

VERMONT CLEAN WATER INITIATIVE 2019 PERFORMANCE REPORT



AGENCY OF ADMINISTRATION
AGENCY OF AGRICULTURE, FOOD & MARKETS
AGENCY OF COMMERCE & COMMUNITY DEVELOPMENT
AGENCY OF NATURAL RESOURCES
AGENCY OF TRANSPORTATION

VERMONT CLEAN WATER INITIATIVE 2019 PERFORMANCE REPORT

Submitted by the Vermont Agency of Administration
January 15, 2020

Reporting Period: State Fiscal Year (SFY) 2016-2019
Part 1: Vermont Clean Water Investment Report
Part 2: Lake Champlain Progress Report

Relevant Reporting Requirements:	Fulfilled by:
10 V.S.A. § 1389a (a) The Report shall summarize all investments, including their cost-effectiveness, made by the Clean Water Board and other State agencies for clean water restoration over the prior fiscal year	Part 1. Vermont Clean Water Investment Report
10 V.S.A. § 1389a (b)(1) Documentation of progress or shortcomings in meeting established indicators for clean water restoration	Part 1. Vermont Clean Water Investment Report
10 V.S.A. § 1389a (b)(2) A summary of additional funding sources pursued by the Board, including whether those funding sources were attained; if it was not attained, why it was not attained; and where the money was allocated from the Fund	Appendix G
10 V.S.A. § 1389a (b)(3) A summary of water quality problems or concerns in each watershed basin of the State, a list of water quality projects identified as necessary in each basin of the State, and how identified projects have been prioritized for implementation	Appendix A
10 V.S.A. § 1389a (b)(4-5) A summary of any changes to applicable federal law or policy related to the State's water quality improvement efforts, including any changes to requirements to implement total maximum daily load plans in the State; a summary of available federal funding related to or for water quality improvement efforts in the State	Appendix H
10 V.S.A. § 1264 (k)(1-3) Report on installation of stormwater treatment practices through operational stormwater permits, including: (1) permitted new development is achieving at least a 70 percent average phosphorus load reduction; (2) estimated total phosphorus load reduction from new development, redevelopment, and retrofit of impervious surface permitted; and (3) number and percentage of projects that implemented Tier 1, 2, or 3 stormwater treatment practices	Appendix E
10 V.S.A. § 1386(e) Activities and Progress of Water Quality Ecosystem Restoration Programs	Appendix I
Lake Champlain Progress Report Part 2: (1) estimated phosphorus reductions from clean water projects in the Lake Champlain basin; (2) external variables affecting phosphorus loading to Lake Champlain; and (3) monitored phosphorus loading to Lake Champlain. Appendix B and C: interim status of priority actions from Tactical Basin Plan "Implementation Tables" for the Lamoille and Missisquoi River basins.	Part 2. Lake Champlain Progress Report and Appendix B and C

ACKNOWLEDGEMENTS

This report was prepared by the Vermont Clean Water Initiative partner agencies on behalf of the Vermont Secretary of Administration. The Vermont Agency of Natural Resources Department of Environmental Conservation (DEC) Clean Water Initiative Program coordinated with staff of the Vermont Agency of Administration; Vermont Agency of Agriculture, Food and Markets; Vermont Agency of Commerce and Community Development; Vermont Agency of Transportation; Vermont Fish and Wildlife Department; Vermont Department of Forests, Parks and Recreation; DEC's Water Investment Division; DEC's Watershed Management Division; Vermont Housing and Conservation Board; U.S. Department of Agriculture Natural Resources Conservation Service; and Lake Champlain Basin Program to complete this report.

Report available electronically at: <https://dec.vermont.gov/water-investment/cwi/reports>

VERMONT CLEAN WATER INITIATIVE - cleanwater.vermont.gov

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COVER PHOTOS



[Buffer planting along Winhall River](#), completed by Connecticut River Conservancy



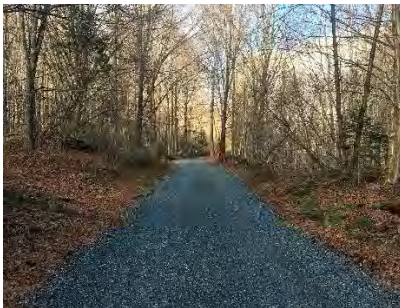
[Lake shoreland improvements at Dolloff Pond](#), completed by North Woods Stewardship Center



[Culvert replacement on Cotton Brook Road](#), completed by Department of Forests, Parks and Recreation



[Construction of stormwater treatment practice at Cambridge Elementary](#), completed by Cambridge Town



[Forest road upgrade](#), completed by Department of Forests, Parks and Recreation



Interseeder equipment, taken by University of Vermont Extension Northwest Crops and Soils Program



Mulcher equipment purchased by town of Eden, via the Grants-in-Aid Program



[Gully erosion remediation at Pouliot Avenue, Barre Town](#), completed by Friends of the Winooski River

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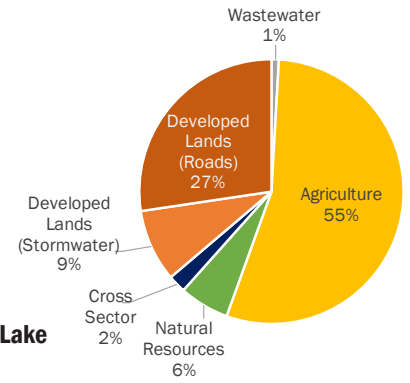
Vermont's Clean Water Investments



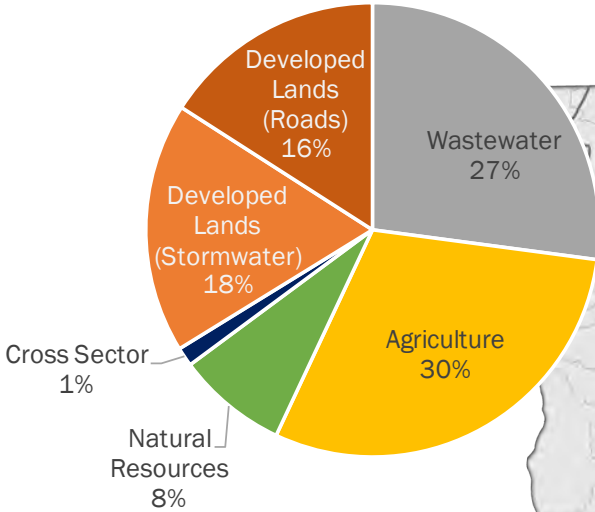
Dollars awarded by State of Vermont agencies to clean water projects, SFY 2016-2019. See report Part 1, "Vermont's Clean Water Investments" for more information.

\$138 million

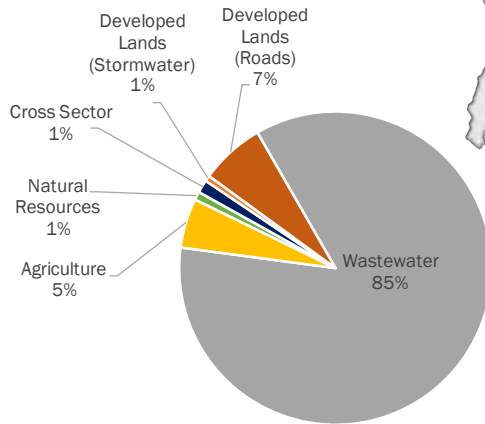
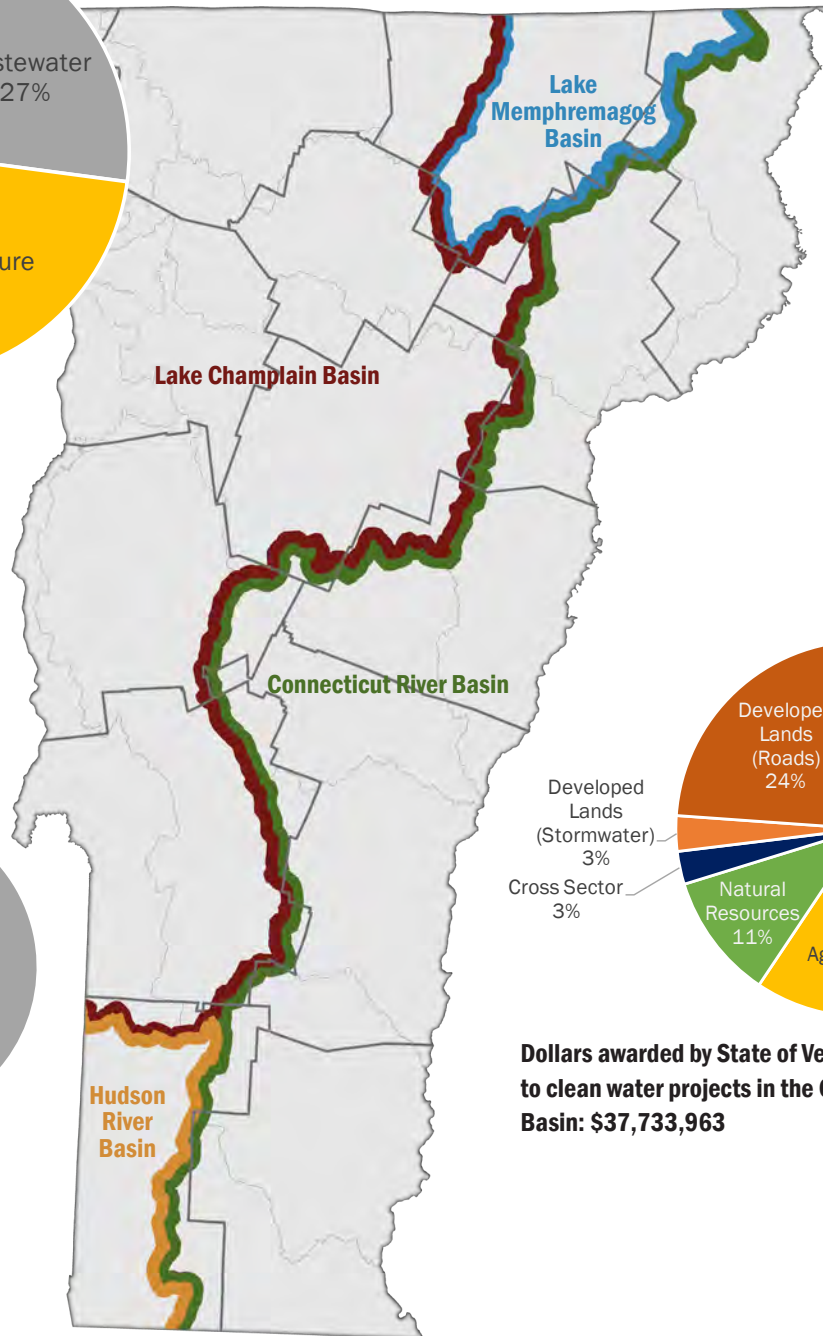
Awarded by State of Vermont agencies to clean water projects, SFY 2016-2019



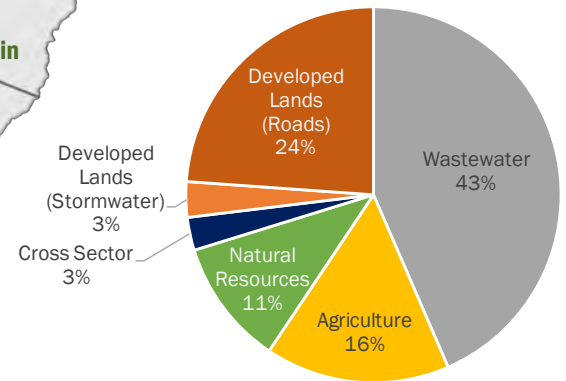
Dollars awarded by State of Vermont agencies to clean water projects in the Lake Memphremagog basin: \$4,702,092



Dollars awarded by State of Vermont agencies to clean water projects in the Lake Champlain basin: \$84,434,341



Dollars awarded by State of Vermont agencies to clean water projects in the Hudson River basin: \$11,300,091



Dollars awarded by State of Vermont agencies to clean water projects in the Connecticut River Basin: \$37,733,963

Results of Vermont's Clean Water Investments



Results of clean water projects funded by State of Vermont agencies, completed SFY 2016–2019, by sector. See report Part 1, “Results of Vermont’s Clean Water Investments” for more information.



AGRICULTURE

AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	5,466	3,261	7,908	10,678	27,313
Acres of agricultural land treated by forest and grass buffers	258	200	228	–	686
Acres of pasture with livestock excluded from surface waters	258	117	97	–	472
Number of barnyard and production area practices installed	57	90	85	52	284
Acres of water quality protections within newly conserved agricultural lands	–	116	200	482	798
Estimated acres of agricultural land treated through equipment	–	2,043	6,594	7,765	16,402
AGRICULTURE POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	713	853	1,352	2,698	



NATURAL RESOURCES

NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored through buffer planting	85	32	59	64	240
Acres of riparian corridor conserved and restored through easements	141	208	222	5	576
Acres of floodplain restored	–	2	4	1	7
Acres of lakeshore restored	0.2	–	9	1	10
Stream miles reconnected for stream equilibrium/fish passage	35	100	108	113	356
Acres of wetland conserved and restored through easements	–	131	44	47	222
Acres of forestland conserved with water quality protections	58	172	598	110	938
Miles of forest road drainage and erosion control improvements	–	0.8	–	8	9
Number of stream crossings improved	–	–	1	19	20
Square feet of gully erosion remediated	–	–	50,668	135	50,803
NATURAL RESOURCES POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	54	120	230	276	



DEVELOPED LANDS



ROADS

DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	0.2	87	28	107	222
Miles of municipal road drainage and erosion control improvements	1	12	68	88	169
Number of municipal road drainage and stream culverts replaced	–	106	137	254	497
Cubic yards of Class IV road gully erosion remediated	–	–	260	33	293
Cubic yards of catch basin outlet erosion remediated	–	–	1	784	785
Acres stabilized through use of hydroseeder/mulcher equipment per year	–	–	19	98	117
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	4	38	134	291	



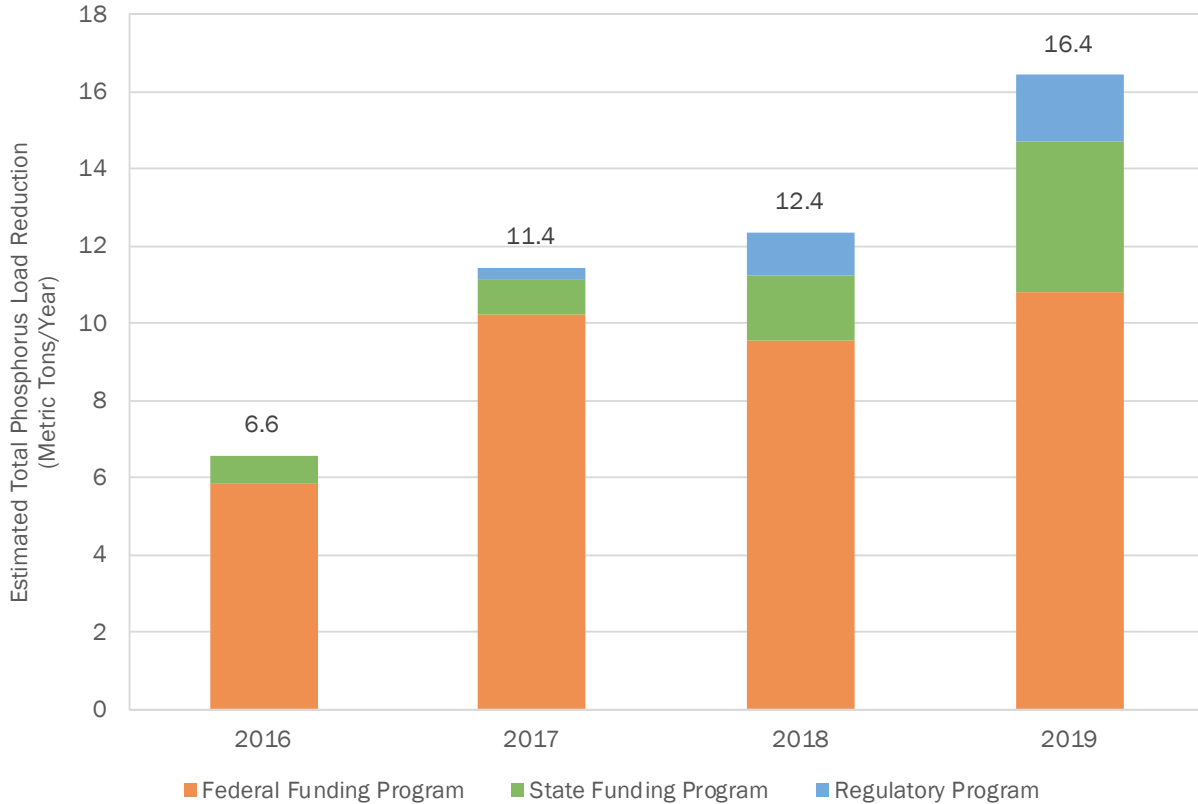
WASTEWATER

WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	4	1	–	–	5
Number of sewer extensions completed	–	2	–	–	2
Number of wastewater collection systems refurbished	–	2	2	2	6
Number of wastewater treatment facilities refurbished	–	–	1	3	4
Number of wastewater treatment facility upgrades completed	1	–	–	–	1

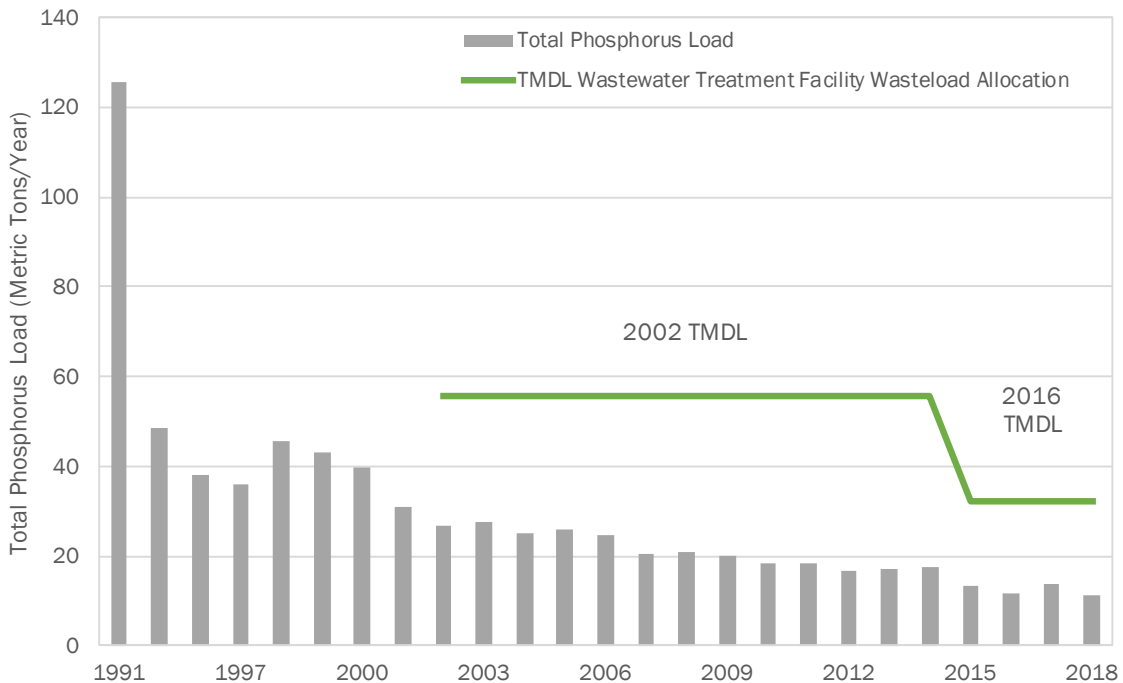
Lake Champlain Progress Report



Annual average estimated total phosphorus load reduction (metric tons per year) achieved by clean water projects that support implementation of the Lake Champlain Total Maximum Daily Load (TMDL), by program category (i.e., federal funding programs, state funding programs, and regulatory programs) completed SFY 2016-2019. See report Part 2 “Lake Champlain Progress” for more information.*



Total phosphorus load (metric tons per year) from Vermont wastewater treatment facilities draining to Lake Champlain relative to TMDL wastewater treatment facility wasteload allocation, calendar year 1991-2018. See report Part 2 “Lake Champlain Progress” for more information.



* Federal funding programs through U.S. Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) agricultural practice data represent practices applied July 1, 2015 (beginning of SFY 2016) through December 31, 2018 (halfway through SFY 2019). Practice data for the remainder of SFY 2019 will be provided next year in the SFY 2020 Annual Performance Report.

Introduction

The Vermont Clean Water Initiative 2019 Performance Report covers State Fiscal Year (SFY) 2016-2019 (July 1, 2015 – June 30, 2019). The purpose of the report is to summarize the State of Vermont’s clean water efforts and demonstrate how clean water investments are making a difference through the following accountability measures:



Investment measures of how State of Vermont invests in clean water projects from planning to design and implementation



Project output measures that quantify the results of state-funded clean water projects

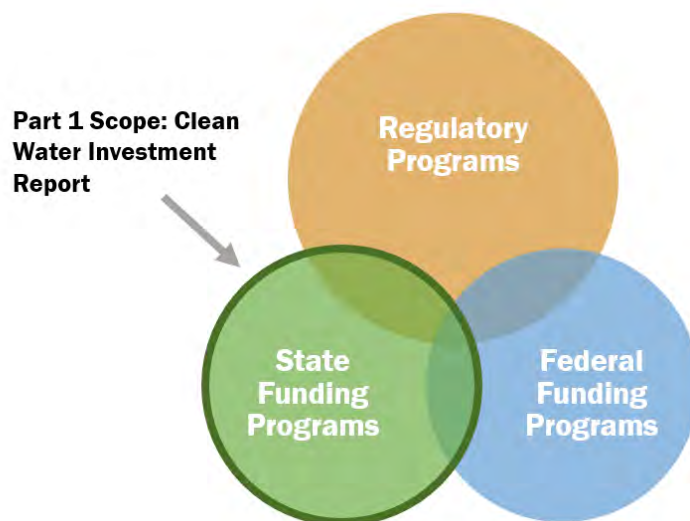


Education measures on outreach and technical assistance to support, identify, and develop clean water projects



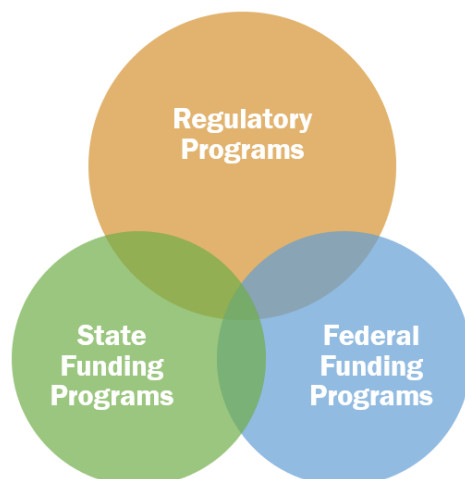
Pollutant reduction measures of estimated nutrient load reductions achieved by clean water projects

Part 1 “Vermont Clean Water Investment Report” summarizes state funding programs including: (a) state investments made in clean water projects through grants, contracts, and loans; (b) state clean water education efforts; and (c) results of state-funded clean water projects.



Part 2 “Lake Champlain Progress Report” summarizes progress under the *Phosphorus Total Maximum Daily Loads (TMDLs) for Vermont Segments of Lake Champlain*, including: (a) estimated phosphorus reductions achieved through state funding, federal funding, and regulatory programs; (b) external variables affecting phosphorus loading to Lake Champlain; and (c) monitored phosphorus loading to Lake Champlain.

Part 2 Scope: Lake Champlain Progress Report



Scope of the 2019 Clean Water Initiative Performance Report

Included in this Report, Part 1: Vermont Clean Water Investment Report

- State agencies' investments in clean water projects through grants, contracts, and loans, awarded SFY 2016-2019.
- Education provided through outreach and technical assistance by state agency staff and external partners under a state grant or contract in SFY 2016-2019.
- Results of clean water projects, funded by state agencies, completed in SFY 2016-2019, including project output measures and nutrient pollutant reductions.¹

Included in this Report, Part 2: Lake Champlain Progress Report

- Estimated total phosphorus load reductions associated with clean water projects completed SFY 2016-2019 through federal funding programs, state funding programs, and regulatory programs.
- External variables affecting phosphorus loading to Lake Champlain, such as climate and land use change.
- Monitored total phosphorus load from Vermont tributaries of Lake Champlain relative to phosphorus target.

Outside the Scope of this Report










- State investments in projects with agreements executed outside the reporting period.
- Results of projects completed outside the reporting period.
- Outreach and technical assistance provided by external partners outside state grants/contracts.
- Federal agencies' direct investments in clean water projects, unless reported as federal match on a state grant or contract.
- Municipal and private investments in clean water projects necessary to comply with water regulations, unless reported as local match on a state grant or contract.
- VTrans' investments in clean water projects to comply with water quality regulations on state highways and VTrans non-road developed lands. Results of VTrans' projects to comply with water quality regulations will be included in future reporting periods once data are available through VTrans' regulatory reporting requirements.

¹ Work completed in the reporting period of SFY 2016-2019 includes funding agreements closed out (all deliverables completed/approved and final payments made) between July 1, 2015 and June 30, 2019.

Clean Water Projects

Clean water projects target nutrient and sediment pollution across various land use sectors. Nutrient and sediment pollution reductions are required by clean water restoration plans, known as Total Maximum Daily Loads (TMDLs), and are driven by the Vermont Clean Water Act (Act 64 of 2015) and the Combined Sewer Overflow (CSO) Rule (2016).

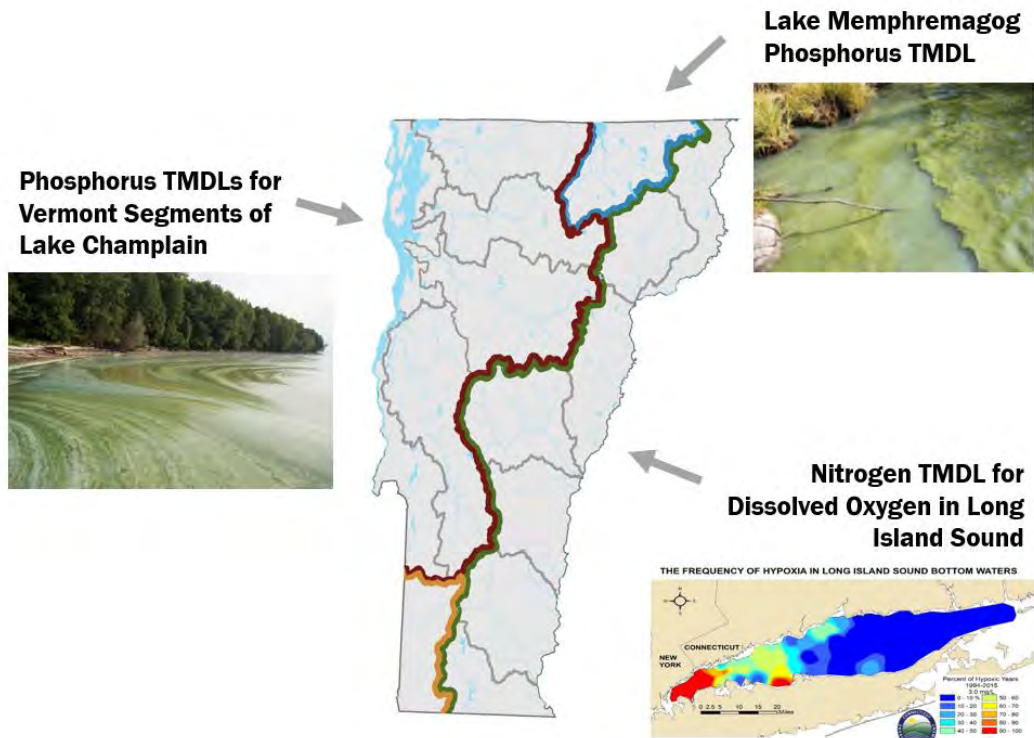
Figure 1. Clean water project land use sectors, objectives, and additional benefits

Land Use	Clean Water Project Objectives and Example Project Images	Additional Benefits
 AGRICULTURE	Addresses runoff and soil erosion from farm production areas and farm fields 	<ul style="list-style-type: none"> • Supports Clean Water Act compliance • Cost-effective • Leverages federal funds • Supports agricultural economy
 DEVELOPED LANDS	Addresses stormwater runoff from developed lands, such as parking lots, sidewalks, and rooftops 	<ul style="list-style-type: none"> • Supports Clean Water Act compliance • Increases flood resilience • May enhance aesthetic appeal
 NATURAL RESOURCES	Restores functions of “natural infrastructure”—river channels, floodplains, lakeshores, and wetlands 	<ul style="list-style-type: none"> • Supports Clean Water Act compliance • Cost-effective • Increases flood resilience • Improves habitat • Enhances recreation
 ROADS	Addresses stormwater runoff from roads 	<ul style="list-style-type: none"> • Supports Clean Water Act compliance • Cost-effective • Increases flood resilience • Leverages federal funds • Reduces future road maintenance costs
 WASTEWATER	Decreases nutrients (phosphorus and nitrogen) through enhanced wastewater treatment and addresses aging infrastructure 	<ul style="list-style-type: none"> • Protects public health and safety • Supports Clean Water Act compliance • Leverages federal funds

Clean Water Restoration Plans (i.e., Total Maximum Daily Loads, or TMDLs)

Most of Vermont’s water quality problems are caused by nonpoint sources of pollution. Nonpoint source pollution can include a variety of pollutants transported from the landscape to waterways by rain-runoff and snowmelt. Nonpoint sources are harder to identify compared to point sources, which come from a single point, such as the end of a pipe. Clean water restoration plans, or “Total Maximum Daily Loads” (TMDLs), target nonpoint source pollutant reductions in addition to end-of-pipe reductions. Most of the State of Vermont is covered by large TMDLs that require nutrient pollutant reductions (i.e., phosphorus and nitrogen) from nonpoint and point sources, shown in Figure 2. While most waters of Vermont are high quality, some suffer from the effect of nonpoint source pollution, including excess nutrients and sediment, which can lead to unhealthy conditions. Lake Champlain and Lake Memphremagog TMDLs target phosphorus pollution to address cyanobacteria blooms (i.e., blue-green algae), as well as other excess algae and aquatic plant growth. The Long Island Sound TMDL targets nitrogen pollution which causes low dissolved oxygen in the Sound. Implementation of these large nutrient TMDLs will also support local water quality needs. For example, Lake Carmi, located in the Lake Champlain basin, also suffers from cyanobacteria blooms. Actions to reduce phosphorus pollution to Lake Carmi will also support implementation of the Lake Champlain TMDL. Refer to Part 2, Appendix B, and Appendix C of this report for more information about Lake Champlain TMDL progress.

Figure 2. Vermont's large TMDLs that require nutrient pollutant reductions

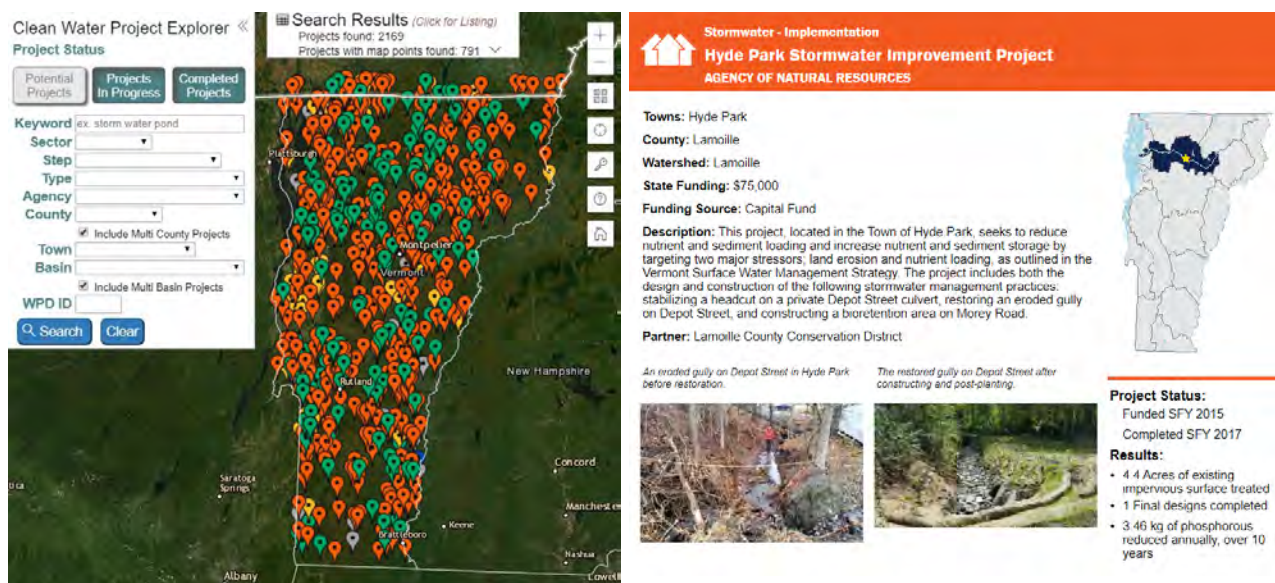


Learn More: Clean Water Projects Explorer

The Clean Water Projects Explorer complements this report by allowing interested parties to search for and learn more about individual state-funded clean water projects. New this year, the Explorer also contains potential projects identified through Tactical Basin Planning – Vermont’s science-based framework to identify clean water projects. Visit the Explorer to search the dataset of clean water projects compiled to prepare this report at:

<https://anrweb.vt.gov/DEC/cleanWaterDashboard/ProjectExplorer.aspx>.

Figure 3. Sample Clean Water Projects Explorer search results (left) and individual project report (right)





Part 1: Vermont Clean Water Investment Report

Vermont’s Clean Water Investments

How is the State of Vermont investing in clean water?

Restoring Vermont’s clean water requires investments at the state, federal, municipal, and private level. The State of Vermont’s clean water investments are channeled through grant, loan, and assistance programs to strategically and cost-effectively restore and safeguard the state’s rivers, streams, lakes, ponds, and wetlands. These funds are used to help identify and prioritize projects, as well as to design and implement projects. This work helps municipalities, farmers, and other landowners comply with regulations, and encourages voluntary actions necessary to address polluted runoff from unregulated sources. Figure 4 through Figure 9 of this chapter summarize State of Vermont’s clean water investments made through the funding programs shown in Table 1.²

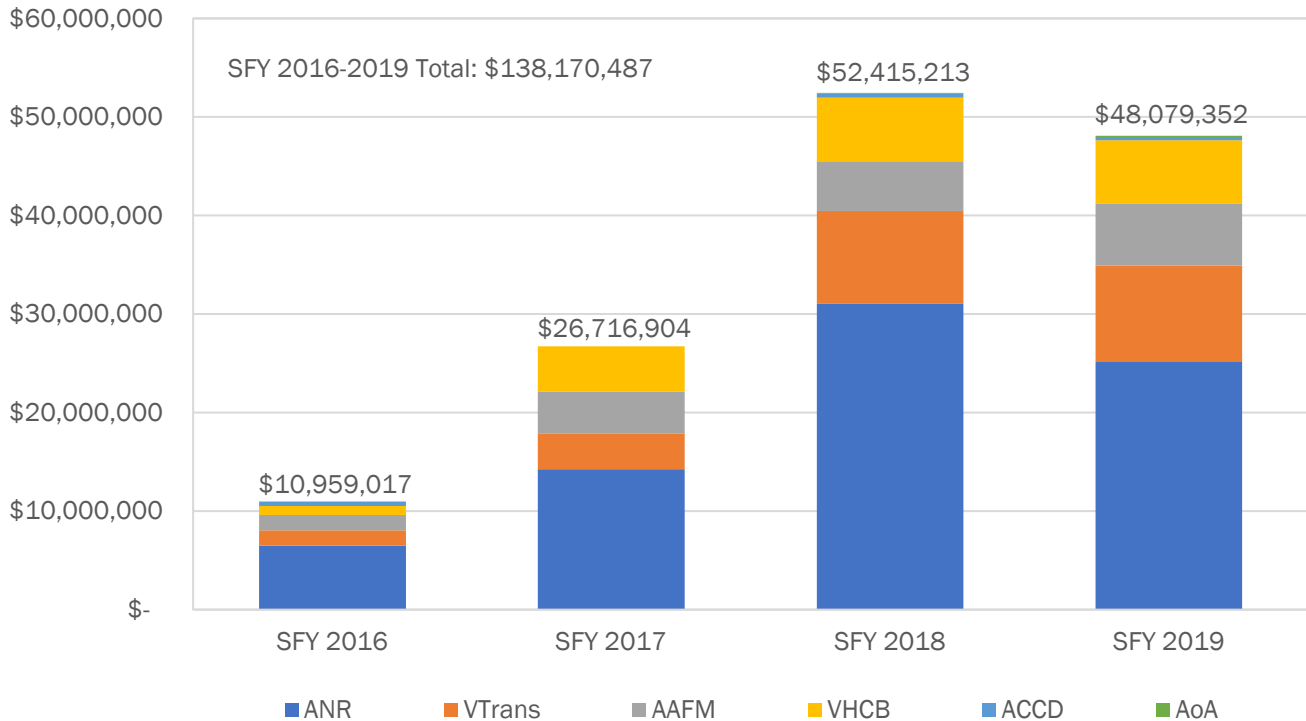
Table 1. State of Vermont funding programs reported by agency

Agency	Clean Water Funding Programs
Agency of Administration (AoA)	Stormwater Utility Incentive Payments Clean Water Project Signs
Agency of Agriculture, Food and Markets (AAFM)	Best Management Practice (BMP) Program Capital Equipment Assistance Program (CEAP) Clean Water Fund Grants and Contracts Clean Water Fund Operational Funds Conservation Reserve Enhancement Program (CREP) Farm Agronomic Practice (FAP) Program Water Quality (WQ) Grants Vermont Phosphorus Innovation Challenge (VPIC)
Agency of Commerce and Community Development (ACCD)	Vermont Center for Geographic Information (VCGI) Better Connections Planning Grant Downtown Transportation Fund
Agency of Natural Resources (ANR)	Clean Water State Revolving Fund (CWSRF) Loans Clean Water Initiative Program Grants and Contracts Fish and Wildlife Department Watershed Grants Municipal Pollution Control Grants Municipal Roads Grants-in-Aid
Agency of Transportation (VTrans)	Better Roads Program Municipal Highway Stormwater Mitigation Program Transportation Alternatives Program (TAP)
Vermont Housing and Conservation Board (VHCB)	Conservation Grants Farmland Protection Grants Water Quality Grants

² State investments are defined as dollars obligated or awarded to clean water projects through grants and contracts, or financed through loans, administered by the State of Vermont. Investments reported include state and federal dollars awarded to projects by state agencies, but exclude federal funds awarded to projects directly by federal agencies.

Investments by State Fiscal Year and Agency

Figure 4. Total dollars awarded to clean water projects through State of Vermont agencies, SFY 2016-2019 by agency (refer to Table 1 for agency abbreviations)³



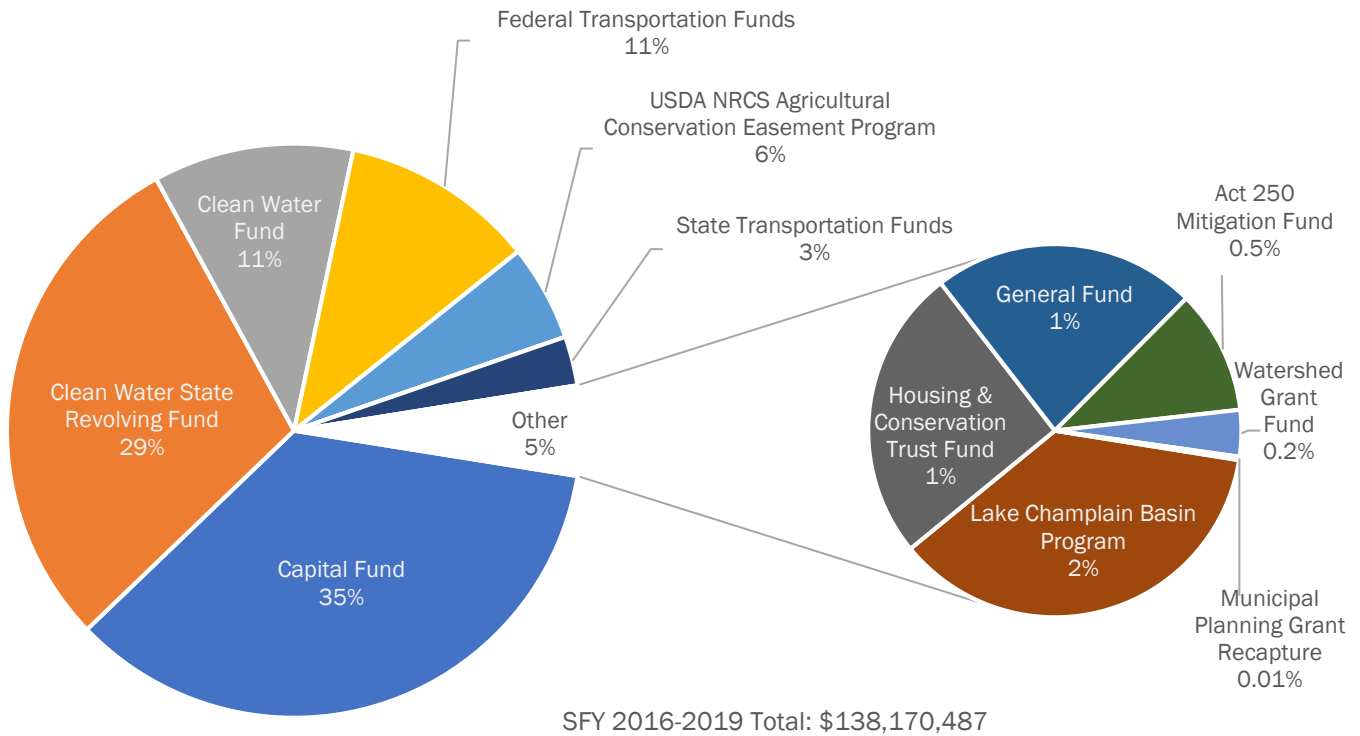
EXPLANATION OF FIGURE

State agencies coordinate to track clean water investments in projects and the results of those investments. Total dollars awarded to clean water projects through State of Vermont agencies show an increasing trend since SFY 2016. However, total dollars awarded decreased slightly by approximately \$4 million from SFY 2018 to SFY 2019. This does not represent a decrease in funds available for clean water projects in SFY 2019 – in fact, clean water dollars appropriated by the State of Vermont increased by approximately \$7 million from SFY 2018 to SFY 2019 and AAFM and VTrans reported increased dollars awarded. What appears to be a decrease in SFY 2019 is due to variability in dollars awarded through ANR’s Clean Water State Revolving Fund Municipal Pollution Control Grants. Large infrastructure projects funded through this program often span multiple years, are contingent on project construction schedules, and dollars are awarded upon project construction.

