LaPlatte River

** Instream Waste Concentration – or the proportion of river flow at lowest base (7Q10) and low median monthly (LMM) flow attributable to discharge, for the facility design flow. Note that the IWC is specific to the flow of receiving water.*

Facility –specific information

Alburg

Treated wastewater is dispersed via spray irrigation on two land application areas that are underdrained. Treated wastewater that infiltrates into the soil and groundwater is collected in the underdrain system and discharges to the lake.

St Albans City

The St Albans City WWTF is considered advanced treatment of wastewater. Following primary clarifiers, trickling filter and rotating biological contactors, the effluent is treated in flocculation tanks with alum and polymer for phosphorus removal. Effluent then flows to secondary clarifiers and sand filters followed by chlorination/dechlorination for disinfection. Planning is currently underway with the ANR Facilities Engineering Division to conduct a facility refurbishment project.

Associated with the collection system for the WWTF is the presence of one active combined sewer overflow (CSO). This overflow occurs near Weldon Street and flows to Stevens Brook. The Agency has issued a §1272 Order, which requires ongoing abatement work to achieve compliance with CSO Policy.

St Albans Northwest Correctional

This treatment facility consists of four aerated lagoons and tertiary filtration followed by ultraviolet disinfection.

VT Fish and Wildlife – Ed Weed Fish Culture

Wastewater flowing through the raceways is sent directly to the 1.3 acre polishing pond while wastewater from the cleaning of the raceways is directed to a clarifier and then to the finishing pond for treatment. While in the clarifier, the wastewater is treated with alum to facilitate solids settling. Effluent discharged from the pond flows down a stabilized channel to Lake Champlain.

Burlington Main

This treatment facility is designed for an average daily flow of 5.3 MGD during dry weather conditions; however, the secondary treatment process has the hydraulic capacity to treat peak flow rates of 13 MGD of combined dry and wet weather wastewaters during storm events. Wet weather flows exceeding 11 MGD are treated through mechanical screening, vortex separation and disinfection to avoid discharge of waterborne human pathogens. This process also provides a high level of treatment for the “first flush” that typically contains the highest level of pollutant concentration. The City is currently (2014) monitoring to determine compliance with the CSO Policy.

South Burlington – Bartlett Bay

This facility provides advanced treatment of wastewater including rotary screening, extended aeration for secondary treatment and nitrification, chemical precipitation for phosphorus removal, a cloth disk filter for effluent polishing, and UV disinfection.

Shelburne 1 – Crown Rd.

This facility provides advanced treatment of wastewater using sequential batch reactors for secondary treatment and nitrification, chemical precipitation for phosphorus removal, a cloth disk filter for effluent polishing and chlorination/dechlorination for disinfection.

Shelburne 2 – Harbor Rd.

This facility provides advanced treatment of wastewater using rotary screening, sequential batch reactors for secondary treatment, nitrification, biological phosphorus removal, chemical precipitation for added phosphorus removal, filter for effluent polishing and ultraviolet light disinfection.

Hinesburg

This treatment system consists of three aerated lagoons, chemical addition for phosphorus removal and chlorination/dechlorination for disinfection. The facility will likely be upgraded within the next five years.