³ Dollars are assigned to SFY reporting periods based on the date funds are awarded at the project-level (e.g., date grant agreement executed). Dollars reported as awarded by SFY in this report are not the same as dollars appropriated by SFY.

Investments by Funding Source

Figure 5. Percentage of dollars awarded to clean water projects through State of Vermont agencies, SFY 2016-2019 by funding or financing source⁴



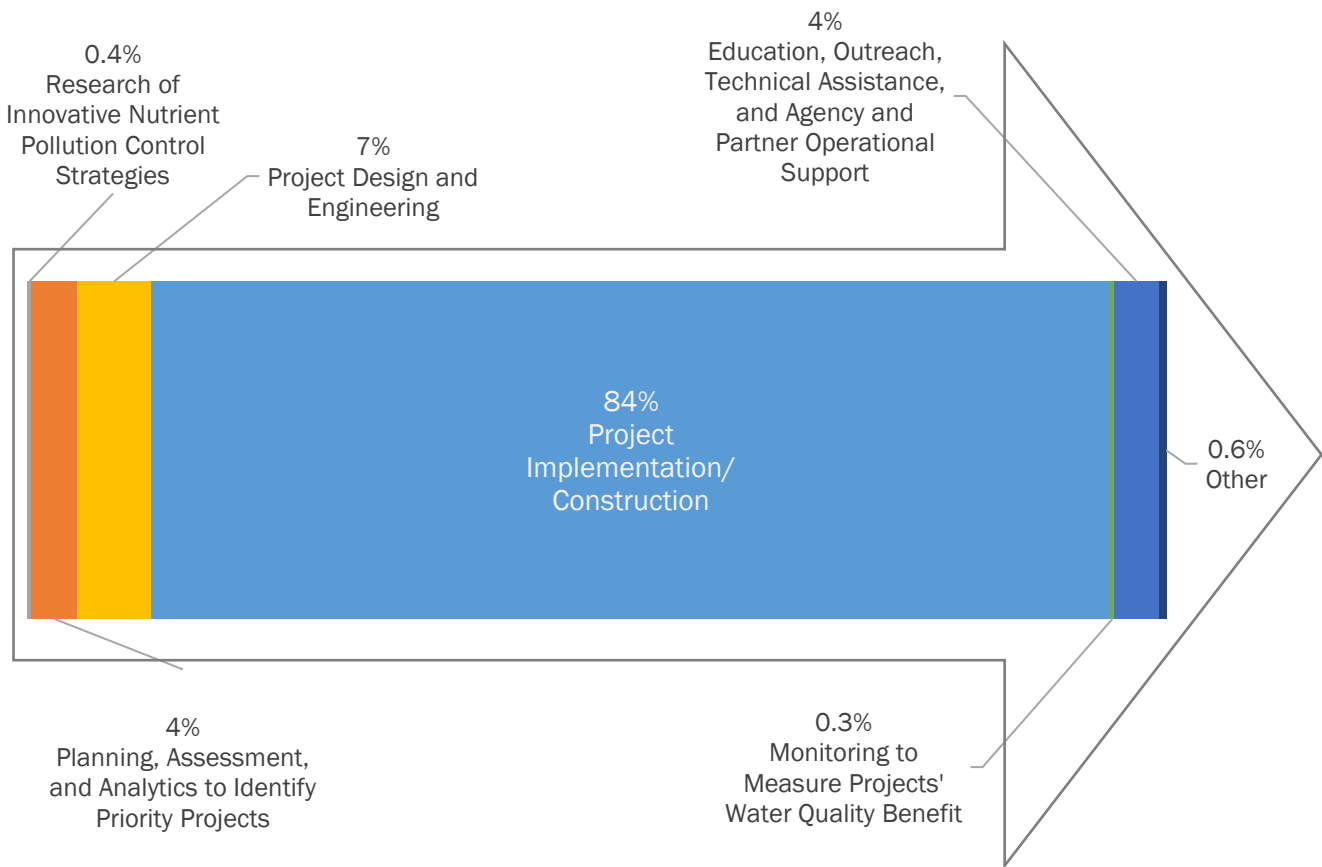
EXPLANATION OF FIGURE

State agencies' clean water investments are supported by a variety of funding sources. This figure shows the percent of total dollars awarded by state agencies to projects by funding source from SFY 2016 to 2019. The variety of funding sources are necessary to support all aspects of clean water projects, from outreach and project development to construction.

⁴ Investments reported include state and federal dollars awarded to projects by state agencies, but exclude federal funds awarded to projects directly by federal agencies. Federal funding sources included in this report: Clean Water State Revolving Fund, Federal Transportation Funds, USDA NRCS Agricultural Conservation Easement Program, and Lake Champlain Basin Program.

Investments by Project Step

Figure 6. Clean water project development process and percentage of dollars awarded to clean water projects through State of Vermont agencies, SFY 2016-2019 by project step

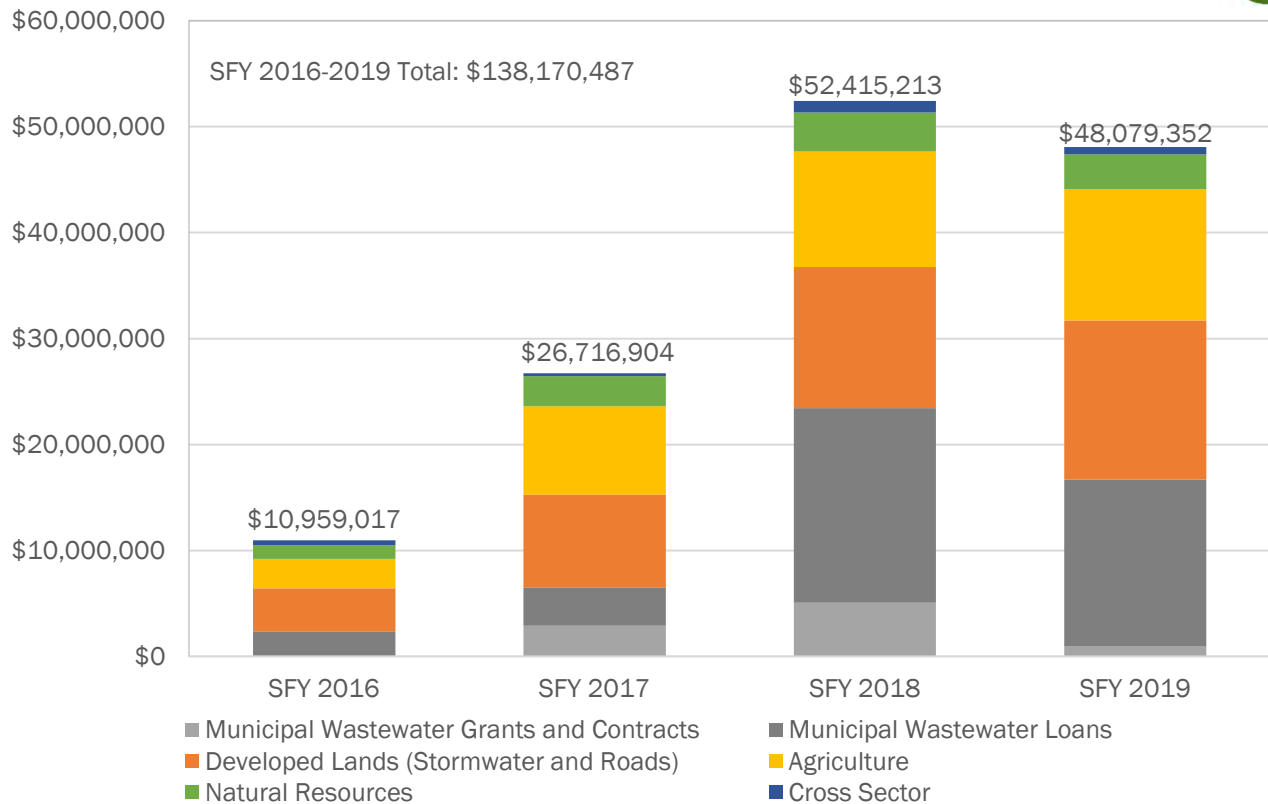


EXPLANATION OF FIGURE

Making wise investments in cost-effective clean water projects requires education and outreach and thorough project planning. Investing in the project development process is key to ensure the state invests in projects that will yield the greatest water quality improvement per dollar and terminates investment in lower-value or non-viable projects early in development. While the state invests in all project steps, most clean water investments are used to construct or implement clean water projects that reduce nutrient and sediment pollution. Monitoring dollars, reported here, represent monitoring activities conducted by State of Vermont grantees and contractors to measure projects' water quality benefit only and are not all-encompassing of the State of Vermont's investments in monitoring activities.

Investments by State Fiscal Year and Land Use Sector

Figure 7. Total dollars awarded to clean water projects through State of Vermont agencies, SFY 2016-2019 by land use sector⁵



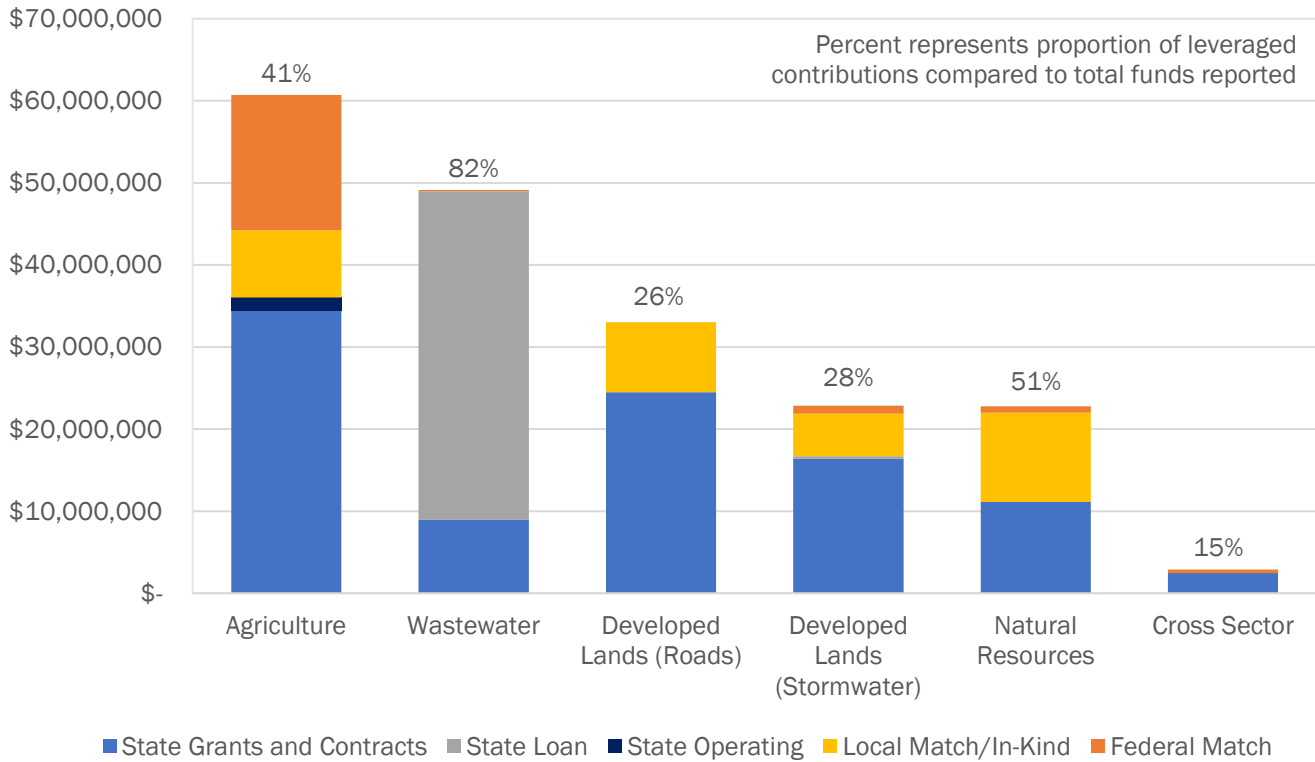
EXPLANATION OF FIGURE

Reaching Vermont’s clean water goals requires an “all-in” approach and investments across all land use sectors, shown in the figure above. While funding awarded in the developed lands and agricultural sector increased from SFY 2018 to 2019, there was a slight decrease in the amount awarded to municipal wastewater grants and loans. What appears to be a decrease is due to variability in dollars awarded through ANR’s Clean Water State Revolving Fund Municipal Pollution Control Grants. Large infrastructure projects funded through this program often span multiple years, are contingent on project construction schedules, and dollars are awarded upon project construction. Additionally, the figure shows a slight decrease in funds awarded to the natural resources sector. The State of Vermont continues to incentivize these non-regulatory projects, however, demand for funding of these projects may vary year-to-year depending on landowner willingness to participate. This highlights the need to continue building our partner capacity and outreach to increase participation.

⁵ The “Cross Sector” category contains projects that span multiple sectors.

Leveraged Contributions by Land Use Sector

Figure 8. Leveraged contributions (i.e., local match/in-kind, federal match, and loans) reported through State of Vermont agencies in addition to grants and contracts, SFY 2016-2019 by land use sector⁶



EXPLANATION OF FIGURE

State-funded clean water projects leverage local and federal contributions to help cover project costs and to further clean water efforts in Vermont. Overall, leveraged contributions, including local match/in-kind, federal match, and loans represent 48 percent of total funds reported SFY 2016 through 2019. Majority of wastewater funds reported are in the form of low-interest loans made to municipalities through the Clean Water State Revolving Fund that will ultimately be paid back. Leveraged contributions reported here include local match/in-kind and federal match reported through State of Vermont grants and contracts only. Direct investments in projects by federal agencies or other organizations are beyond the scope of this report.

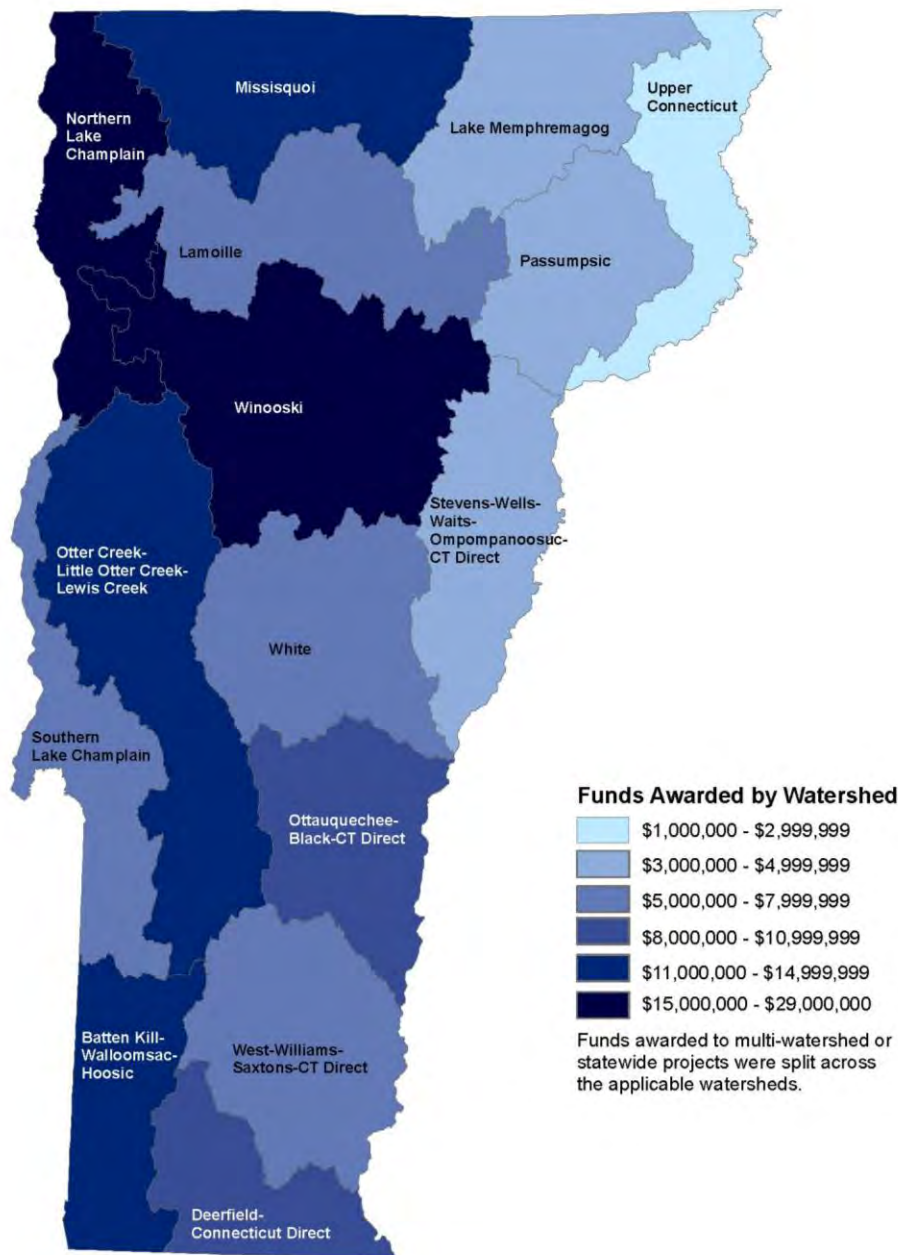
State-funded clean water projects have leveraged substantial investments since SFY 2016:

Total State Grants and Contracts:	\$97,813,406	(51 percent of total)
Total State Loans:	\$40,357,081	(21 percent of total)
Total State Operating (Personnel):	\$1,650,000	(1 percent of total)
Total Local Match/In-Kind:	\$32,815,489	(17 percent of total)
Total Federal Match:	\$18,815,535	(10 percent of total)

⁶ The "Cross Sector" category contains projects that span multiple sectors. State operating represents AAFM personnel funded through the Clean Water Fund.

Investments by Watershed Region

Figure 9. Map of total dollars awarded to clean water projects through State of Vermont agencies, SFY 2016-2019 by Tactical Basin Plan watershed



EXPLANATION OF FIGURE

Each of Vermont's 15 Tactical Basin Plan watersheds benefit from state investments in clean water projects. The Northern Lake Champlain and Winooski River watersheds experienced the largest investments since SFY 2016 at approximately \$28 million and \$18 million respectively. Significant investments in these basins are largely driven by municipal wastewater treatment and CSO abatement requirements, as well as municipal stormwater treatment requirements for Vermont's most populous municipalities. The Batten Kill-Walloomsac-Hoosic watershed (drains to Hudson River) experienced an increase in funding in SFY 2019 due to large wastewater investments. See Appendix A for detail on funding and results by watershed.

Vermont's Clean Water Education








How is the State of Vermont educating stakeholders to improve clean water?

Reducing nutrient and sediment pollution sources fundamentally means changing or adjusting our land uses and employing sound land use management practices. Thus, education and outreach to Vermont's landowners, stakeholders, business owners and other members of the public is critical to achieve our water quality goals. The State of Vermont is delivering clean water education through outreach (i.e., workshops, trainings, and public/stakeholder meetings) and technical assistance (i.e., targeted, one-on-one interactions). Clean water education aims to:

- Increase public awareness and engagement in establishing and implementing clean water priorities;
- Increase landowner acceptance of new and changing policies and willingness to adopt best management practices;
- Support stakeholders in preparing to meet new regulatory requirements in the most cost-effective manner;
- Support stakeholders in planning and securing resources to implement clean water projects; and
- Increase adoption and effectiveness of best management practices to improve water quality.

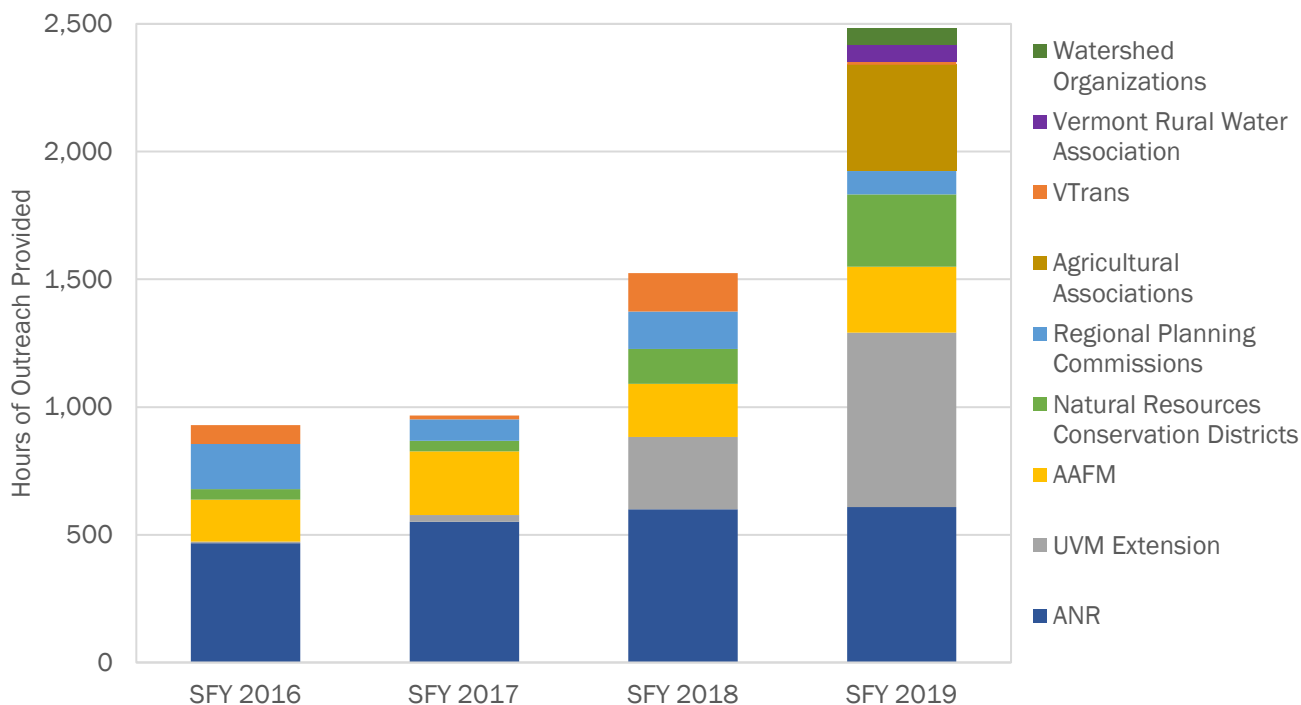
Educational efforts support all land use sectors in planning and securing resources to implement clean water projects. Table 2 summarizes the primary or target audience per sector. Clean water education measures, summarized in this report, show the extent of outreach and technical assistance conducted by state agencies and partners with state financial support.

Table 2. Summary of primary or target audiences per land use sector (listed in alphabetical order)

Land Use Sector	Primary or Target Audiences
 AGRICULTURE	Businesses, farmers, natural resources conservation districts, nongovernmental organizations (e.g., watershed groups), public
 DEVELOPED LANDS	Businesses, municipalities, natural resources conservation districts, nongovernmental organizations (e.g., watershed groups), public, regional planning commissions, residential landowners
 ROADS	Municipalities, other governmental organizations, public, regional planning commissions, residential landowners
 WASTEWATER	Businesses, municipalities, public, residential landowners
 NATURAL RESOURCES	Loggers and foresters, nongovernmental organizations (e.g., watershed groups), natural resources conservation districts, other governmental organizations, public, regional planning commissions, residential landowners

Outreach by Agency

Figure 10. Total hours of education provided to participants of State of Vermont clean water outreach events (i.e., workshops, trainings, and public/stakeholder meetings), SFY 2016-2019 by outreaching organization/organization category



EXPLANATION OF FIGURE

State clean water outreach efforts increased each year from SFY 2016 (when outreach data collection began) to SFY 2019. In total, 1,718 outreach events have been reported, reaching 47,468 attendees, with 4,827 hours of education provided. New in SFY 2019, AAFM is funding agricultural assistance programs and the results of this expanded effort are shown here. For presentation purpose, Figure 10 excludes outreaching organizations/organization categories with less than 50 hours of education provided in SFY 2019, if not reported previously.

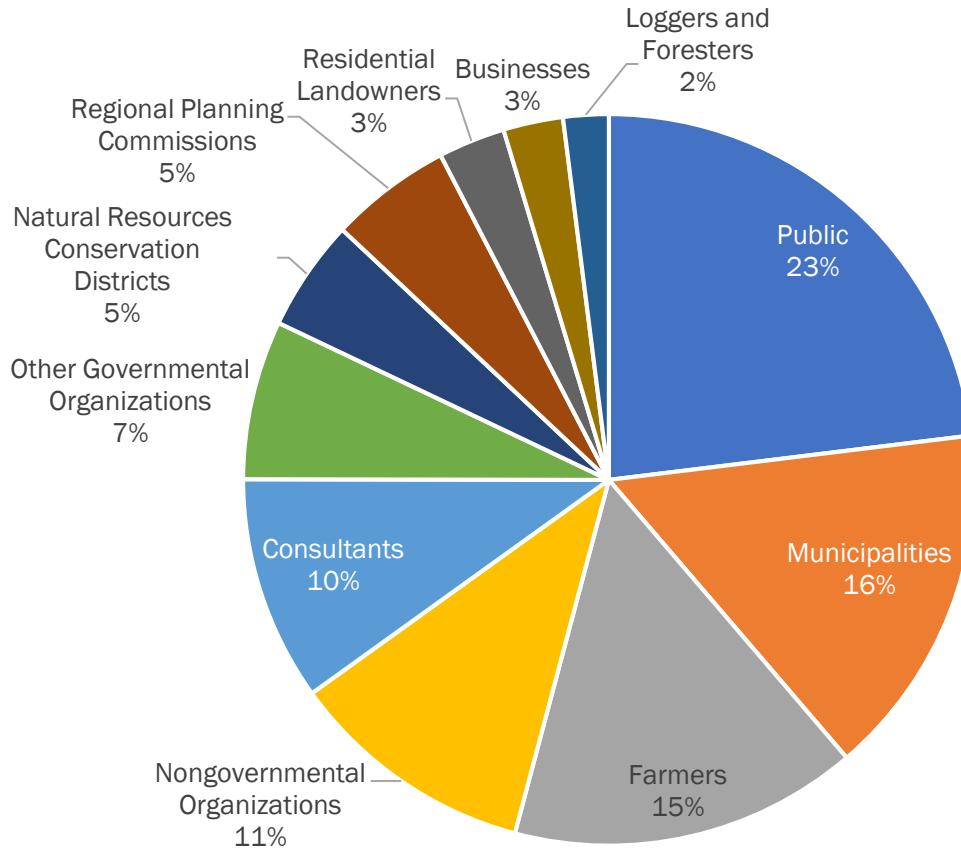


Figure 11. Left: April Stools' Day volunteers learned environmental impacts of pet waste and participated in a Williston clean-up event coordinated by the Lake Champlain Committee (Source: Lake Champlain Committee); Right: ANR staff teach students at the Lake Champlain Waldorf School about the importance of wetlands



Outreach by Target Audience

Figure 12. Target audiences reached through State of Vermont clean water outreach efforts (i.e., workshops, trainings, and public/stakeholder meetings), SFY 2016-2019



EXPLANATION OF FIGURE

This figure demonstrates how the state's outreach efforts target different sector and organization-based audiences. One of the state's water quality priorities is to support municipalities and farmers in addressing stormwater, wastewater, and agricultural sources of nutrient pollution, which is why outreach to these audiences is so important. In addition, nongovernmental organizations, such as watershed groups, regional planning commissions, and natural resources conservation districts, play a very important role working with municipalities, farmers, and other landowners to secure funds to implement priority clean water projects. It is also important to keep the public engaged for broader support of the state's clean water efforts.

Technical Assistance Targeting Agricultural Audiences

The State of Vermont aims to support farmers in addressing agricultural sources of nutrient pollution. AAFM conducts regulatory farm visits to ensure compliance with Required Agricultural Practices (RAPs) and Medium Farm Operation (MFO) and Large Farm Operation (LFO) Rules, as well as non-regulatory farm visits to support the implementation of conservation practices on farms. AAFM also provides financial assistance to enhance local partner capacity (e.g., natural resources conservation districts) to help farmers install and maintain conservation practices.




Land Use Sector	Primary or Target Audiences
	Businesses, farmers, natural resources conservation districts, nongovernmental organizations (e.g., watershed groups), public

Table 3. State of Vermont regulatory oversight, technical assistance, and capacity building to support clean water improvements on agricultural lands, SFY 2016-2019

Technical Assistance Measures	2016	2017	2018	2019	Total
Number of water quality compliance farm visits conducted by AAFM to ensure compliance with RAPs and MFO and LFO Rules	186	352	675	614	1,827
Number of technical assistance visits conducted by AAFM to support implementation of conservation practices	594	348	592	550	2,084
Acres of production area inspected by AAFM for RAP compliance	--	1,200	670	1,445	3,315
Number of farmers directly assisted by partner organizations	--	--	--	145	145
Number of new or expanded partner-provided agricultural services	--	--	21	32	53



Figure 13. University of Vermont Extension staff educating farmers on water quality best practices through the Northwest Crops and Soils Program (Source: University of Vermont Extension)

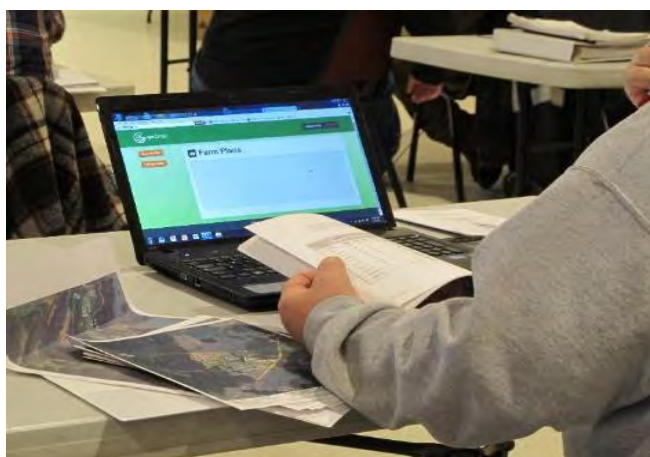


Figure 14. Farmers create their own nutrient management plans with the assistance of the University of Vermont Extension and the Vermont Association of Conservation Districts Northwest Crops and Soils Program (Source: University of Vermont Extension)



Figure 15. Farmers and custom operators in the Otter Creek watershed learn about grassland manure injection technology at an event hosted by the University of Vermont Extension (Source: AAFM)



Figure 16. Farmers in the Northeast Kingdom learn about methods to improve grazing management, wastewater collection, and irrigation systems at an event hosted by the Orleans County Natural Resources Conservation District (Source: AAFM)



Figure 17. AAFM staff training agricultural service providers about water quality regulations for farms and Required Agricultural Practices compliance and inspections (Source: AAFM)



Figure 18. AAFM staff evaluating required field buffer widths adjacent to annual crop fields. (Source: AAFM)

Technical Assistance Targeting Developed Lands and Wastewater Audiences

The State of Vermont aims to support municipalities, businesses, and other landowners in addressing stormwater and wastewater sources of nutrient pollution. Much of this work is driven by wastewater discharge permits, stormwater permits, and the Municipal Roads General Permit. The state’s educational programs help municipalities prepare to meet new regulatory requirements in the most cost-effective manner and secure resources to increase adoption and implementation of clean water projects.






Land Use Sector	Primary or Target Audiences
 DEVELOPED LANDS	Businesses, municipalities, natural resources conservation districts, nongovernmental organizations (e.g., watershed groups), public, regional planning commissions, residential landowners
 ROADS	Municipalities, other governmental organizations, public, regional planning commissions, residential landowners
 WASTEWATER	Businesses, municipalities, public, residential landowners

Table 4. State of Vermont technical assistance targeting stormwater, roads, and wastewater treatment improvements, SFY 2016-2019

Technical Assistance Measures	2016	2017	2018	2019	Total
Approximate hours of technical assistance provided by DEC’s Water Investment Division engineers on municipal stormwater and wastewater projects	–	5,300	6,400	5,200	16,900
Hours of water quality municipal technical assistance provided by VTrans staff	–	1,483	1,489	2,063	5,035



Figure 19. Pre-construction site visit under the Municipal Roads Grants-in-Aid program to identify and select priority project locations and best management practices (Source: Addison County RPC)



Figure 20. VTrans and ANR staff educate partners on municipal river and road related issues

Technical Assistance Targeting Natural Resources Restoration Audiences



Natural resources restoration efforts are voluntary and not driven by regulation. Successful natural resource restoration and protection projects require landowner commitment. Education targeting the public and landowners increases likelihood of natural resource restoration projects moving forward. Nongovernmental organizations (e.g., watershed groups) and natural resources conservation districts conduct outreach to landowners and help secure funds to complete projects. Educational activities help: (a) identify and prioritize opportunities for natural resource restoration, (b) gain landowner commitment to projects, and (c) inform the public on the value and co-benefits of natural resource restoration to increase adoption of projects.


Land Use Sector	Primary or Target Audiences
 NATURAL RESOURCES	Loggers and foresters, nongovernmental organizations (e.g., watershed groups), natural resources conservation districts, other governmental organizations, public, regional planning commissions, residential landowners

Table 5. State of Vermont technical assistance to support natural resource restoration, SFY 2016-2019

Technical Assistance Measures	2016	2017	2018	2019	Total
Number of logging operation site visits to provide Acceptable Management Practices (AMP) technical assistance ⁷	11	12	17	--	40
Square miles of forest lands covered by Use Value Appraisal (UVA) site inspections ⁷	296	330	305	--	931
Number of communities receiving Urban and Community Forestry Program technical assistance	94	78	78	102	352

Figure 21. Left: Portable skidder bridge workshop; Right: Portable skidder bridge in Addison used at logging operation to avoid erosion at stream crossings (Source: Department of Forests, Parks and Recreation)



⁷ Data are reported by calendar year rather than state fiscal year. Given the timeline of this report, calendar year 2019 data are not yet available. Data for calendar year 2019 will be available next year. FPR annual statewide summary reports are available at: <https://fpr.vermont.gov/forest/managing-your-woodlands/acceptable-management-practices>.

Results of Vermont's Clean Water Investments



What difference are the State of Vermont's investments making to improve clean water?

Results of state-funded clean water projects completed SFY 2016-2019, including both project output measures and estimated phosphorus reductions, are summarized in the following sections by land use sector. At this time, phosphorus reductions can only be quantified for projects in Lake Champlain and Lake Memphremagog basins. See Appendix F for summary of methods used to estimate pollutant reductions. Clean water investments and results are also summarized by watershed region in Appendix A.



Agriculture

Installation or application of conservation practices that reduce sources of nutrient and sediment pollution from farm production areas and agricultural fields.



Developed Lands (Stormwater)

Installation of stormwater practices that treat polluted stormwater runoff from developed lands, such as parking lots, sidewalks, and rooftops.



Developed Lands (Roads)

Installation of stormwater treatment and roadside erosion control practices that prevent erosion and treat road-related sources of nutrient and sediment pollution.



Wastewater

Improvements to municipal wastewater infrastructure that decrease nutrient (e.g., phosphorus and nitrogen) and other pollutants from municipal wastewater systems through treatment upgrades, optimization, combined sewer overflow (CSO) abatement, and refurbishment of aging infrastructure.



Natural Resource Restoration

Restoration of "natural infrastructure" functions that prevent and abate nutrient and sediment pollution. Natural infrastructure includes floodplains, river channels, lakeshores, wetlands, and forest lands.



Results of Agricultural Pollution Prevention Projects

Agricultural pollution prevention projects involve the installation or application of conservation practices that reduce sources of nutrient and sediment pollution from farm production areas and agricultural fields.

Agricultural pollution prevention projects contribute to and count toward progress for a combination of the following requirements and co-benefits:

- Implementation of TMDL requirements
- Implementation of Vermont Clean Water Act (Act 64 of 2015) requirements
- Compliance with Required Agricultural Practices (RAPs), as well as Medium Farm Operation (MFO) and Large Farm Operation (LFO) Rules
- Improved flood resiliency and flood hazard mitigation by supporting healthy soils
- Supports agricultural working lands
- Improved habitat function

The following sections summarize the results of state-funded agricultural pollution prevention projects based on quantified project outputs (e.g., acres of agricultural lands treated) and estimated pollutant reductions (e.g., kilograms of total phosphorus load reduced annually).



Agricultural Project Outputs

Table 6. Outputs of state-funded agricultural pollution prevention projects implemented, SFY 2016-2019

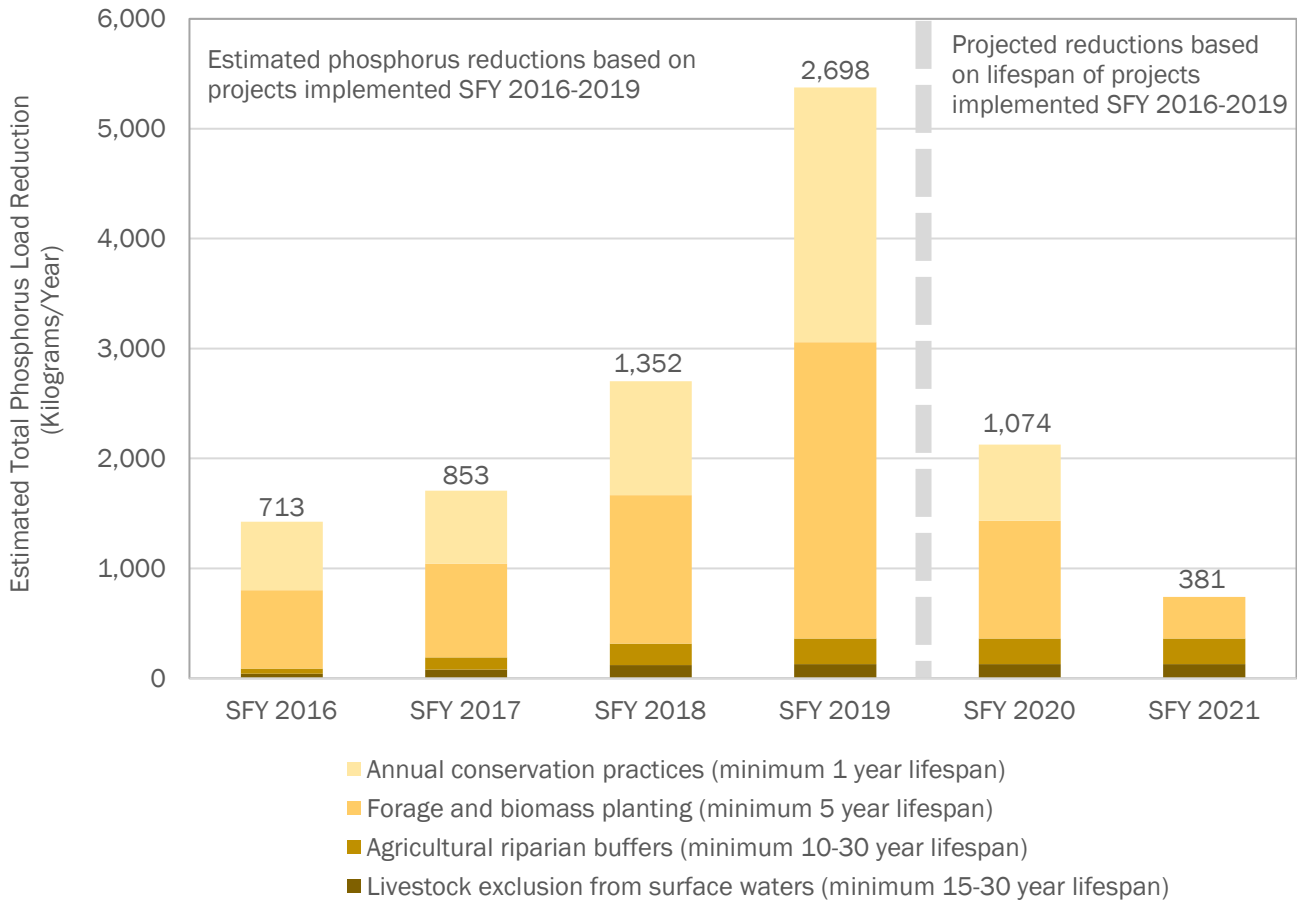
Project Output Measures	2016	2017	2018	2019	Total
Acres of agricultural land treated by conservation practices	5,466	3,261	7,908	10,678	27,313
Acres of agricultural land treated by forest and grass buffers	258	200	228	--	686
Acres of pasture with livestock excluded from surface waters	258	117	97	--	472
Number of barnyard and production area practices installed	57	90	85	52	284
Acres of water quality protections within newly conserved agricultural lands	--	116	200	482	798
Estimated acres of agricultural land treated through innovative equipment	--	2,043	6,594	7,765	16,402

EXPLANATION OF TABLE

Acres of agricultural land treated by conservation practices continue to increase significantly each year since SFY 2016. Approximately 28,000 acres of agricultural lands have been treated by state-funded projects since SFY 2016. The SFY 2019 gap in buffer and livestock exclusion outputs is attributed to a gap in project implementation under the U.S. Department of Agriculture Conservation Reserve Enhancement Program (CREP) in SFY 2019 due to land eligibility issues. The CREP will be available for Vermont agricultural lands in SFY 2020.

Agricultural Project Pollutant Reductions

Figure 22. Annual estimated total phosphorus load reduction (kilograms per year) achieved by state-funded agricultural pollution prevention projects implemented SFY 2016-2019 (projected reductions are based on lifespan of projects completed SFY 2016-2019)



EXPLANATION OF FIGURE

Phosphorus pollutant reductions achieved by agricultural projects nearly doubled from SFY 2018 to SFY 2019. Projected pollutant reductions, shown to the right of the dashed line, are based on anticipated lifespan (noted in legend) of projects completed SFY 2016-2019. Practices with a lifespan of greater than one year must be maintained for pollutant reductions to continue in future years. See Appendix F for summary of methods used to estimate pollutant reductions. Phosphorus reductions can only be estimated for practices installed in the Lake Champlain and Lake Memphremagog basins at this time. This figure represents state-funded projects only. See Part 2 of this report for phosphorus reductions associated with regulatory programs and USDA-NRCS funded agricultural projects implemented in the Lake Champlain basin.

Table 7. Extent of agricultural pollutant prevention project outputs with estimated phosphorus pollutant reductions, completed SFY 2016-2019 statewide⁸

Project Output Measures	Outputs with Phosphorus Estimates	Total Project Outputs	Percent Outputs with Phosphorus Estimates
Acres of agricultural land treated by conservation practices	17,953	27,313	66%
Acres of agricultural land treated by forest and grass buffers	516	686	75%
Acres of pasture with livestock excluded from surface waters	352	472	75%
Number of barnyard and production area practices installed	Quantified based on production area compliance status assessed through AAFM inspections; see report Part 2 for load reductions in the Lake Champlain basin		
Acres of water quality protections within newly conserved agricultural lands	0	798	0%
Estimated acres of agricultural land treated through equipment	Implementation of practices supported by equipment is tracked by AAFM; see report Part 2 for load reductions in the Lake Champlain basin		

⁸ Phosphorus reductions can currently only be quantified in the Lake Champlain and Lake Memphremagog basins and may be further limited by lack of data and/or methods to quantify phosphorus reductions. For example, phosphorus reductions cannot be quantified for output “acres of water quality protections within newly conserved agricultural lands” because a method is not yet in place for this work. The Clean Water Service Delivery Act (Act 76 of 2019) requires addressing gaps and publishing methods to estimate phosphorus reductions for clean water projects implemented in the Lake Champlain and Lake Memphremagog basins by November 1, 2021. Act 76 of 2019 also requires setting a schedule to publish methods for quantifying other (i.e., non-phosphorus) water quality impairments by November 1, 2023. See Appendix F for more information.

Agricultural Pollution Prevention Project Examples

Figure 23. Workers installing the last panels of a new slurrystore manure storage project in the Lamoille watershed funded by the AAFM Best Management Practice Program (Source: AAFM)



Figure 24. Construction of a milk house and creamery wastewater collection system on a small diversified farm in the Winooski River watershed funded by the AAFM Best Management Practice Program (Source: AAFM)



Figure 25. Before (left) and after (right) installation of a perennial vegetated filter strip in the Lake Memphremagog watershed to filter field runoff from the adjacent agricultural field, funded by the AAFM Best Management Practice Program; technical support for installation of the practice provided by the Vermont Association of Conservation Districts funded by AAFM Clean Water Fund Grants and Contracts (Source: AAFM)



Results of Developed Lands (Stormwater, Roads) Projects



Developed lands projects decrease nutrient (e.g., phosphorus and nitrogen) and sediment pollution through: (a) installation of structures that treat polluted stormwater runoff from developed lands, such as roads, parking lots, sidewalks, and rooftops, as well as (b) installation of road erosion remediation practices that prevent road/roadside erosion.



Developed lands projects (stormwater and roads) contribute to and count toward progress for a combination of the following requirements and co-benefits:

- Implementation of TMDL requirements
- Implementation of Vermont Clean Water Act (Act 64 of 2015) requirements
- Compliance with municipal stormwater permits
- Compliance with the Municipal Roads General Permit
- Improved flood resiliency and flood hazard mitigation for public health and safety

The following sections summarize the results of state-funded developed lands projects based on quantified project outputs (e.g., acres of impervious surface treated) and estimated pollutant reductions (e.g., kilograms of total phosphorus load reduced annually).

Developed Lands Outputs

Table 8. Outputs of state-funded stormwater treatment and road erosion remediation project development (i.e., planning and design) work completed, SFY 2016-2019



Project Development Measures	2016	2017	2018	2019	Total
Number of projects identified through Stormwater Master Plans	52	120	141	104	417
Number of illicit/unauthorized discharges confirmed (to be addressed by the responsible municipality or landowner)	40	9	1	29	79
Number of preliminary (30%) designs completed	19	13	57	26	115
Number of final (100%) designs completed	9	19	13	7	48
Hydrologically connected municipal road miles inventoried	--	208	463	589	1,260
Hydrologically connected municipal road miles identified that require water quality improvements	--	95	223	207	525

Table 9. Outputs of state-funded stormwater treatment and road erosion remediation projects implemented/constructed, SFY 2016-2019

Project Output Measures	2016	2017	2018	2019	Total
Acres of existing impervious surface treated by stormwater treatment practices	0.2	87	28	107	222
Miles of municipal road drainage and erosion control improvements	1	12	68	88	169
Number of municipal road drainage and stream culverts replaced	-	106	137	254	497
Cubic yards of Class IV road gully erosion remediated	-	-	260	33	293
Cubic yards of catch basin outlet erosion remediated	-	-	1	784	785
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	19	98	117

EXPLANATION OF TABLES

In SFY 2018 there was an increase in the number of stormwater designs completed, which led to a significant increase in stormwater projects implemented in SFY 2019.

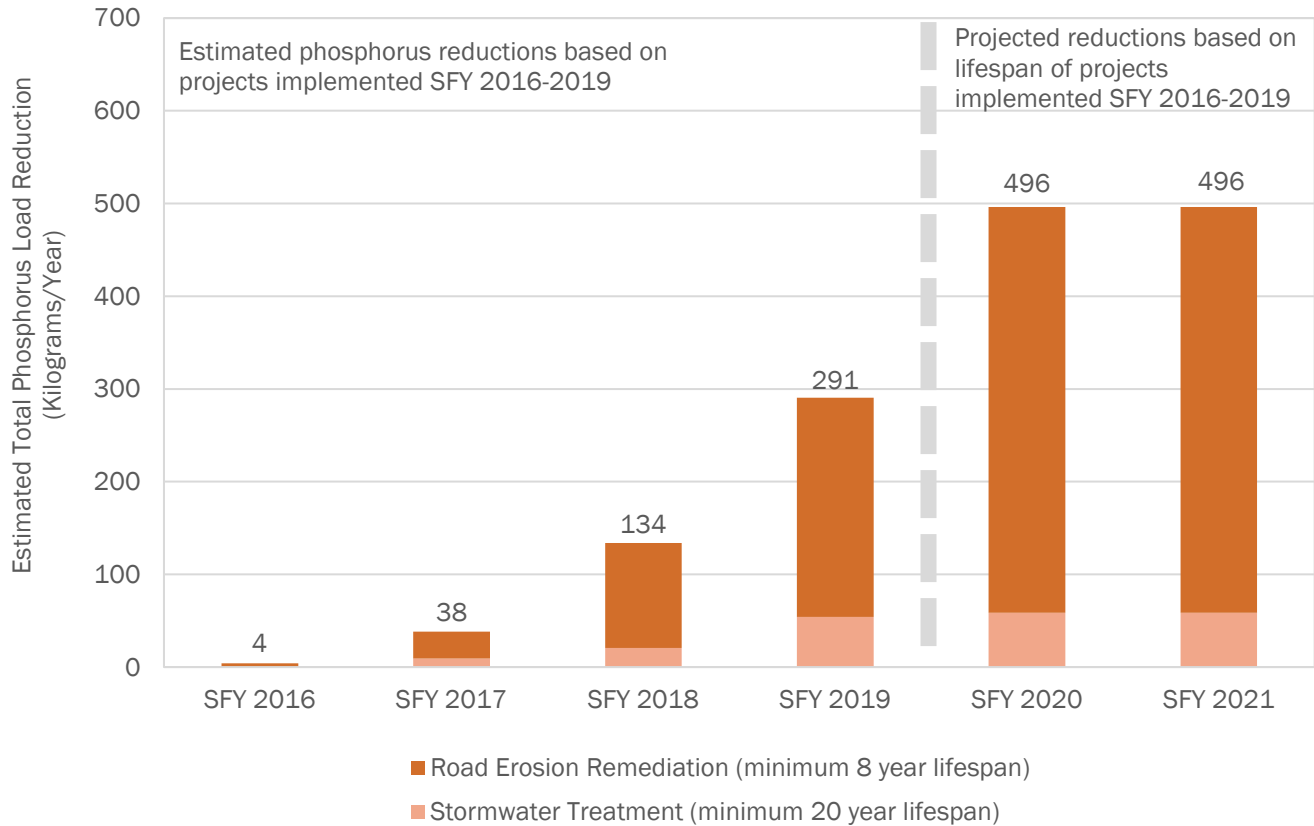
Municipalities are required to complete Road Erosion Inventories by the end of 2020 under the Municipal Roads General Permit for road segments adjacent to and intersecting surface waters (i.e., hydrologically connected). Based on early submittal of state-funded Road Erosion Inventory data through the Municipal Roads General Permit Portal, approximately 20 percent of municipal hydrologically connected road miles have been inventoried. Inventories identify and prioritize road erosion remediation projects for construction.

The Municipal Roads Grants-in-Aid Program was available for the second year in SFY 2019 with 193 municipalities completing road projects. This resulted in 51 miles of road being brought into full compliance with the Municipal Roads General Permit in addition to 44 miles improved in the previous year.

Developed Lands Pollutant Reductions



Figure 26. Annual estimated total phosphorus load reduction (kilograms per year) achieved by state-funded stormwater treatment and road erosion remediation projects implemented/constructed SFY 2016-2019 (projected reductions are based on lifespan of projects completed SFY 2016-2019)



EXPLANATION OF FIGURE

New phosphorus pollutant reductions achieved by road erosion remediation projects more than doubled in SFY 2019 compared to SFY 2018. Phosphorus pollutant reductions achieved by stormwater treatment practices increased by about 163 percent from SFY 2018 to SFY 2019. Projected pollutant reductions, shown to the right of the dashed line, are based on anticipated lifespan (noted in legend) of projects completed SFY 2016-2019. Practices must be maintained for pollutant reductions to continue in future years. See Appendix F for summary of methods used to estimate pollutant reductions.

Table 10. Extent of developed lands (stormwater treatment and road erosion remediation) project outputs with estimated phosphorus pollutant reductions, completed SFY 2016-2019 statewide⁹

Project Output Measures	Outputs with Phosphorus Estimates	Total Project Outputs	Percent Outputs with Phosphorus Estimates
Acres of existing impervious surface treated by stormwater treatment practices	172	222	77%
Miles of municipal road drainage and erosion control improvements	81	169	48%
Number of municipal road drainage and stream culverts replaced	0	497	0%
Cubic yards of Class IV road gully erosion remediated	112	293	38%
Cubic yards of catch basin outlet erosion remediated	692	785	88%
Acres stabilized through use of hydroseeder/mulcher equipment per year	0	117	0%

⁹ Phosphorus reductions can currently only be quantified in the Lake Champlain and Lake Memphremagog basins and may be further limited by lack of data and/or methods to quantify phosphorus reductions. The Clean Water Service Delivery Act (Act 76 of 2019) requires addressing gaps and publishing methods to estimate phosphorus reductions for clean water projects implemented in the Lake Champlain and Lake Memphremagog basins by November 1, 2021. Act 76 of 2019 also requires setting a schedule to publish methods for quantifying other (i.e., non-phosphorus) water quality impairments by November 1, 2023.

Developed Lands and Road Project Examples

Figure 27. Stormwater treatment practice installed at Warren Elementary School; a practice recommended by a stormwater master plan funded through a DEC Clean Water Initiative Program grant



Figure 28. A newly purchased hydroseeder to stabilize a road-side drainage ditch in Glover, funded through the Municipal Roads Grants-in-Aid Program



Figure 29. Before (left) and after (right) installation of stone-lined drainage ditches, removal of high road shoulders and replacement of drainage culverts along Dorset Hill Road by the Town of Dorset in partnership with Bennington County Regional Commission funded through the Municipal Roads Grants-in-Aid Program



Figure 30. Before (left) and after (right) upgrade and expansion of an existing stormwater treatment pond located at the Commerce Square Shopping Center in South Burlington completed by the City of South Burlington funded through a DEC Clean Water Initiative Program grant





Results of Wastewater Treatment Projects

Wastewater treatment projects decrease nutrient (e.g., phosphorus and nitrogen) and other pollutants from municipal wastewater systems through treatment upgrades, combined sewer overflow (CSO) abatement, and refurbishment of aging infrastructure.

Wastewater treatment projects contribute to and count toward progress for a combination of the following requirements and co-benefits:

- Implementation of TMDL requirements
- Implementation of Vermont Clean Water Act (Act 64 of 2015) requirements
- Compliance with municipal wastewater discharge permits
- Compliance with the 2016 Combined Sewer Overflow (CSO) Rule
- Protects public health and safety
- Improved flood resiliency and flood hazard mitigation

The following sections summarize the results of state-funded wastewater treatment projects based on quantified project outputs (e.g., number of upgrades completed). Wastewater treatment facilities measure changes in pollutants of concern as part of wastewater discharge permit requirements. Phosphorus treatment by Vermont wastewater treatment facilities that drain to Lake Champlain are summarized in Part 2 of this report on Lake Champlain TMDL progress.

Wastewater Treatment Project Outputs

Table 11. Outputs of state-funded/financed wastewater treatment project development (i.e., planning and design) work completed, SFY 2016-2019



Project Development Measures	2016	2017	2018	2019	Total
Number of preliminary (30%) designs completed	--	5	4	4	13
Number of final (100%) designs completed	4	3	8	1	16
Number of municipal wastewater asset management plans completed	--	3	3	4	10

Table 12. Outputs of state-funded/financed wastewater treatment projects constructed, SFY 2016-2019

Project Output Measures	2016	2017	2018	2019	Total
Number of combined sewer overflow abatements completed	4	1	--	--	5
Number of sewer extensions completed	--	2	--	--	2
Number of wastewater collection systems refurbished	--	2	2	2	6
Number of wastewater treatment facilities refurbished	--	--	1	3	4
Number of wastewater treatment facility upgrades completed	1	--	--	--	1

EXPLANATION OF TABLES

State grants and low interest loans capitalized through the Vermont and U.S. Environmental Protection Agency (EPA) Clean Water State Revolving Fund (CWSRF) finance municipal wastewater improvements. The results in the tables describe the number and type of municipal wastewater improvement projects completed and closed each fiscal year. Often these projects are very large and take a long time to complete so results can vary widely year to year.



Wastewater Treatment Project Pollutant Reductions

Wastewater treatment facilities treat phosphorus and nitrogen, as well as many other pollutants, from the communities they serve. Facility operators monitor for pollutants of concern, depending on the discharge permit requirements, and report these data to the State of Vermont through Discharge Monitoring Reports. Facilities in the Lake Champlain and Lake Memphremagog basins monitor for total phosphorus and facilities in the Connecticut River basin (drains to Long Island Sound) monitor for nitrogen. Due to the complexity of these treatment systems, the results of individual state-funded wastewater improvement projects, summarized in this section, cannot be directly connected to changes in pollutants discharging from the facility to surface waters, with the exception of wastewater treatment facility upgrades for specific pollutants (e.g., phosphorus treatment upgrade). Therefore Table 13 shows zero percent of wastewater treatment project outputs with phosphorus estimates. Refer to Part 2 of this report on Lake Champlain TMDL progress for phosphorus treatment by Vermont wastewater treatment facilities that drain to Lake Champlain.

Table 13. Extent of wastewater treatment project outputs with estimated phosphorus pollutant reductions, completed SFY 2016-2019 statewide

Project Output Measures	Outputs with Phosphorus Estimates	Total Project Outputs	Percent Outputs with Phosphorus Estimates
Number of combined sewer overflow abatements completed	0	5	0%
Number of sewer extensions completed	0	2	0%
Number of wastewater collection systems refurbished	0	6	0%
Number of wastewater treatment facilities refurbished	0	4	0%
Number of wastewater treatment facility upgrades completed	Based on Discharge Monitoring Reports required under DEC permits; see report Part 2 for changes in load in the Lake Champlain basin		

Wastewater Treatment Project Example

Figure 31. Replacement of rotating biological contactors (RBC) for wastewater treatment, completed by the Town of Bennington with financing from the Clean Water State Revolving Fund (CWSRF)





NATURAL RESOURCES

Results of Natural Resource Restoration Projects

Natural resource restoration projects involve the restoration and protection of “natural infrastructure” functions that prevent and abate nutrient and sediment pollution.

Natural infrastructure includes floodplains, river channels, lakeshores, wetlands, and forest lands.

Projects that restore and protect natural infrastructure count toward progress for a combination of the following requirements and co-benefits:

- Implementation of TMDL requirements
- Improved flood resiliency and flood hazard mitigation for public health and safety
- Supports outdoor recreation opportunities and economy
- Improved habitat function and biodiversity

Natural Resource Restoration Project Outputs

Table 14. Outputs of state-funded natural resource restoration project development (i.e., planning and design) work completed, SFY 2016-2019



Project Development Measures	2016	2017	2018	2019	Total
Stream miles assessed by Stream Geomorphic Assessment, River Corridor Plan	113	29	70	7	219
Number of natural resources restoration projects identified	125	17	129	43	314
Acres of river corridor scoped for easement	17	14	--	253	284
Number of preliminary (30%) designs completed	10	--	--	10	20
Number of final (100%) designs completed	9	6	18	5	38

Table 15. Outputs of state-funded natural resource restoration projects implemented, SFY 2016-2019

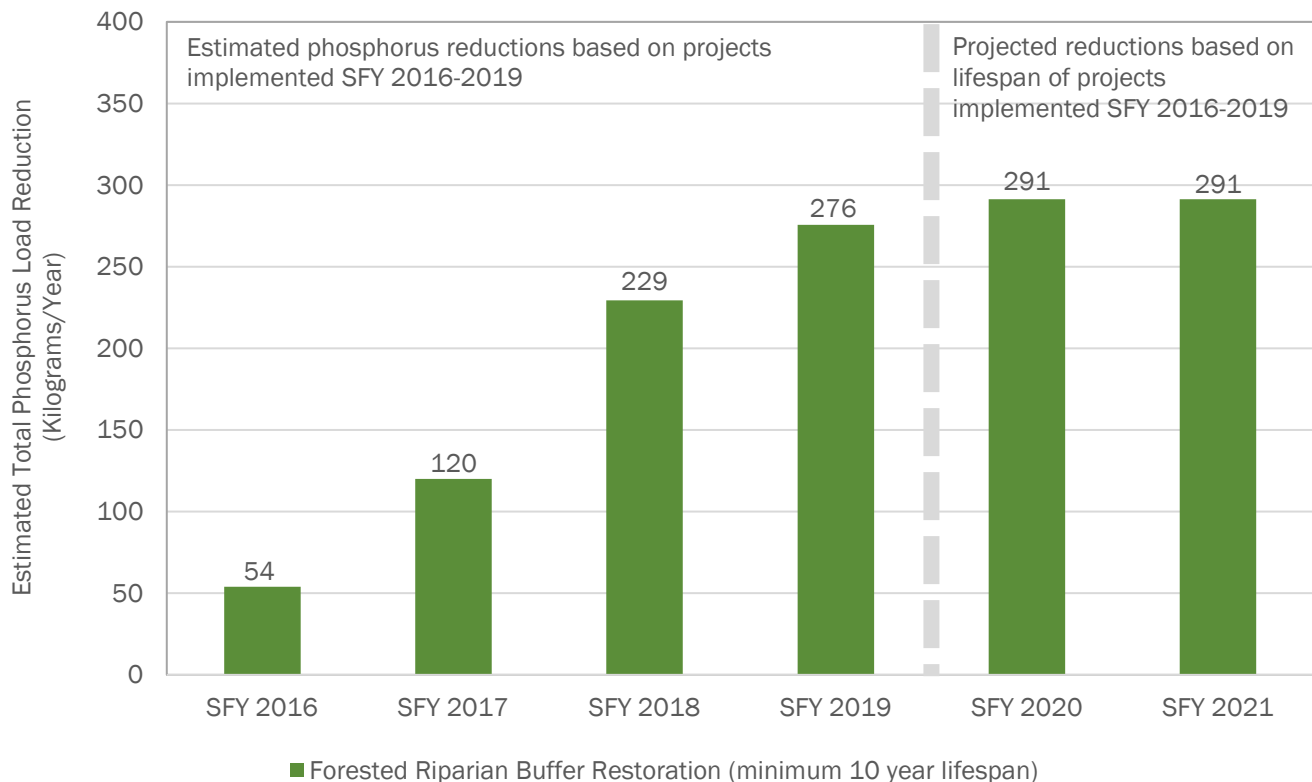
Project Output Measures	2016	2017	2018	2019	Total
Acres of forested riparian buffer restored through buffer planting	85	32	59	64	240
Acres of riparian corridor conserved and restored through easements	141	208	222	5	576
Acres of floodplain restored	--	2	4	1	7
Acres of lakeshore restored	0.2	--	9	1	10
Stream miles reconnected for stream equilibrium/fish passage	35	100	108	113	356
Acres of wetland restored and conserved through easements	--	131	44	47	222
Acres of forestland conserved with special water quality protections	58	172	598	110	938
Miles of forest road drainage and erosion control improvements	--	0.8	--	8	9
Number of stream crossings improved	--	--	1	19	20
Square feet of gully erosion remediated	--	--	50,668	135	50,803

EXPLANATION OF TABLES

Two hazardous dams were removed from waterways in SFY 2019, allowing the affected rivers to return to a more natural, less erosive state. Since SFY 2016, state funds have incentivized restoration of over 200 wetland acres through conservation easements, supporting water quality, flood resiliency, and habitat functions. Some measures show a decrease in results this year compared to last year. For example, acres of riparian corridor conserved and restored through easements decreased significantly. In the same reporting period, acres of river corridor scoped for easements increased substantially, which will likely lead to more acres conserved in future years. Natural resources restoration projects are voluntary, and results may vary year-to-year depending on landowner willingness to participate and other factors. This highlights the need to continue building our partner capacity and outreach to increase participation.

Natural Resource Restoration Pollutant Reductions

Figure 32. Annual estimated total phosphorus load reduction (kilograms per year) achieved by state-funded forested riparian buffer restoration projects implemented SFY 2016-2019 (projected reductions are based on lifespan of projects completed SFY 2016-2019)



EXPLANATION OF FIGURE

Pollutant reductions achieved by restoration of forested riparian buffers have increased significantly each year since SFY 2016. Projected pollutant reductions of projects completed SFY 2016-2019 are shown to the right of the dashed line, based on projects' anticipated lifespan (noted in legend). Practices must be maintained for pollutant reductions to continue in future years. See Appendix F for summary of methods used to estimate pollutant reductions. Phosphorus estimation methods are under development for other natural resources restoration project types.

Table 16. Extent of natural resources restoration project outputs with estimated phosphorus pollutant reductions, completed statewide SFY 2016-2019 ¹⁰

Project Output Measures	Outputs with Phosphorus Estimated	Total Project Outputs	Percent Outputs with Phosphorus Estimates
Acres of forested riparian buffer restored	109	240	45%
Acres of riparian corridor conserved and restored through easements	0	576	0%
Acres of floodplain restored	0	7	0%
Acres of lakeshore restored	0	10	0%
Stream miles reconnected for stream equilibrium/aquatic organism passage	0	356	0%
Acres of wetland conserved and restored through easements	0	222	0%
Acres of forestland conserved with water quality protections	0	938	0%
Miles of forest road drainage and erosion control improvements	0	9	0%
Number of stream crossings improved	0	20	0%
Square feet of gully erosion remediated	0	50,803	0%

¹⁰ Phosphorus reductions can currently only be quantified in the Lake Champlain and Lake Memphremagog basins and may be further limited by lack of data and/or methods to quantify phosphorus reductions. The Clean Water Service Delivery Act (Act 76 of 2019) requires addressing gaps and publishing methods to estimate phosphorus reductions for clean water projects implemented in the Lake Champlain and Lake Memphremagog basins by November 1, 2021. Act 76 of 2019 also requires setting a schedule to publish methods for quantifying other (i.e., non-phosphorus) water quality impairments by November 1, 2023. See Appendix F for more information.

Natural Resource Restoration Project Examples

Figure 33. Before (left) and after (right) stabilization of an eroding lakeshore access path on Lake Carmi in Franklin County, completed by the Franklin Watershed Committee with funding from a DEC Clean Water Initiative Program grant



Figure 34. Before (left) and after (right) removal of the Mill Brook Dam in West Windsor, completed by Southern Windsor County Regional Planning Commission with funding from a DEC Clean Water Initiative Program grant



Figure 35. Before (left) and after (right) replacement of a deteriorating, 30-year old culvert with a bridge on Boulley Brook in Johnson completed by Vermont Department of Forests, Parks and Recreation with funding from a DEC Clean Water Initiative Program grant (clean water project sign posted during construction)

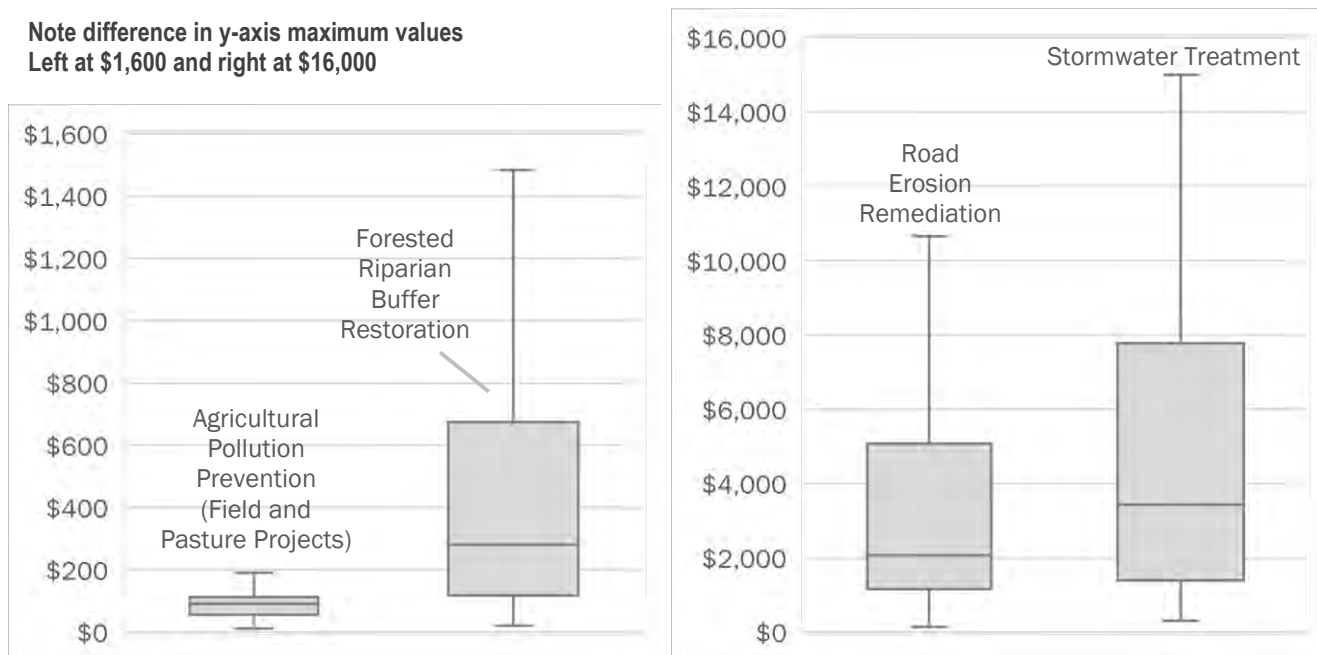


Cost Effectiveness of State Clean Water Investments



This report contains results of clean water projects funded through State of Vermont agencies completed SFY 2016 through SFY 2019. Projects completed during the reporting period total approximately \$66 million in funds awarded by State of Vermont agencies, of which approximately \$7 million are associated with projects that have estimated phosphorus reductions, plus \$4 million in local match/in-kind and federal match. The relative cost effectiveness of projects *with* estimated phosphorus reductions are expressed as cost per unit of estimated total phosphorus load reduction (kilograms), shown in Figure 36 by project type. Cost effectiveness of phosphorus reductions accounts for projects' anticipated lifespans. If projects exceed the anticipated lifespan, cost effectiveness estimates in the figure below will improve.

Figure 36. Estimated cost per kilogram of total phosphorus load reduced, based on clean water projects funded through State of Vermont agencies with estimated total phosphorus load reductions completed SFY 2016-2019 (project costs include local match/in-kind and federal match where reported)



EXPLANATION OF FIGURE

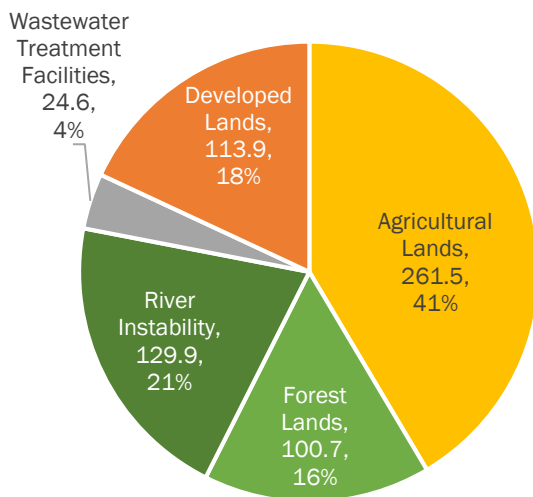
Generally, agriculture pollution prevention projects on fields and pasture and natural resources restoration projects are the most cost effective in reducing phosphorus. Agricultural projects in this figure include projects on fields and pasture only. Agricultural projects are highly cost effective, but generally have shorter lifespans compared to structural projects. This figure does not include barnyard and production area management projects, which are generally more expensive, structural fixes. Reductions from agricultural production areas are not included in this figure, as phosphorus is estimated based on compliance status for the whole site and not at the individual project-level. Reductions from wastewater treatment are also not measured at the project-level, therefore, wastewater treatment is not included in this figure. Road erosion remediation projects are also relatively cost effective, but generally municipalities are targeting the highest priority, most complex road segments first to comply with the Municipal Roads General Permit, which are relatively more expensive than other road segments. Stormwater treatment is relatively more expensive per unit phosphorus reduced compared to the other project types shown above, as these are structural engineered solutions. However, stormwater treatment projects have relatively longer lifespans – anticipated to perform 20 years or more if properly maintained.

Part 2: Lake Champlain Progress Report

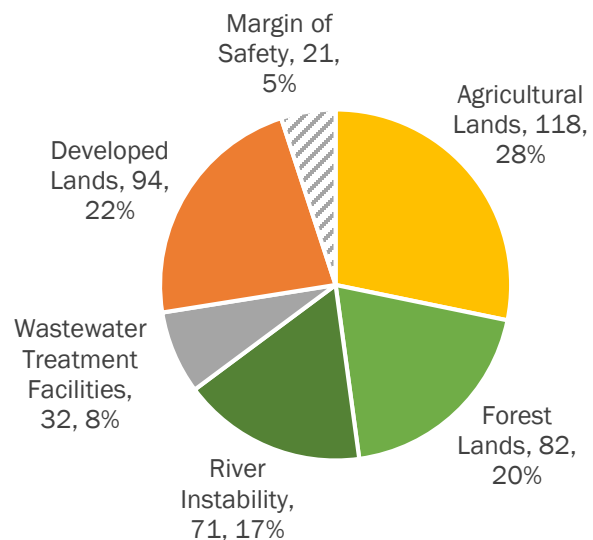
The Lake Champlain restoration plan, titled *Phosphorus Total Maximum Daily Loads for Vermont Segments of Lake Champlain*¹¹ (i.e., Lake Champlain TMDL) approved June 2016 identifies phosphorus pollutant reductions that must be achieved for all segments of Lake Champlain to comply with State of Vermont water quality standards (baseline and target phosphorus loads shown in Figure 37).

Figure 37. Lake Champlain TMDL baseline (left) and target (right) total phosphorus load in metric tons per year (requires a total reduction of 212.4 metric tons per year)¹²

Baseline total phosphorus load to Lake Champlain (average of 2001-2010):
631 metric tons per year



Target total phosphorus load to Lake Champlain:
418 metric tons per year



The Lake Champlain TMDL Accountability Framework is intended to ensure adequate progress reducing phosphorus pollution to Lake Champlain. The Framework sets a schedule (see Figure 38) for U.S. Environmental Protection Agency (EPA) to issue report cards on the State of Vermont’s progress throughout the 20-year implementation timeframe (2017-2038). EPA will determine satisfactory progress based on the status of implementation plans known as “Tactical Basin Plans.” Tactical Basin Plans are updated on a five-year rotating basis and include Implementation Tables with priority actions to implement the Lake Champlain TMDL. EPA will issue interim report cards halfway through the five-year planning cycle and final report cards at the end of the five-year planning cycle. The Lamoille

¹¹ Phosphorus Total Maximum Daily Loads for Vermont Segments of Lake Champlain available at: <https://dec.vermont.gov/watershed/cwi/restoring/champlain>.

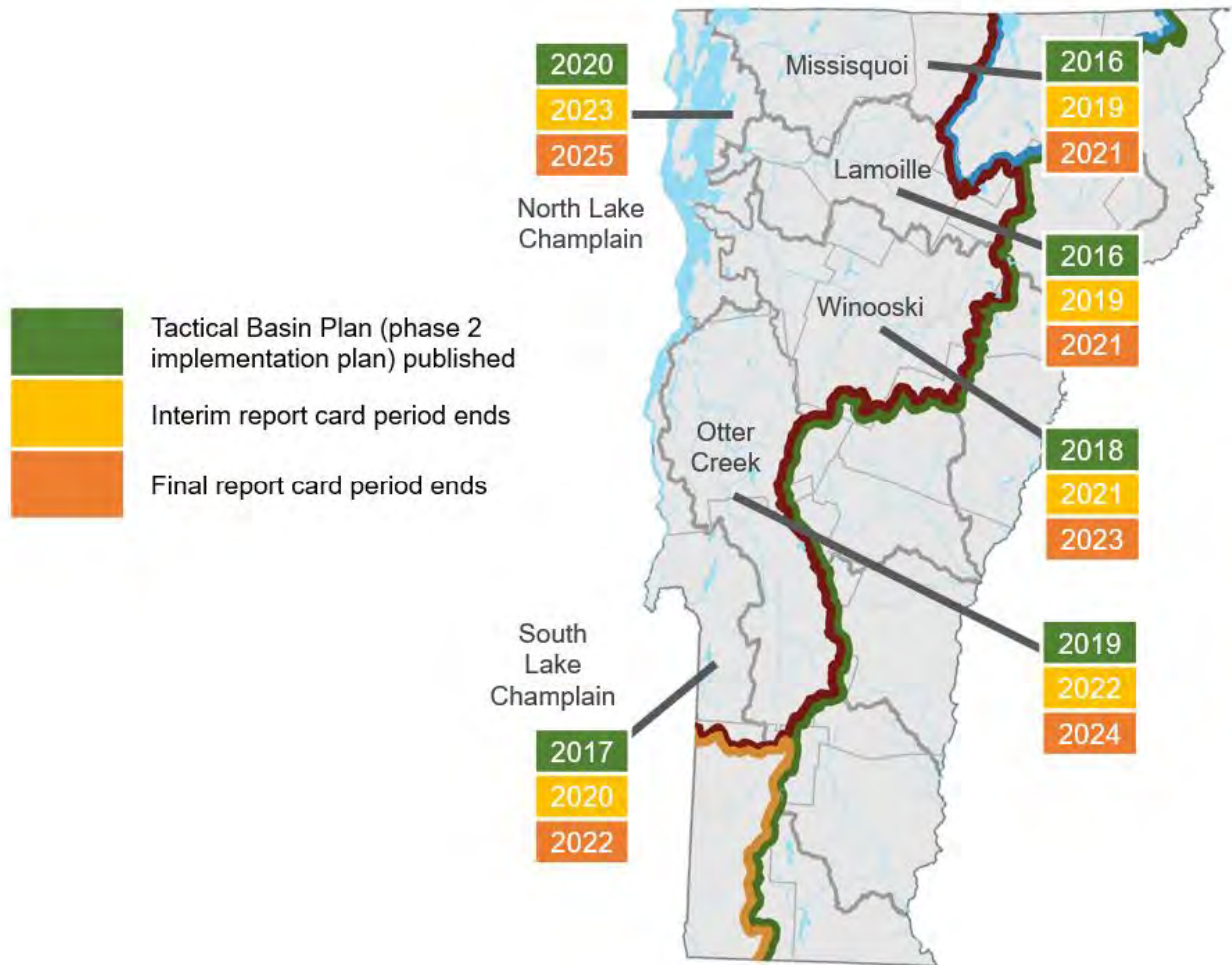
¹² The baseline for wastewater treatment facilities shows baseline discharge levels; the target for wastewater treatment facilities shows maximum permissible discharge levels.

River and Missisquoi River Tactical Basin Plans are the first plans due for interim report cards, covering January 1, 2017 through June 30, 2019.

This Lake Champlain Progress Report presents the following data and information to support EPA’s determination and provide transparency to the public on the State of Vermont’s efforts restoring Lake Champlain.

1. Lake Champlain TMDL performance measures: Estimated total phosphorus load reductions basin-wide associated with projects/best management practices completed SFY 2016-2019 through federal funding programs, state funding programs, and regulatory programs.
2. External variables affecting phosphorus loading to Lake Champlain: data summarized include climate change, human population change, land use change, and agricultural considerations.
3. Monitored phosphorus loading to Lake Champlain: Monitored total phosphorus load from Vermont tributaries of Lake Champlain relative to the Lake Champlain TMDL target phosphorus load allocation.
4. Interim status of Lamoille River and Missisquoi River Tactical Basin Plan Implementation Tables: See Appendices B and C).

Figure 38. Lake Champlain TMDL Accountability Framework schedule by Tactical Basin Plan watershed



Lake Champlain TMDL Performance Measures

This Lake Champlain Progress Report includes phosphorus estimates associated with projects/best management practices completed through federal funding programs and regulatory programs, in addition to state funding programs reported in Part 1 of this report.

Part 2 Scope: Lake Champlain Progress Report

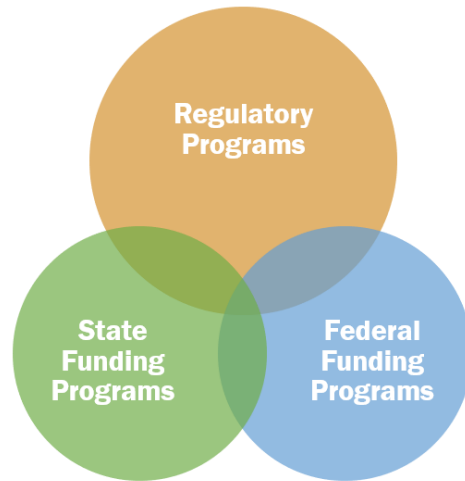
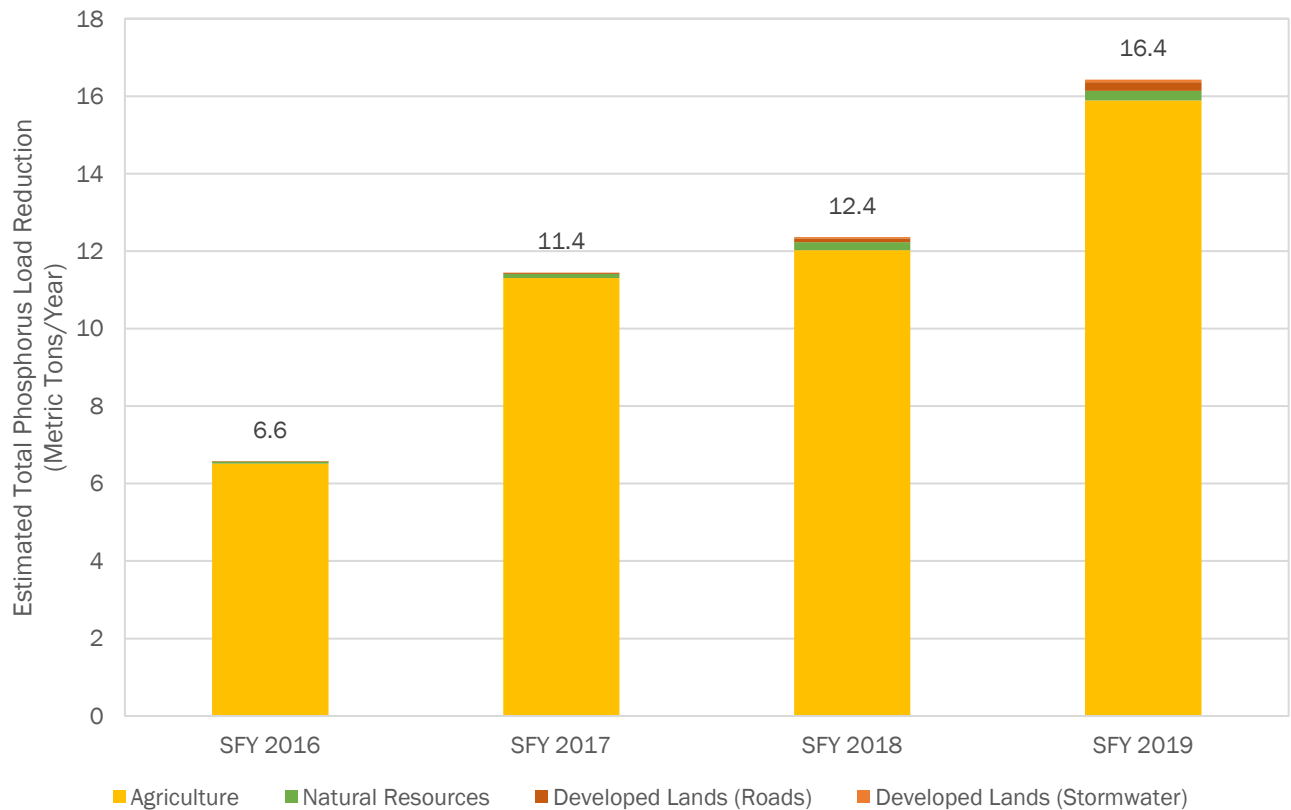
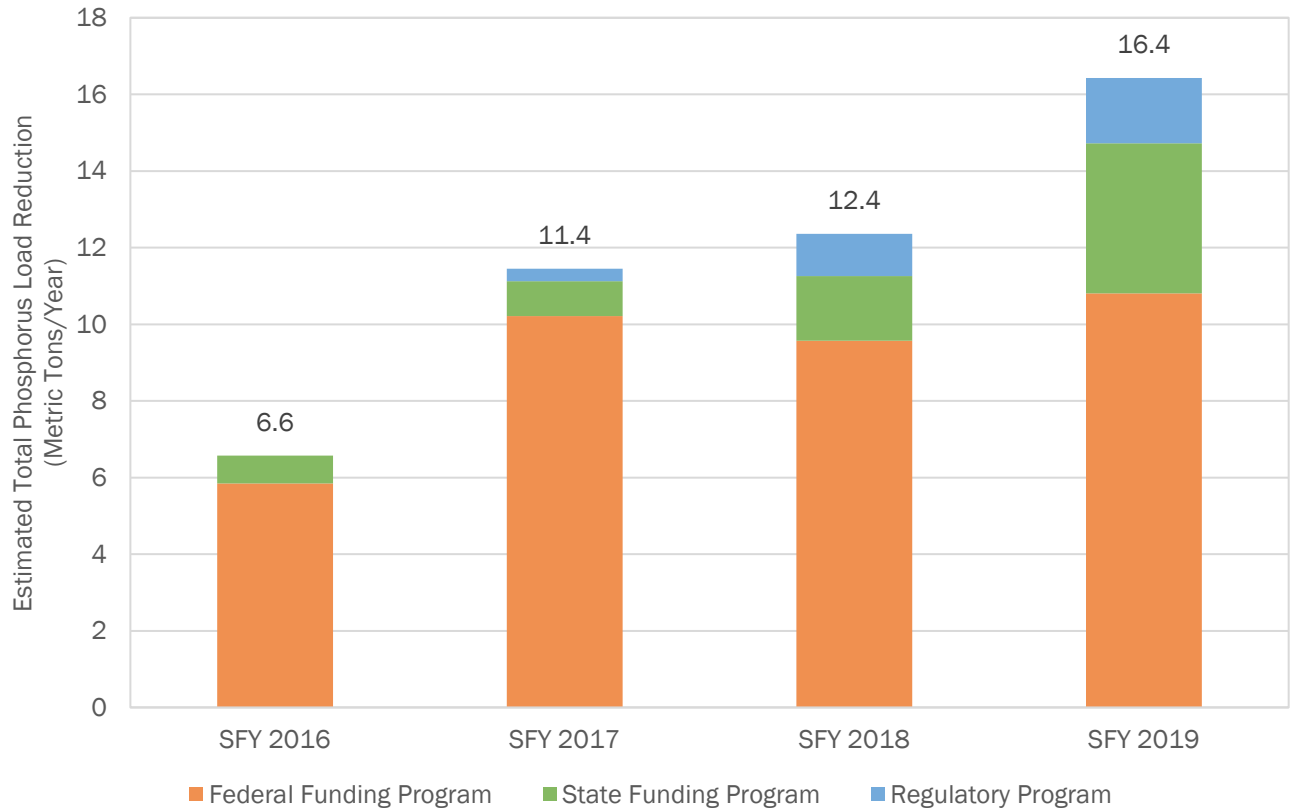


Table 17. Federal funding programs and regulatory programs within the scope of the SFY 2019 report Part 2 “Lake Champlain Progress Report” and planned future additions

	Newly Included in SFY 2019	Planned Future Additions
Federal Funding Programs	U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) agricultural practices ¹³ Lake Champlain Basin Program	USDA-NRCS forest and wetland practices
Regulatory Programs	Production area compliance for Large, Medium, and Certified Small Farm Operations Operational Stormwater Permits Wastewater National Pollutant Discharge Elimination System (NPDES) Permits	Cropland and pasture Required Agricultural Practices (RAPs) compliance Operational Stormwater Permits with 3-acre site retrofits Municipal Roads General Permit (MRGP) Municipal Separate Storm Sewer System (MS4) Permit Transportation Separate Storm Sewer System (TS4) Permit

¹³ Federal funding programs through USDA-NRCS agricultural practice data represent practices applied July 1, 2015 (beginning of SFY 2016) through December 31, 2018 (halfway through SFY 2019). Practice data for the remainder of SFY 2019 will be provided next year in the SFY 2020 Annual Performance Report.