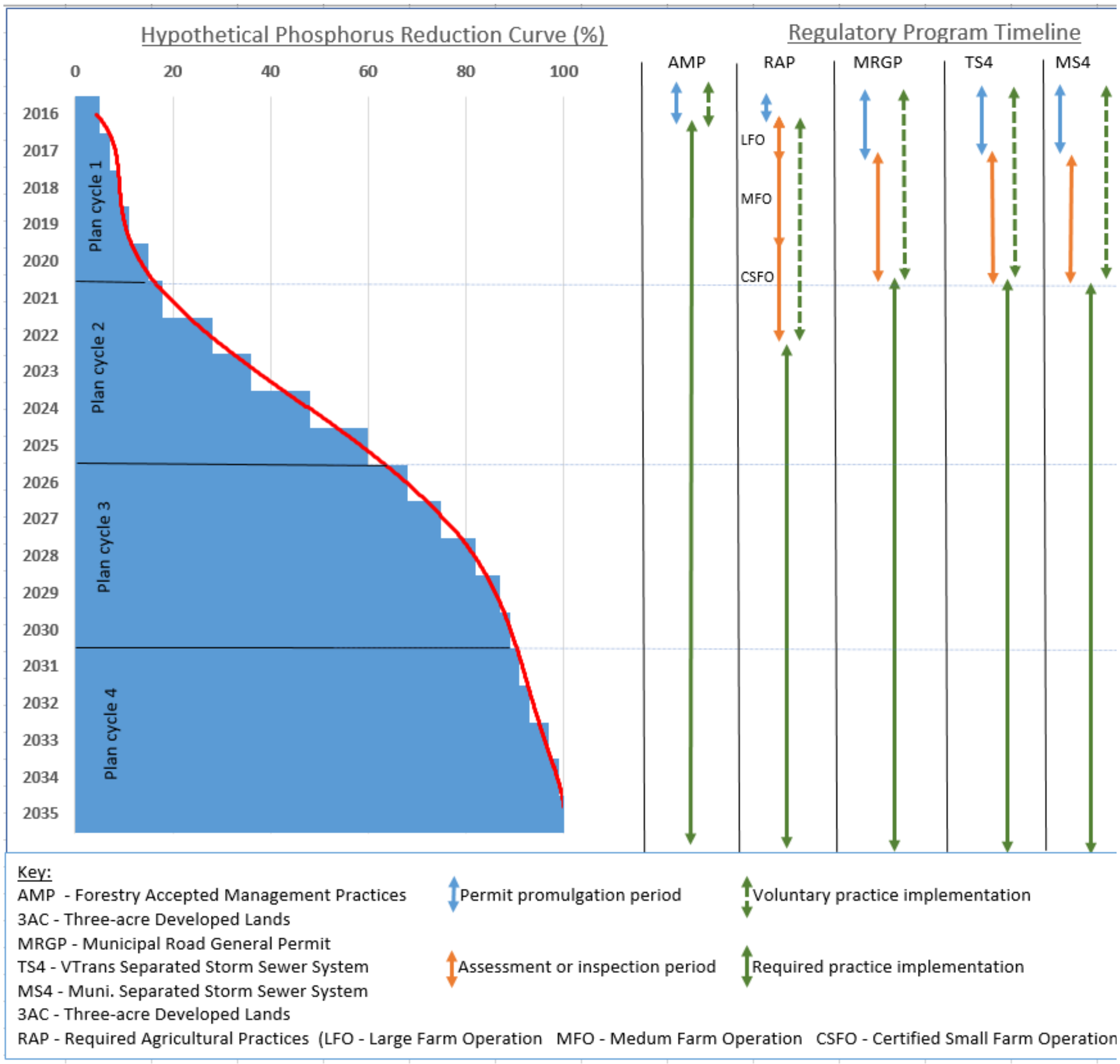
Summary

The information provided in the foregoing provides the best-available information regarding the locations of the North Lake Basin where phosphorus loading is modeled to be greatest. This information is provided by source sector, and tied to the regulatory programs that are highlighted by Act 64 to compel phosphorus pollution reductions for each sector. An important consideration in the development of this modeling analysis is the pace at which the expected reductions may be achieved from any given sector. Generally, the Lake Champlain TMDL is envisioned to be implemented over a 20-year timeframe. Figure 18 provides a hypothetical representation of the pace at which nutrient reductions may be achieved, informed by the timelines during which each regulatory program is being put into place.

The capability for the State to compel reductions in the first five-year iteration of this tactical plan cycle is limited by the timelines set forth by Act 64 for the establishment and promulgation of the permit programs. and the availability of funding. In the first instance, the State cannot compel, for example, the reduction of phosphorus from specific municipal road segments, until: 1) that permit program has been established; 2) the municipality has applied for coverage under that program; and, 3) the municipality has completed their road assessment, and staged a plan for implementation based on the most effective phosphorus reduction efforts. Further, in order for those plans to be implemented, there needs to exist funding to support implementation of the specific projects. Figure 19 provides the timelines for permit promulgation, permit application and assessment/inspection, and implementation. These timelines do not, however, preclude any particular landowner or municipality from taking action sooner on specific projects, and many owners or municipalities have done so. The following link provides access to the database resources discussed in this Plan:

VTDEC Watershed Projects Database and Tracking System

Figure 24. Theoretical phosphorus reduction, relative to the load and wasteload reductions required by the LC TMDL. The timelines for regulatory programs are also shown.



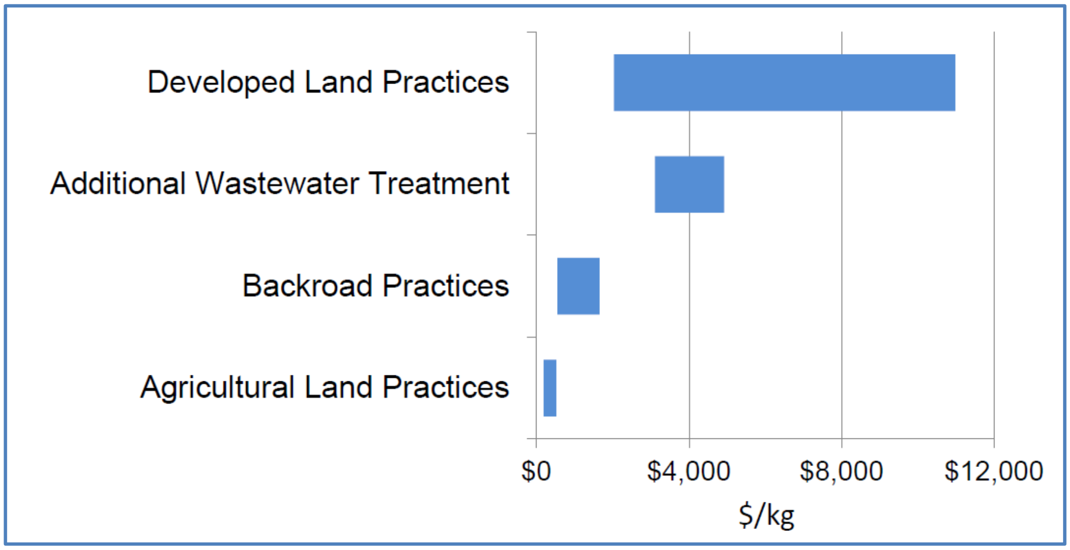
Regarding funding, this current tactical basin plan cannot yet articulate a precise estimation of the total cost of implementation to achieve the full completion of TMDL activities. However, the following information provides a cost perspective based on a statewide view of clean water funding needs, and a sector-specific estimated cost per unit reduction for phosphorus.

The forthcoming State of Vermont Treasurer's report describes the full costs of implementing Act 64 to achieve clean water for the entire State of Vermont. Figures available as of this writing suggest a total *statewide* annualized cost of $115M, and a total gap, derived from currently available clean water funding, of $67M. These figures pertain to the entire implementation lifecycle of the Lake Champlain TMDL, identified as 20 years based on the Lake Champlain Phase I Implementation Plan.

From the perspective of sector-specific costs, Figure 20, adapted from the Phase I Plan, presents useful practice-level cost estimates. These latter estimates indicate a gradient of cost efficiency, with highest efficiencies associated with agricultural practices, followed by roads, developed lands, and wastewater infrastructure.

Over the course of this tactical basin plan lifecycle, as projects are documented as a result of assessments, they will be entered into the implementation tracking system, and incremental, project-level costs can begin to be aggregated.

Figure 25. General costs of practices, by land use sector, expressed by kilogram of phosphorus reduced.



As has been described in this Chapter, a robust phosphorus reduction tracking approach is being put into place to document implementation of on-the-ground practices and projects. It is through this system that accurate phosphorus reduction projections, and documented accomplishments will be tracked. These accomplishments will be reported publicly, as required by Act 64 on an annual basis. As of this writing, the modeling and projected phosphorus reductions shown by this Chapter are the best information available to Vermonters, but remain a starting point. Future iterations of the North Lake Tactical Basin Plan will provide augmented specificity in regard to phosphorus reductions achieved, reductions planned, costs, and as appropriate, success stories documenting incremental water quality improvement.