Figure 39. Annual estimated total phosphorus load reduction (metric tons per year) achieved by clean water projects that support implementation of the Lake Champlain TMDL completed SFY 2016-2019, by federal funding, state funding, and regulatory programs (top) and land use sector (bottom)¹⁴



¹⁴ Federal funding programs through USDA-NRCS agricultural practice data represent practices applied July 1, 2015 (beginning of SFY 2016) through December 31, 2018 (halfway through SFY 2019). Practice data for the remainder of SFY 2019 will be provided next year in the SFY 2020 Annual Performance Report.

EXPLANATION OF FIGURE

Estimated Phosphorus Reductions by Program Type (top graphic)

SFY 2019 is the first reporting period that begins to incorporate federal funding programs and regulatory programs into report scope. Figure 39, top graphic, shows estimated phosphorus reductions based on data reported through federal funding programs, state funding programs, and regulatory programs. It highlights the importance of leveraging federal resources to meet Vermont's clean water goals – 66 percent of estimated phosphorus reductions achieved in SFY 2019 are associated with federal funds through the USDA-NRCS. Additionally, phosphorus reductions achieved through regulatory programs are included this year with data on agricultural production area compliance for Large, Medium, and Certified Small Farm Operations, Operational Stormwater Permits, and Wastewater National Pollutant Discharge Elimination System (NPDES) Permits. In future years, phosphorus reductions reported through regulatory programs are anticipated to grow significantly due to rollout of programs and planned reporting additions shown in Table 17. See Appendix F for summary of methods used to estimate pollutant reductions.

Estimated Phosphorus Reductions by Land Use Sector (bottom graphic)

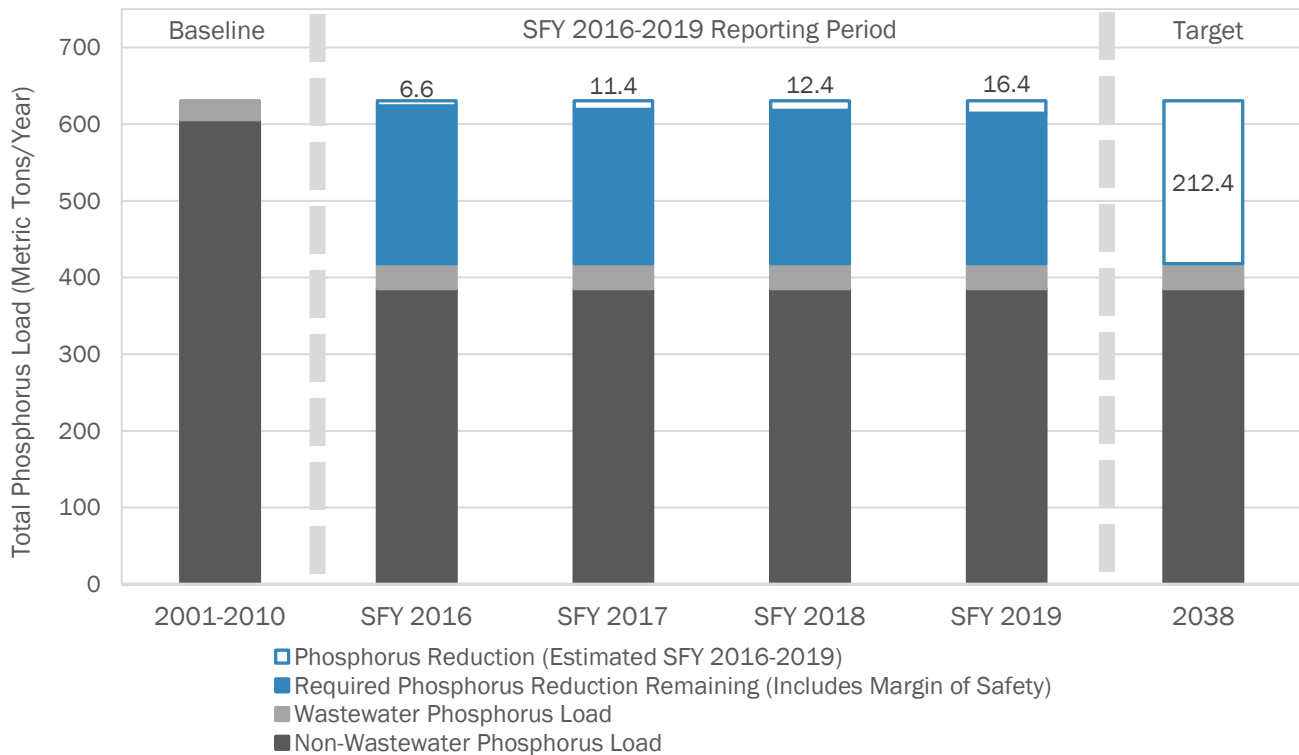
Figure 39, bottom graphic, shows phosphorus reductions based on data reported through federal funding programs, state funding programs, and regulatory programs by land use sector. Phosphorus reductions are trending in the right direction – nearly doubled from SFY 2016 to 2017 and increased again by nearly a third from SFY 2018 to 2019. Most phosphorus reductions estimated are associated with agricultural projects for three reasons:

1. Agricultural conservation practices are highly cost-effective in treatment of phosphorus;
2. Substantial federal funds leveraged through the USDA-NRCS layer on top of state funds to support this work (approximately \$20.2 million in Federal Fiscal Year 2019 provided directly to agricultural producers); and
3. Methods are currently in place to quantify reductions associated with most types of agricultural conservation practices, while other land use sectors have gaps in methods to quantify phosphorus reductions (see Appendix F for summary of methods to estimate phosphorus reductions).

It is important to note that 84 percent of the agricultural reductions are associated with annual practices (one-year lifespan). If these practices are not implemented each year, the phosphorus reductions will not carry through to future years. Structural projects, such as stormwater treatment practices or forested riparian buffers, in contrast, have longer term lifespans (10-20 years or more if properly maintained) and phosphorus reductions achieved by these projects will continue in future years.

Figure 40, on the following page, presents estimated phosphorus reductions from Figure 39 within the context of the Lake Champlain TMDL baseline phosphorus load (2001-2010) and target phosphorus load reduction (2038).

Figure 40. Lake Champlain TMDL total phosphorus load baseline (2001-2010), quantified estimated total phosphorus load reductions achieved through federal funding, state funding, and regulatory programs (SFY 2016-2019 reporting period), and target phosphorus load (2038) in metric tons per year¹⁵



EXPLANATION OF FIGURE

Figure 40 presents estimated total phosphorus load reductions based on data reported through federal funding programs, state funding programs, and regulatory programs within the context of the Lake Champlain TMDL baseline (2001-2010) and target loads (2038) for the Vermont portion of the Lake Champlain basin. Total phosphorus load must be reduced by 212.4 metric tons per year from Vermont sources for Lake Champlain to meet State of Vermont water quality standards by 2038. The TMDL further allocates phosphorus reduction targets by “lake segment” watershed. Refer to Appendix D for estimated total phosphorus load reductions achieved by lake segment watershed.

The Lake Champlain TMDL implementation timeframe is 2017-2038. SFY 2019 represents the third full year since the Lake Champlain TMDL went into effect. Quantified estimates of phosphorus reductions associated with clean water projects are trending in the right direction, representing approximately 8 percent of the required reduction. This result is expected to increase substantially in the coming years for the following reasons:

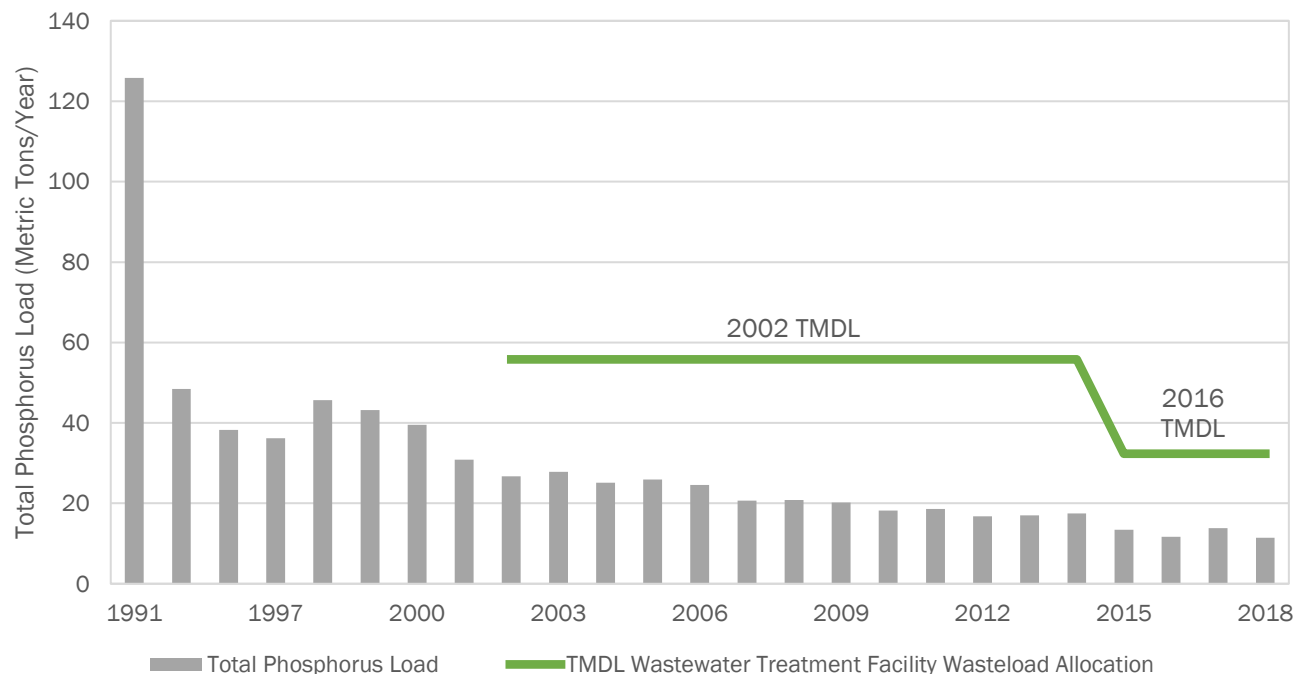
1. Gaps in the state’s ability to quantify phosphorus reductions for all projects: The State of Vermont is expanding its ability to quantify phosphorus reductions for all project types; however, some gaps still exist, described in Appendix F. The Clean Water Service Delivery Act (Act 76 of 2019) requires addressing gaps and publishing methods to estimate phosphorus reductions for clean water projects by November 1, 2021.
2. Programs are ramping up to increase the pace of phosphorus reductions: The Lake Champlain TMDL timeframe began in 2017 and its implementation plan included a “ramping-up” phase of regulatory and financial and technical assistance programs. New regulatory programs are now in place that will drive phosphorus reductions from agricultural sources, developed lands, and roads, with meaningful progress expected in the coming years.

¹⁵ Federal funding programs through USDA-NRCS agricultural practice data represent practices applied July 1, 2015 (beginning of SFY 2016) through December 31, 2018 (halfway through SFY 2019). Practice data for the remainder of SFY 2019 will be provided next year in the SFY 2020 Annual Performance Report.

EXPLANATION OF FIGURE CONTINUED

For example, draft Stormwater General Permit 3-9050 (i.e., “3-acre permit”) will require stormwater treatment at sites with three or more acres of impervious surfaces – hard surfaces such as roofs, parking lots, and roads – that were previously unpermitted or permitted before 2002. This general permit will cover more than 700 projects, all of which are required to have permit coverage by no later than 2023.

Figure 41. Total phosphorus load (metric tons per year) from Vermont wastewater treatment facilities draining to Lake Champlain relative to TMDL wastewater treatment facility wasteload allocation, calendar year 1991-2018



EXPLANATION OF FIGURE

Vermont wastewater treatment facilities contributed approximately 24.6 metric tons per year during the TMDL baseline period (2001-2010), representing approximately 4 percent of total phosphorus load from Vermont sources to Lake Champlain. During the baseline period, cumulative wastewater treatment facility discharge was already well below the wasteload allocation (i.e., phosphorus limit) of 55.8 metric tons required under the former 2002 Lake Champlain TMDL. The 2016 Lake Champlain TMDL for Vermont reduced the wastewater treatment facility wasteload allocation from 55.8 to 32.3 metric tons. These data, based on monitored discharges, indicate that cumulative wastewater treatment facility discharge to Lake Champlain remains well below the 2016 TMDL limit. All Vermont facilities that drain to Lake Champlain are required to optimize operations for phosphorus treatment and some facilities are required to complete phosphorus treatment upgrades to meet individual facility permit limits.

External Variables Affecting Phosphorus Loading to Lake Champlain

Phosphorus is the pollutant of concern for Lake Champlain, leading to algae blooms (i.e., cyanobacteria) limiting recreational uses and making it potentially unsafe to swim. The majority (96 percent) of phosphorus sources to Lake Champlain are nonpoint and stormwater sources, transported from the landscape to waterways by rainfall and snowmelt. Due to the nature of nonpoint and stormwater pollution, many variables can affect the amount of phosphorus load delivered to Lake Champlain. For example, while the state can make significant progress installing clean water projects, a significant climate event like Tropical Storm Irene can deliver a year's worth of phosphorus to the lake. This section of the report summarizes data on external variables that may affect phosphorus loading to Lake Champlain, including climate change, human population change, land use change, and agricultural considerations.

CLIMATE CHANGE AND CYANOBACTERIA

Cyanobacteria, also known as blue-green algae, are a natural component of surface waters. They provide important ecological services including photosynthesis and the transfer of nitrogen from the atmosphere to the aquatic environment through nitrogen fixation. They also can produce potent toxins harmful to people and animals. For this reason, the Vermont Department of Health recommends avoiding contact with cyanobacteria.

Climate change is predicted to affect several key factors that regulate cyanobacteria growth – temperature, nutrient availability, and water column stability. Warmer summer temperatures and shorter, warmer winters will increase the length of time that cyanobacteria can proliferate each year. Already, the cyanobacteria monitoring program on Lake Champlain since 2003 has documented that blooms are occurring earlier in the summer and persisting later into the fall. The monitoring season now begins about two weeks earlier than it did in 2003 and documents blooms occurring into mid-October. In 2019, blooms persisted into late October. Moreover, scientists in Vermont and elsewhere are noting the incidence of cyanobacteria blooms at lower-than-expected phosphorus concentrations, indicating that the factors noted above are important in driving the incidence of bloom condition.

Weather conditions influence the amount of nutrients like phosphorus that reach surface waters. The increasingly heavy precipitation events



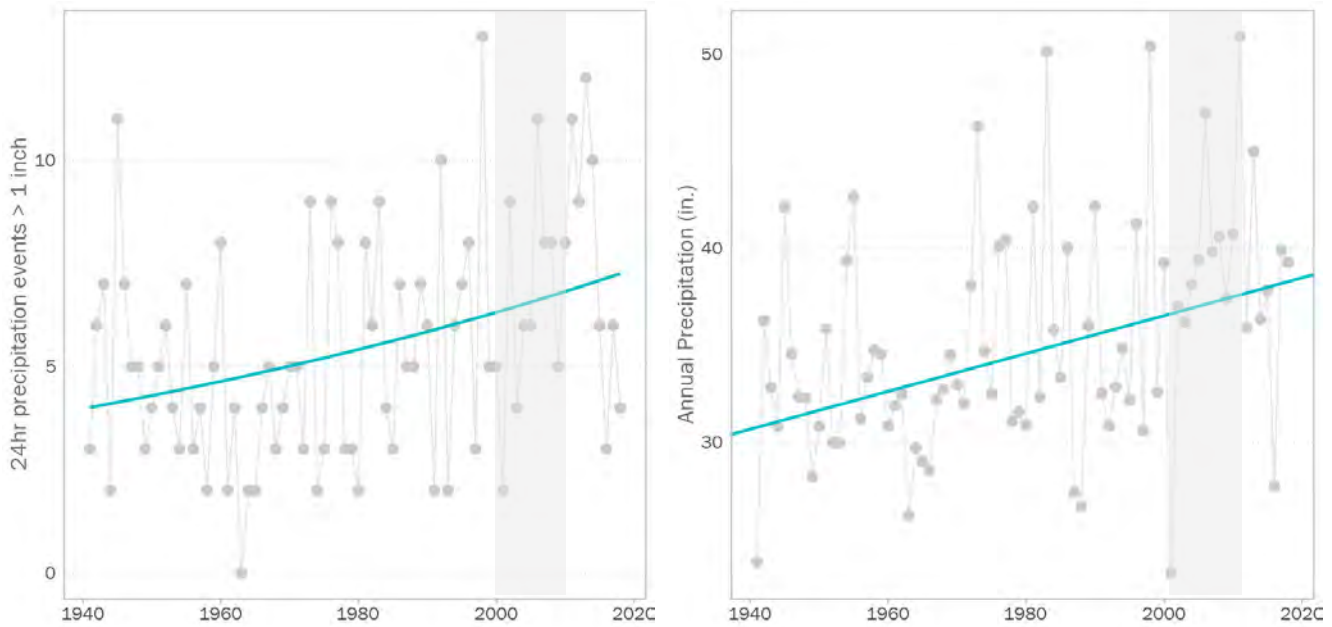
expected as a result of climate change are likely to wash more phosphorus into lakes and ponds.

Timing of precipitation events may also change, with more occurring during the warmer months of the year when cyanobacteria are actively growing and using phosphorus. Cyanobacteria's ability to regulate buoyancy will allow it to move toward sunlight under the calm conditions that often accompany hot summer days and during turbid conditions after intense rainfall.

Climate change is expected to increase opportunities for cyanobacteria growth in Vermont. Because we will have little control over weather patterns and precipitation, Vermont will need to focus on land-use management and control of nutrient loading to surface waters in order to reduce the number of cyanobacteria blooms.

Climate Change

Figure 42. Change in number of days with precipitation greater than one inch (left), change in annual total precipitation (right) using Burlington to represent Vermont portion of Lake Champlain basin, 1940-2018 (gray shading represents Lake Champlain TMDL 2001-2010 baseline period and blue line represents trend)



EXPLANATION OF FIGURES

Climate data indicate statistically significant increase in frequency of intense storms and annual total precipitation. The trend has been building for decades, including since the TMDL baseline period (2001-2010).

Change in precipitation patterns may result in:

1. Increased erosion of unstable road networks and unnatural stream banks and lakeshores transporting phosphorus to Lake Champlain; and
2. Increased volume of stormwater runoff from impervious/hard surfaces, such as roads, parking lots, and rooftops, transporting phosphorus to Lake Champlain.

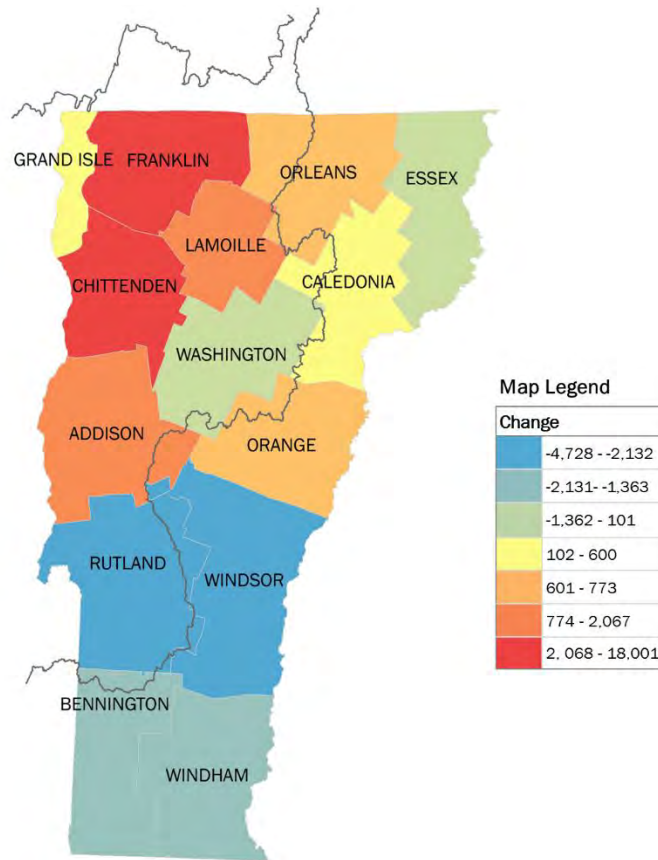
Change in precipitation patterns highlight the importance of climate adaptation, for example:

1. Protection and restoration of natural resources (e.g., wetlands, floodplains, lakeshores) to naturally mitigate extreme weather events;
2. Implementation of revised road, bridge, and culvert standards for resilience against higher flow and more intense storms; and
3. Implementation of Stormwater Management Manual standards that emphasize the importance of infiltrating stormwater runoff into soils.

Source: National Oceanic and Atmospheric Administration, Burlington International Airport climate station
Frequency Updated: Continuous

Human Population

Figure 43. Population change in Vermont by county with overlay of Lake Champlain basin, 2000-2018



EXPLANATION OF FIGURE

Population is tracked by county. All counties that overlap with the Lake Champlain basin (except Rutland County) have experienced population growth since 2000 (start of the Lake Champlain TMDL baseline period).

Change in population may result in:

1. Increased development that may lead to increased stormwater sources of pollution; and
2. Increased pressure on wastewater infrastructure and combined sewer systems.

However, regulatory programs are in place to mitigate potential impacts, including:

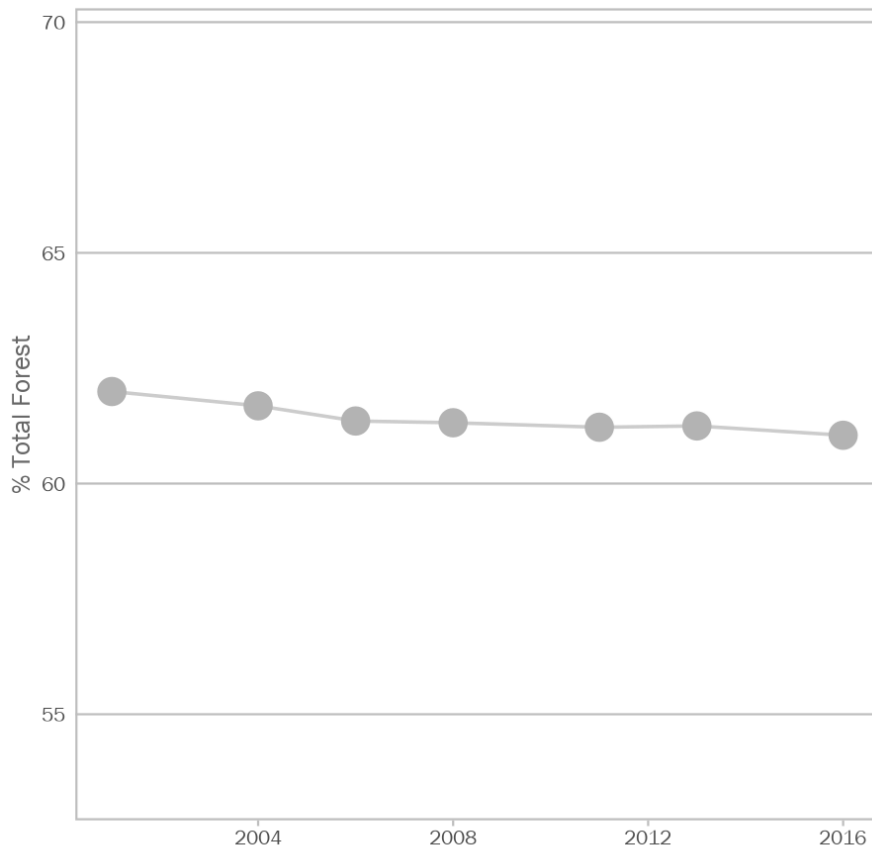
1. Operational Stormwater Permits requiring stormwater treatment associated with development that will result in one or more acres of new impervious surface;
2. Combined Sewer Overflow (CSO) Rule requires implementation of Long Term Control Plans to reduce/eliminate CSOs; and
3. Wastewater treatment facility National Pollutant Discharge Elimination System (NPDES) permits maintain phosphorus limits on facilities regardless of population change.

Source: 2000 and 2010 U.S. Census data; 2018 U.S. Census estimate

Frequency Updated: 10 years

Land Use Change

Figure 44. Percent of forested land use in Vermont portion of Lake Champlain Basin, 2001-2016



EXPLANATION OF FIGURE

Land use data from 2001 to 2016 show an approximate 1 percent decrease in forested land cover in the Lake Champlain basin since the TMDL baseline period (2001-2010). The forestland decrease represents 44 square miles – approximately three times the area of the City of Burlington. Forested lands produce the lowest yield of phosphorus and greatest benefit to water quality of all land uses.

This land use change may result in:

1. Conversion of forested land to other land uses less protective of water quality (e.g., developed or agricultural lands).

This highlights the importance of efforts underway to protect and restore forested lands:

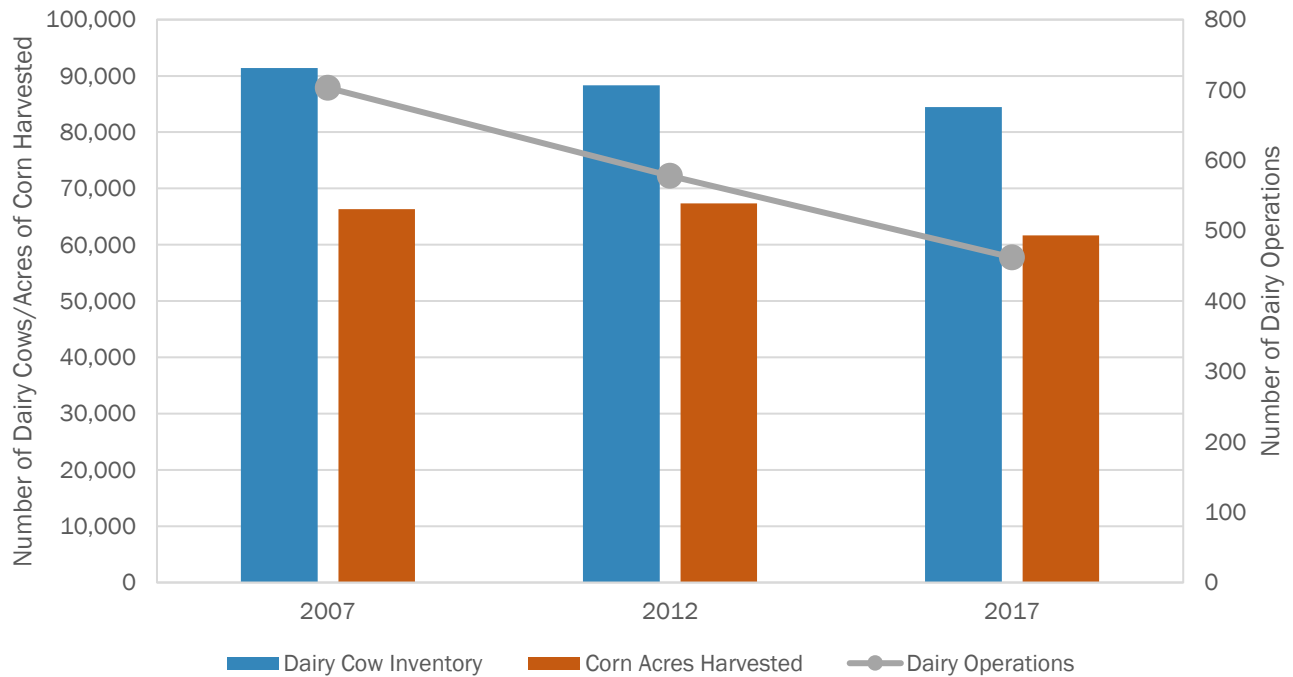
1. Conservation easements help maintain water quality benefits of forest lands; and
2. Use Value Appraisal (UVA) Program provides tax incentives for private landowners to keep woodlands intact.

Source: National Land Cover Dataset

Frequency Updated: 4 years

Agricultural Considerations

Figure 45. Dairy cow inventory, acres of corn harvested and number of dairy operations in counties predominantly in the Lake Champlain basin (Addison, Chittenden, Franklin, Grand Isle, Lamoille, Rutland, and Washington counties), 2007-2017



EXPLANATION OF FIGURE

Data presented in Figure 45 indicate overall dairy production in terms of number of dairy cows and acres of corn harvested have remained relatively constant. However, the number of dairy operations has decreased by approximately one-third from 2007 to 2017. This may indicate an increase in larger farm operations absorbing smaller farm operations.

This change in dairy operations may result in:

1. Increased regulatory oversight of dairy operations; and
2. Improved infrastructure supporting water quality at dairy operations.

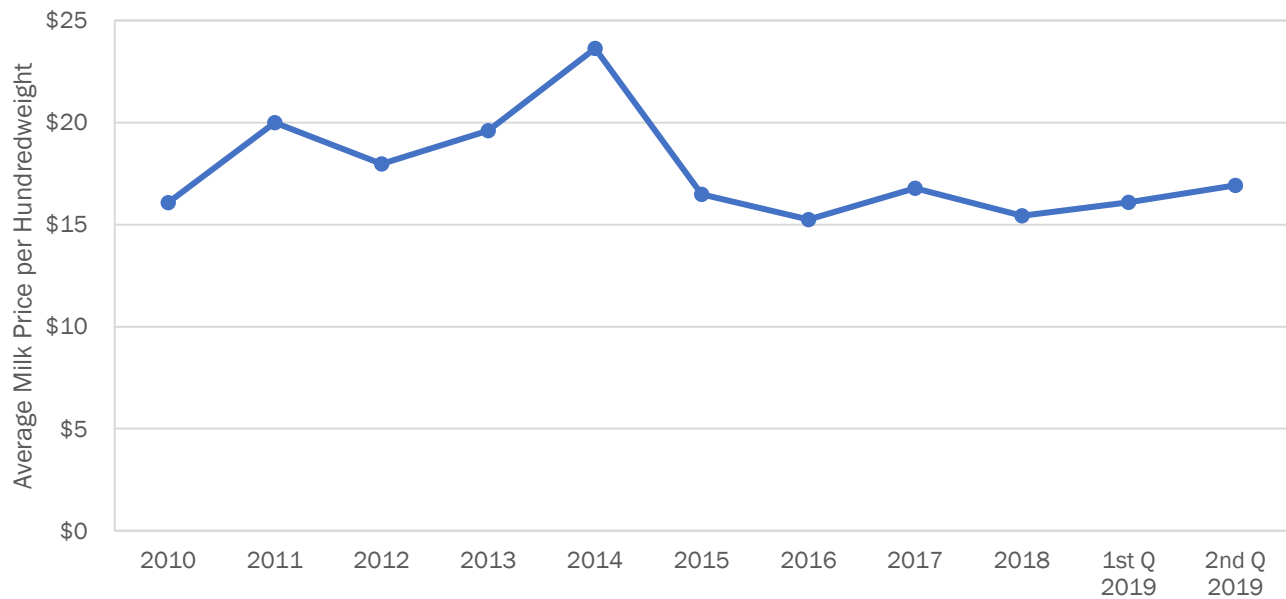
This highlights the importance of financial, technical, and regulatory assistance efforts to farmers, for example:

1. The AAFM Agricultural Nonpoint Source Pollution Control Program inspects Large Farm Operations annually, Medium Farm Operations at least once every three years, and Certified Small Farm Operations at least once every seven years to ensure regulatory compliance; and
2. AAFM and USDA-NRCS offer substantial technical and financial assistance to farmers to implement agricultural conservation practices and to install infrastructure improvements at barnyards/production areas.

Source: USDA Census of Agriculture

Frequency Updated: 5 years

Figure 46. Change in Vermont average milk price per hundredweight, 2010 through quarter 2 of calendar year 2019



EXPLANATION OF FIGURE

Vermont average milk prices are shown in Figure 46. While farmers expect variability in milk prices, the extended length of low milk prices since 2015 have presented challenges for dairy farmers. During this timeframe, farmers may be operating at a loss to stay in business, where the average cost of production is often well above the price received.

Consistently low milk prices directly affect farmers ability to pay bills and any additional costs, such as water quality improvements, are almost impossible. Even with substantial state and federal funding, farmers are challenged to meet their portion of the cost of implementing agricultural conservation practices and improvements to infrastructure supporting water quality at dairy operations.

Milk prices directly affect farmers' ability to:

1. Meet cost share requirements for implementing agricultural conservation practices and improvements to infrastructure supporting water quality at dairy operations.

This highlights the importance of agricultural financial and technical assistance efforts, for example:

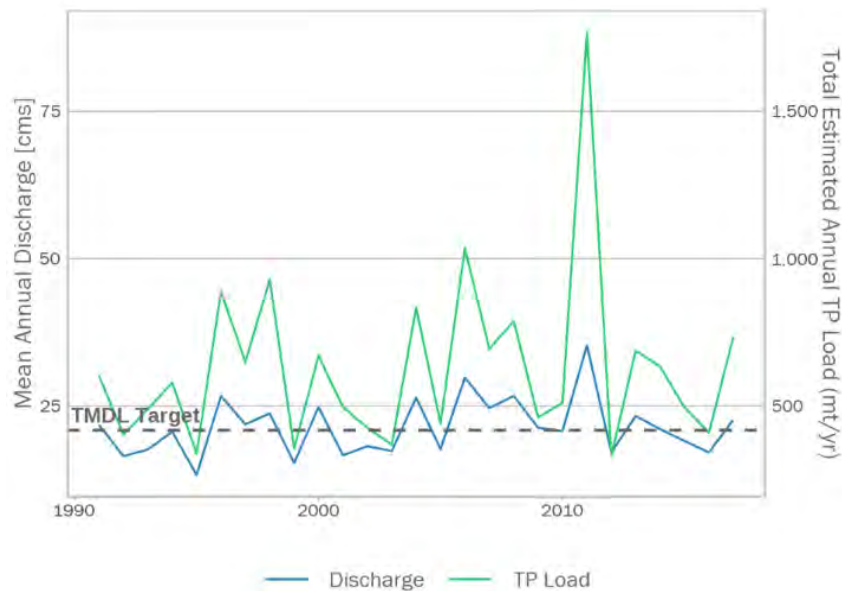
1. AAFM and USDA-NRCS offer substantial technical and financial assistance to farmers to implement agricultural conservation practices and to install infrastructure improvements at barnyards/production areas;
2. State and federal funds also support agricultural partners and non-profits such as University of Vermont Extension and the Vermont Association of Conservation Districts, who work one-on-one with farmers to support water quality; and
3. The Vermont Farm and Forest Viability Program provides business advice and financial consultation to farmers to improve farm economic viability and assist with long term planning.

Source: AAFM

Frequency Updated: Quarterly

Monitored Phosphorus Loading to Lake Champlain

Figure 47. Monitored average annual flow (cubic meters per second) and estimated total phosphorus (TP) load (metric tons per year) from Vermont tributaries to Lake Champlain relative to the TMDL total phosphorus target, 1991-2017



EXPLANATION OF FIGURE

Lake Champlain tributary streamflow and water quality concentrations can be used to estimate total phosphorus loading to the lake. Phosphorus loading fluctuates due to a variety of factors, such as land use and precipitation patterns. Higher amounts of precipitation move more phosphorus from the land to our rivers, where it is ultimately carried downstream to Lake Champlain. As a result, annual phosphorus loading patterns closely follow annual river flow or discharge patterns. The graph above reflects how closely these are correlated. For example, the notable spike in total phosphorus load and discharge in 2011 is associated with Tropical Storm Irene. The target total phosphorus load is 418 metric tons per year, which is the maximum amount of phosphorus Lake Champlain can receive annually in order to meet State of Vermont water quality standards. Figure 47 shows total phosphorus load, at times, less than 418 metric tons when annual average discharge was very low.

Additional regulatory, project delivery, and funding mechanisms, as well as long-term revenue sources to support clean water projects, have been established with the passage of the Vermont Clean Water Act (Act 64) in 2015 and the Clean Water Service Delivery Act (Act 76) in 2019. The components of these acts have varying timelines for implementation. In many cases, full implementation of these programs may not be fully realized for a decade or more. One example of this is the Municipal Roads General Permit (MRGP), which requires municipalities to meet MRGP standards for all hydrologically connected road segments by 2036.

As new regulations take effect and implementation of clean water projects ramps up, it is expected that decreased loading will be first measurable at a local level in individual smaller rivers and streams. While targets may be met at the local scale, it will take many years – possibly decades – before cumulative improvements are observable in larger tributaries and subsequently in Lake Champlain.

Source: VTDEC, U.S. Geological Survey, Lake Champlain Basin Program

Frequency Updated: Monitored continuously; dataset updated every two years

Appendices

A. Summary of Vermont Water Quality Priorities and Projects by Watershed

B. Interim Lake Champlain TMDL Progress Report for Lamoille River

C. Interim Lake Champlain TMDL Progress Report for Missisquoi River

D. Estimated Total Phosphorus Load Reductions by Lake Segment Watershed

E. Results of Operational Stormwater Permits

F. Summary of Methods used to Estimate Pollutant Reductions

G. Report of the Working Group on Water Quality funding under 2017 Act 73

Available at: <https://anr.vermont.gov/sites/anr/files/specialtopics/Act73WorkingGroup/2017-11-15-FINAL-act-73-water-quality-funding-report.pdf>

H. Summary of Federal Law, Policy, and Funding related to Clean Water in Vermont (2019)

Available at:

<https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/2019%20Vermont%20Federal%20Clean%20Water%20Funding%20ReportFinal08302019.pdf>.

I. SFY 2019 Ecosystem Restoration Grant Program Projects

Appendix A: Vermont Water Quality Priorities and Projects by Watershed

Appendix A fulfills the reporting requirement of 10 V.S.A. § 1389 (b)(3), and includes:

- A. A summary of the Tactical Basin Planning process that prioritizes projects for implementation;
- B. A summary of water quality problems or concerns in each major basin of the state; and
- C. A summary of projects funded and completed by State of Vermont agencies in each Tactical Basin Planning watershed.

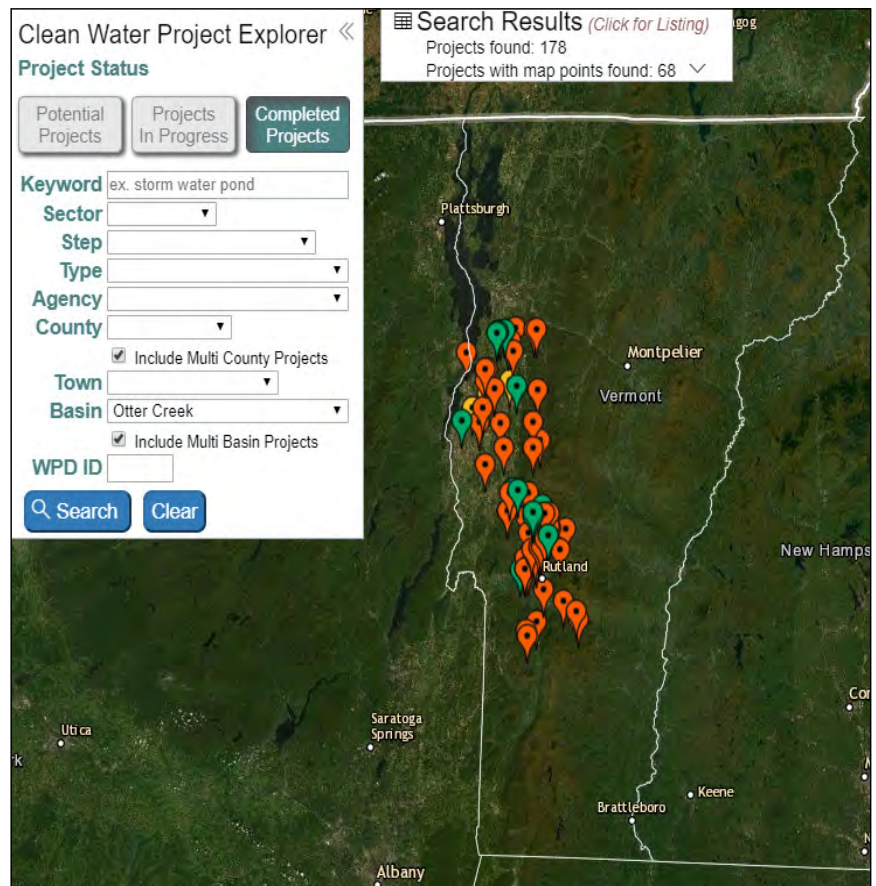
Summaries for each of the fifteen Tactical Basin Planning watersheds, organized alphabetically by watershed name, present:

- 1. Total dollars awarded by State of Vermont agencies to clean water projects by sector in SFY 2016-2019;
- 2. Total dollars awarded by State of Vermont agencies to clean water projects by sector and State Fiscal Year; and
- 3. Summary of project results for completed clean water projects by sector and by State Fiscal Year, including phosphorus load reductions for the Lake Champlain and Lake Memphremagog watersheds.

Visit the Clean Water Project Explorer, available at <https://anrweb.vt.gov/DEC/CleanWaterDashboard/ProjectExplorer.aspx>, to view:

- 1. Potential Projects: Clean water projects identified through Tactical Basin Planning to address water quality issues in each watershed of the state.
- 2. Projects in Progress: Clean water projects funded through State of Vermont agencies that are not yet complete.
- 3. Completed Projects: Clean water projects funded through State of Vermont agencies that are complete with results reported.

The image on the right, for example, shows a Clean Water Project Explorer query of clean water projects funded through State of Vermont agencies that are complete with results reported in the Otter Creek watershed. Users may view projects as points on the map or as a listing and select links to project reports to learn more about individual projects.



Vermont Tactical Basin Planning:

The science-based framework to assess, plan and implement priority clean water projects

Given the significant costs of restoring and safeguarding water quality, the state must spend its resources efficiently and effectively. State agencies utilize Tactical Basin Plans, where possible, to identify projects that will provide the greatest return on investment for clean water.

Tactical Basin Plans identify and prioritize clean water projects across multiple sectors, including stormwater, rivers, roads, and wastewater treatment, based on scientific monitoring data and assessment results. The list of priority strategies necessary to achieve clean water goals, found in each Tactical Basin Plan's Implementation Table, is complemented by an online database of clean water projects, which is continuously updated (visit: <https://anrweb.vt.gov/DEC/CleanWaterDashboard/WPDSearch.aspx>).

Tactical Basin Planning is integral to identifying priority projects to achieve clean water targets described in clean water restoration plans, known as Total Maximum Daily Loads (TMDLs), the Vermont Clean Water Act, and the 2016 Combined Sewer Overflow (CSO) Rule.

Community and stakeholder engagement is a key component of Tactical Basin Plan development and implementation. Local partners, including municipalities, natural resources conservation districts, regional planning commissions, and watershed organizations, also utilize Tactical Basin Plans to target their clean water activities/projects.

Clean water projects are prioritized in Tactical Basin Plans using the following criteria:

1. Expected environmental benefit and cost effectiveness based on:
 - a. Nutrient and sediment pollution reduction,
 - b. Improved flood resiliency, and
 - c. Improved habitat function.
2. Expected feasibility based on:
 - a. Partner capacity and local support, and
 - b. Funding availability.



LAKE CHAMPLAIN BASIN

Watersheds:

Northern Lake Champlain
Missisquoi Bay
Winooski River
South Lake Champlain, Poultney, Mettewee Rivers
Otter Creek
Lamoille River

Priority Water Quality

Concerns:

Nutrients/Sediment
Bacteria (*E. coli*)
Invasive Species

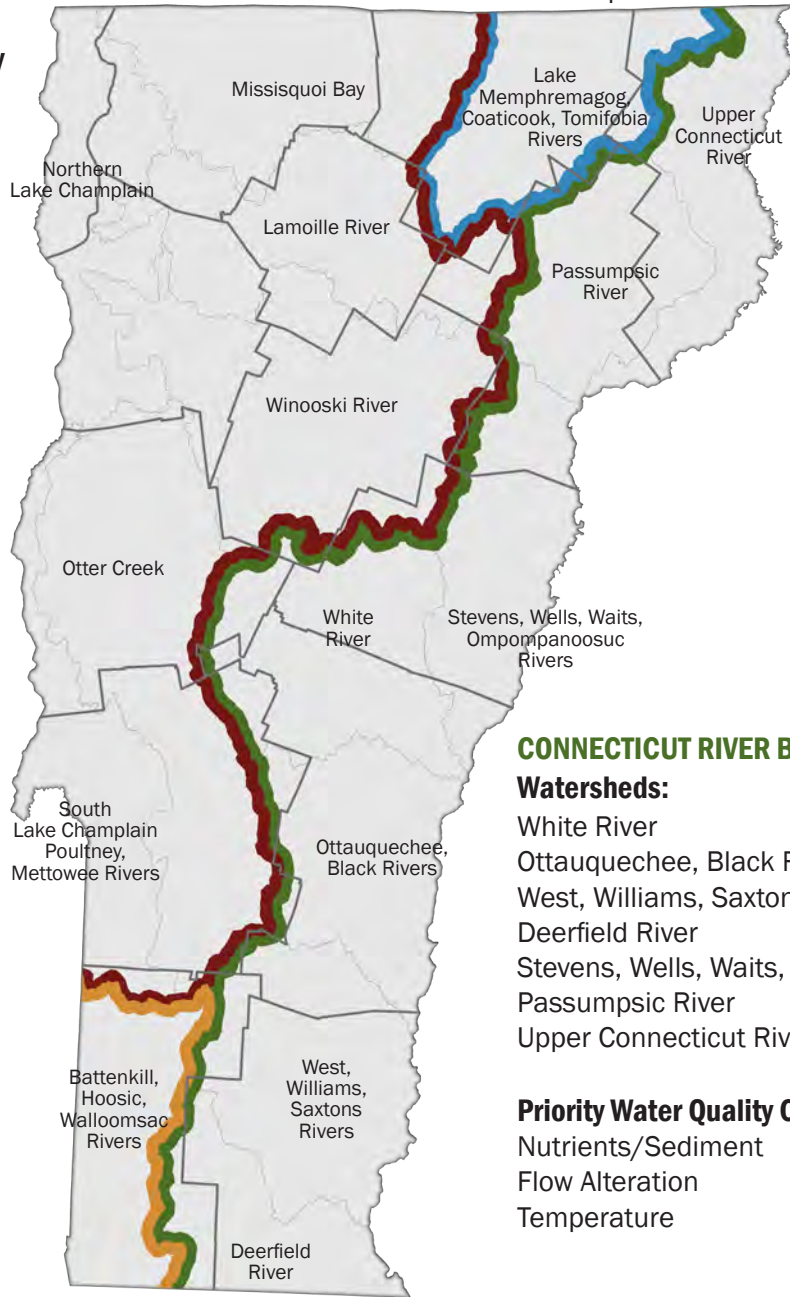
LAKE MEMPHREMAGOG BASIN

Watersheds:

Lake Memphremagog, Coaticook, Tomifobia Rivers

Priority Water Quality Concerns:

Nutrients/Sediment
Flow Alteration
Invasive Species



HUDSON RIVER BASIN

Watersheds:

Battenkill, Hoosic,
Walloomsac Rivers

Priority Water Quality

Concerns:

Nutrients/Sediment
Habitat
Temperature

CONNECTICUT RIVER BASIN

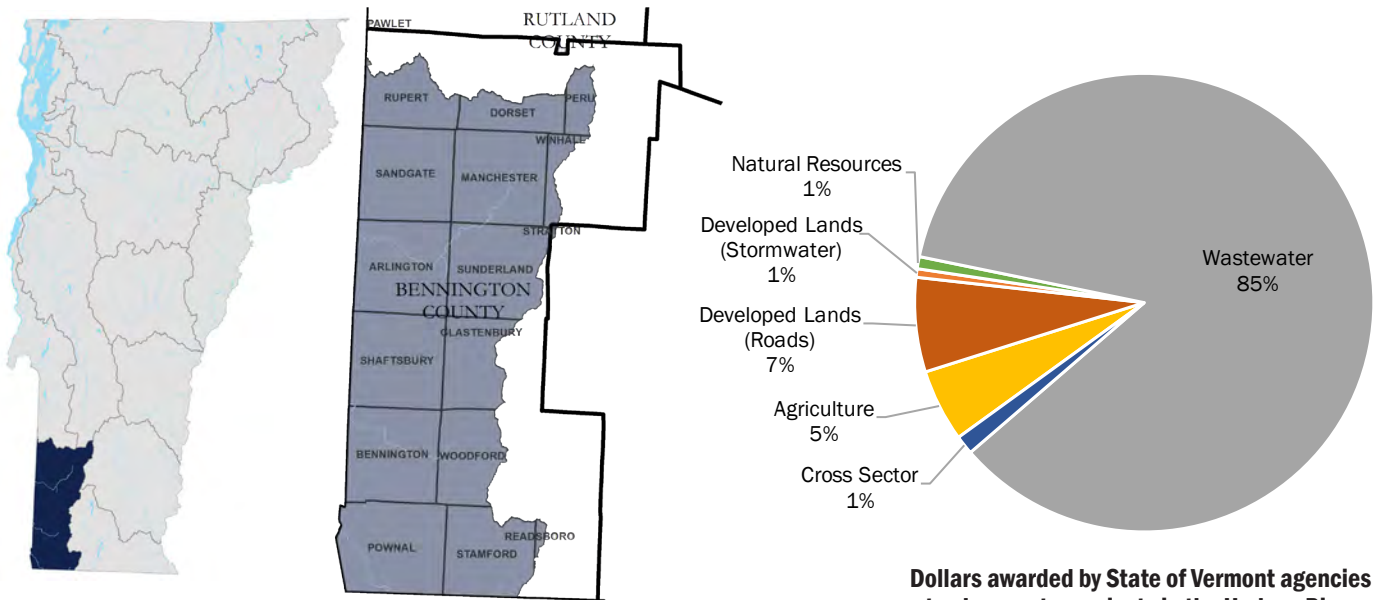
Watersheds:

White River
Ottauquechee, Black Rivers
West, Williams, Saxtons, Connecticut Rivers
Deerfield River
Stevens, Wells, Waits, Ompompanoosuc Rivers
Passumpsic River
Upper Connecticut River

Priority Water Quality Concerns:

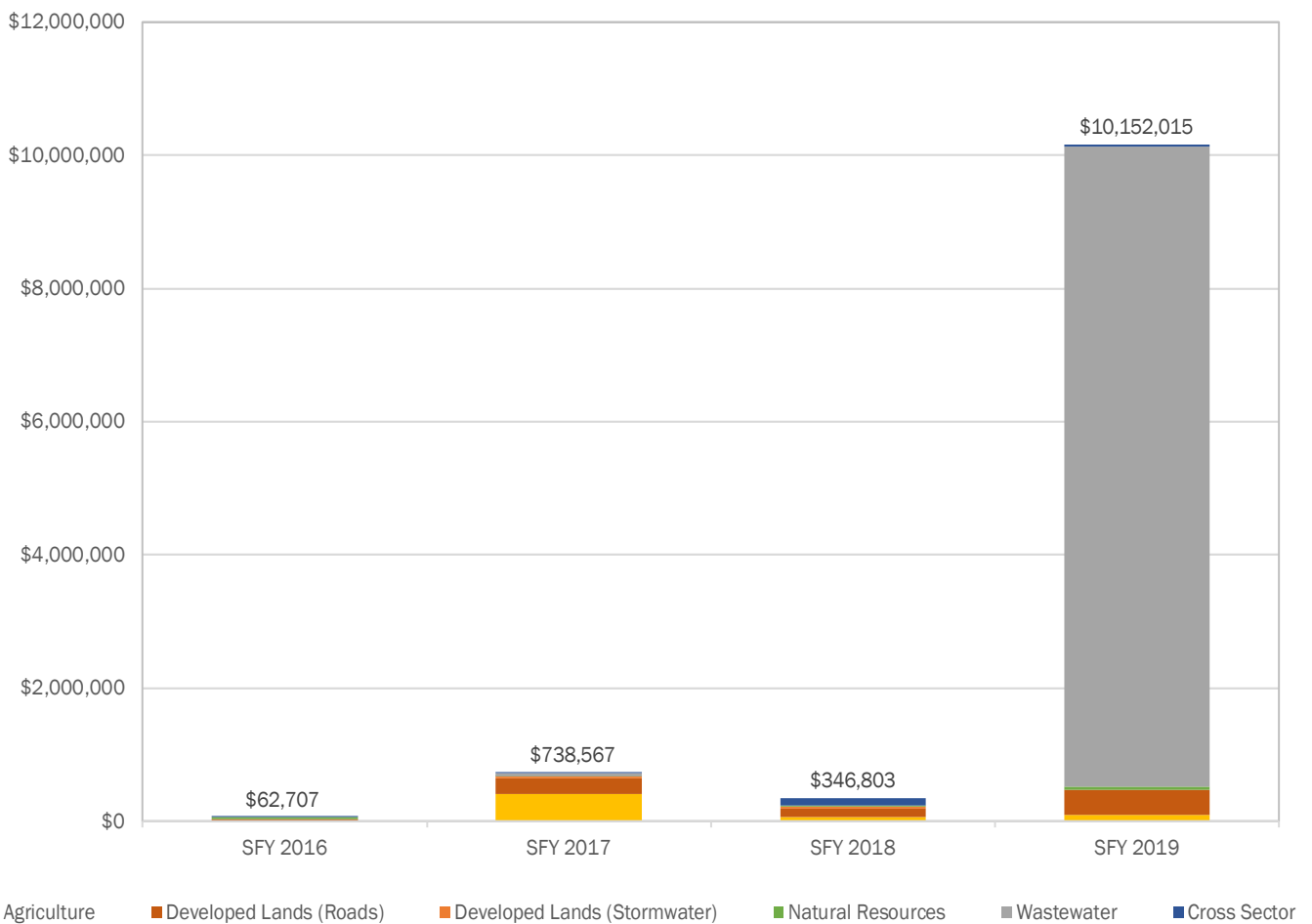
Nutrients/Sediment
Flow Alteration
Temperature

Battenkill, Walloomsac, Hoosic (Hudson) Rivers Watershed Investments



**Dollars awarded by State of Vermont agencies to clean water projects in the Hudson River watershed, SFY 2016-2019, by sector
Total: \$11,300,091**

Dollars awarded by State of Vermont agencies to clean water projects in the Hudson River watershed, by sector and State Fiscal Year.



Battenkill, Walloomsac, Hoosic (Hudson) Rivers Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Hudson River watershed.

Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	-	-	155	-	155
Acres of agricultural land treated by forest and grass buffers	-	-	-	-	-
Acres of pasture with livestock excluded from surface waters	-	-	-	-	-
Number of barnyard and production area practices installed	-	-	-	-	-
Acres of water quality protections within newly conserved agricultural lands	-	3	-	-	3
Estimated acres of agricultural land treated through equipment	-	-	-	-	-

AGRICULTURE POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	1	0.5	-	3	5
Acres of riparian corridor conserved and restored through easements	-	-	-	-	-
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	-	-	-	-	-
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	-	-	-	-	-
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	27	27

NATURAL RESOURCES POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	-	-	-	-
Miles of municipal road drainage and erosion control improvements	-	0.2	3	4	7
Number of municipal road drainage and stream culverts replaced	-	5	6	9	20
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	12	0.1	12

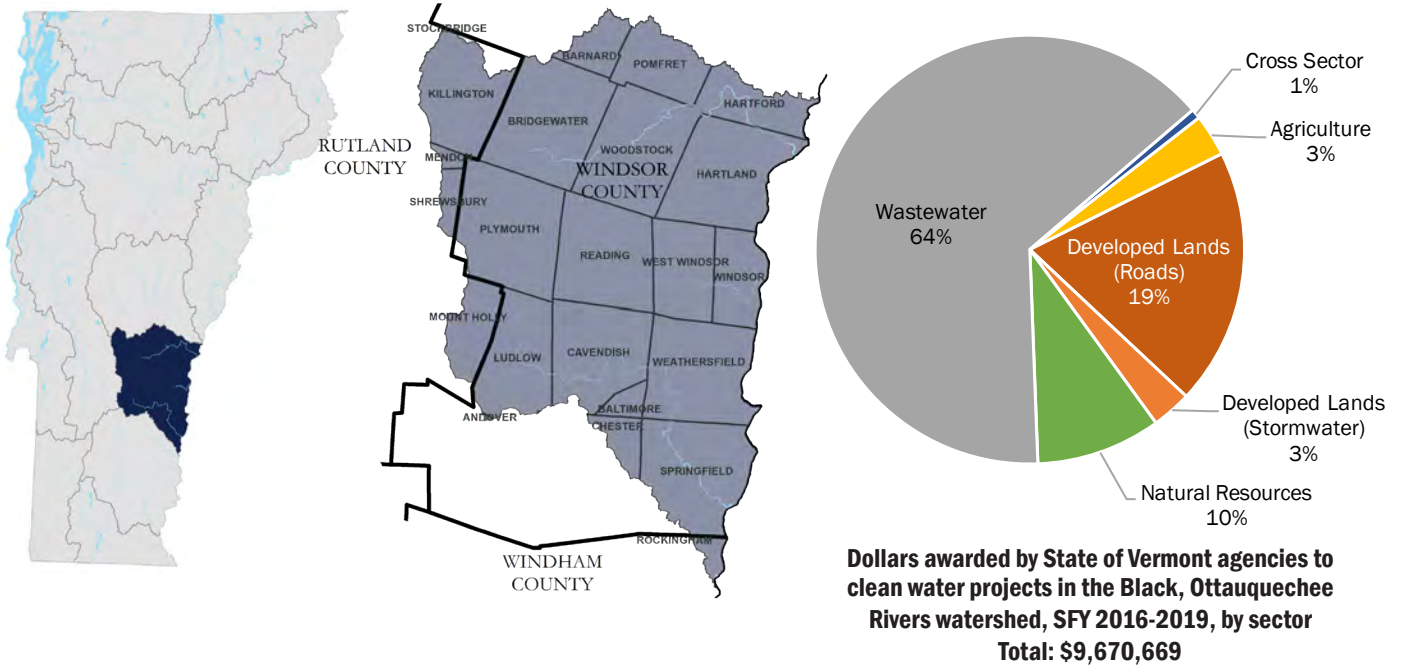
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins

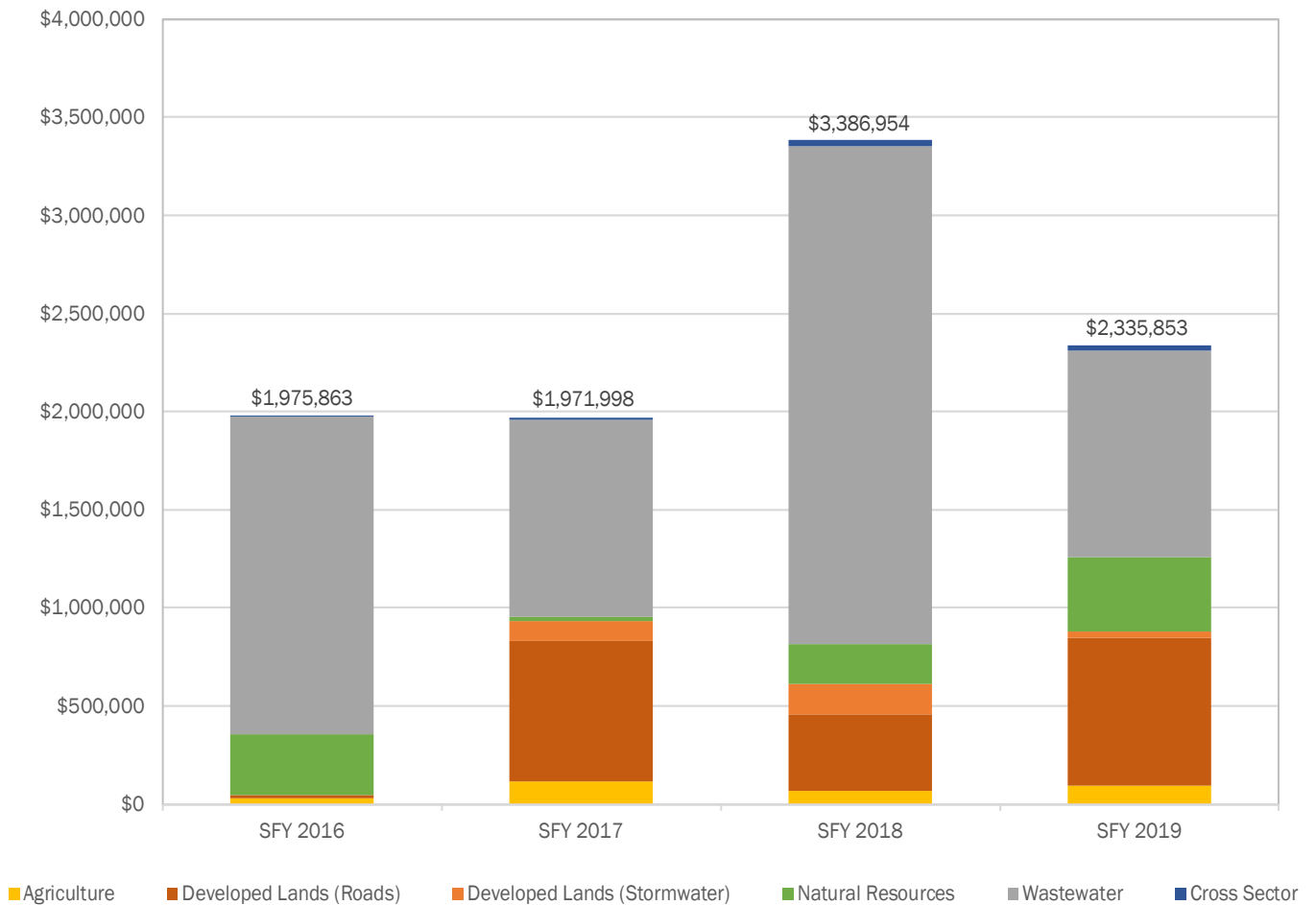


WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	1	1
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Black, Ottauquechee Rivers Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the Black, Ottauquechee Rivers watershed, by sector and State Fiscal Year.



Black, Ottauquechee Rivers Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Black, Ottauquechee Rivers watershed. Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	-	-	-	43	43
Acres of agricultural land treated by forest and grass buffers	-	-	-	-	-
Acres of pasture with livestock excluded from surface waters	-	-	-	-	-
Number of barnyard and production area practices installed	-	-	-	-	-
Acres of water quality protections within newly conserved agricultural lands	-	-	-	-	-
Estimated acres of agricultural land treated through equipment	-	-	46	-	46
AGRICULTURE POLLUTANT REDUCTION					
Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins					



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	1	1	0.8	0.8	4
Acres of riparian corridor conserved and restored through easements	47	-	-	-	47
Acres of floodplain restored	-	-	-	1	1
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	-	-	-	26	26
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	58	-	-	-	58
Miles of forest road drainage and erosion control improvements	-	0.8	-	-	1
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	-	-
NATURAL RESOURCES POLLUTANT REDUCTION					
Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins					

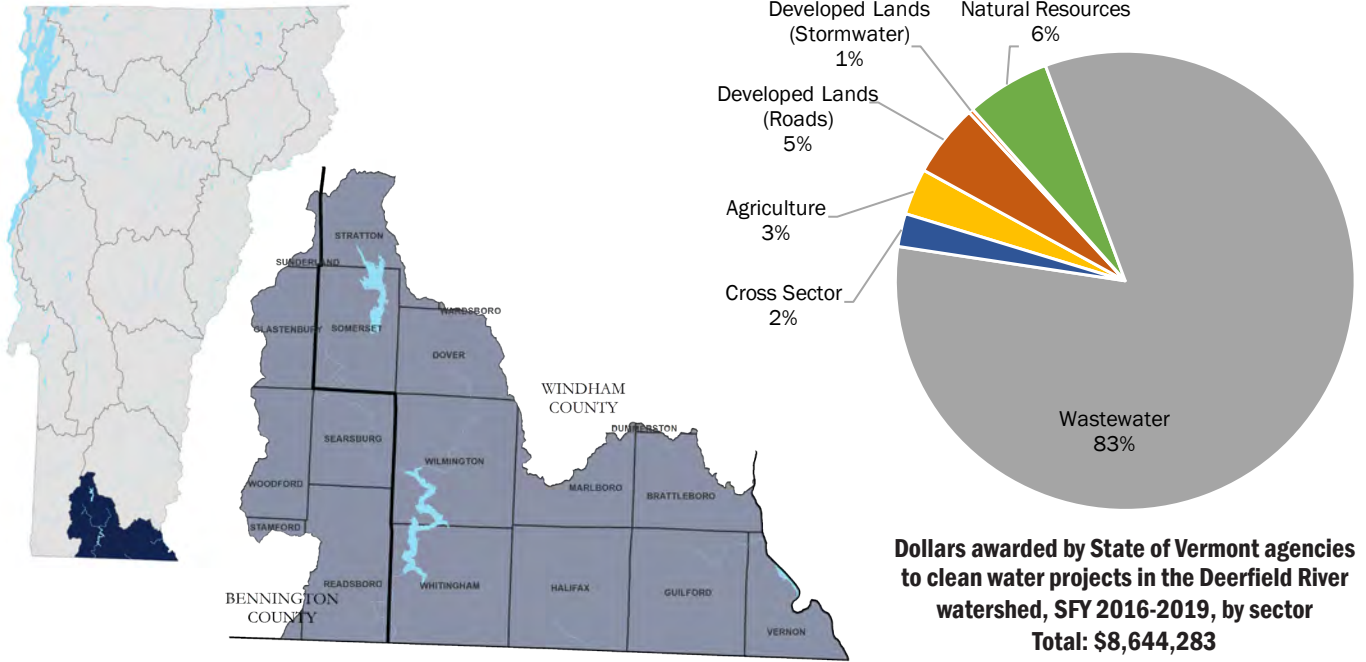


DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	-	-	-	-
Miles of municipal road drainage and erosion control improvements	-	0.4	3	6	9
Number of municipal road drainage and stream culverts replaced	-	3	4	7	14
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	36	36
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	-	-	-
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION					
Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins					

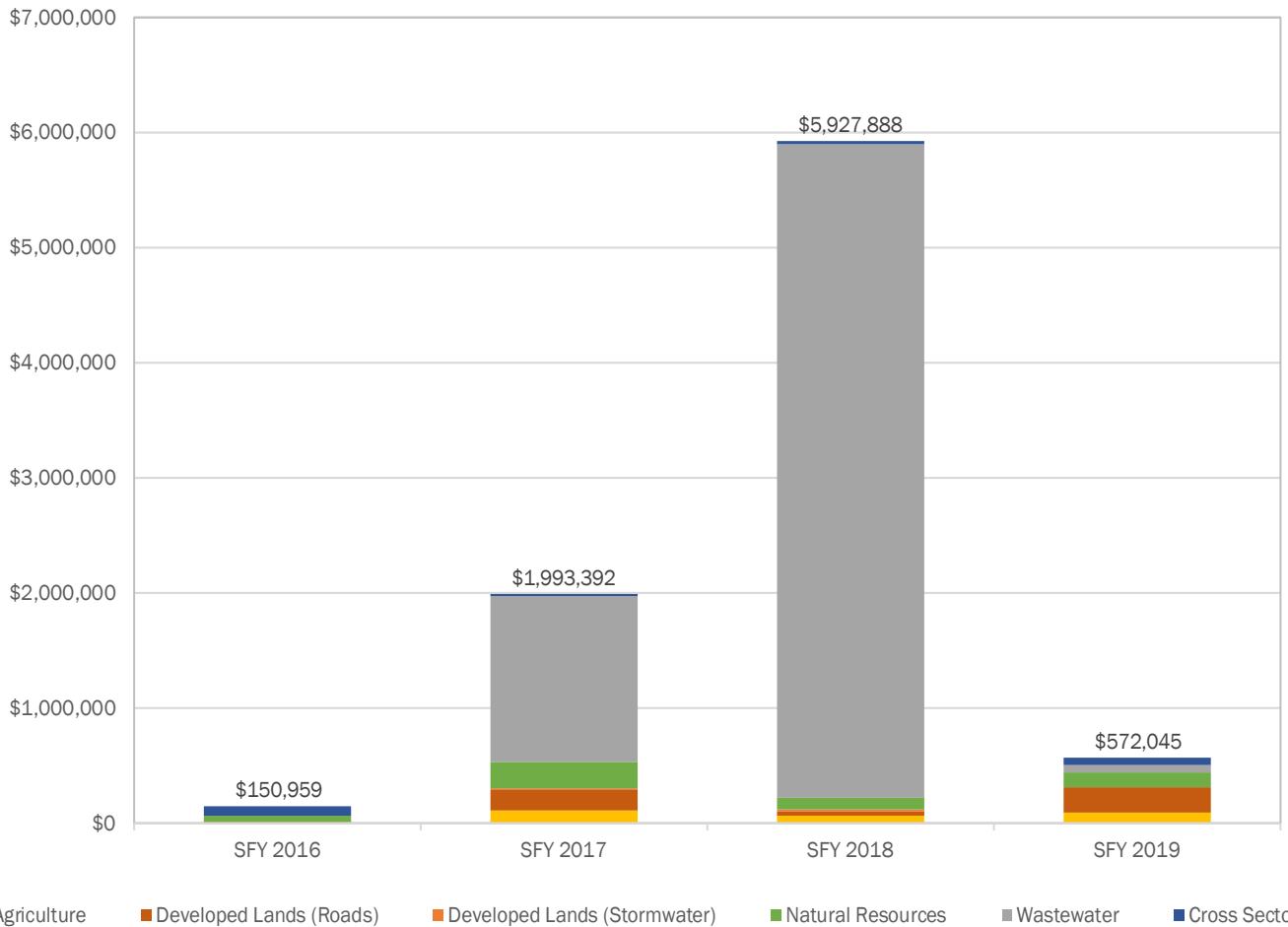


WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	2	1	-	-	3
Number of sewer extensions completed	-	2	-	-	2
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Deerfield River Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the Deerfield River watershed, by sector and State Fiscal Year.



Deerfield River Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Deerfield River watershed.
 Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	-	-	-	-	-
Acres of agricultural land treated by forest and grass buffers	-	-	-	-	-
Acres of pasture with livestock excluded from surface waters	-	-	-	-	-
Number of barnyard and production area practices installed	-	-	-	-	-
Acres of water quality protections within newly conserved agricultural lands	-	-	-	-	-
Estimated acres of agricultural land treated through equipment	-	-	46	-	46

AGRICULTURE POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	2	0.5	-	0.8	3
Acres of riparian corridor conserved and restored through easements	-	-	-	-	-
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	5	0.4	5
Stream miles reconnected for stream equilibrium/fish passage	-	-	-	-	-
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	-	-	-	-	-
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	-	-

NATURAL RESOURCES POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	-	-	-	-
Miles of municipal road drainage and erosion control improvements	-	0.1	3	1	4
Number of municipal road drainage and stream culverts replaced	-	2	-	3	5
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	-	-	-

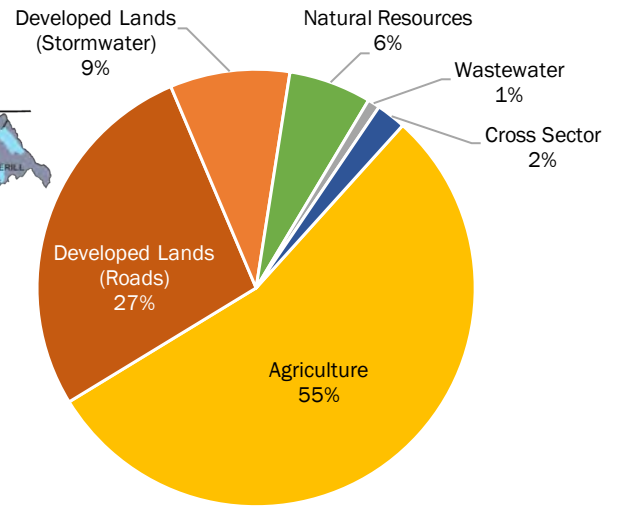
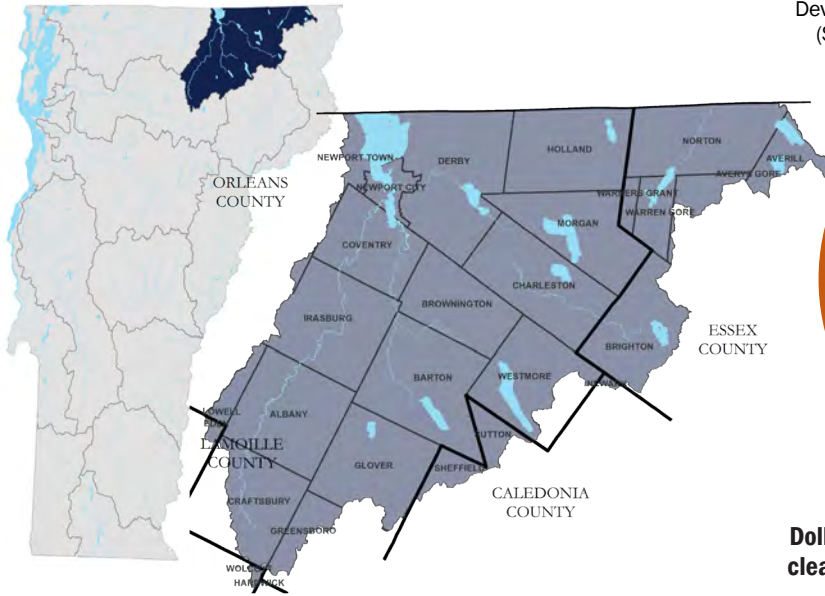
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



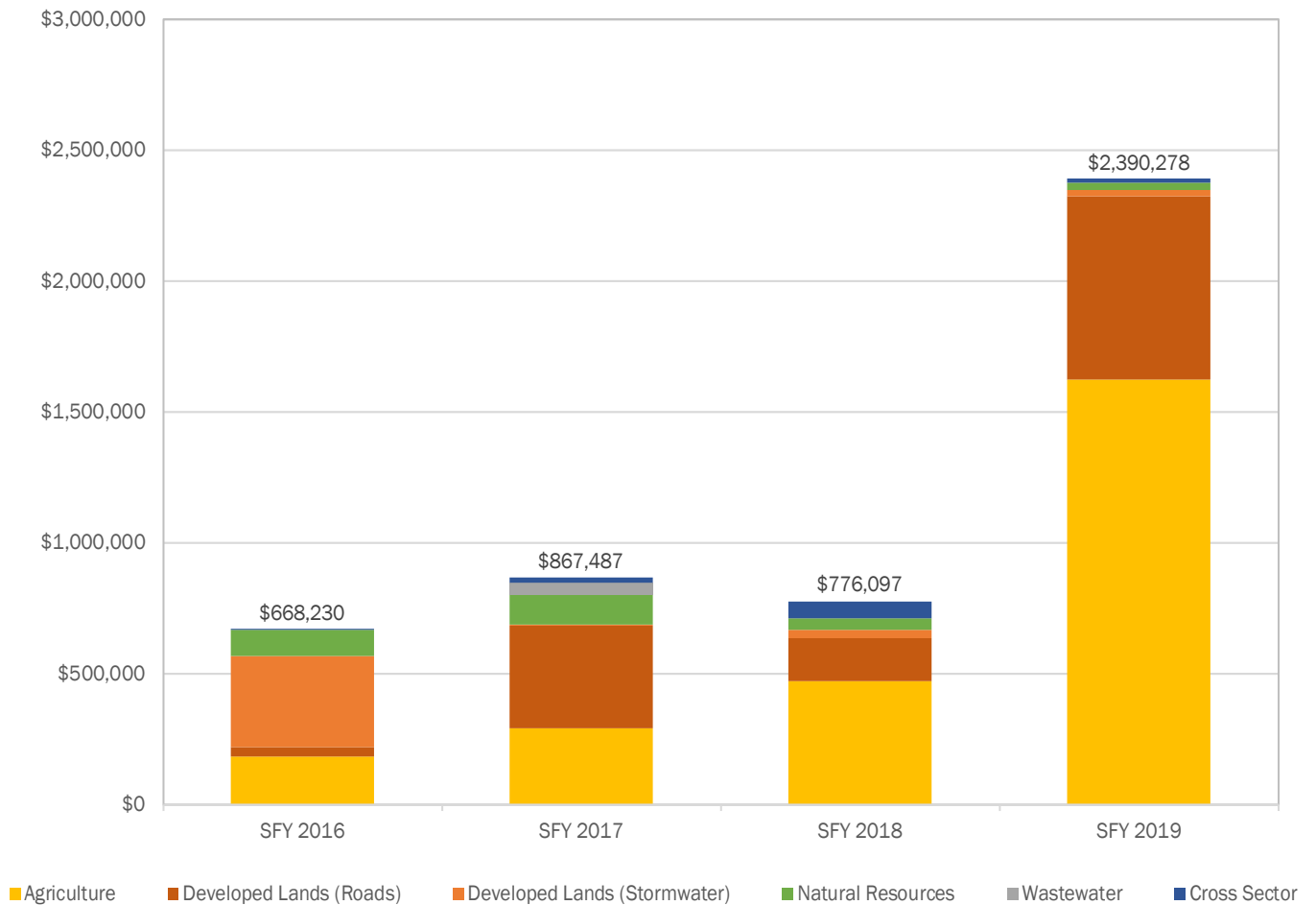
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Lake Memphremagog Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the Lake Memphremagog watershed, SFY 2016-2019, by sector
Total: \$4,702,092

Dollars awarded by State of Vermont agencies to clean water projects in the Lake Memphremagog watershed, by sector and State Fiscal Year.



Lake Memphremagog Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Lake Memphremagog watershed¹. Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	650	146	2,209	899	3,904
Acres of agricultural land treated by forest and grass buffers	-	-	20	-	20
Acres of pasture with livestock excluded from surface waters	-	-	-	-	-
Number of barnyard and production area practices installed	7	2	4	11	24
Acres of water quality protections within newly conserved agricultural lands	-	-	-	6	6
Estimated acres of agricultural land treated through equipment	-	-	-	460	460
AGRICULTURE POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	38.7	75.5	41.0	234.0	



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	4	6	15	3	29
Acres of riparian corridor conserved and restored through easements	-	-	-	-	-
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	0.2	-	-	-	0.2
Stream miles reconnected for stream equilibrium/fish passage	-	-	-	-	-
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	-	29	-	-	29
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	-	-
NATURAL RESOURCES POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	2.3	18.6	24.2	30.1	



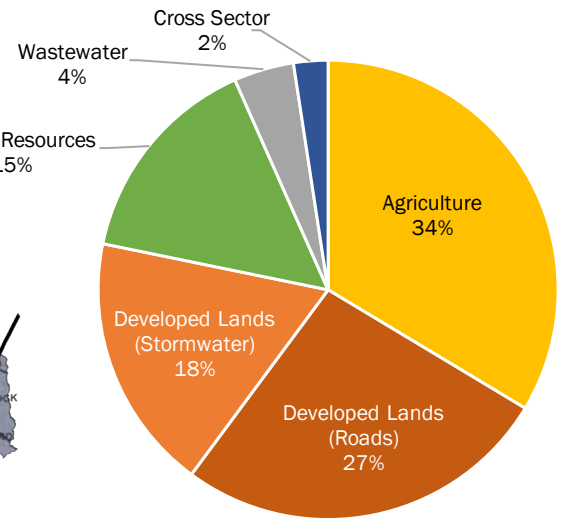
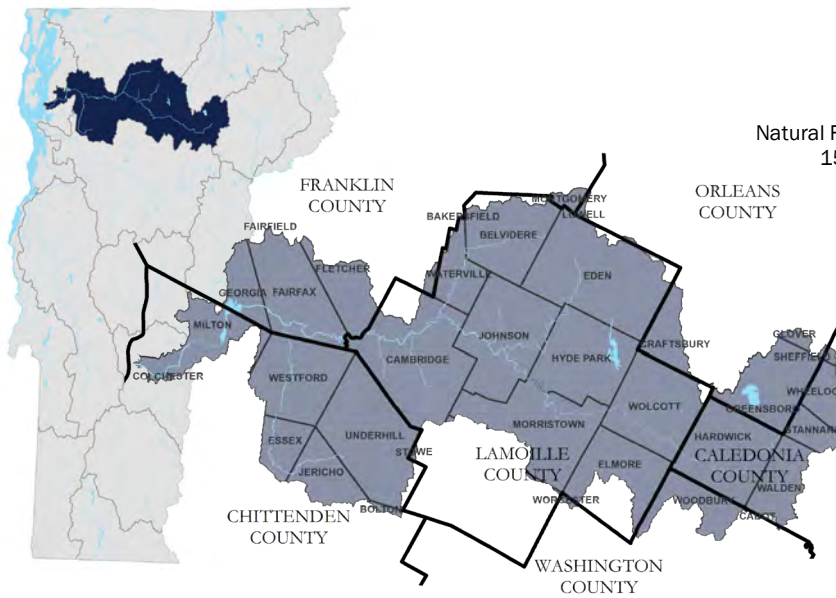
DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	-	-	0.3	0.3
Miles of municipal road drainage and erosion control improvements	-	3	4	10	17
Number of municipal road drainage and stream culverts replaced	-	11	12	17	40
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	1	8	9
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	-	4.5	10.4	19.8	



WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

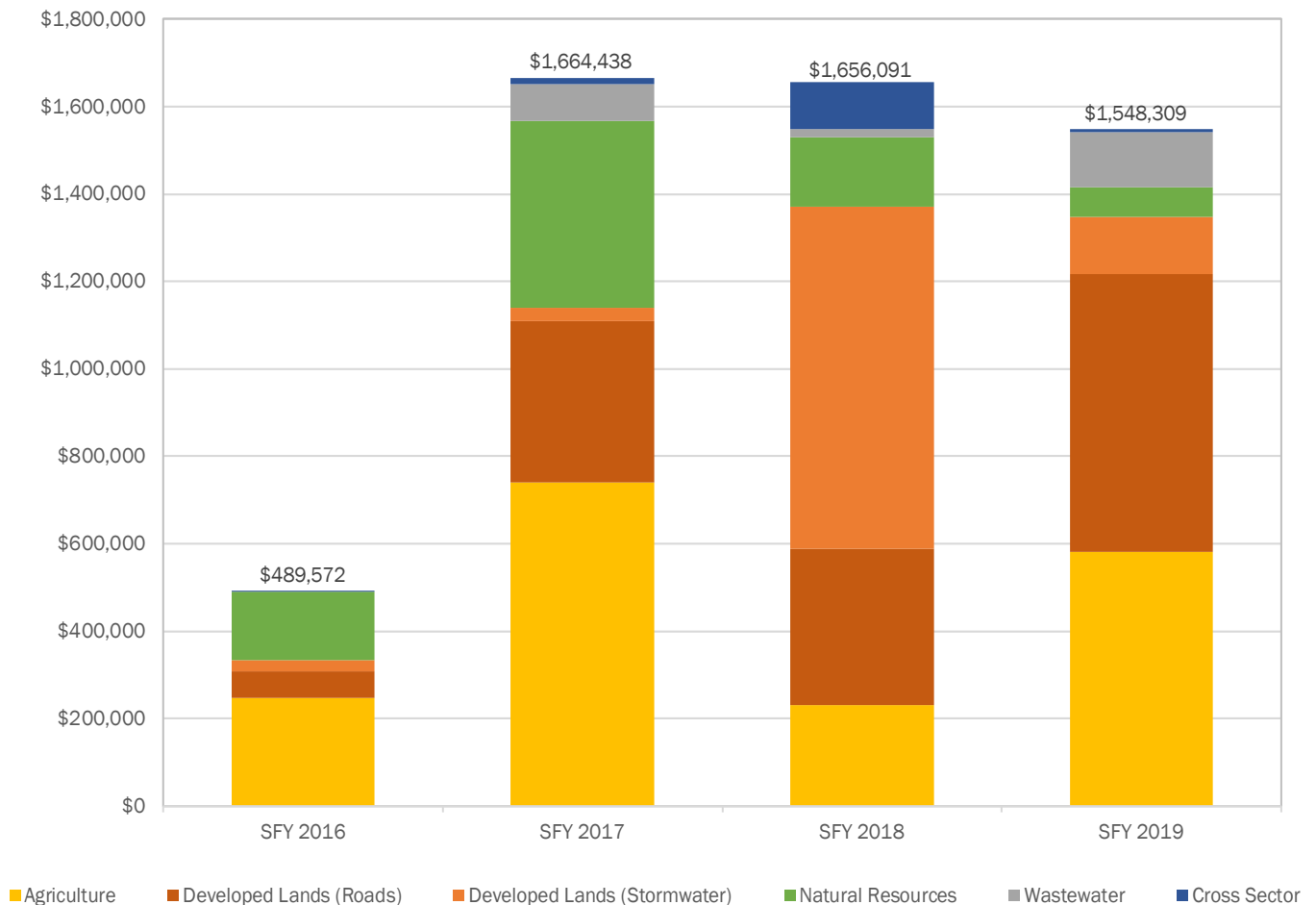
¹ Investments and outputs reported for the Lake Memphremagog Tactical Basin Planning watershed include the Tomifobia River and Coaticook River subwatersheds, which do not drain to Lake Memphremagog, but are included in the watershed boundary for planning purposes. Phosphorus load reductions cannot be quantified for projects implemented in the Tomifobia River and Coaticook River subwatersheds.