Appendix G- Draft of proposed projects for Rugg and Stevens Brooks Flow Restoration Plan

Rugg Brook Watershed- Credits Model BMPs

Site Name	New or Existing Site	Owner-ship of Land where BMP is located	Permit # if applicable	Address	TMDL Flow Target Addressed	Does the project fix known issue?	Retrofit Description	Site Constraints/ Comments
City of St. Albans								
J&L Service Center Back lot	New	Private	NP	S. Main St.	Low Flow		Underground Infiltration gallery under back parking lot	B Soils. Private Land in Town. Runoff from City and Town impervious
Town of St. Albans								
Tanglewoods	Existing	Private	1-0908	Tanglewood Dr.	High Flow	Erosion/Floodin	Expand and retrofit Detention Basin	WCA has done survey and design
1-1442 Sunset Terrace Pond	Existing	Private	1-1442	Sunset Terrace	High Flow		Clean out Pond, re-route drainage from west side of street.	Town may take over road, but private owner maintains SW ownsership.
Industrial Park Pond	Existing	Town	3348-9010/1-1268	Industrial Park Rd.	High Flow		Expand abandonded pond and redirect parking lot/road runoff	Cross Engineering has done a design for this already.- We have plans.
Pineview Estates Pond 1 (A)	Existing	Private	1-1563	Fairfax Rd.	High Flow		Retrofit outlet structure of Existing Pond "A"	

Site Name	New or Existing Site	Owner-ship of Land where BMP is located	Permit # if applicable	Address	TMDL Flow Target Addressed	Does the project fix known issue?	Retrofit Description	Site Constraints/ Comments
St. Albans Milk and Maple Pond 1	Existing	Private	1-1428	Fairfax Rd./Interstate	High Flow		Retrofit outlet structure of Existing Pond "a"	
Freeborn St.	New	Private	NP	Freeborn/Potter Ave	Low Flow	Erosion	Dry Well adjacent to parking lot.	Small pocket of B Soils. Significant erosion, exposed Sewer pipe.
Nason St./ Green Mountain Dr.	New	Private	NP	Green Mt. Dr/Nason St.	High Flow		Bioretention with underdrain along roadway.	D soils. Aesthetic benefit.
Thorpe Ave	New	Private	NP	Thorpe Ave/Twin CT	High Flow	Erosion	New Detention Basin.	New detention pond. Engineering plans in progress- need to acquire.
I-89/Holyoke Farm	New	Private	NP	Holyoke Farm Rd.	Low Flow		New Infiltration Basin	Permeable soils, Private Farm land, Verfiy groundwater table.
Clyde Allen Dr.	New	Private	check	Clyde Allen Dr.	High Flow	Flooding	New Detention Basin	Existing drainage issues. Solve wet basement with new routing and Basin
* NP = No permit								

Proposed BMP ID	Address	Model	BMP Type	BMP Land Ownership	Permit #	Impervious Cover Managed (ac)	Runoff Area (ac)
Hungerford- Lower Basin	Rewes Rd.	Proposed	Basin	Private	NP	31.67	91.36
Greenwood Cemetary	Upper Gilman St.	Proposed	Basin	City/Private	NP	5.23	22.62
Lemnah Dr.	Lemnah Dr.	Proposed	Basin	City	NP	5.09	12.14
St. Albans Town Education Center	169 South Main Street	EXISTING/Retrofit	Retrofit Basin	Private	1-1206	8.95	48.96
65 Bishop St- Pocket Yard	65 Bishop St.	Proposed	Storage Chambers	City/Private	NP	4.89	32.89
Industrial Park (SB Collins)	Lemnah Dr.	Proposed	Basin	Private	2-1157	3.79	5.71
Governor Smith Retrofit	Congress/Smith st.	EXISTING/Retrofit	Retrofit Basin	Private	NP	0.83	15.28
Homeland Security	79 Lower Weldon St.	Proposed	Storage Chambers	Federal	NP	2.75	2.75
Houghton St.- State of VT	Houghton St.	Proposed	Basin	State	NP	1.52	2.42
Maple St.	La Salle/Maple St.	Proposed	Infiltration	Private	NP	1.00	1.31
NWMC-Main Pond (Hill Farm Estates)	Crest Rd., Hill Farm	EXISTING/Retrofit	Retrofit Basin	Private	1-1477, 1-0650	15.32	45.44
Grice Brook Retirement Community	Grice Brook Rd	Proposed	Basin	Private	1-1194	2.76	18.79
NWMC-South Pond A	Crest Rd.	EXISTING/Retrofit	Retrofit Basin	Private	1-1477	3.75	5.59
East View Subdivision - New Pond	East View Dr.	Proposed	Basin	Private	NP	2.74	13.14
NWMC-South Pond B	Home Health Circle	EXISTING/Retrofit	Retrofit Basin	Private	1-1477	0.95	1.79

Appendix H – Existing Use Tables

During the Basin 5 planning process, the Agency collected sufficient information to document and determine the presence of existing uses for fishing and boating on flowing waters. The Agency did not find sufficient information to document swimming as an existing use on any of the flowing waters in the basin. The Agency will continue to consider the existence of swimming as an existing use on a case-by-case basis during the Agency's consideration of a permit application, as well as on an ongoing basis during any future amendments of this plan. All surface waters used as public drinking water supplies were also identified. The Agency presumes that all lakes and ponds in the basin have existing uses of fishing, contact recreation and boating. This simplified assumption is being used because of the well-known and extensive use of these types of waters for these activities based upon their intrinsic qualities and, to avoid the production and presentation of exhaustive lists of these waterbodies across Basin 5. This presumption may be rebutted on a case-by-case basis during the Agency's consideration of a permit application, which might be deemed to affect these types of uses.

The following lists are not intended to represent an exhaustive list of all existing uses, but merely an identification of well-known existing uses having public access. Additional existing uses of contact recreation, boating and fishing on/in flowing waters and additional public drinking water supplies may be identified during the Agency's consideration of a permit application or in the future during subsequent basin planning efforts.

Table 8 Determination of existing uses of flowing waters for boating in Basin 5.

Waterbody	Town	Basis for determining the presence of an existing use
LaPlatte River Mouth to RM 1	Shelburne	Lake Champlain Land Trust Shelburne River Park canoe and kayak launch at RM 1[9]. Majority of riparian buffer is part of a Nature Conservancy Preserve

[9] RM is river mileage measured from the river terminus.

Table 9 Determination of existing uses of flowing waters for fishing in Basin 5.