Lamoille River Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the Lamoille River watershed, SFY 2016-2019, by sector
Total: \$5,358,410

Dollars awarded by State of Vermont agencies to clean water projects in the Lamoille River watershed, by sector and State Fiscal Year.



Lamoille River Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Lamoille River watershed. Note: Does not include results of projects funded, but not yet completed. The Lamoille River Tactical Basin Plan is due for an interim report card as part of the Lake Champlain Progress Report this reporting period. Refer to Part 2 “Lake Champlain Progress Report” and Appendix B “Interim Lake Champlain TMDL Progress Report for Lamoille River” of this report for more information.



AGRICULTURE

AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	189	87	182	840	1,298
Acres of agricultural land treated by forest and grass buffers	-	14	100	-	114
Acres of pasture with livestock excluded from surface waters	-	9	27	-	36
Number of barnyard and production area practices installed	12	29	2	2	45
Acres of water quality protections within newly conserved agricultural lands	-	-	42	-	42
Estimated acres of agricultural land treated through equipment	-	153	2	104	259
AGRICULTURE POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	29.6	34.3	86.9	243.0	



NATURAL RESOURCES

NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	1	1	0.9	8	11
Acres of riparian corridor conserved and restored through easements	21	35	35	-	91
Acres of floodplain restored	-	-	0.3	-	0.3
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	-	-	-	-	-
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	-	15	15	-	30
Miles of forest road drainage and erosion control improvements	-	-	-	0.8	1
Number of stream crossings improved	-	-	-	2	2
Square feet of eroding gully remediated	-	-	-	27	27
NATURAL RESOURCES POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	0.5	2.7	6.2	6.8	



DEVELOPED LANDS



ROADS

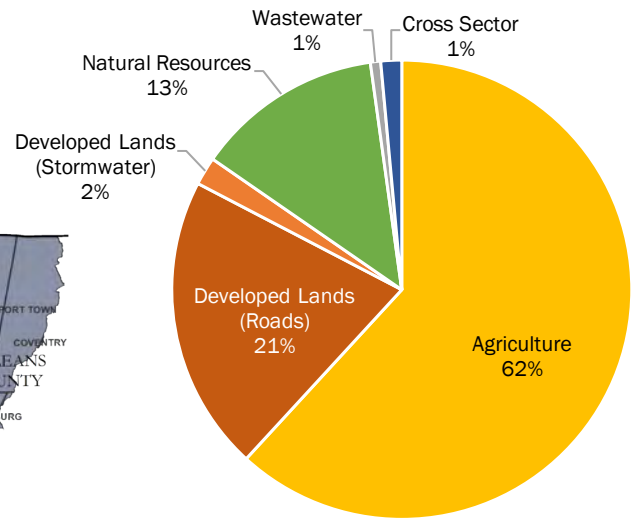
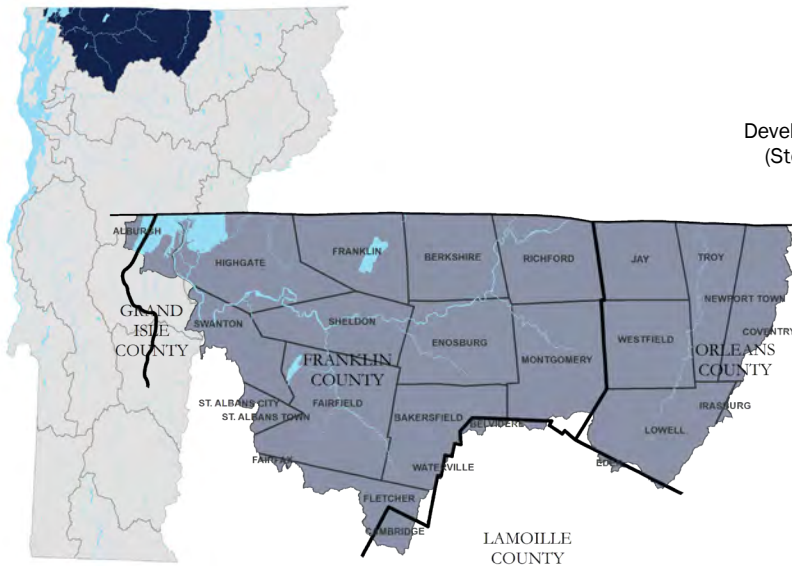
DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	4	10	3	17
Miles of municipal road drainage and erosion control improvements	-	0.7	7	4	12
Number of municipal road drainage and stream culverts replaced	-	1	32	11	44
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	1	81	82
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	-	3.9	30.9	48.5	



WASTEWATER

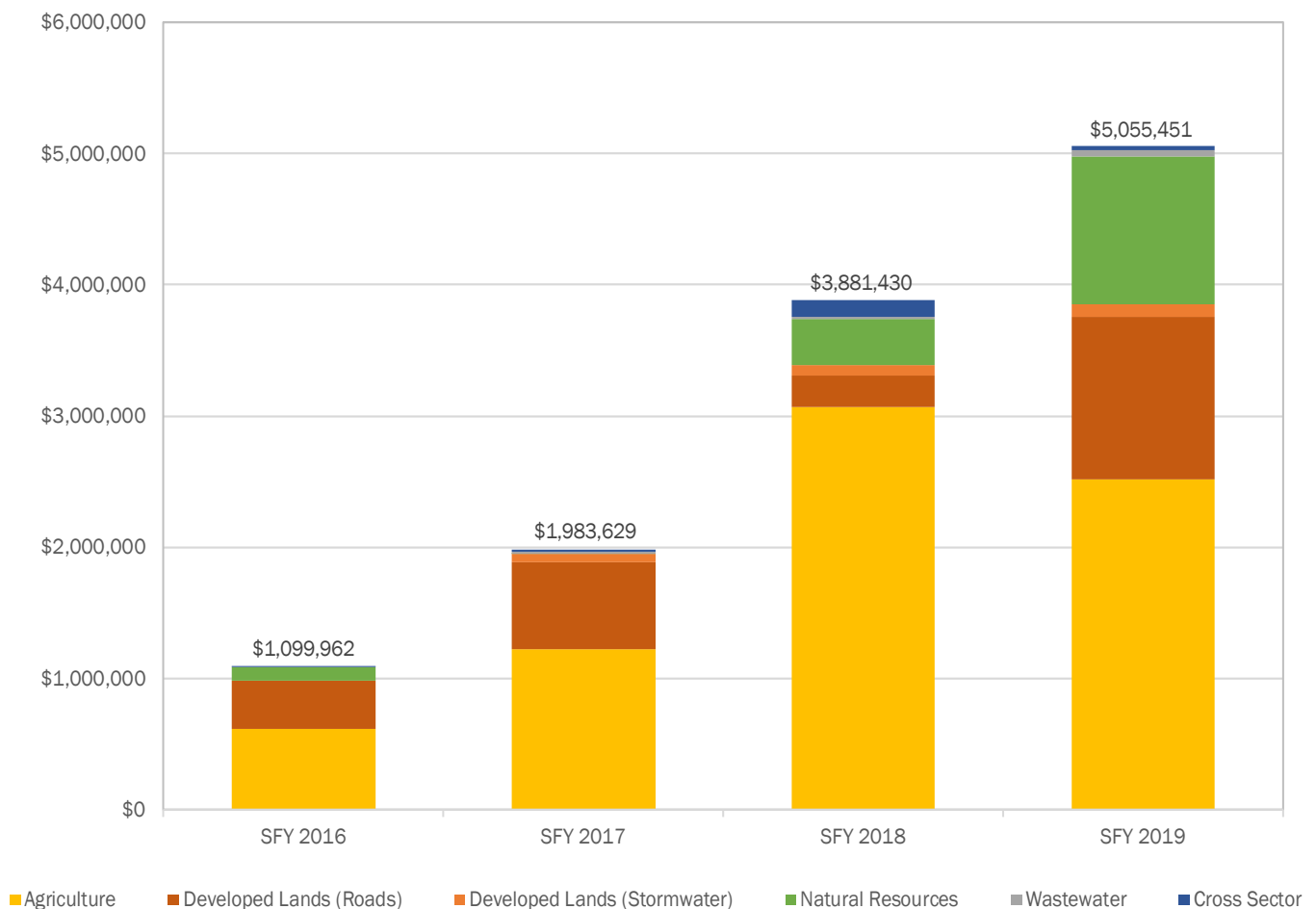
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Missisquoi Bay Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the Missisquoi Bay watershed, SFY 2016-2019, by sector
Total: \$12,020,472

Dollars awarded by State of Vermont agencies to clean water projects in the Missisquoi Bay watershed, by sector and State Fiscal Year.



■ Agriculture
 ■ Developed Lands (Roads)
 ■ Developed Lands (Stormwater)
 ■ Natural Resources
 ■ Wastewater
 ■ Cross Sector

Missisquoi Bay Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Missisquoi Bay watershed. Note: Does not include results of projects funded, but not yet completed. The Missisquoi River Tactical Basin Plan is due for an interim report card as part of the Lake Champlain Progress Report this reporting period. Refer to Part 2 “Lake Champlain Progress Report” and Appendix C “Interim Lake Champlain TMDL Progress Report for Missisquoi River” of this report for more information.



AGRICULTURE

AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	210	760	2,794	3,764	7,529
Acres of agricultural land treated by forest and grass buffers	97	-	85	-	182
Acres of pasture with livestock excluded from surface waters	97	-	47	-	144
Number of barnyard and production area practices installed	9	23	32	14	78
Acres of water quality protections within newly conserved agricultural lands	-	36	3	115	154
Estimated acres of agricultural land treated through equipment	-	745	927	1,443	3,114
AGRICULTURE POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	84.2	128.8	557.4	1,159.1	



NATURAL RESOURCES

NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	-	0.5	12	3	16
Acres of riparian corridor conserved and restored through easements	-	38	51	-	89
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	-	-	1	-	1
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	-	-	-	-	-
Miles of forest road drainage and erosion control improvements	-	-	-	5	5
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	27	27
NATURAL RESOURCES POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	-	-	11.8	26.4	



DEVELOPED LANDS



ROADS

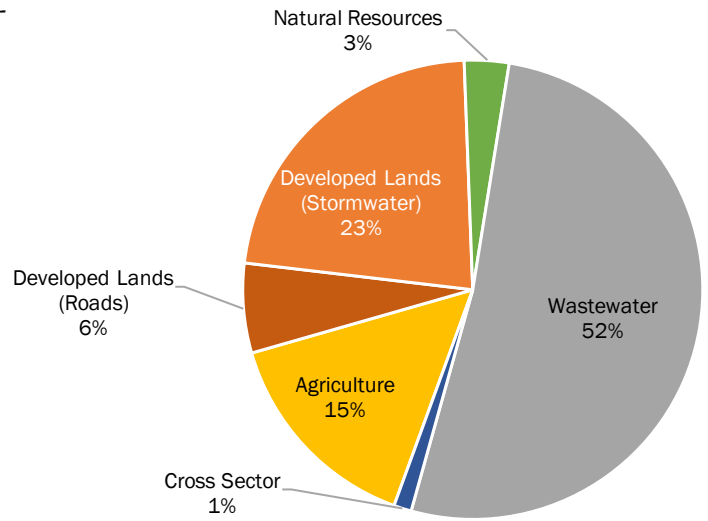
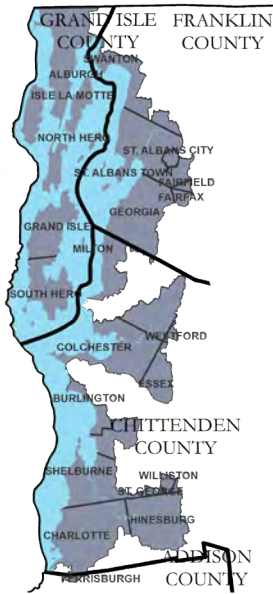
DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	20	-	-	20
Miles of municipal road drainage and erosion control improvements	0.5	0.5	4	3	9
Number of municipal road drainage and stream culverts replaced	-	9	8	6	23
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	0.7	-	1
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	-	8	8
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	1.8	6.2	16.8	28.3	



WASTEWATER

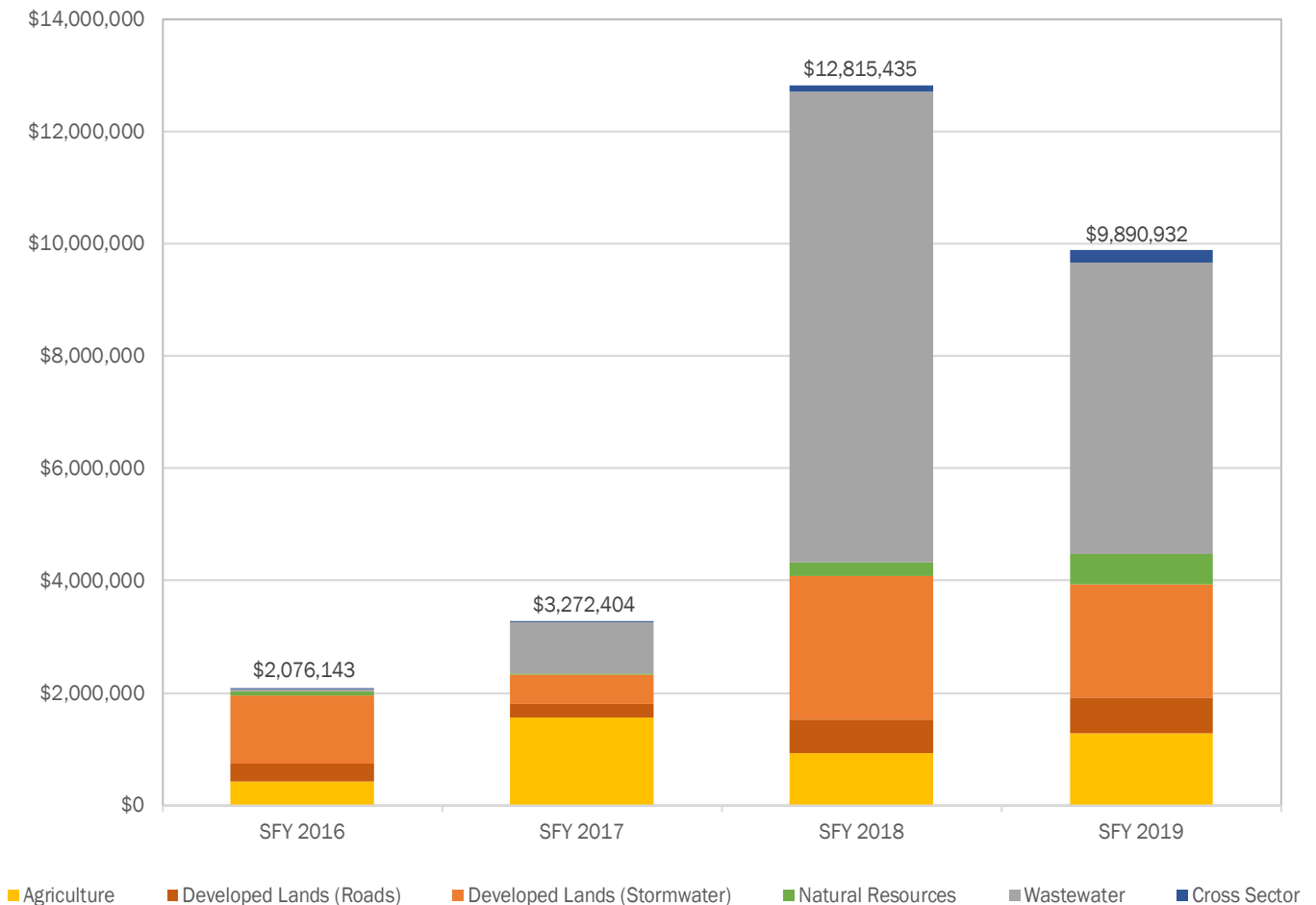
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Northern Lake Champlain Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the Northern Lake Champlain watershed, SFY 2016-2019, by sector
Total: \$28,054,915

Dollars awarded by State of Vermont agencies to clean water projects in the Northern Lake Champlain watershed, by sector and State Fiscal Year.



Northern Lake Champlain Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Northern Lake Champlain watershed. Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	229	615	457	1,233	2,534
Acres of agricultural land treated by forest and grass buffers	-	81	-	-	81
Acres of pasture with livestock excluded from surface waters	-	81	-	-	81
Number of barnyard and production area practices installed	18	4	7	3	32
Acres of water quality protections within newly conserved agricultural lands	-	20	14	-	34
Estimated acres of agricultural land treated through equipment	-	153	2,018	4,934	7,105
AGRICULTURE POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	2.0	111.0	73.8	332.7	



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	-	9	4	3	16
Acres of riparian corridor conserved and restored through easements	-	-	-	-	-
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	-	-	-	-	-
Acres of wetland conserved and restored through easements	-	-	-	17	17
Acres of forestland conserved with water quality protections	-	-	8	-	8
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	7,108	27	7,135
NATURAL RESOURCES POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	-	8.0	13.2	13.2	

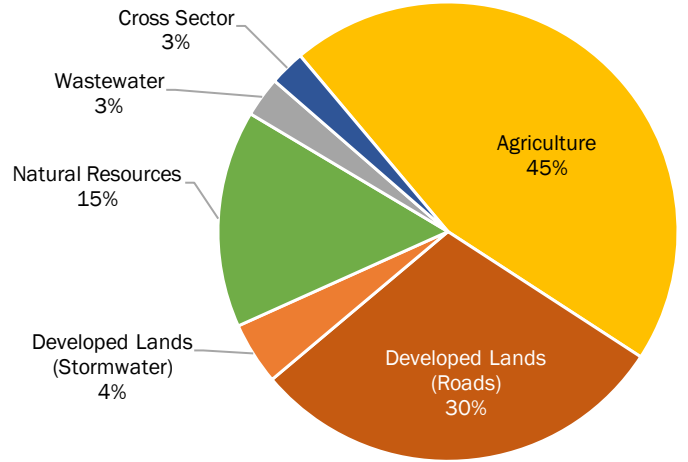
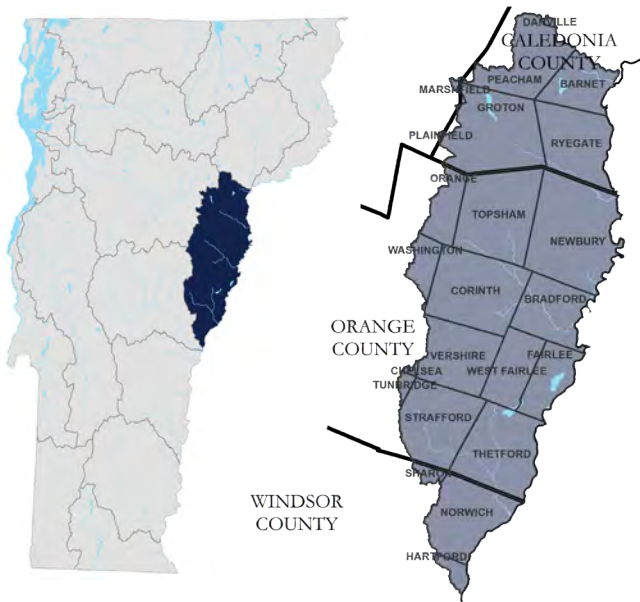


DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	0.2	-	0.7	67	68
Miles of municipal road drainage and erosion control improvements	-	0.1	2	5	7
Number of municipal road drainage and stream culverts replaced	-	-	2	17	19
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	-	-	-
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	0.1	1.0	2.2	34.3	



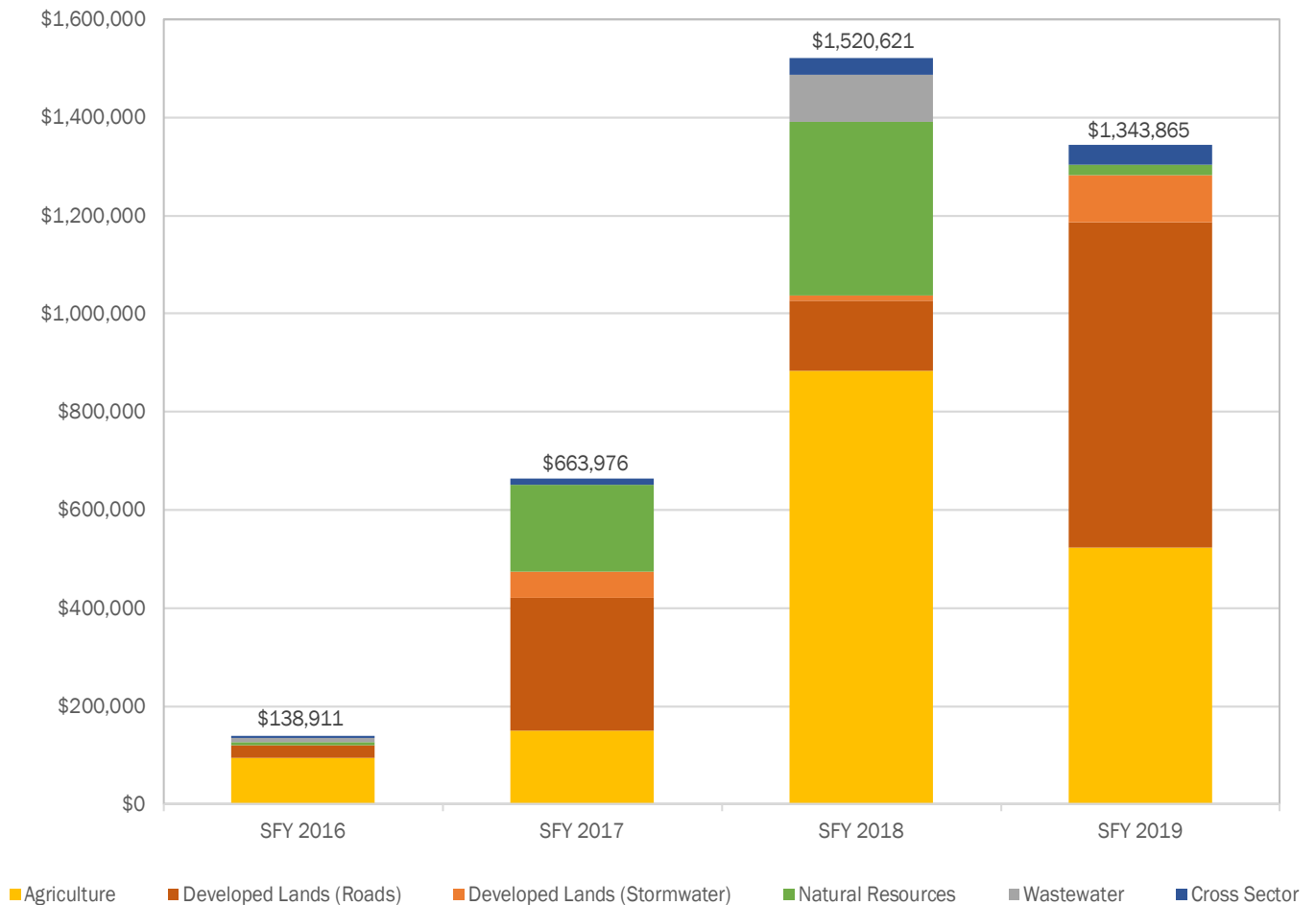
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Ompompanoosuc, Stevens, Waits, Wells Rivers Watershed Investments



**Dollars awarded by State of Vermont agencies to clean water projects in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed, SFY 2016-2019, by sector
Total: \$3,667,372**

Dollars awarded by State of Vermont agencies to clean water projects in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed, by sector and State Fiscal Year.



Ompompanoosuc, Stevens, Waits, Wells Rivers Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed. Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	508	177	-	117	802
Acres of agricultural land treated by forest and grass buffers	40	67	-	-	108
Acres of pasture with livestock excluded from surface waters	40	22	-	-	62
Number of barnyard and production area practices installed	1	2	7	2	12
Acres of water quality protections within newly conserved agricultural lands	-	-	27	-	27
Estimated acres of agricultural land treated through equipment	-	266	46	-	312

AGRICULTURE POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	2	0.5	13	0.8	17
Acres of riparian corridor conserved and restored through easements	-	32	87	-	119
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	28	-	-	-	28
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	-	-	-	-	-
Miles of forest road drainage and erosion control improvements	-	-	-	0.7	1
Number of stream crossings improved	-	-	-	6	6
Square feet of eroding gully remediated	-	-	-	-	-

NATURAL RESOURCES POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	-	-	-	-
Miles of municipal road drainage and erosion control improvements	-	0.4	4	7	11
Number of municipal road drainage and stream culverts replaced	-	4	-	25	29
Cubic yards of Class IV road gully erosion remediated	-	-	104	33	137
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	1	-	1

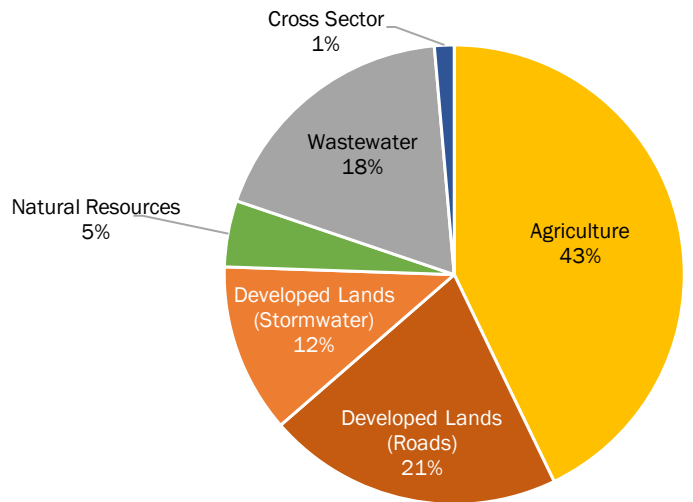
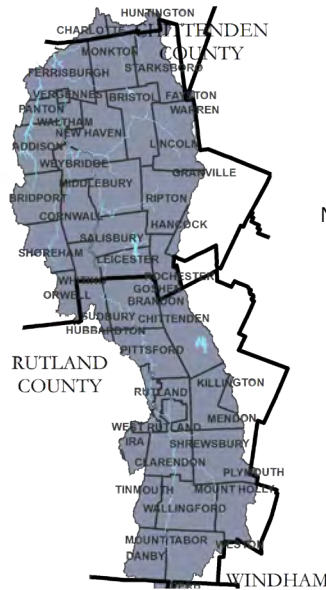
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



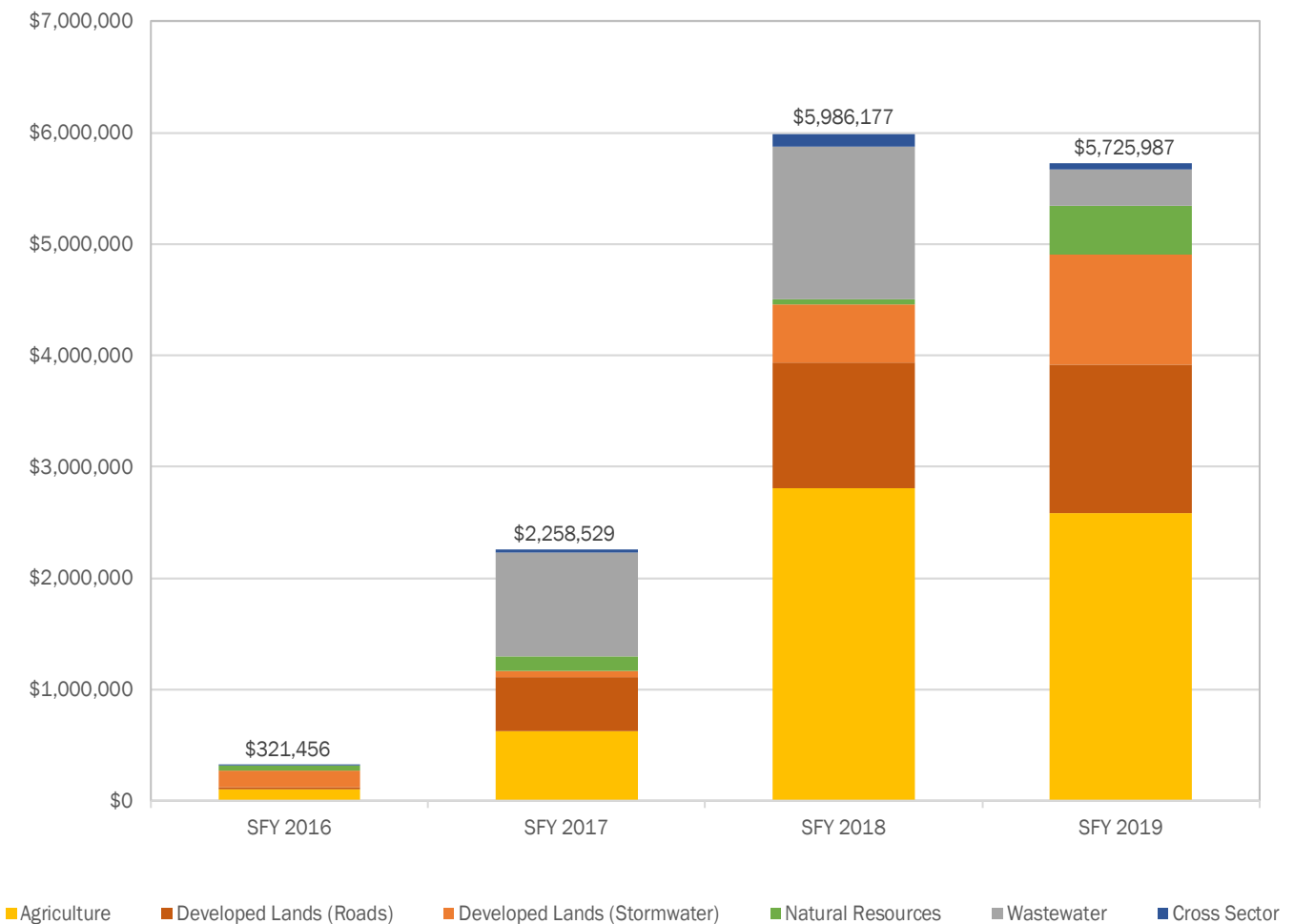
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	1	-	1
Number of wastewater treatment facility refurbished	-	-	1	-	1
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Otter Creek Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the Otter Creek watershed, SFY 2016-2019, by sector
Total: \$14,292,148

Dollars awarded by State of Vermont agencies to clean water projects in the Otter Creek watershed, by sector and State Fiscal Year.



Otter Creek Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Otter Creek watershed. Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	995	695	1,127	1,777	4,594
Acres of agricultural land treated by forest and grass buffers	-	-	23	-	23
Acres of pasture with livestock excluded from surface waters	-	-	23	-	23
Number of barnyard and production area practices installed	-	5	11	6	22
Acres of water quality protections within newly conserved agricultural lands	-	-	33	293	326
Estimated acres of agricultural land treated through equipment	-	153	1,531	104	1,788
AGRICULTURE POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	143.2	101.3	222.1	202.5	



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	8	0.5	3	5	17
Acres of riparian corridor conserved and restored through easements	-	-	-	-	-
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	-	-	-	-	-
Acres of wetland conserved and restored through easements	-	131	-	-	131
Acres of forestland conserved with water quality protections	-	-	-	-	-
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	-	-
NATURAL RESOURCES POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	12.9	21.6	40.7	42.8	

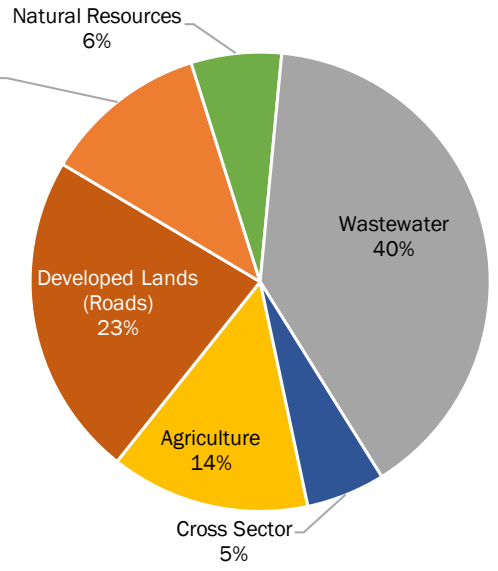
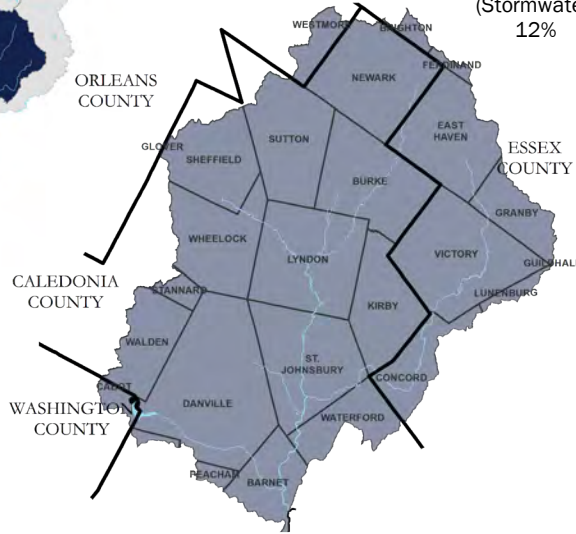
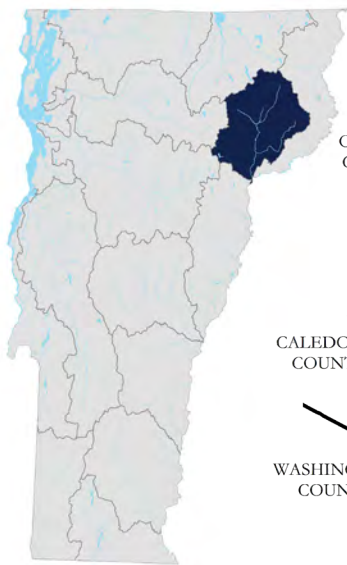


DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	10	2	9	21
Miles of municipal road drainage and erosion control improvements	-	1	8	9	18
Number of municipal road drainage and stream culverts replaced	-	10	5	36	51
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	-	-	-
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	-	5.5	17.8	47.5	



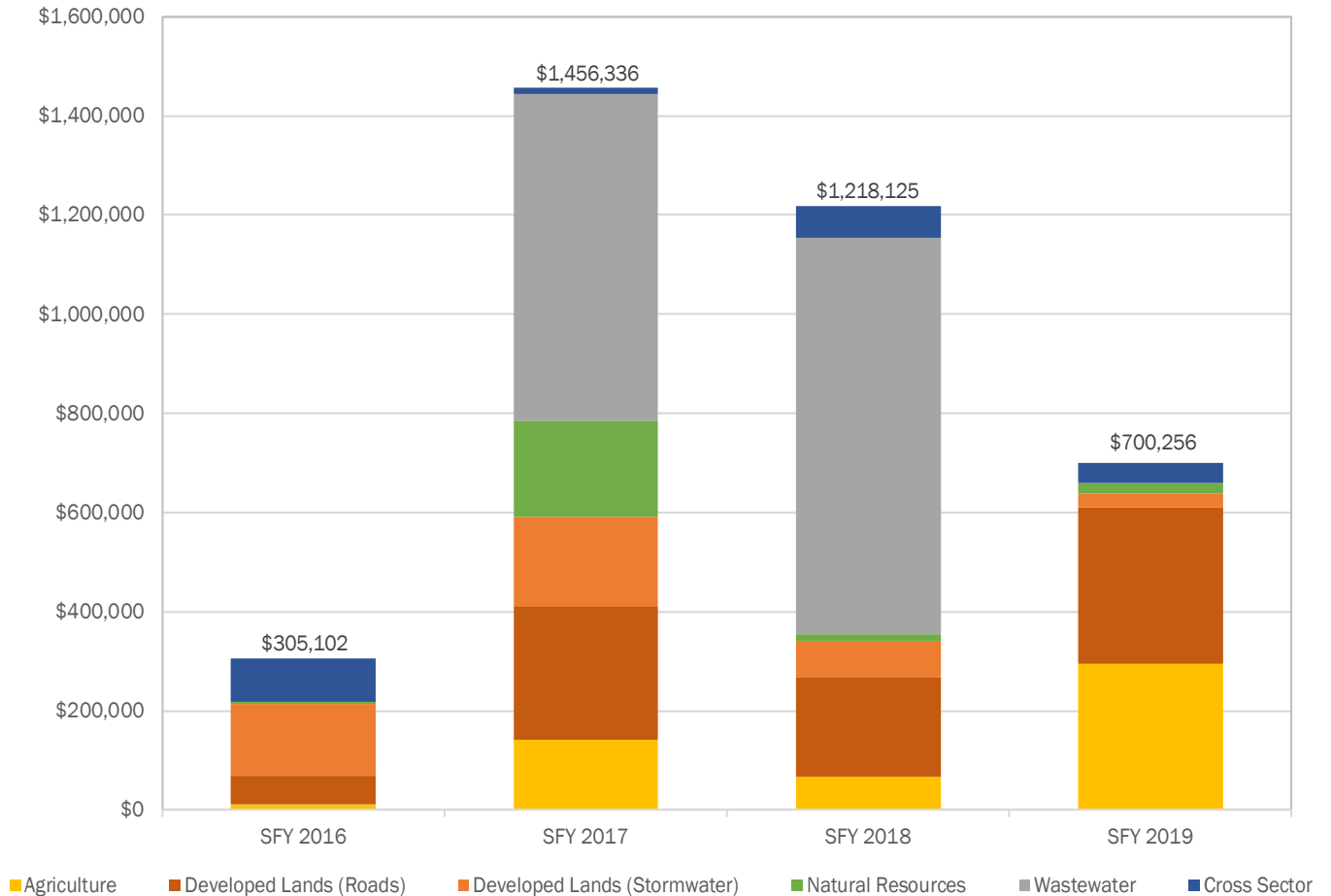
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	1	-	-	-	1
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	1	1
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Passumpsic River Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the Passumpsic River watershed, SFY 2016-2019, by sector
Total: \$3,679,818

Dollars awarded by State of Vermont agencies to clean water projects in the Passumpsic River watershed, by sector and State Fiscal Year.



Passumpsic River Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Passumpsic River watershed.
 Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	-	-	-	190	190
Acres of agricultural land treated by forest and grass buffers	30	-	-	-	30
Acres of pasture with livestock excluded from surface waters	30	-	-	-	30
Number of barnyard and production area practices installed	-	-	1	4	5
Acres of water quality protections within newly conserved agricultural lands	-	-	-	-	-
Estimated acres of agricultural land treated through equipment	-	-	46	-	46

AGRICULTURE POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	1	0.5	-	3	5
Acres of riparian corridor conserved and restored through easements	-	-	-	-	-
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	-	0.05	0.1
Stream miles reconnected for stream equilibrium/fish passage	-	-	99	-	99
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	-	-	-	-	-
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	-	-

NATURAL RESOURCES POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	41	-	2	43
Miles of municipal road drainage and erosion control improvements	0.2	1	4	3	9
Number of municipal road drainage and stream culverts replaced	-	18	18	15	51
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	57	57
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	1	-	1

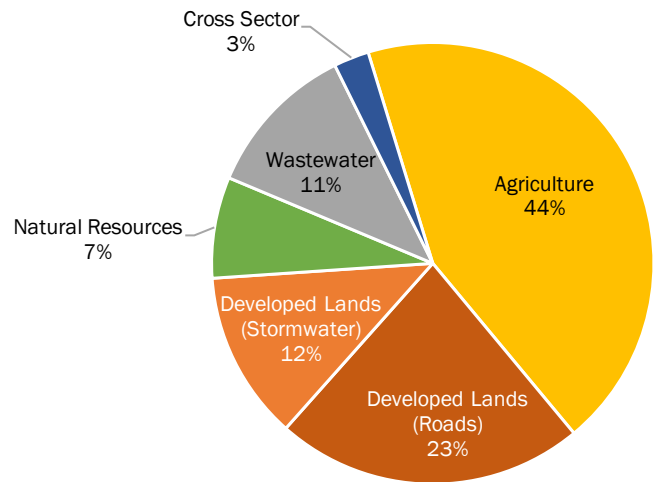
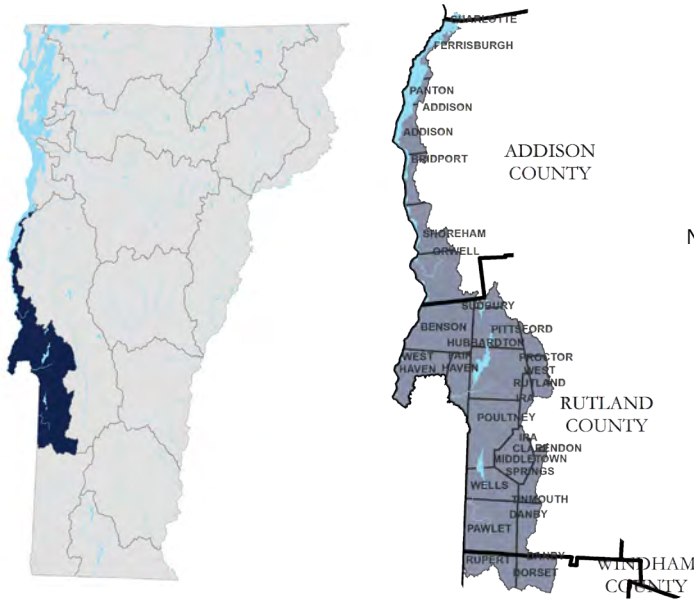
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



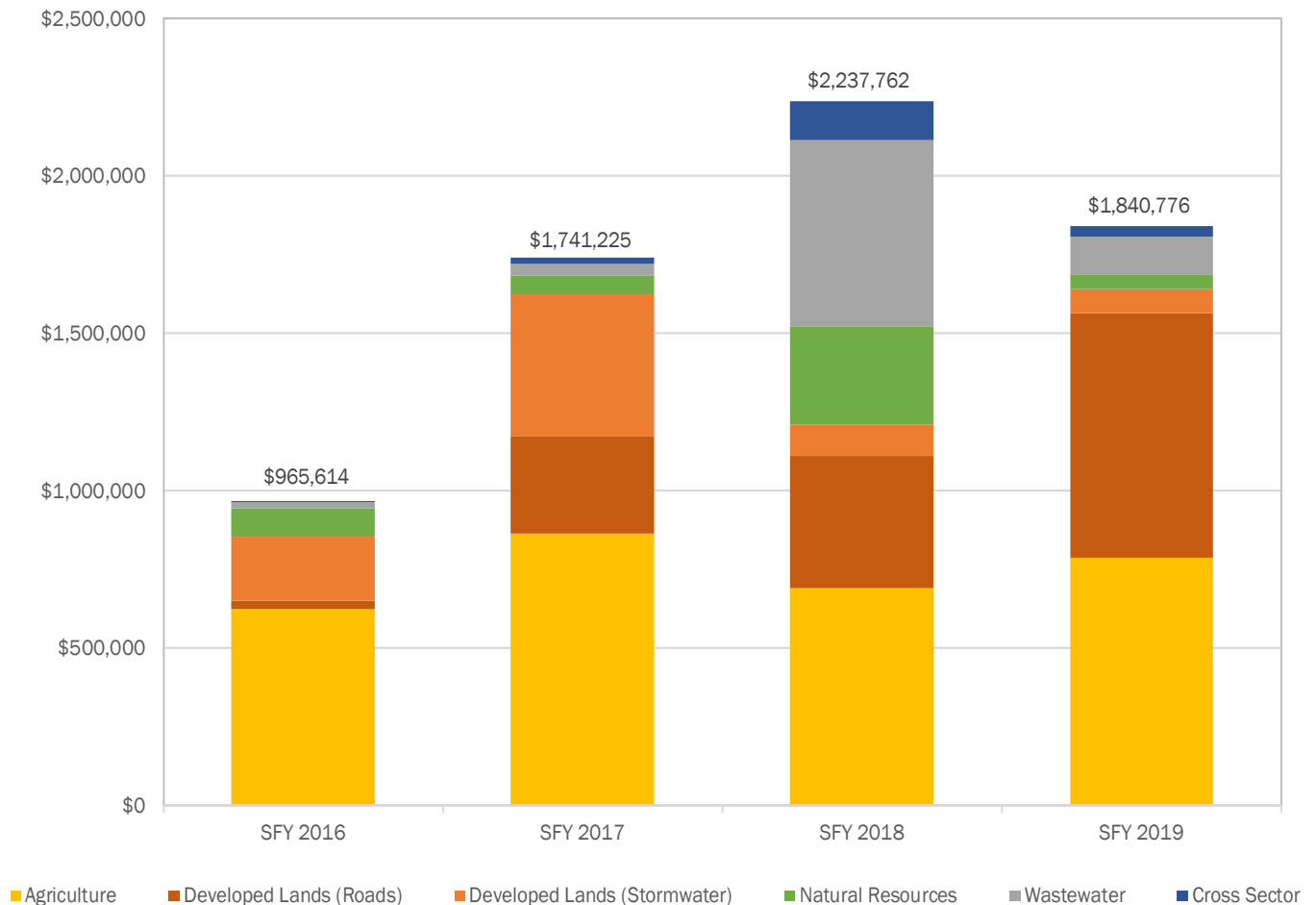
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	1	-	-	-	1
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

South Lake Champlain, Poultney, Mettowee Rivers Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the South Lake Champlain, Poultney, Mettowee Rivers watershed, SFY 2016-2019, by sector
Total: \$6,785,377

Dollars awarded by State of Vermont agencies to clean water projects in the South Lake Champlain, Poultney, Mettowee Rivers watershed, by sector and State Fiscal Year.



South Lake Champlain, Poultney, Mettowie Rivers Watershed Investments



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the South Lake Champlain, Poultney, Mettowie Rivers watershed. Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	1,945	237	398	735	3,316
Acres of agricultural land treated by forest and grass buffers	-	-	-	-	-
Acres of pasture with livestock excluded from surface waters	-	-	-	-	-
Number of barnyard and production area practices installed	-	11	8	2	21
Acres of water quality protections within newly conserved agricultural lands	-	34	-	25	59
Estimated acres of agricultural land treated through equipment	-	153	353	104	610
AGRICULTURE POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	301.4	223.0	149.0	198.0	



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	2	0.5	1	18	22
Acres of riparian corridor conserved and restored through easements	-	-	-	-	-
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	5	0.4	5
Stream miles reconnected for stream equilibrium/fish passage	-	-	4	-	4
Acres of wetland conserved and restored through easements	-	-	40	25	65
Acres of forestland conserved with water quality protections	-	109	93	-	202
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	43,560	-	43,560
NATURAL RESOURCES POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	9.5	33.0	60.9	71.4	

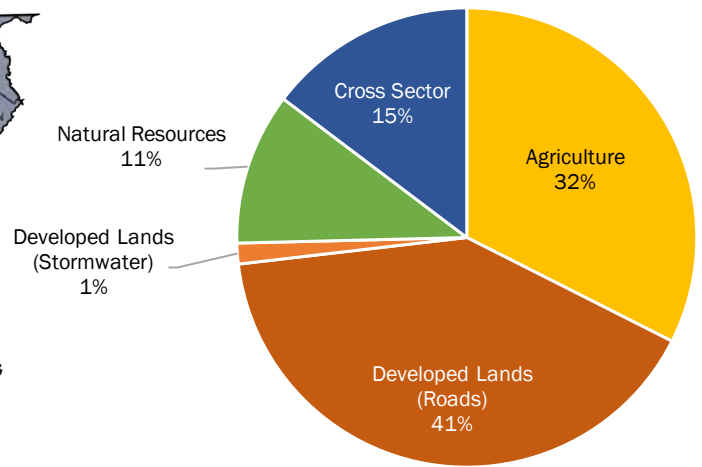
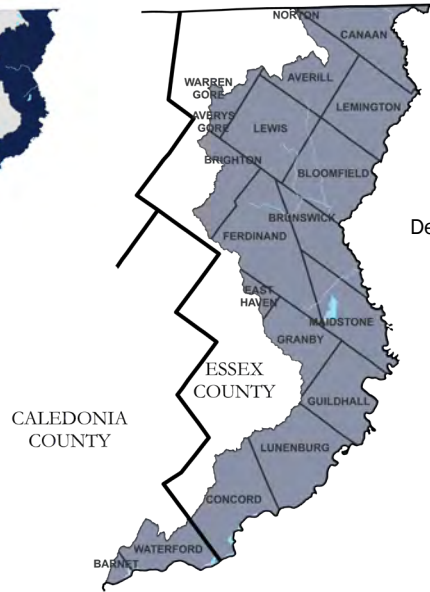


DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	-	-	-	-
Miles of municipal road drainage and erosion control improvements	-	1	5	7	13
Number of municipal road drainage and stream culverts replaced	-	7	20	35	62
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	-	-	-
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	-	5.7	21.4	38.8	



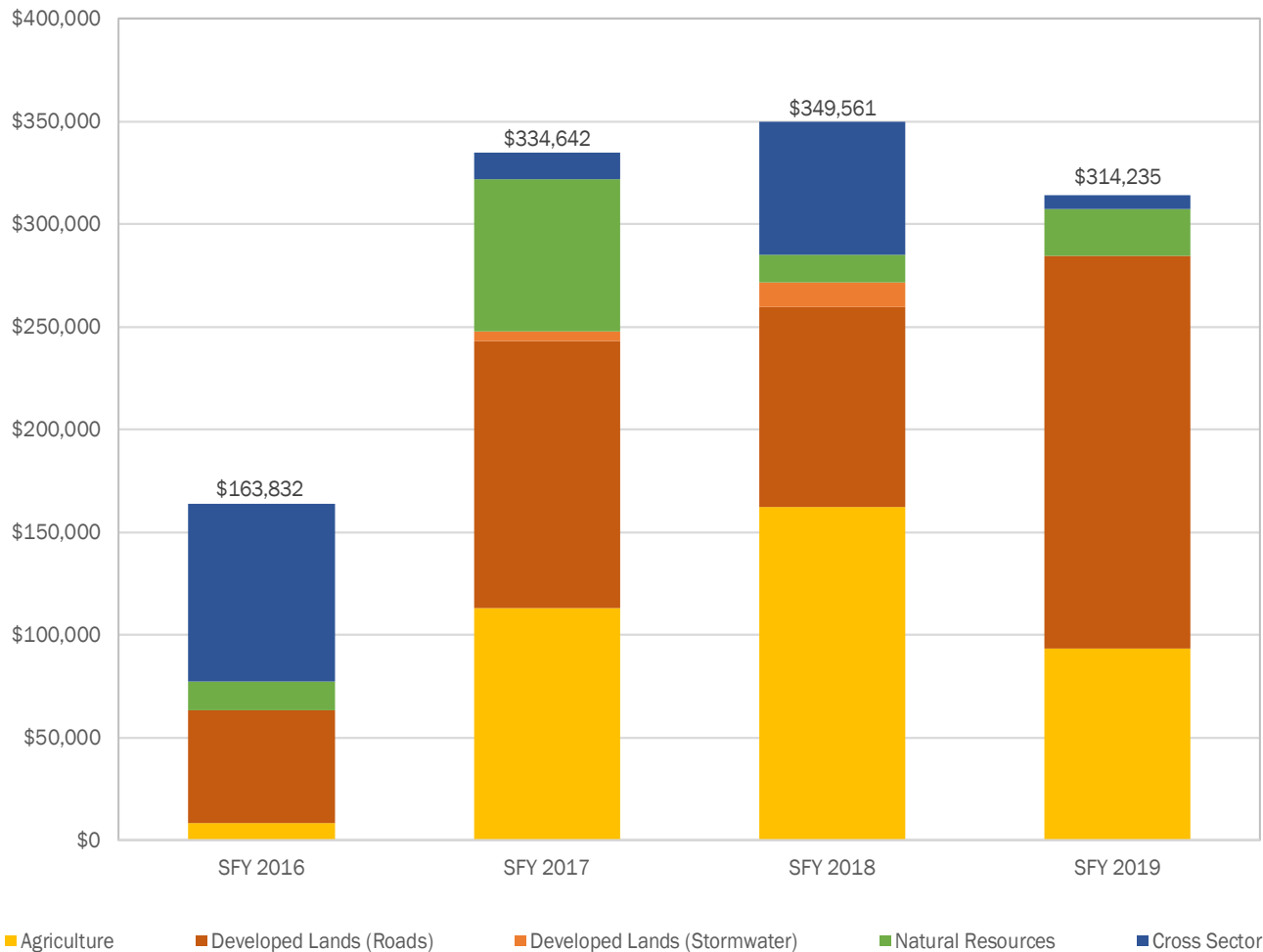
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	1	1
Number of wastewater treatment facility refurbished	-	-	-	1	1
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Upper Connecticut River Watershed Investments



**Dollars awarded by State of Vermont agencies to clean water projects in the Upper Connecticut River watershed, SFY 2016-2019, by sector
Total: \$1,162,270**

Dollars awarded by State of Vermont agencies to clean water projects in the Upper Connecticut River watershed, by sector and State Fiscal Year.



Upper Connecticut River Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Upper Connecticut River watershed. Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	-	-	-	-	-
Acres of agricultural land treated by forest and grass buffers	-	-	-	-	-
Acres of pasture with livestock excluded from surface waters	-	-	-	-	-
Number of barnyard and production area practices installed	-	-	-	-	-
Acres of water quality protections within newly conserved agricultural lands	-	-	6	-	6
Estimated acres of agricultural land treated through equipment	-	-	46	-	46

AGRICULTURE POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	-	0.5	-	3	4
Acres of riparian corridor conserved and restored through easements	73	7	-	-	80
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	-	-	-	-	-
Acres of wetland conserved and restored through easements	-	-	4	-	4
Acres of forestland conserved with water quality protections	-	-	-	-	-
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	-	-

NATURAL RESOURCES POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	-	-	-	-
Miles of municipal road drainage and erosion control improvements	-	2	2	2	6
Number of municipal road drainage and stream culverts replaced	-	14	3	6	23
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	1	-	1

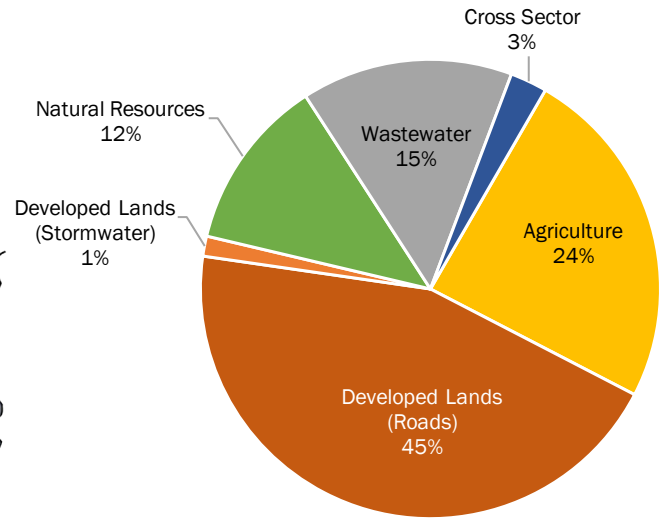
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



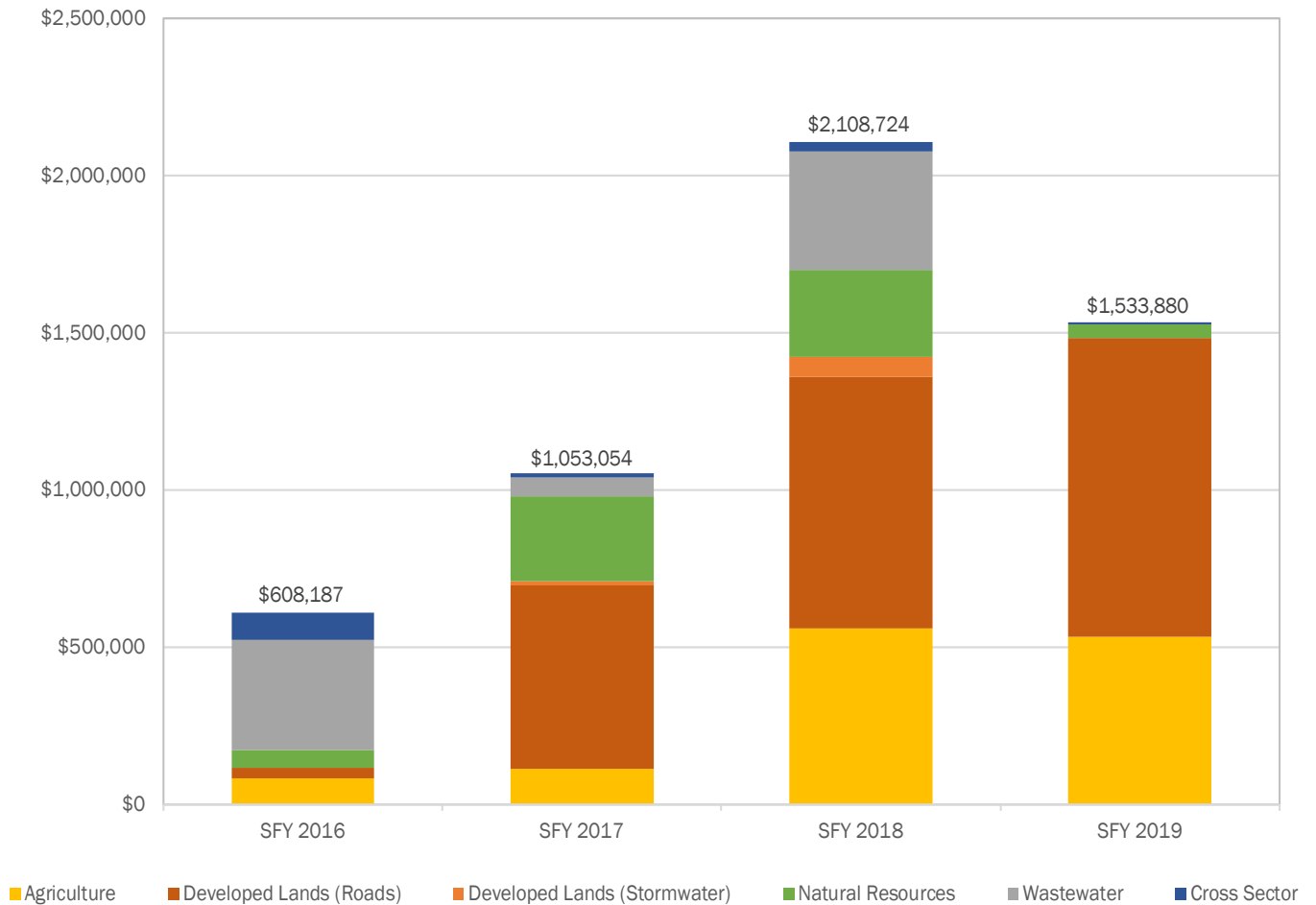
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

West, Williams, Saxtons, Connecticut Rivers Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the West, Williams, Saxtons, Connecticut Rivers watershed, SFY 2016-2019, by sector
Total: \$5,303,845

Dollars awarded by State of Vermont agencies to clean water projects in the West, Williams, Saxtons, Connecticut Rivers watershed, by sector and State Fiscal Year.



West, Williams, Saxtons, Connecticut Rivers Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the West, Williams, Saxtons, Connecticut Rivers watershed. Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	-	-	-	-	-
Acres of agricultural land treated by forest and grass buffers	-	-	-	-	-
Acres of pasture with livestock excluded from surface waters	-	-	-	-	-
Number of barnyard and production area practices installed	-	-	4	-	4
Acres of water quality protections within newly conserved agricultural lands	-	-	-	34	34
Estimated acres of agricultural land treated through equipment	-	-	46	-	46

AGRICULTURE POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	2	1	2	0.8	6
Acres of riparian corridor conserved and restored through easements	-	14	-	-	14
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	-	-	4	-	4
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	-	16	5	-	21
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	-	-

NATURAL RESOURCES POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	-	-	-	-
Miles of municipal road drainage and erosion control improvements	-	0.7	5	9	15
Number of municipal road drainage and stream culverts replaced	-	2	-	7	9
Cubic yards of Class IV road gully erosion remediated	-	-	44	-	44
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	-	-	-

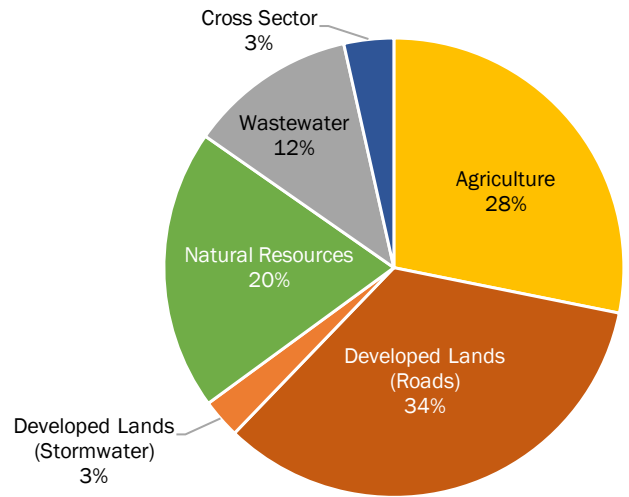
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



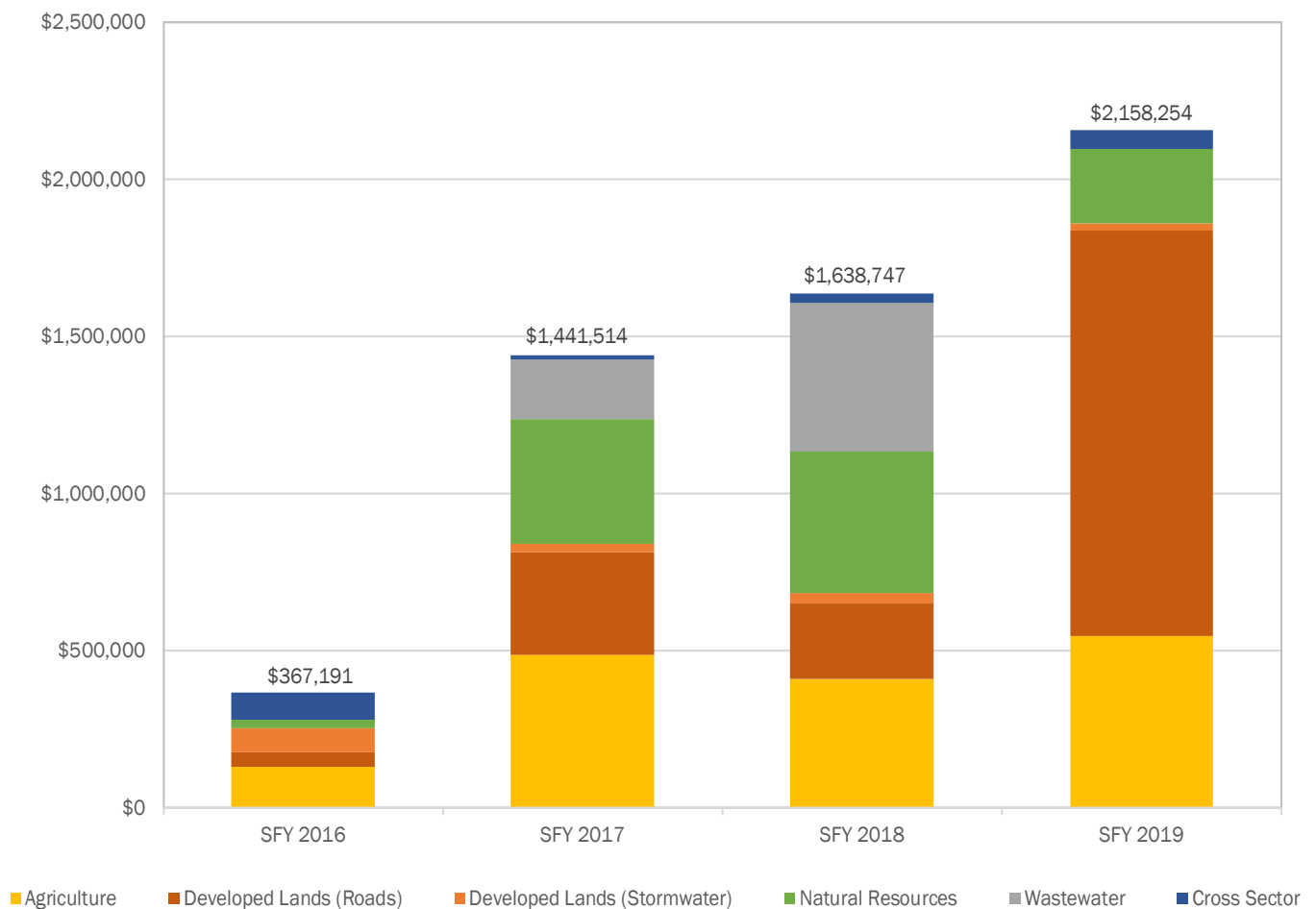
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	1	-	1
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

White River Watershed Investments



**Dollars awarded by State of Vermont agencies to clean water projects in the White River watershed, SFY 2016-2019, by sector
Total: \$5,605,706**

Dollars awarded by State of Vermont agencies to clean water projects in the White River watershed, by sector and State Fiscal Year.



White River Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the White River watershed. Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	222	-	-	128	349
Acres of agricultural land treated by forest and grass buffers	21	11	-	-	32
Acres of pasture with livestock excluded from surface waters	21	6	-	-	27
Number of barnyard and production area practices installed	1	9	6	2	18
Acres of water quality protections within newly conserved agricultural lands	-	21	-	9	30
Estimated acres of agricultural land treated through equipment	-	266	693	-	959

AGRICULTURE POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	13	5	3	3	24
Acres of riparian corridor conserved and restored through easements	-	32	49	-	81
Acres of floodplain restored	-	-	-	-	-
Acres of lakeshore restored	-	-	-	-	-
Stream miles reconnected for stream equilibrium/fish passage	-	98	-	87	185
Acres of wetland conserved and restored through easements	-	-	-	-	-
Acres of forestland conserved with water quality protections	-	3	457	-	460
Miles of forest road drainage and erosion control improvements	-	-	-	-	-
Number of stream crossings improved	-	-	-	-	-
Square feet of eroding gully remediated	-	-	-	27	27

NATURAL RESOURCES POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	-	-	-	-
Miles of municipal road drainage and erosion control improvements	-	0.1	6	6	12
Number of municipal road drainage and stream culverts replaced	-	14	13	23	50
Cubic yards of Class IV road gully erosion remediated	-	-	-	-	-
Cubic yards of catch basin outlet erosion remediated	-	-	-	-	-
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	-	-	-

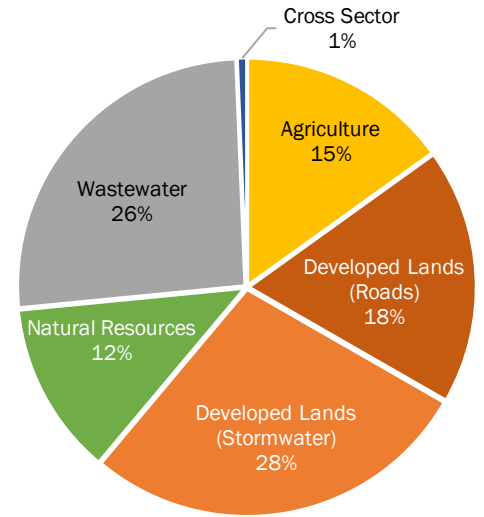
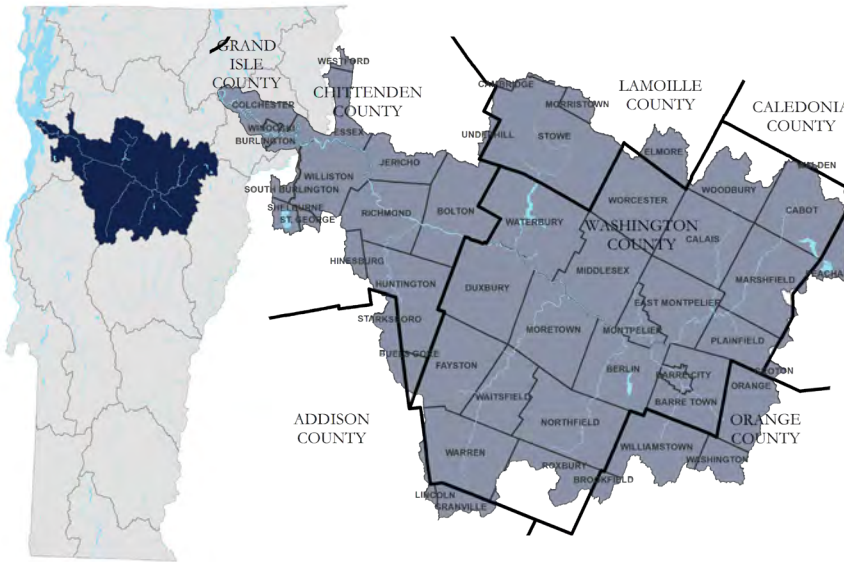
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION

Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins



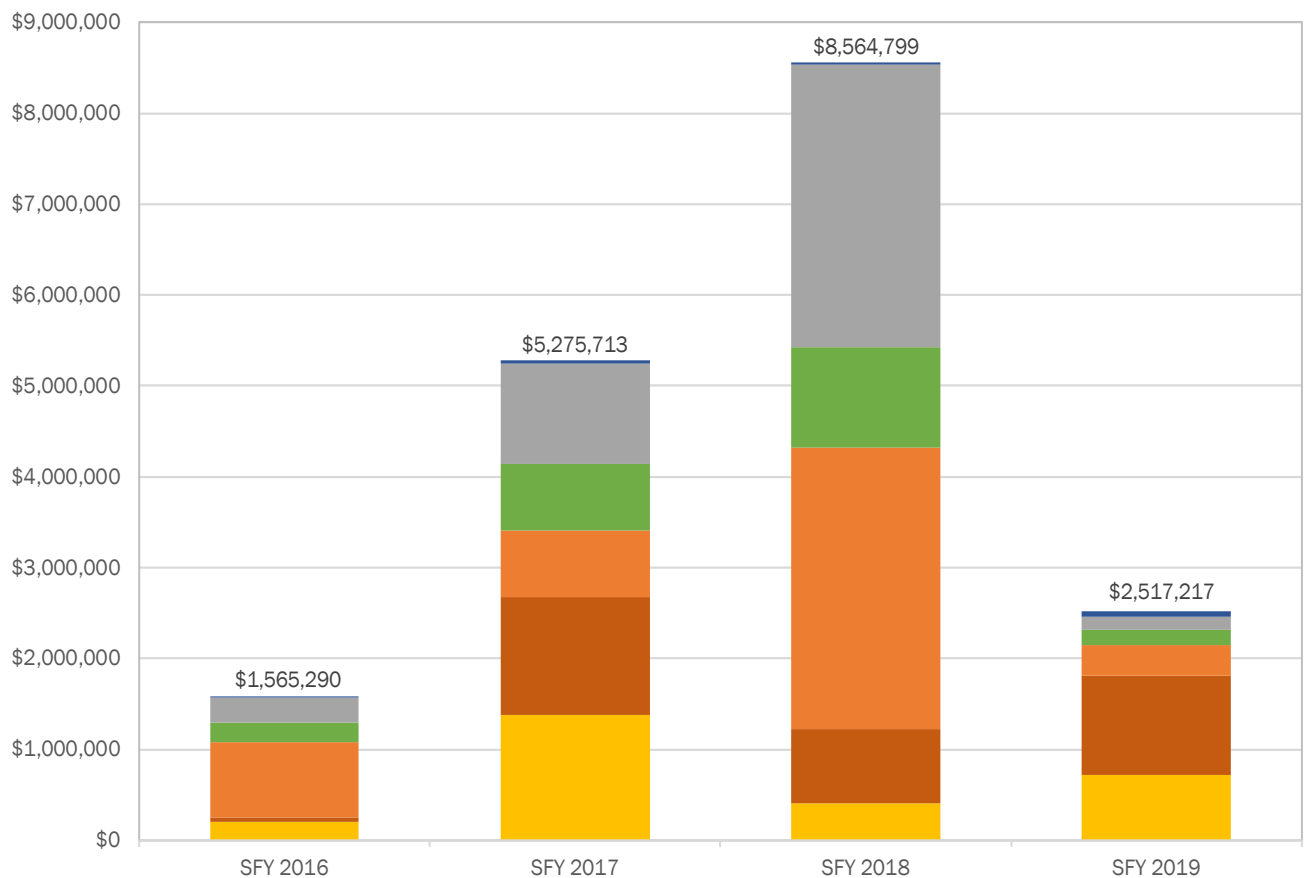
WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	-	-	-	-
Number of wastewater treatment facility refurbished	-	-	-	1	1
Number of wastewater treatment facility upgrades completed	-	-	-	-	-

Winooski River Watershed Investments



Dollars awarded by State of Vermont agencies to clean water projects in the Winooski River watershed, SFY 2016-2019, by sector
Total: \$17,923,019

Dollars awarded by State of Vermont agencies to clean water projects in the Winooski River watershed, by sector and State Fiscal Year.



■ Agriculture
 ■ Developed Lands (Roads)
 ■ Developed Lands (Stormwater)
 ■ Natural Resources
 ■ Wastewater
 ■ Cross Sector

Winooski River Watershed Results



Results of clean water projects funded by State of Vermont agencies completed, SFY 2016-2019, by sector, in the Winooski River watershed.
 Note: Does not include results of projects funded, but not yet completed.



AGRICULTURE

AGRICULTURE PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of agricultural land treated by conservation practices	517	544	586	951	2,599
Acres of agricultural land treated by forest and grass buffers	69	27	-	-	96
Acres of pasture with livestock excluded from surface waters	69	-	-	-	69
Number of barnyard and production area practices installed	9	5	3	6	23
Acres of water quality protections within newly conserved agricultural lands	-	2	75	-	77
Estimated acres of agricultural land treated through equipment	-	153	796	618	1,567
AGRICULTURE POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	113.6	178.9	222.2	328.8	



NATURAL RESOURCES

NATURAL RESOURCES PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of forested riparian buffer restored	47	5	4	9	65
Acres of riparian corridor conserved and restored through easements	-	51	-	5	56
Acres of floodplain restored	-	2	4	-	6
Acres of lakeshore restored	-	-	-	0.4	0.4
Stream miles reconnected for stream equilibrium/fish passage	7	2	-	-	9
Acres of wetland conserved and restored through easements	-	-	-	5	5
Acres of forestland conserved with water quality protections	-	-	20	110	130
Miles of forest road drainage and erosion control improvements	-	-	-	2	2
Number of stream crossings improved	-	-	1	11	12
Square feet of eroding gully remediated	-	-	-	-	-
NATURAL RESOURCES POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	28.7	36.2	72.4	85.1	



DEVELOPED LANDS



ROADS

DEVELOPED LANDS AND ROADS PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Acres of existing impervious surface treated by stormwater practices	-	11	17	26	54
Miles of municipal road drainage and erosion control improvements	1	1	9	10	21
Number of municipal road drainage and stream culverts replaced	-	7	14	37	58
Cubic yards of Class IV road gully erosion remediated	-	-	112	0.5	113
Cubic yards of catch basin outlet erosion remediated	-	-	0.7	691	692
Acres stabilized through use of hydroseeder/mulcher equipment per year	-	-	-	2	2
DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION	2016	2017	2018	2019	
Total phosphorus load reduction (kilograms per year)	2.2	11.4	34.4	73.3	



WASTEWATER

WASTEWATER PROJECT OUTPUTS	2016	2017	2018	2019	TOTAL
Number of combined sewer overflow abatements completed	-	-	-	-	-
Number of sewer extensions completed	-	-	-	-	-
Number of wastewater collection systems refurbished	-	2	-	-	2
Number of wastewater treatment facility refurbished	-	-	-	-	-
Number of wastewater treatment facility upgrades completed	1	-	-	-	1



Interim TMDL Implementation Status for the Lamoille River (Basin 7)



The Lamoille River from Prospect Rock in Johnson, VT

December 2019 | Water Investment Division

Appendix B

Interim TMDL Implementation Status for the Lamoille River (Basin 7) Planning Basin

The 2016 *Phosphorus Total Maximum Daily Loads (TMDLs) for Vermont Segments of Lake Champlain* include an Accountability Framework that establishes a process to ensure implementation of the TMDL moves forward at a steady rate. A major part of the Accountability Framework is the Vermont Department of Environmental Conservation's (VDEC) development of basin-specific Tactical Basin Plans (TBP). These plans are developed on a 5-year rotating basis that, in part, include Implementation Tables that lay out priority actions essential to implementation of the TMDL. It's through review of the Implementation Tables, and the progress made in accomplishing the tasks, that EPA intends to track implementation progress in each basin. Review will occur midway through and at the end of each 5-year planning cycle whereby EPA will develop a "report card" reflecting the sufficiency of progress made.

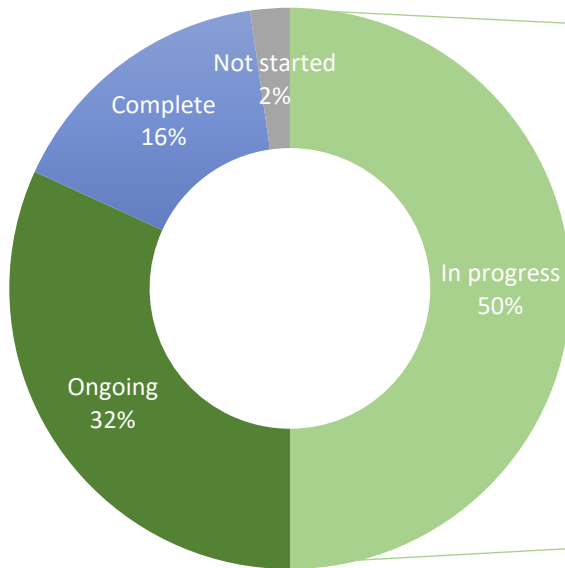
In mid-2019, two TBPs were due to receive their interim report cards – the Missisquoi River (Basin 6) and the Lamoille River (Basin 7). As progress is assessed annually for many of the performance measures, the interim status report submitted herein, include progress to end of 2019. These plans were finalized at the end of 2016. The following sections describe the Implementation Tables for each basin and include information to help EPA assess the status of each action item listed. A status condition is provided for each item (e.g. complete, ongoing, etc.) as well as a narrative description of actions taken. In some instances, performance measures based on implementation data are included to provide a quantitative measure of implementation. However, calculations of phosphorus mass loading reductions to the lake are not presented as part of this exercise. Instead, detailed mass loading reductions are presented in the *Vermont Clean Water Initiative Annual Performance Report* to allow comparison to the TMDL phosphorus allocations. Based on the Annual Performance Report and its companion database, the Clean Water Reporting Framework, projects implemented through state funding, federal funding, and regulatory programs in SFY 2016-2019 resulted in an estimated total phosphorus load reduction of 850 kilograms in SFY 2019 in the Lamoille River watershed, of which 297 kilograms are associated with state funding programs. Quantified load reductions in SFY 2019 include results of projects implemented since SFY 2016 with lifespans that carry into SFY 2019.

Basin 7 Status Update

Of the 44 actions identified to date, 7 have been completed, 22 are in progress, 1 has not been started, and 14 are ongoing (see figure 1). Actions listed as "completed" are discrete actions with a clear end point that have been implemented. Actions listed as "in progress" are discrete actions with a clear end point that are in progress or in the queue (includes projects that are on hold due to funding, timing, resources, support, etc.). An action listed as "ongoing" is a programmatic or multi-layered action and is in progress but has no defined end date. Examples of ongoing actions include those to meet regulatory requirements, ongoing State Agency outreach efforts, or a suite of voluntary projects, like those identified in River Corridor Plans that are not all expected to be completed. A project listed as "not started" is a discrete or programmatic strategy that has not been initiated or taken up for various reasons - no funding, no partner, no interest, or not as high a priority.

Actions identified as "in progress" were evaluated based on their likelihood of being completed by 2021 when the Phase III content for the Lake Champlain Phosphorus TMDL will be developed. Of the 22 actions that are in progress 36% (8) have a high likelihood of being completed, 23% (5) have a medium

**Basin 7 Implementation Table Action Status
(n=44)**



**Likelihood of Actions to be completed by 2021
(n=22)**

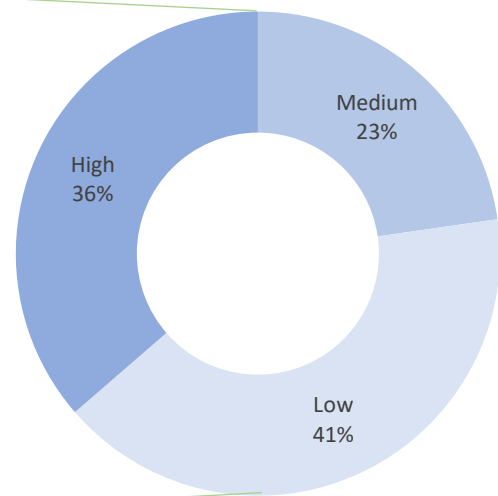


Figure 1

likelihood of being completed, and 41% (9) have a low likelihood of being completed by 2021 (see figure 1).

The actions with a high likelihood of being completed are those that have received funding, have a strong partner, local support, and positive momentum. They are also further along in the process. In addition, some of these actions have a regulatory hook that require they be completed. Actions that have a medium likelihood of completion have been initiated and may have received funding, but the end date for completion is beyond 2021. In many cases, medium likelihood actions have support, but may be lacking funding or an entity to bring the project to fruition. These projects are next in line to be completed once the high likelihood actions are complete, which will free up capacity for entities that carry out the projects. Actions with low likelihood of completion by 2021 are those that require significant funding and resources to complete. In some cases, the support is there, and funding may be available, but capacity to develop the actions is not. Additionally, three of the nine low likelihood actions depend on towns' interest to adopt local regulations that project water quality and would decrease phosphorus loading in the long-term.

In summary, the major barriers to completion of Implementation Table actions by 2021 are capacity to develop and carry out projects, and interest and support by crucial stakeholders. At this point, funding is not a major hurdle to complete projects unless related to capacity building.

A new act supporting the delivery of clean water services, [Act 76](#), was established in 2019 to increase regional capacity to develop and carry out projects that fulfill actions identified in the Phase II Lake Champlain Phosphorus TMDL Implementation Table. The [Act 76 fact sheet](#) developed by VDEC explains the fundamental aspects of the Act. Despite the challenges identified with completing projects within a 5-year timeframe, 80% of the actions have been completed, are on-going, or have a high to medium likelihood of being completed by 2021.