Waterbody	Town	Basis for determining the presence of an existing use
Mud Creek - Lake Champlain to the dam in Alburgh (just upstream of Route 78 bridge).	Alburgh	General state fishing regulations pertaining to Lake Champlain apply. Parking at Fish and Wildlife Mud Creek Wildlife Management Area off Rte. 78..
Mill River - Lake Champlain to the falls in Georgia (just upstream of Georgia Shore Rd bridge).	Georgia	General state fishing regulations pertaining to Lake Champlain apply. Town of Georgia parking lot at Georgia Shore Road bridge provides access to area with conservation easement.
Malletts Creek to the first falls upstream of Roosevelt Highway (US 2 and US 7) in Colchester.	Colchester	General state fishing regulations pertaining to Lake Champlain apply. During spring high water, the stretch can be canoed (personal communications, Bernie Pientka, DFW fisheries biologist).
LaPlatte River to the falls in Shelburne (under Falls Road Bridge	Shelburne	General fishing regulations pertaining to Lake Champlain apply. State Fish and Wildlife access ramps located at mouth of LaPlatte. Falls can be reached by boat from the Lake Champlain Land Trust Shelburne River Park canoe and kayak launch at RM 1

Table 10 Determination of existing uses of waters for public surface water supplies in Basin 5.

Waterbody	Town	Basis for determining the presence of an existing use
Colchester Pond	Colchester	Classified at an A(2) (Water Resources Panel 2006)
St. Albans Reservoir North	Fairfield	Water source for one or more community water supplies regulated by the Water Supply Division
Northeast Arm - Lake Champlain	N/A	Same as above
Main Lake – Lake Champlain	N/A	Same as above
Malletts Bay – Lake Champlain	N/A	Same as above
Burlington Bay	N/A	Same as above
Shelburne Bay	N/A	Same as above

Appendix I –Aquatic Invasive Species and Fish and Wildlife Pathogen Precautions.

As recreational or professional users of Vermont's aquatic resources, we all have the potential to spread aquatic invasive species and fish and wildlife pathogens from stream to stream and watershed to watershed. Responsible stewards of our state waters take needed precautions to minimize the spread of these threats.

Follow these 'Best Practices' to minimize the spread of aquatic nuisance species, such as didymo, as well as invasive pests, including spiny waterflea, zebra mussels, and certain fish pathogens. These practices are designed to minimize the chance that undesirable species are spread via watercraft and gear, and have been widely adopted nationally and internationally.

BEST PRACTICES to minimize the spread of aquatic invasive species and fish and wildlife pathogens while using Vermont waters:

- Before launching AND before leaving any waterbody, "Clean, Drain, Dry."
    - CLEAN off mud, plants, and animals from boats, trailers, and equipment. Rinse boats and trailers with hot, pressurized water (if available). Soak fishing lines, anchor lines, and all used gear in hot water for at least five minutes.
    - DRAIN watercraft and equipment away from the water. This includes the motor, all live-wells, bait buckets, bilges, ballast tanks, and any other reservoir that could transport lake water.
    - DRY anything that comes into contact with water for five days, preferably in the sun. This period of time is needed to kill the eggs and larval stages of some invasive pests, including zebra mussels and spiny waterflea.
- NEVER release plants, fish, or animals into a body of water unless they came out of that body of water.
- Anglers, Guides, Outfitters – Designate waders/boots/canoes/tubes/etc. for different watersheds or have multiple sets available for same-day travel, when needed. Avoid using gear in different watersheds in short time periods.
- Canoeists, Kayakers, Boaters – Remove drain plugs (if applicable) and drain any water prior to leaving boat launch, and leave plugs out during transport to ensure complete drainage.
- Under any circumstance, DO NOT move water between waterbodies.

For more information regarding aquatic invasive species, contact Josh Mulhollem at

(802)490-6121 or Josh.Mulhollem@vermont.gov

Attachment A:

Onsite wastewater systems' influence on phosphorus loading in lakes

Phosphorus loading to lakes can be a serious problem when excess phosphorus exacerbates algal growth which in turn can decrease water clarity, dissolved oxygen levels and create an overall uninviting place for recreation. Phosphorus loading originates from several sources in a watershed including: runoff from impervious surfaces, agricultural and forest lands, point sources like wastewater treatment facilities, eroding stream channels, groundwater and even directly from precipitation.

One of the most visible potential contributors are the septic systems associated with shoreline homes or camps. Wastewater from these systems infiltrates the ground where, in a properly functioning system, phosphorus is bound to the soil and the vast majority is prevented from entering the lake. On occasion, a poorly functioning septic system can contribute more phosphorus to a lake than it should. However, several investigations in Vermont have shown that, even when a portion of the septic systems are assumed to be sub-standard, overall they consistently represent a small fraction of the overall phosphorus load. Below are a few examples of scientific investigations in Vermont that accounted for septic system phosphorus loads

Lake Morey Diagnostic/Feasibility Study

Morgan, J. T. Moye, E. Smeltzer, and V. Garrison. 1984. Lake Morey Diagnostic-Feasibility Study Final Report. Vermont Department of Water Resources and Environmental Engineering. Montpelier, VT.

- "Common knowledge" and circumstantial evidence initially pointed to shoreline septic systems as the primary source of nutrients for excessive algal growth in Lake Morey in the 1970s and early 1980s. No direct studies were conducted to determine the level of septic system inputs prior to the D/F study.
- The D/F study utilized several methods to quantify the groundwater contribution to the hydrologic budget and septic system phosphorus loading rates.
- Conclusions from the investigation found that "Total groundwater inputs of phosphorus, including septic system inputs, were only <u>1% of the total external supply of phosphorus to the lake.</u>"

Lake Carmi TMDL Study

- A comprehensive phosphorus budget was developed for Lake Carmi whereby the total septic system loading was determined to be 1% of the total annual phosphorus load.

Ticklenaked Pond TMDL Study

- A comprehensive phosphorus budget was developed for Ticklenaked Pond whereby the total septic system loading was determined to be 2% of the total annual phosphorus load.

Lake Iroquois Diagnostic/Feasibility Study

Roesler, C. and A. Regan. 1985. Lake Iroquois Diagnostic-Feasibility Study Final Report. Vermont Department of Water Resources and Environmental Engineering. Montpelier, VT.

Excerpts from the report include:

- p.29. "Residential sewage *in* the Lake Iroquois watershed is handled by on-site disposal. Shoreline septic systems were found to achieve high levels of phosphorus retention. Two partially failing systems were observed *in* the watershed, although no specific attempt to examine systems not on the shoreline was made. Sewage appears to make a relatively small contribution to the lake's phosphorus supply, although it does provide yet another addition above background conditions."
- p. 200. "The phosphorus contribution to Lake Iroquois from groundwater and septic systems was relatively minor. Groundwater contributed less than 3% of the total phosphorus budget of the lake, and phosphorus derived from shoreline septic systems was only about 1% of the total external phosphorus load."
- 1982 Septic systems were calculated to contribute 1.3% of total P load (Table 34)
- 1983 Septic systems were calculated to contribute <1.0% of total P load (Table 35)
- p. 184 "Eight of the twelve east shore septic system wells had dilution factors of 5% or greater. Six of these eight had mean P concentrations less than 13 ug/l, and SO exhibited a Pretention greater than 95%. Two of the eight wells (numbers B-24,27) which were both below the same septic system, had slightly higher mean P concentrations (23.2 and 13.5 ug/l), but still indicated phosphorus retention values in excess of 90%. The four remaining east shore septic system wells had dilution factors less than 5%, and so P retention percentages could not be calculated since predicted P concentrations fell into the range of background P concentrations. However, since the well P concentrations were at background levels, it seems quite likely that a 95% or greater P retention would be applicable to these sites as well."

Hypothetical calculations for St Albans Bay straight pipes

- One area of Lake Champlain that routinely suffers from problematic algal growth due to excess phosphorus loading is St. Albans Bay. In order to present a "worst-case scenario" several assumptions are made in the below illustration.
- Assumptions include there are 1,000 residents living on St. Albans Bay, for 360 days per year, where household wastewater is piped untreated directly to the lake. The total phosphorus load would be 1,204.5 kg/yr. (1,000 people*360day*3.3g P/cap/day). As a comparison, the Lake Champlain TMDL summary in the draft plan documents 9,516 kg/yr from the agricultural sector alone. So under this most presumably overestimated septic scenario, the total percentage of phosphorus attributable to septic discharge would be 7.7% of the total estimated load to this lake segment.

TWM Northeast. 1991. St. Albans Bay Pollution Abatement Feasibility Study. Prep for Towns of Georgia and St. Albans. Williston, VT.

- The actual report is not readily available but WSMD staff recalls the shoreline septic system phosphorus load was similar in magnitude to other lake studies in the state.

Vermont DEC onsite wastewater (septic) system program

The Drinking Water and Groundwater Protection Division issue permits for the construction of wastewater systems and construction of potable water supply systems. The program issues approximately 3000 permits per year, including connections to public water systems and municipal sewer extensions and connections. Homeowners with failed onsite systems must hire a Licensed Designer and provide a design for a replacement system which meets the current regulations to the greatest extent possible. Variances can be granted, but there are situations where a holding tank that is pumped to a wastewater treatment plant may be the worst case option. There are five Regional Offices that administer this program and staff are available for assistance in going through the permit application process.

Appendix J. Basin Plan Update Public Comments and Responsiveness Summary

(continued on next page)

Vertmont Agency of Natural Resources

Northern Lake Champlain Direct Drainages Tactical Basin Plan Update

PUBLIC COMMENTS RESPONSIVENESS SUMMARY

December 2017

On November 17, 2017, the Vermont Agency of Natural Resources, Department of Environmental Conservation (DEC) released a final draft of the Northern Lake Champlain Direct Drainages Tactical Basin Plan Update for public comment. The public comment period began on November 17, 2017 and ended on December 18, 2017, and included two public meetings. The meetings were held in St. Albans, Vermont on November 28, and Essex Junction on November 30.

The DEC prepared this responsiveness summary to address specific comments and questions and to indicate how the plan has been modified. The comments below may have been paraphrased or quoted in part. The full text of the comments is available for review or copying at the Essex Junction Regional Office of the Department of Environmental Conservation, 111 West Street, Essex Junction, VT.

SUMMARY OF COMMENTS RECIEVED BY THE VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION (DEC):

Commenter: Conservation Law Foundation

1. **In addition, the "see the basin specific reports" merely links to DEC's homepage. It is unclear what is meant by basin specific reports.**

   The link will be fixed in the final draft to these Basin specific reports.

2. **Include stream descriptions in the plan instead of referring reader to other DEC reports that provide the more detailed information.**

   DEC provides a detailed description of the water resources in the 2013 DEC Basin 5 Water Quality and Assessment Report, which is updated prior to the initiation of the tactical basin planning process. Future iterations of each Tactical Basin Plan will refer to these online assessment reports to provide more detailed descriptions of the watershed, as this will allow successive iterations of a TBP to use these assessment reports as more extensive reference materials in order to focus on strategy and project development in the Plan itself, thereby allowing stakeholders to more readily understand the actions identified in each Plan in meeting water restoration and protection goals.

3. **The implementation priorities lack clearly defined priority practices or even priority sectors**.

   As described in the 2016 LC TMDL, the need to accurately identify, prioritize, fund, and implement the necessary phosphorus control measures is articulated in Chapter 5 per the tactical basin planning process and contingent on continued funding through the (now) Clean Water Initiative Program (CWIP). DEC relies on many factors to continue to refine the TBP process and the ability to accurately "find and fund" effective projects including but not limited to: refreshed water quality data, sector specific assessment reports, technical (programmatic input), implementation partners, and continued funding of high priority projects. Contributing to this dynamic is the time necessary to undertake comprehensive water quality monitoring (in each planning basin), the time necessary to coordinate and conduct sector-specific assessments, necessary outreach to landowners as well as the regulated sectors, and available funding. In this regard, DEC is limited by the staffing, technical, and financial resources necessary to undertake all of these tasks concurrently in focused planning basins, in addition to the enhanced coordination necessary with partners who are also technically and financially capable of delivering these services across all sectors. In addition, prioritization under regulatory programs also requires extensive time and resources (e.g., the development of Pollution Control Plans under the Municipal Separate Storm Sewer System (MS4) permits; road erosion inventories under the Municipal Roads General Permit (MRGP)).

4. **Include a priority column in the implementation table that provides additional granularity to the current prioritization of high, medium, low, (explained on pages 58-59 in the plan). particularly important given the role that TBPs can play in prioritizing certain projects for funding so that implementation can be expedited and tracked transparently**

   As explained in the plan, The Department plans to continuously increase the granularity of the prioritization process in subsequent iterations of Tactical Basin Plans as more assessments are completed, regulatory programs under Act 64 have been rolled out, permits issued and hopefully, additional funding secured. As an outcome of a DEC LEAN event held in December 2017, The Department is currently working on refining the prioritization process to include the review of projects at all three levels (feasibility, design and implementation). Currently DEC Ecosystem Restoration Grant Program, the funding source for many of the projects, does take responsibility for ensuring that criteria for prioritizing projects for funding are transparent. To that end, criteria and associated score(s) are included in the grant application.

5. **Regarding Stage Gate:**
   a. **Projects that maintain high quality waters should be prioritized equally to those that improve water quality**
   b. **Will opportunities for pairing projects (such as stormwater and natural resource projects), public private partnerships, and other nonconventional project types l be discouraged by the step-wise approach.**

c. **it is critical that the scheme does not merely prioritize projects with the least resistance, i.e. a project with a willing landowner passes through a gate and is funded despite not having the greatest water quality benefit.**

DEC agrees that the Tactical Basin Plans should include more project prioritization information specific to the basins that allow partner organizations to better understand sector-specific criteria that have identified priority project opportunities. The Agency's Tactical Basin Planning process utilizes integrated watershed assessment information (water quality monitoring and sector-specific assessment reports) to understand water quality conditions and identify appropriate restoration and protection strategies to inform the TBP Implementation Tables. Within this context, sector specific and project specific criteria are applied to a broader draft list of projects to determine the most appropriate implementation and funding mechanisms, which then informs priority ranking within those TBP Implementation Tables. In this case, the term "stagegate" is used to describe a point in a vetting process where a project proposal can be examined, and criteria can be applied to the decision-making process relating to specific resources and efficiencies to determine the greatest priorities for implementation. This process includes project scoping, project design or feasibility, project implementation, and easements (the Ecosystem Restoration Program funds capital-eligible nutrient and sediment reduction projects). In order for a project to move from the project feasibility analysis phase into the project design or implementation phase, it must meet the criteria to pass through that "gate" or threshold. If a specific project does not meet those criteria, it may be placed back into the stagegate queue, or simply placed on hold until a later date due to a variety of factors (landowner willingness, timeliness, or other factors) or it may be simply dropped from consideration if it is not deemed to be effective and/or an efficient investment of capital funds.

In December 2017, DEC convened a LEAN event to examine the process by which projects are identified and prioritized through the tactical planning process, and then the process by which those are proposed for funding. The outcome of this LEAN event is an effort to refine the "stagegate" process into standardized criteria and stepwise methodology for the identification and prioritization of prospective water quality improvement projects. DEC's intent is to continue to refine this process and share both the methodology and criteria with stakeholders to reflect this process, criteria, and our methodology in applying project prioritization.

6. **In order for funding opportunities to be better aligned with need, the actual dollar amounts of available funding and project costs is necessary. While the majority of calculated costs align with regulatory programs, there is significant need to implement the list of voluntary practices included in TBP implementation tables. To advance the funding conversation at the State House and to elucidate the total cost, CLF encourages DEC to include cost estimates in the implementation table. At a minimum, DEC should provide average costs for similar projects or a range of potential costs.**

DEC has calculated the overall dollar figure required for meeting the goals of the Lake Champlain Phosphorus TMDL. The figure is based on the overall phosphorus reduction required for each lake segment and an estimation of cost for implementing sector-related practices. This is the figure needed to determine state-level funding needs.

The implementation tables include a list of strategic actions that have been identified to date that if implemented would work towards meeting phosphorus reduction goals. They may or may not be implemented based on feasibility and further prioritization. It would be helpful to potential applicants if estimated costs were included for specific projects by sector and where we have identified costs, where estimated, in the Watershed Projects Database. For the purposes of understanding what funds are necessary to meet our water resource goals, it is more useful to develop a calculation on a larger scale that helps in the pursuit of State or federal funding sources.

DEC agrees that it would be useful to have data on average cost for similar projects. The continuing effort to document completed projects by the DEC's Clean Water Initiative Program (CWIP) program in the Watershed Management Division will provide the necessary data over the next several years to enable the Department to calculate average costs for similar projects.

7. **Appendix D should be comprehensive and more clear. In an effort to match project costs to available funds, it would be helpful to have a comprehensive summary of federal and state funding streams**.

   The majority of the funds outlined in Appendix D are federal and were committed to Vermont as part of grants or special allotments (such as the current USDA-NRCS Regional Conservation Partnership Program) to implement water resource protection projects across the working landscape, especially agricultural lands. The funds for nonagricultural sources are expected to come primarily from the State of Vermont. At this time, a long-term funding stream has not been identified by the Legislature, and therefore it would be difficult to provide expected available State funds beyond the current year.

8. **Appendix D is confusing for the general public. For example, most Vermonters are not aware that RCPP stands for the Regional Conservation Partnership Program.**

   DEC agrees and will ensure that all acronyms are initially preceded by their full name in the plan.

9. **In the online database that captures the implementation table, projects do not include specific deadlines. Without associated timeframes it is challenging to hold the State accountable for actual implementation. For this reason, the 2016 TMDL explicitly states that "[e]ach Tactical Basin Plan will include an "Implementation Table" that lays out the priority actions to be taken by *specific dates*" (emphasis added). The Northern Lake Champlain TBP fails to follow this assumption.**

Dates met or expected for the promulgation of permit programs and implementation of required assessments are shown in section I in Chapter 2. Successful implementation of voluntary actions (i.e., natural resource projects) also depends on all the following: coordinating partners to implement, willing landowners, and, availability of funds. We were not able to accurately predict when each of these would be aligned for each project to establish start and end dates for each project in the implementation table. As explained in Appendix F, we have provided the end of the planning period, 2021, as the date by which we expect priority regulatory development actions to be completed, and nearly all required assessments. DEC absolutely recognizes the need to ensure implementation of actual projects, not just assessments, and are so committed. As the project identification and prioritization process continues to be refined, regulatory programs under Act 64 roll out, and hopefully additional funding sources are created, successive iterations of tactical basin plans will include more specificity on projected project implementation timing. It is important to remember that the Lake Champlain TMDL Phase I Implementation Plan and Act 64 were promulgated fairly recently, and both include expectations that implementation will take time. DEC's Accountability Framework recognizes this.

10. There are far fewer projects identified in this TBP than the Lamoille River and Missisquoi Bay TBPs released last year. It would be helpful to better understand why there is a disparity in the number of identified projects.

In addition to the projects that are identified with partners and the communities in the watershed, we included projects from DEC-supported assessments. The number of projects in the database can be closely associated with the amount of assessment work supported by community groups with the help of DEC and other partners over the years. These include geomorphic assessments and stormwater master plans. The number of projects for a basin in the Watershed Projects Database (WPD) is dependent on the amount of assessment that has been completed in the basin. There are also assessment results that are located in a separate database, where it has been decided that it is more efficient to refer to the database as a source of specific projects. Examples include projects identified in culvert assessments. The number of projects in a basin is not static number as new assessments will result in new projects. The Department does not believe that it is necessary to explain the reason for the discrepancy in number of projects among basins, as this is an evolving effort in coordination with partner organizations.

Sector-specific assessments are critical in identifying the highest priorities for implementation. The Watershed Projects Database will be updated as new assessments are completed and the offspring of those assessment reports are subsequently incorporated into WPD. In doing so, the Implementation tables become "refreshed" with these most current prioritization rosters. However, assessments will be staggered, and we will not necessarily arrive at a moment when all assessments have been completed. As our natural resource processes and land use activities are dynamic, so must be the assessments that need to be conducted to refresh project priorities

11. Agricultural Best Management Practices

The regulatory program identified to achieve implementation of agricultural best management practices (BMPs) is the Required Agricultural Practices (RAPs). However, RAPs are not BMPs, meaning the RAP standards do not reflect the practices modeled by the Environmental Protection Agency to achieve the required phosphorus reductions from the agriculture sector. Rather the RAPs set a lower bar, including only partial livestock exclusion, allowing uses that could increase phosphorus loading within riparian buffers, and relying heavily on nutrient management plans to anticipate BMP implementation. Given the import of widespread implementation of best management practices, CLF is concerned the Northern Lake Champlain TBP only references the RAPs as the regulatory framework for achieving this goal. Instead, CLF encourages DEC to include the Agency of Agriculture, Food, and Markets Revised Secretary's Decision regarding Farm Best Management Practices in Missisquoi Bay Basin, and to articulate the need to expand this program, which will result in extensive BMP implementation, to St. Albans, Otter Creek, and South Lake watersheds.

Nonpoint source pollution from agricultural sources is managed by the Agency of Agriculture, Food, and Markets and is not subject to DEC's jurisdiction. While agriculture is a significant contributor to phosphorous pollution in the Lake, concerns should be addressed to the AAFM.

12. Stormwater Treatment

To achieve the mandated phosphorus reductions from developed lands, DEC is promulgating a permit to control stormwater discharges on sites with three acres of impervious surface and requiring Municipal Separate Sewer System (MS4) communities to create plans to manage phosphorus. Unfortunately, DEC is slated to miss the December 31, 2017 deadline to establish these essential regulatory programs. CLF is concerned the Northern Lake Champlain TBP continues to assert the MS4 and three-acre permits will be issued in 2017 when this is clearly not the case.11 DEC is blowing past deadlines, delaying critical regulatory programs, and roadblocking the funding conversation. At a minimum, the TBP should articulate why the Agency is missing a statutory deadline, provide a realistic timeframe for completion, and emphasize the need to establish these regulatory programs to meet stormwater treatment targets.

The Department is currently engaging MS4 General Permit stakeholders on the specifics of phosphorus control plan requirements to be included in the revised MS4 GP. The Department expects to issue the draft general permit in early January of 2018.

The Department has prepared a draft, revised stormwater rule that will serve as the basis for the 3-acre general permit. The Department is currently reviewing the proposed standards in the rule to ensure consistency with the goals of Act 64 and the Lake Champlain TMDL. The Department expects to release both the stormwater rule and general permit in early 2018.

13. CLF encourages DEC to articulate the extensive costs of implementing widespread river corridor, wetland, and floodplain protections in addition to wastewater treatment facility upgrades.

The cost estimates associated with natural resource project implementation will vary greatly based on a multitude of factors that would be too complicated to model or include in project specific cost breakdown. The costs estimated for priority wastewater treatment facility upgrades, expansion, and optimization as well as municipal stormwater system retrofits have been estimated in ANR's FY18 Intended Use Plan, where specific projects have been targeted for Clean Water State Revolving Loan Funds (CWSRF). That report can be viewed from this link:
http://dec.vermont.gov/facilities-engineering/water-financing/srf/intended-use-plans

14. The TBP is remiss in not even considering the potential need for statewide regulatory programs to protect river corridors and floodplains. There is some attempt to identify towns that have adopted river corridor and floodplain protection bylaws; however, Figure 15 is confusing. Both the use of acronyms and similar shades of beige undermine the clarity of this figure.

DEC agrees and (we) have redesigned the map in Figure 15 to increase its clarity. Statewide-regulations of river corridors and floodplains is an important discussion. However, policy discussion suggesting the need for a new and significant statewide land use regulation is beyond the scope of a Tactical Basin Plan for one watershed. The goal of the TBP is to target specific actions that can be taken by towns and partners to improve water quality – municipal river corridor and floodplain bylaw adoption is an appropriate scale action to target in the TBP.

15. The Northern Lake Champlain TBP does not highlight what the State intends to do should projects not be implemented. A successful TBP must include specific projects and deadlines that will be evaluated using BATT in addition to what measures the State is committed to taking if we're not on track. What if projects simply aren't being implemented, or projects aren't removing sufficient phosphorus? The State needs to have backstops. What actions does the State intend to take?

The Northern Lake Champlain TBP provides in-depth information, and includes a number of important tables and graphics that showcase the data. However, it lacks the level of specificity necessary in successful planning. The TBP falls short of providing deadlines, costs, and regulatory gap analysis. Without these essential details, it is impossible to provide guidance on how to move forward and craft alternative action plans should targets not be met.

The State of Vermont is tracking TMDL Phase 2 implementation through funding and regulatory programs, and using the BMP Accounting and Tracking Tool (BATT) to quantify phosphorus reductions associated with project implementation.

Further, the Lake Champlain TMDL and the Lake Champlain Phase I Plan contain a comprehensive description of the accountability framework developed jointly between DEC and USEPA. As described in the DEC's TMDL Accountability Framework, TMDL implementation progress will be assessed by the State of Vermont and EPA on a five-year rotating basis. Beginning in 2018 and per the DEC Accountability Framework, TBPs (which incorporate and serve as LC TMDL Phase 2 Implementation Plans) will establish implementation schedules and interim (i.e., five year) phosphorus reduction targets. If insufficient progress is made implementing Phase 2 plans, additional actions may be required based on the TMDL Accountability Framework, which may include:

- Allocation of load reductions from nonpoint to point sources;
- Expansion of NPDES permit coverage to unregulated sources; and/or
- Increase and target federal enforcement and compliance assurance in the watershed.

The implementation table focuses on encouraging voluntary behavior while also implementing regulatory permit requirements. DEC expects that most of the phosphorus reduction will occur through the regulatory programs, including agriculture. The efforts of DEC and our partners include adaptive management. At the end of the five-year planning period, we will review our progress and at that time make necessary adjustments.

Commenter: Chittenden County Regional Planning Commission (CCRPC) Clean Water Advisory Committee (CWAC)

16. **We provide the comments below for consideration in future basin plan updates. It is clear that the DEC is directed to involve RPCs and municipalities in the development of Tactical Basin Plans. DEC needs to provide 60-90 days for RPC and municipal review of a final draft assuming that we are able to see a rough/pre-draft earlier in the process. It is imperative to continue to work together in a timely fashion on the other TBPs to ensure coordination between the CCRPC, as well as other Regional Planning Commissions, our municipalities and DEC to carry out the statutory intent.**

    DEC anticipates better coordination through the anticipated FY18 Tactical Basin Planning grant agreement with the RPCs and municipalities with a longer time period for review.

17. **At this early stage of Basin Planning to achieve the Lake Champlain TMDL, we realize that there are a lot of projects that have not yet gone through project development and therefore do not have clear scopes, costs, or phosphorus reduction estimates. We would like to be able to offer more specific project priorities in future years, but without this data, we are unable to offer more specific recommendations at this time.**

a. **CRPCC recommends that more funding be allocated toward project development at this early stage so that in subsequent years it will be easier to determine which projects reduce the most phosphorus per dollar. Development of projects in Critical Source Areas for phosphorus loading should receive priority.**
b. **In general, CCRPC recommends that for project implementation, priority be given to those projects that reduce the most phosphorus per dollar spent regardless of permit requirements.**
c. **Additional weight should be given to projects located in Critical Source Areas as well as to projects that provide co-benefits such as other TMDLs (i.e. Flow Restoration Plans, *E.coli*, mercury, etc.) hazard mitigation, transportation improvement, aquatic organism passage, and/or listed in municipal comprehensive plans and capital plans.**
d. **CCRPC recommends that the State provide mechanisms (such as via phosphorus credit trading) for municipalities and other property owners with permits to invest in Natural Resource sector phosphorus reduction would clearly provide for much more phosphorus reduction per dollar spent. Trading across municipalities should also be promoted.**
e. **We also recommend that the State continue its analysis on how to foster credit trading between municipalities and the agricultural sector**

Thank you for your recommendations. They will continue to be part of our internal, as well as external discussions, during the continued development of the process for identifying additional funding sources, as well as criteria for funding projects.

Commenter: George Boomhower

18. **When manure, especially, in the liquid form is spread on a field that is raw, no sod, it is primed for erosion with the first rains. When the rains come, the manure heads for the nearest stream/creek/river along with soil it was sitting on. I didn't mention hay in my little scenario because hay is the fix. When I said to Chuck Ross that Farmers in the immediate watershed of St Albans bay need to be encouraged to switch to hay for their cows, he said "I can't tell farmers what to plant". If farmers are being subsidized, the source of those subsidies should, at least, be able to tell the farmers what (not to plant). The process of mono cropping corn is depleting the soil and leaving pollution behind. Mono cropping corn, as I understand it, is the process of planting corn in the same spot year after year. Corn depletes so badly one year, that in following years excess amounts manure, chemical fertilizers, herbicides and pesticides have to be applied just to grow again.**

    Nonpoint source pollution from agricultural sources is managed by the Agency of Agriculture, Food, and Markets. While agriculture is a significant contributor to phosphorous pollution in the Lake, these concerns should be addressed to the AAFM.

19. The summer of 2016 was hot and still, the water level got low but yet the Georgia shore stayed nearly pristine. The water quality along our shore in 2017 was nearly as good as 2016. Is the legacy sediment far less potent than assumed? There appears to be a lot less corn being planted in the north and east part of St Albans bay watershed. Is that a factor? Does it mean if we can get the excess corn stopped, converted to hay and grass in the north and west part of the watershed that we will see another such improvement? The north and west part of the watershed, of course, is Jewett Brook, the worst, by far, stream running into the lake and it is running into the top of our little St Albans bay.

An explanation for why Georgia Shore may have looked pristine, which we will interpret as fewer incidents of Cynobacteria blooms (i.e., blue green algae), is explained in the following paragraphs:

Cyanobacteria are sensitive to several important environmental stimuli, including phosphorus reaching the water column from both precipitation and internal loading. Lake stratification plays an important role in determining how much internal loading occurs each year and when internal phosphorus becomes available to cyanobacteria. Temperature and wind also strongly influence the extent and location of blooms. There is also competition from aquatic plants for available nutrients.

Though it is difficult to pinpoint how these factors combine each year to produce a cyanobacteria bloom, each does have a role. In particular, prevailing wind and currents generally from south to north during the summer months, determines where cyanobacteria blooms are likely to accumulate. Typically, cyanobacteria densities increase deeper into the bay as a result. 2016 was a dry year with no summer storm events to provide additional phosphorus on top of that already provided by internal loading. The St. Albans area experienced lower overall cyanobacteria density and less bloom activity. In 2017, the opposite occurred. The rainy summer provided significant nutrient loading that cyanobacteria were able to utilize once the weather turned back to high summer in late August. Cyanobacteria all around the state responded and several locations experienced intense late season blooms, including many areas of St. Albans Bay. The Georgia shore was likely spared because prevailing wind and currents carried cyanobacteria in another direction.