Actions were also evaluated based on status by sector (see figure 2), but no obvious trends were identified. Overall, progress has been made in each sector. Only one action out of 44 has not been started. Lakes projects are only classified as “in progress”. One reason for this is that funding around lake best management practices is limited and the actions are completely voluntary. However, lake communities are usually

Basin 7 Implementation Status by Sector (n=44)

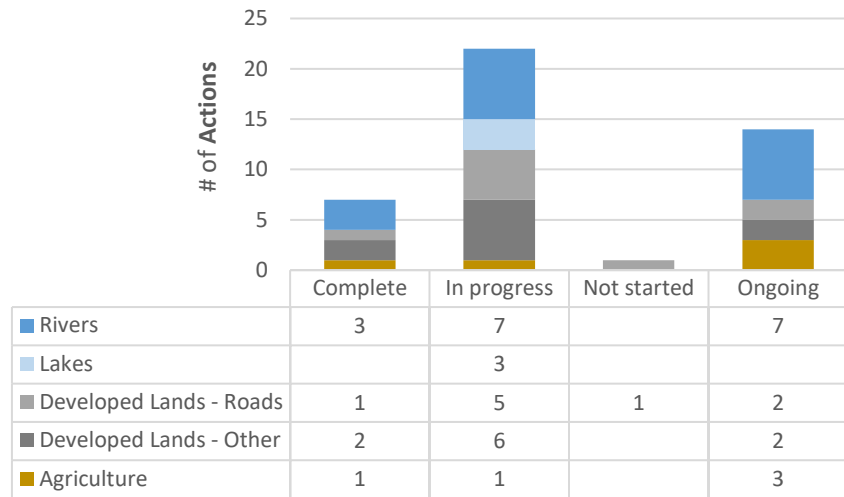


Figure 2

motivated and supportive of initiatives for clean water, but lack the capacity and funding to get the initial buy-in. Building the capacity of the VDEC Lake Wise Program would help to get more lake actions to the completion stage. Increased project development funding and the improvement of outreach strategies around local river protection regulations may help to bring river actions to completion. And continued outreach and funding to towns for the remediation of priority stormwater projects and road segments identified in the Implementation Table and to implement the Municipal Roads General Permit (MRGP) will promote completion of developed lands priorities. The Vermont Agency of Natural Resources’ Municipal Roads Grants-in-Aid Program helps to fund municipal road projects to meet this objective. The necessities for project completion point to a need for increased capacity to manage and develop these projects with the assurance that funding will be available to move them to the implementation stage. Further explanation is provided in the “explanation” column of the Implementation Table Status Update (see table 1) for each action.

Basin 7 Implementation Table Interim Status

The interim status report (see table 1) was compiled by the Water Investment Division's Watershed Planning Program using data from the Vermont Department of Environmental Conservation's (VDEC) Clean Water Reporting Framework, Regional Planning Commissions, Natural Resource Conservation Districts, and additional watershed partners involved in project development and implementation for the time period beginning State Fiscal Year (SFY) 2016 to 2019. The Implementation Table is not an exhaustive list of water quality projects that lead to phosphorus reductions. See the *Vermont Clean Water Initiative Annual Performance Report* for full reporting of quantified estimated phosphorus reductions associated with state funding, federal funding, and regulatory programs.

Table 1. Basin 7 Implementation Table Interim Status Report. This table includes data from SFY 2016 to 2019.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
Work with landowner to identify current sources of nutrients and employ practices to address the sources	Halfmoon Pond	Milton	Agriculture	Complete	100	No major/recent projects have been implemented since 2011. In 2011 AAFM BMP program partnered with NRCS on a waste management system in this watershed. There is one permitted MFO that is on a 3-year inspection rotation and continues to work with the Agency in terms of MFO rule and RAP compliance. VDEC will continue to monitor water quality in the receiving waters.	A11	NA
Develop stormwater master plan for the Village of Hardwick and identify priority projects for mitigating runoff	Upper Lamoille River - adjacent to the village of Hardwick	Hardwick	Developed Lands - Other	Complete	100	525 acres assessed or covered by a plan, 14 projects identified, 2 preliminary designs completed. 2 final designs from the SWMP were funded in 2018.	B4	NA
Identify potential sources of stormwater runoff and nutrient input and prioritize a list of actions to address sources. Stressed watershed.	Streeter Brook - 0.6 miles by falls north and south of Sanderson Road	Milton	Developed Lands - Other	Complete	100	1 Stream Stormwater Runoff Assessment. 2 projects identified. DEC conducted a river walk along the most densely developed area outside the I-89 corridor in the Streeter Brook watershed and no obvious stormwater runoff sources were identified. Most non-point sources are in the I-89 corridor above a large wetland complex. Milton SWMP focused on this area to identify potential stormwater projects. No obvious sites of runoff were identified outside of road projects.	B18	NA

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
Wolcott Town Garage and Fire Station Stormwater management project	Lamoille River	Wolcott	Developed Lands - Roads	Complete	100	1 acre of impervious surface treated; 200 Linear feet of road drainage improved. This project addresses sediment and nutrient loading to the Lamoille River by means of disconnecting roof runoff that currently causes sediment from the parking area to discharge to the river, as well as providing settling pools to treat runoff. The project also helps reduce sediment laden runoff from the sand pile stored at the site. The project scope involved: installation of roof gutters, re-establishment of two existing settling pools, re-grading and re-surfacing of work road, installation of concrete block retaining walls to better confine the sand pile, and Installation of concrete block header on the School Street culvert.	B11	NA
SGA and river corridor plan to identify stressors and priority projects to address stressors. Focus on all stressed segments.	Haynesville Brook, Tucker Brook, Stannard Brook, Bunker Brook, Kate Brook, Seymour River, Ryder Brook	Walden, Hardwick, Woodbury, Cambridge, Underhill, Morristown	Rivers	Complete	100	1 RCP completed. 6 River Walks or Windshield Tours completed. Completed for SGA and RCP for Seymour River. River Walks and Windshield Tours completed for Ryder Brook, Bunker Brook, Haynesville Brook, Tucker Brook, Kate Brook and Stannard Brook. Focus is on Seymour River project development for 2021.	C5, C6, C7, C19, C20, C21, C23	NA
Implement high priority flood mitigation projects identified in the Jeffersonville Flood Mitigation Master Plan	Middle Lamoille waters	Jeffersonville	Rivers	Complete	100	6.2 acres of river corridor conserved at 2 sites and 1000 linear feet of riparian corridor conserved. 0.25 acres of floodplain reconnected and restored. 2 bypass culverts installed to improve flow conveyance from a flood chute to the Lamoille River. A total of three projects identified in the Jeffersonville Flood Mitigation Master Plan included 2 river corridor easements and a new bridge installation and floodplain restoration project.	C18	NA
Complete Lamoille River HUC 1 Corridor Plan and prioritize projects	Lamoille River	Johnson, Cambridge, Fletcher, Fairfax,	Rivers	Complete	100	River Corridor Plan complete with projects prioritized. 0.4 acres river corridor buffer planted	C29	NA

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
		Georgia, Milton, Colchester				in Milton. 0.12 acres of river corridor buffer planted in Morristown.		
Establish Conservation Tillage/Cover Cropping Program for high priority sites along the Lamoille River	Lamoille Watershed with a focus on priority catchments	All towns with priority catchments	Agriculture	Ongoing	100	<p>1151 acres of farmland received cover crop between 2016-2019 in priority catchments. The VAAFM Farm Agronomic Practices (FAP) Program and NRCS invests state funds in soil-based agronomic practices to improve soil quality, increase crop production, and reduce erosion and surface runoff from agricultural fields.</p> <p>VAAFM has increased funding annually for this program in the last three years. Practices eligible for payment are reviewed on an annual basis. Rotational Grazing is a new practice eligible for payment in the FY 2020 FAP program. Other FAP practices eligible for payment include cover crops, crop rotation, conservation tillage, manure injection, aeration, no-till pasture and hay land renovation, as well as education and instructional activities.</p> <p>Other major program changes include geospatial tracking of all practices receiving payment by the state in the Partner Database, for purposes of phosphorus reduction accounting and tracking.</p>	A1	NA
Provide education and assistance to agricultural communities in priority watersheds on agricultural BMPs to meet TMDL requirements in high priority catchments	Porter Brook, Bailey Brook, Perkins Meadow Brook, Haynesville Brook, Lamoille mainstem, Centerville	Hardwick, Walden, Cambridge, Johnson, Morristown, Hyde Park, Wolcott, Craftsbury, Underhill, Jericho, Essex, Westford, Fletcher, Fairfax, Milton	Agriculture	Ongoing	100	<p>16 Education and Outreach Projects. 15 Technical Assistance Projects. Includes: FWA Farm Mentorship Program, Agricultural Conservation Practices Technical Assistance, Lamoille Watershed Agricultural Project, Nutrient Management Planning, Champlain Valley Farmer Coalition, Vermont Environmental Stewardship Program, On-Farm Workshops, and Reduction of Nutrient Runoff to Lake Champlain through No-Till Workshops & Equipment Upgrades</p>	A3, A6, A9	NA

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
	Brook, Lower Gihon, Middle Wild Branch, Seymour River, Lamoille Mainstem, Beaver Meadow Brook, Deer Brook, Stones Brook, Mill Brook, Browns River							
Identify areas of nutrient input, identify high priority projects, and implement agricultural water quality practices in high priority catchments	Porter Brook, Bailey Brook, Perkins Meadow Brook, Haynesville Brook, Lamoille mainstem, Centerville Brook, Lower Gihon, Middle Wild Branch, Seymour River, Lamoille Mainstem, Beaver Meadow Brook, Deer Brook, Stones Brook, Mill Brook, Browns River	Hardwick, Walden, Johnson, Morristown, Hyde Park, Wolcott, Craftsbury, Cambridge, Underhill, Jericho, Essex, Westford, Fletcher, Fairfax, Milton	Agriculture	Ongoing	100	Inspections and practices installed in high priority catchments between 2016-2019: 105 acres of production areas were inspected, 42 barnyard and production area practices were installed, 4 final designs were completed, and 27 acres of hydrologically connected land was excluded from livestock access. Practices will be tracked by the Multi-Partner Agricultural Conservation Practice Tracking and Planning Geospatial Database (Partner Database). The database is a non-regulatory online geospatial database for the planning, tracking and reporting of agricultural best management practices by field staff of a multi-organizational partnership. The database provides a central place to plan and track practice implementation across the State and across organizations and aims to improve coordination and efficiency among partners working with farms. It also provides an opportunity to track non-cost share or farmer-funded practices. All practice implementation entered in the Partner Database by authorized field staff of the partnership will be reported to DEC to account for water quality improvement in terms of nutrient and sediment reduction for the TMDL. In doing so, will	A4, A7, A10	NA

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
						reach the most comprehensive representation of nutrient load reductions to waters of the state from agriculture for TMDL tracking and reporting. *Please note that intended purpose of Partner Database excludes any regulatory processes or components.		
Implement projects addressing vulnerabilities from flooding and fluvial erosion from county and municipal All-Hazards Mitigation Plans	Lower Lamoille and tributaries - segments receiving stormwater runoff	Milton, Colchester, Westford, Jericho, Underhill, Essex	Developed Lands - Other	Ongoing	100	Project reports for 2017-2018 were submitted to the CCRPC for Milton, Colchester, Westford, Jericho, Underhill and Essex. Each report includes an implementation monitoring worksheet detailing progress on hazard mitigation actions*. The projects include: Colchester - Establishment of a municipal stormwater utility, street sweeping and catch basin cleaning, review of land development proposals, annual upgrades to stormwater infrastructure, and implementation of Flow Restoration (FRP) and town wide Phosphorus Control Plans (PCP). Essex - stormwater management; plan for repair of vulnerable infrastructure; erosion mitigation, fluvial erosion hazard mitigation implementation, mitigation of impacts of runoff, implementation of FRP and PCP. Jericho - Flood hazard mitigation project implementation, culvert upgrades, drainage improvements, road improvements, development of Road Stormwater Management Plan (RSMP) and implementation of RSMP. Milton - Catch basin cleaning and street sweeping, land development review and regulation, development of PCP, completion of culvert upgrades, completion of drainage improvement projects, and upgrade of town bridge #6. Underhill - Develop zoning district & bylaws to reduce risk from fluvial erosion, upgrade priority culverts, improve drainages, improve roads, develop stormwater master plan, develop RSMP, and begin RSMP implementation	B23, C39	NA

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
						(See appendix for project detail in each town). Westford - Upgrade priority culverts, improve drainages, improve roads, adopt river corridor regulations, develop RSMP, begin RSMP implementation. *Some hazard mitigation priorities are also listed as separate actions in the 2016 Lamoille Tactical Basin Plan (e.g. development of Underhill SWMP).		
Continue to carry out the minimum control measures outlined the Milton Stormwater Management Plan and develop a phosphorus control plan for lands within the MS4 area.	Lower Lamoille River	Milton	Developed Lands - Other	Ongoing	100	1 Stormwater Master Plan (SWMP) for the Town of Milton, VT , which is located within the Lamoille and Northern Direct-to-Lake Basins, is in development. The SWMP will be based upon an analysis of previous data and a 2018 field assessment and it will help the Town begin to develop the elements of a Phosphorus Control Plan, identify 30 projects, and the prepare conceptual design plans and cost estimates for 15 of those.	B19	NA
Regional Hydroseeder Program	Middle Lamoille	Regional	Developed Lands - Roads	Ongoing	100	132 hours equipment in use per year, 7.5 acres stabilized through use of hydroseeder/mulcher equipment per year. The Regional Hydroseeder Program was implemented through Lamoille County Conservation District to develop (and continue) a Regional Hydroseeder Program for three Natural Resources Conservation Districts, Lamoille, Caledonia, and Essex Counties in the northeast region of Vermont, and its municipalities. Three hydroseeders were collectively shared with at least four towns within each district. Using hydroseeders promotes and accelerates the use of vegetation stabilization for roadside ditches and steep side slopes especially when used during the wet fall season when most ditches are improved.	B1	NA

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
Implement high priority road projects identified by road erosion inventories	Lamoille River - all connected surface waters	All Lamoille County towns with a focus on Johnson, Hyde Park, and Cambridge, Milton, Colchester, Westford, Jericho, Underhill, Essex	Developed Lands - Roads	Ongoing	100	This information is tracked in the MRGP Implementation Table Portal. Towns are using a combination of Regional Transportation Funds, VTrans Better Roads grants, DEC Grants-in-Aid funds and their own municipal funds to implement projects to bring segments up to MRGP standards.	B9, B22	NA
Scope and implement culvert replacements and retrofits in areas of high priority for aquatic organism passage and stream geomorphic compatibility	Basin wide with a focus on streams stressed or impaired by encroachment, channel and land erosion	Multiple	Rivers	Ongoing	100	USFWS is currently working in the Lake Champlain Basin to prioritize high priority culvert replacements. In addition, as culverts are replaced on State and town roads, they are reviewed by the Rivers Program to ensure structures meet current standards for geomorphic compatibility. Towns are replacing culverts when funding is available.	C3*	NA
Undertake flood modeling and alternatives analysis and implement best choices for flood resiliency, floodplain restoration, buyouts, protection (RCEs)	Lamoille River, Wild Branch	Wolcott, Johnson, Cambridge	Rivers	Ongoing	100	The LCPC continues to work with several communities to model the impacts of various flood mitigation alternatives along the Main Stem of the Lamoille River. The model was developed using a similar process used in Jeffersonville in 2013 (see C18). Alternative scenarios tested in Jeffersonville included infrastructure changes, floodplain excavation, natural vegetation, home elevations, and impacts of dams. Multiple projects have been funded for project development and are currently underway because of the modeling and alternatives analysis.	C17	NA

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
Scope and implement priority incomplete projects and actions identified in the River Corridor Plans for Brewster River, Centerville Brook, Elmore Branch, Gihon River, Rodman Brook, Wild Branch	Brewster River, Centerville Brook, Elmore Branch, Gihon River, Rodman Brook, Wild Branch	Cambridge, Hyde Park, Elmore, Eden, Johnson, Morristown, Wolcott, Craftsbury	Rivers	Ongoing	100	3 final designs completed, and 6 additional projects identified. 8 projects funded for implementation. Work completed by LCCD and Smugglers Notch Resort on the Brewster River. The Brewster River Floodplain Restoration was funded in 2017. 12.3 acres of river corridor conserved, and 2578 linear feet of riparian corridor conserved on the Gihon River. 29.3 acres of river corridor conserved, and 4123 linear feet of riparian corridor conserved on two properties along the Wild Branch and an ongoing wetland and floodplain restoration project by VFWD at the mouth of the river in Wolcott.	C23, C24, C25, C26, C27, C28	NA
Identify target areas for easements and river corridor protection and restoration and work with landowners to secure easements; SGA and river corridor plan to identify stressors and priority projects to address stressors	North Branch Lamoille - stressed segment	Cambridge	Rivers	Ongoing	100	1 River Corridor Easement (RCE) and 21 acres of river corridor conserved including wetland and floodplain protection in a high priority area. This action will be carried out as opportunities present themselves for conservation and restoration.	C30	NA
Scope and implement priority incomplete projects and actions identified in the HUC 2 Corridor Plan and prioritize projects	Lamoille River	Hardwick, Wolcott, Hyde Park, Johnson	Rivers	Ongoing	100	1 acre of river corridor buffer planted in Wolcott. This action will be carried out as opportunities present themselves for conservation and restoration.	C31	NA
Scope, prioritize and implement projects identified in the Browns River Corridor Plan	Browns River - from west of Jericho/Essex line up 7.5 miles and fluvial erosion hazard areas	Underhill, Jericho, Essex, Westford	Rivers	Ongoing	100	1.05 acres of river corridor buffer planted on 3 sites in Jericho. Trees for Streams plantings by WNRCD. Projects have been prioritized for scoping and a project development grant to complete this task has been applied for but has not been funded. We continue to identify funding for this project. This action will be carried out as opportunities	C34	NA

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
						present themselves for conservation and restoration.		
Identify and implement wetland restoration on high priority sites identified by VDEC	Browns River - lower part of the watershed	Westford, Underhill, Jericho, Essex	Rivers	Ongoing	100	Project development funding to complete this task was applied for but was not funded. Partners are continuing to search for project funding. This action will be carried out as opportunities present themselves for conservation and restoration.	C35	NA
Map areas of corn-hay rotation, continuous corn, and continuous hay based on soil type located in floodable soils to identify cover crop and conservation tillage priorities in high priority catchments	Porter Brook, Bailey Brook, Perkins Meadow Brook, Haynesville Brook, Lamoille mainstem, Browns River, Centerville Brook, Lower Gihon, Middle Wild Branch, Seymour River, Lamoille Mainstem, Beaver Meadow Brook, Deer Brook, Stones Brook, Mill Brook, Browns River	Hardwick, Walden, Cambridge, Johnson, Morristown, Hyde Park, Wolcott, Craftsbury, Underhill, Jericho, Essex, Westford, Fletcher, Georgia, Fairfax, Milton	Agriculture	In progress	50	<p>A Critical Source Area (CSA) map layer is being developed by VAAFM to quantify the relative risk of erosion and runoff to surface water from agricultural fields. It is being used as an additional tool by VAAFM Inspectors (and potentially other technical assistance providers) to identify and prioritize critical fields to visit during an inspection or site visit. The layer is currently developed for the Missisquoi Bay Basin.</p> <p>In terms of water quality, it is important to factor the erosion occurring in the field and subsequent runoff to surface water. The VAAFM CSA layer thus quantifies erosion and runoff risk based on properties of the soil types in the field and proximity to surface water.</p> <p>The soil properties assessed are slope gradient, runoff potential (hydrologic group), erodibility (Kw factor) and flood frequency class.</p>	A2, A5, A8	High

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
Design and implement high priority projects identified in stormwater master plans and stormwater mapping reports	Entire Watershed	All towns with stormwater mapping and master plans	Developed Lands - Other	In progress	50	See specific master plan and mapping stormwater strategies	B2	Low
Design and implement green stormwater infrastructure projects to mitigate stormwater runoff along Laundon Avenue	Greensboro Brook - waters downstream of town center	Greensboro	Developed Lands - Other	In progress	75	3 final designs for green stormwater infrastructure project to mitigate stormwater runoff along Laundon Ave. in Greensboro, Vermont and identify and rectify stormwater runoff issues impacting town and residential infrastructure and Greensboro Brook. The project will result in an overall benefit to water quality in Greensboro Brook and Caspian Lake and stormwater management in the town center. Town is applying for implementation for 1 design through the 2019 Clean Water Block Grant.	B3	Medium
Install road erosion BMPs/SW GSI/gully erosion stabilization. *Can also be addressed through town wide road erosion inventory as well	Caspian Lake	Greensboro	Developed Lands - Other	In progress	50	This strategy should be addressed by the VT MRGP. The REI for Greensboro is complete and includes the road around Caspian Lake. Grant-in-Aid has funded two road projects outside of the Caspian Lake Drainage. Segments hydrologically connected to Caspian Lake that are not meeting or partially meeting standards are required to be fixed to meet standards.	B5	Low
Re-visit gully restoration design and review for implementation; implement stormwater priorities identified in the Georgia Stormwater Master Plan; work with AOT to replace eroding culverts on I-89. Impaired watershed.	Deer Brook - mouth to 2.5 miles upstream	Georgia	Developed Lands - Other	In progress	25	12 stormwater preliminary designs. A watershed group is applying for implementation funding for 1 of the projects. This project is in the Deer Brook Watershed which includes approximately 8.4 square miles in the towns of Georgia and Fairfax. Stormwater discharges are known to be an important contributor to the sediment impairment in Deer Brook and from the homes, businesses and roadways along U.S. Route 7, which discharge to the "Deer Brook Gully". The results of the project will include 1) updated impervious cover mapping	B16	Low

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
						within the watershed, 2) a survey of stormwater management opportunities in the area draining to the gully, 3) final engineering designs for a suite of practices to improve stormwater management, and 4) a final report including an Identification all permits that will be required. This action should be about 75% complete by 2021.		
Final design and implementation of stormwater projects identified for Johnson State College	Direct tributary to Lamoille	Johnson	Developed Lands - Other	In progress	25	LCCD is working with Northern Vermont University on two projects to address stormwater priorities. One is the Johnson SWMP which will assess the 3-acre area on the Johnson Campus and the other is the application for a project development grant to work on a high priority stormwater mitigation project on campus.	B15	High
Implement priority projects identified in Stormwater Mapping reports	Middle Lamoille - segments receiving stormwater runoff in priority catchments	Hyde Park, Wolcott, Johnson, Cambridge	Developed Lands - Other	In progress	50	2 Stormwater Master Plans were funded for Johnson & Cambridge. 1 stormwater infiltration practice was installed in Hyde Park resulting in 4.4 acres of impervious surface treated, 1 final design completed. The project included both the design and construction of the following stormwater management practices: stabilizing a head cut on a private Depot Street culvert, restoring an eroded gully on Depot Street, and constructing a bioretention area on Morey Road.	B12	Low
Inventory and prioritize municipal road erosion features using VDEC's MRGP interim road erosion inventory guidance	Lamoille River - all connected surface waters	Walden, Hardwick, Greensboro, Craftsbury, Hyde Park, Morristown, Fletcher, Fairfax, Milton, Georgia, Westford	Developed Lands - Roads	In progress	75	Road Erosion Inventories funded, in progress or completed in Craftsbury, Fairfax, Fletcher, Georgia, Greensboro, Hardwick, Hyde Park, Milton, Morristown, Walden and Westford.	B6, B8, B21	High
Develop stormwater master plans and identify priority projects for mitigating runoff using stormwater	Lamoille River	Hyde Park, Morrisville, Johnson, Cambridge, Fairfax, Underhill, Jericho	Developed Lands - Roads	In progress	75	SWMP completed for 3 towns (Fairfax, Jericho, Underhill). 4 towns are in progress (Morrisville, Hyde Park, Johnson & Cambridge). SWMPs should be completed by 2021.	B10, B20	High

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
mapping information with a focus on priority catchments.								
Re-locate or build a salt shed for salt and sand storage for the Town of Belvidere	North Branch Lamoille	Belvidere	Developed Lands - Roads	In progress	25	LCPC has been working with the town to determine the best course of action. The town hopes to finish the current pile of sand and move to a new location. However, that location has not been confirmed.	B13	Medium
Develop a stormwater management project for the Elmore town garage sand storage area	Elmore Lake	Elmore	Developed Lands - Roads	In progress	25	The town of Elmore received funding for this project but will need to postpone allocating funds for match. This project was also recently identified in the Elmore Lake Watershed Assessment as a priority for funding.	B14	Medium
Repair eroding access road in VTrans right-of-way along I-89 southbound. Tributary discharges into the Lamoille on the west side of the I-89 crossing on the south bank.	Direct tributary to the Lower Lamoille	Milton	Developed Lands - Roads	In progress	25	VTrans was made aware of the project and a site visit was completed. We need to identify funding source and partner to carry out.	B17	Low
Initiate Lake Wise Program to determine projects that will improve shoreland and lake habitat	Lake Caspian	Greensboro	Lakes	In progress	25	During 2016, 2 Lake Wise assessments were completed and shoreland stabilization practices were recommended. Only 2 shoreland properties have received Lake Wise Certificates . A town wide Water Quality group formed in 2019 with a focus on the Caspian Lake Watershed. They are potential partners to encourage Lake Wise around the lake.	E2	Medium
Initiate Lake Wise Program to determine projects that will improve shoreland and lake habitat and reduce sedimentation; Full lake	Lake Elmore	Elmore	Lakes	In progress	75	22 Lake Wise site assessments completed in 2018 and 2019. 12 best management practices implemented in 2018 as a result. LCCD received funding for 1 Lake Watershed Assessment. The report should be completed by 2021.	E6	High

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
assessment is recommended								
Determine what is causing declining water quality, sedimentation, and shoreland and lake habitat trend and initiate the Lake Wise Program; Full lake assessment is recommended	Lake Eden	Eden	Lakes	In progress	75	1 Lake Watershed Assessment funded. 3 Lake Wise Assessments completed. The Lake Assessment is being developed for Lake Eden to assess causes of increased sedimentation in the lake and water quality decline and identify solutions working with the Town of Eden, the Eden Lake Association, shoreline landowners, and local recreational users. The report should be complete in 2020.	E7	High
Protect river corridors to support flood resiliency and river equilibrium in target areas	Basin wide with a focus on target towns	Hardwick, Wolcott, Johnson, Cambridge, Jeffersonville, Westford	Rivers	In progress	25	Jeffersonville and Westford have adopted River Corridor Protection. Outreach will be focused on the remaining towns, but it is unlikely that these towns will adopt river corridor standards by 2021.	C1	Low
Assess and catalogue VFWD riparian/streambank parcels for streambank protection and potential easement opportunities	Lamoille River	Multiple	Rivers	In progress	75	1 project funded with a focus on Barton, Black, Willoughby and Lamoille River parcels. VFWD is the lead and the assessment is almost complete. Several projects were identified in the Lamoille Basin along the Lamoille River for project development and assigned to project leads. This work will continue into 2021, but the assessment will be complete in 2021.	C2	High
Propose and complete alternatives analysis for Jackson Dam	Hardwick Lake and Lamoille River	Hardwick	Rivers	In progress	25	Alternative analysis option was presented to the town by DEC and Caledonia NRCD. This was not a high priority for the town in 2019, but a group is being convened to discuss options to move forward and assess the town's need based on the poor condition of the dam and a new VT statute addressing dam management. This project does not have a high likelihood of completion before 2021.	C3*	Low

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
Follow up on preliminary management strategies identified in the Upper Lamoille River Phase 2 SGA	Upper Lamoille River	Greensboro, Hardwick	Rivers	In progress	25	Better Connections grant app was submitted and denied for Greensboro Bend area, but not funded. The group hopes to apply for funding again. This grant will develop water quality projects in the Upper Lamoille River. The VFWD riparian lands assessment (C2) also identified sites for project development in the focus area. The development of these projects would meet the goals for this action.	C8	Medium
Work with towns to consider joining the NFIP as part of an effort to increase ERAF rating	Lamoille Basin	Wheelock, Walden, Eden, Waterville	Rivers	In progress	25	None of the target towns have adopted the NFIP. Outreach will continue to be focused on these towns when the opportunity allows. Adoption of NFIP before 2021 is unlikely.	C9, C13	Low
Work with towns to adopt river corridor protection or strengthen existing river protection by-laws, setbacks, and zoning	Lamoille Basin	Hardwick, Stannard, Wheelock, Walden, Greensboro, Craftsbury, Woodbury, Eden, Elmore, Wolcott, Johnson, Cambridge, Hyde Park, Morristown, Belvidere, Waterville, Georgia, Fletcher, Fairfax, Westford, Underhill	Rivers	In progress	25	Elmore, Hyde Park, Milton and Westford have adopted River Corridor Protection. Outreach to Georgia in the process of reviewing River Corridor for adoption. Outreach to Johnson, Hardwick, Wheelock, but chose not to adopt. Outreach will be focused on the remaining towns, but it is unlikely that these towns will adopt river corridor standards by 2021.	C1, C10, C14, C32, C37	Low
Work with towns to add approved RPC flood resiliency section to town plan	Lower Lamoille waters	Stannard, Walden, Craftsbury, Elmore, Wolcott, Hyde Park, Cambridge, Waterville, Fletcher, Fairfax, Milton	Rivers	In progress	75	All town plans except for Stannard, Walden, and Fletcher have been updated with a flood resilience element. These plans should be updated with a Flood Resilience element by 2021.	C11, C15, C33	High

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Status	Percent Complete	Explanation	Crosswalk to Plan Strategy Number	Likelihood of Completion by 2021
Develop a stormwater management project for implementation for the town sand storage area	Stannard Brook - all connected surface waters	Stannard	Developed Lands - Roads	Not started	0	No progress recorded toward this project.	B7	Medium

***Duplicate plan strategy number**



Interim TMDL Status for the Missisquoi Bay Watershed (Basin 6)



The Missisquoi River – Upper Branch

December 2019 | Water Investment Division

Appendix C

Interim TMDL Implementation Status for the Missisquoi Bay (Basin 6) Planning Basin

The 2016 *Phosphorus Total Maximum Daily Loads (TMDLs) for Vermont Segments of Lake Champlain* include an Accountability Framework that establishes a process to ensure implementation of the TMDL moves forward at a steady rate. A major part of the Accountability Framework is VTDECs development of basin-specific Tactical Basin Plans. These plans are developed on a 5-year rotating basis that, in part, include Implementation Tables that lay out priority actions essential to implementation of the TMDL. It's through review of the Implementation Tables, and the progress made in accomplishing the tasks, that EPA intends to track implementation progress in each basin. Review will occur midway through and at the end of each 5-year planning cycle whereby EPA will develop a "report card" reflecting the sufficiency of progress made.

In mid-2019, two Tactical Basin Plans were due to receive their interim report cards – the Missisquoi River (Basin 6) and the Lamoille River (Basin 7). As progress is assessed annually for many of the performance measures, the interim status report submitted herein, include progress to the end of 2019. These plans were finalized at the end of 2016. The following sections describe the Implementation Tables for each basin and include information to help EPA assess the status of each action item listed. A status condition is provided for each item (e.g. complete, ongoing, etc.) as well as a narrative description of actions taken. In some instances, performance measures based on implementation data are included to provide a quantitative measure of implementation. However, calculations of phosphorus mass loading reductions to the lake for each action are not presented as part of this exercise. Instead, detailed mass loading reductions are presented in the *Vermont Clean Water Initiative Annual Performance Report* to allow comparison to the TMDL phosphorus allocations. Based on the Annual Performance Report and its companion database, the Clean Water Reporting Framework, projects implemented through state funding, federal funding, and regulatory programs in SFY 2016-2019 resulted in an estimated total phosphorus load reduction of 4,067 kilograms in SFY 2019 in the Missisquoi River watershed, of which 1,214 kilograms are associated with state funding programs. Quantified load reductions in SFY 2019 include results of projects implemented since SFY 2016 with lifespans that carry into SFY 2019

Basin 6 Status Update

Of the 23 actions in the plan associated with nutrient and sediment reduction, 19 are ongoing, 3 are complete, and 1 has not yet been started (Figure 1). Actions listed as "completed" are discrete actions with a clear end point that have been implemented. An action listed as "ongoing" is a programmatic or multi-layered action and is in progress but has no defined end date. Examples of ongoing actions include those to meet regulatory requirements, ongoing State Agency outreach efforts, or a suite of voluntary projects, like those identified in River Corridor Plans that are not all expected to be completed. A project listed as "not started" is a discrete or programmatic strategy that has not been initiated or taken up for various reasons - no funding, no partner, no interest, or not as high a priority.

Actions in Basin 6 are associated with regulatory requirements or voluntary actions. The narrative for each of the actions describes a community that is well on its way to meeting permit compliance or is actively adopting voluntary practices. Continuation of availability of resources will ensure that this pattern continues. At this point, funding is not a major hurdle to complete projects unless related to

capacity building. A new act supporting the delivery of clean water services, [Act 76](#), was established in 2019 to increase regional capacity to develop and carry out projects that fulfill actions identified in the Phase II Lake Champlain Phosphorus TMDL Implementation Table. The [Act 76 fact sheet](#) developed by VDEC explains the fundamental aspects of the Act. Despite the challenges identified with completing projects within a 5-year timeframe, all but one of the actions are either completed or on-going.

Overall, progress has been made in each sector and only the Natural Resource sector has a project that has not been started. This project, reclassification of a wetland to improve protection of its existing functions, will be a challenge to complete, see narrative in Table 2, because of the nature of land use and ownership. To support acceleration of permit compliance in front of current deadlines or voluntary actions, continued outreach and funding to permittees will be necessary.

Basin 6 Implementation Status by Sector
(n=23)

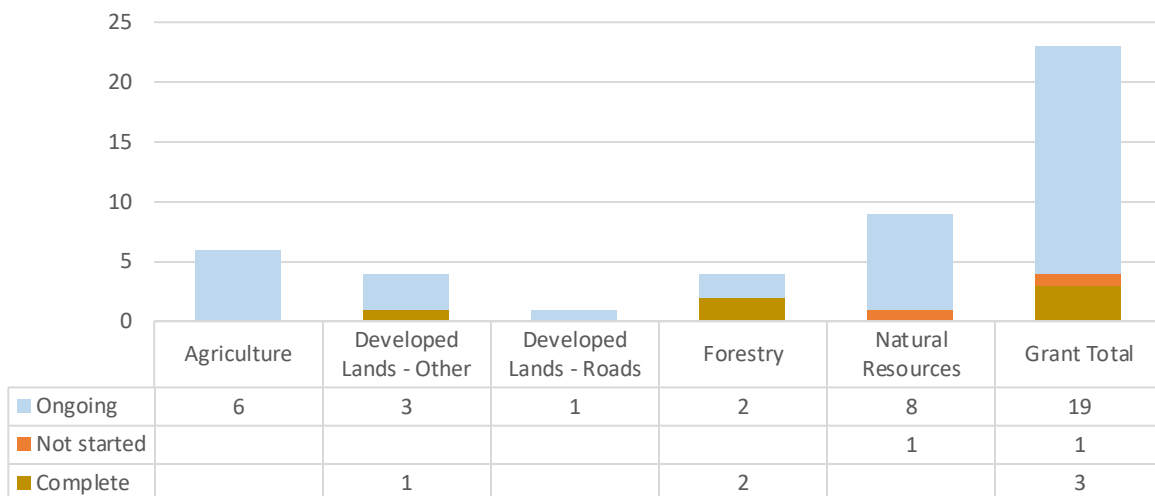


Figure 1. Status of strategies in Basin 6 by sector as either Ongoing, Not Started or Complete

Estimated total phosphorus load reductions quantified at the project-level from SFY 2016 and 2019 in the basin also provide a measurement of progress. Table 1 shows estimated total phosphorus load reductions (kilograms per year) for SFY 2016-2019 associated with state funding, federal funding, and regulatory programs. Phosphorus reductions have increased each year since SFY 2016. Appendix A of the *Vermont Clean Water Initiative 2019 Performance Report* shows estimated phosphorus reductions associated with state-funded projects ONLY by Tactical Basin Plan watershed.

Table 1. Estimated total phosphorus load reduction (kilogram/year) by land use sector for SFY 2016 through 2019 associated with projects implemented through state funding, federal funding, and regulatory programs

Basin 6 - Missisquoi, Rock, Pike P Load Reduction by Year and Total	Sector	2016 (kg/yr)	2017 (kg/yr)	2018 (kg/yr)	2019 (kg/yr)	Total (kg/yr)
	Agriculture	1,887.6	2,693.8	3,279.8	4,010.7	11,872.0
	River			11.8	26.4	38.2
	Road	1.8	3.6	13.4	24.9	43.8
	Stormwater		2.6	2.5	2.9	8.1

Table 2. Basin 6 Implementation Table Interim Status Report. This table includes data from SFY 2016 to 2019.

Strategies	Priority Subbasin	Priority Towns	Sector	Status	Explanation (see Acronyms, p.9)
Expand small farm Nutrient Management Plan (NMP) development courses and workshops, trainings for farmers, manure applicators and technical service providers	Missisquoi Bay		Agriculture	Ongoing	AAFM funds supported the work of the FNRCD and the ONRCD to provide NMP courses to farms, leading to NMP adoption. As of June 2019, 55 of 85 known CSFO have full NMP. To assist in ensuring accurate implementation of NMP, between December 2016 and June 2019, 88 custom manure applicators in the state have been certified through 683 hours of training by AAFM.
Increase inspections in critical watersheds: Finalize reporting of North Lake Farm Survey (NLFS) in Missisquoi Bay watersheds and target implementation based upon the results	Missisquoi Bay		Agriculture	Ongoing	2015 to 2016, AAFM conducted 309 full surveys on farms in basin and in northern St. Albans Bay watershed. The resulting report supported additional case management. See below for more detail including targeting of implementation.
Increase implementation in critical watersheds: 1. Provide farms with access to case managers to increase conservation practice implementation through participation in State and federal financial and technical assistance programs; 2 provide modeling analyses as needed to identify most effective BMPs	Pike, Rock Rivers and Mud Creek and farms identified in Northern Lake Farm Survey (NLFS)		Agriculture	Ongoing	1. As an outcome of above report, AAFM provided grant funding to three partners to support case management and project coordination to 36 farms, prioritized based on resource concerns identified in the above surveys. Through 795 hours of technical assistance, 11 farms were assisted in implementing 21 conservation practices with BMP grants to address survey findings. 2. ANR has provided modeling results identifying high phosphorus loading agricultural areas to help target geographic areas for implementation of specific practices for most effective and efficient reduction of phosphorus loading.
Increase technical assistance in critical watersheds: Hire technical staff to work with farms to meet RAP and higher BMPs based on Northern Lake Farm survey; and other partners as needed for Mud Creek	Pike, Rock, Mud Creek and farms identified in NLFS		Agriculture	Ongoing	In addition. AAFM's AgCWIP supports a wide variety of partners to provide technical assistance. Since tracking of outcomes began in 2019, partners have provided 104 direct technical assistance visits to farmers and 174 technical assistance contacts with farmers. In addition, NRCS has provided additional technical assistance to meet needs identified in their plans for the Rock and Pike.

Strategies	Priority Subbasin	Priority Towns	Sector	Status	Explanation (see Acronyms, p.9)
Develop and pilot the Environmental Stewardship Program to incentivize additional practice adoption 2016 2020	Missisquoi Bay		Agriculture	Ongoing	In 2018, the AAFM began a pilot of the Vermont Environmental Stewardship Program (see https://agriculture.vermont.gov/vesp). The pilot includes 10 farms (none in Basin 6), with the full program expected to start in 2020.
Create grassed waterways program Target funding to critical source areas in coordination with partners	Missisquoi Bay		Agriculture	Ongoing	Completed practices under this program include 32 acres of critical source area repaired, as well as multiple projects currently in the planning phase. Farmers in the Missisquoi watershed are eligible for this voluntary program and two contractors are working directly within the watershed to identify and implement projects. NRCS provides a similar program that is currently more popular.
Provide technical assistance on stormwater master planning (SWMP) to identify and prioritize actions	Mid Missisquoi,	Richford	Developed lands – other	Complete	DEC Ecosystem Restoration grants funded NRPC to develop Richford and Fairfield SWMPs. DEC basin planners aided the NRPC in completing plans, including attending meetings and reviewing draft material. Overall, 44 projects were identified during development of 2 SWMPs. All of the SWMP identified as needed in TBP were completed.
Support implementation of completed Stormwater Master Plans (SWMP)	Multiple	Enosburgh, Fairfield, Franklin, Highgate, Sheldon, Swanton	Developed lands – other	Ongoing	In total, there are 6 SWMPs completed for municipalities in the basin. DEC provided technical and financial assistance. 20 acres of existing impervious and 18 acres of new impervious surface has been treated as part of efforts to implement these SWMPs. Additional acres have been treated with nonstate funding sources
Help municipalities control runoff from gravel and paved roads: implement road assessment protocol to assist with prioritization; provide technical and financial resources to assist with implementation; implement Municipal Roads General Permit (MRGP)	Upper Missisquoi, Trout (West Hill Brook)	Lowell, Troy, Westfield, Jay, Montgomery, Bakersfield, Berkshire, Enosburgh, Enosburg Falls, Fairfield, Highgate Richford, Franklin and Swanton	Developed lands – roads	Ongoing	617 individuals received training in 2019 by RPCs and others to support municipalities in their development of REI and associated work to meet MRGP requirements. 13 of the 18 towns that are almost entirely in the basin have completed REIs and identified priority road segments with assistance from DEC. All but one town was assisted by NRPC or NVDA who were in turn supported by DEC. Most towns are involved in subsequent work to improve stormwater management on priority road segments with local and state funds.

Strategies	Priority Subbasin	Priority Towns	Sector	Status	Explanation (see Acronyms, p.9)
Support municipal stormwater regulation adoption , include incorporation of Low Impact Development and Green Stormwater Infrastructure		Towns with Stormwater master plan	Developed land - other	Ongoing	During work with towns on bylaws, NRPC provided technical assistance on using bylaws to enhance stormwater management: Berkshire*, Enosburg Falls*, Fairfield, Fletcher*, Swanton, Bakersfield*. Those that adopted regulations are noted with an asterisk. NRPC also presented on floodplain and river corridor regulations with municipalities listed above and Montgomery. DEC provided support to the RPCs.
Increase the number of river and floodplain restoration projects Re-establish connections to floodplains	Hungerford, Mid-Missisquoi	Sheldon, Enosburgh, Berkshire	Natural Resources	Ongoing	The two-tiered ditch is the most promising approach to reestablishing flood plain in agriculturally dominated areas where landowners are reluctant to lose productive land. A 2019 project on the Rock River restored floodplain along 2,500 feet of ditched stream. An additional project is in design. Three traditional floodplain restoration projects have been identified and are in the planning stages.
Replace geomorphologically incompatible culvert and bridges: RPCs work with towns to identify, add to capital budget, seek additional funding sources	Upper Missisquoi	Montgomery, Orleans County	Natural Resources	Ongoing	NRPC staff have had conversations and informed communities around undersized culverts and assisted with Better Roads Category D grant applications for Richford, Sheldon, Swanton, Montgomery, St. Albans Town, Franklin, Highgate, and Fairfield in this time period. NRPC will hold additional consultations with towns to process REI reports and aid in forming the MRGP and capital planning discussions.
Increase River Conservation Easements: support projects which incorporate channel management and riparian buffer provisions	Trout, Upper Missisquoi, Tyler and Black Creek	Franklin and Orleans Counties	Natural Resources	Ongoing	89 acres of river corridor were conserved through river corridor easements since SFY 2016.
Enhance the Flood Resilient Communities Program with funding and technical assistance incentives for municipalities	Upper Missisquoi, Trout, Tyler Branch	Franklin and Orleans Counties	Natural Resources	Ongoing	In addition to the work completed by the RPCs described above, DEC has provided information to 11 towns.
Support studies to investigate benefits	All	All	Natural Resources	Ongoing	Studies were completed on the Black Creek and East Highgate dams as

Strategies	Priority Subbasin	Priority Towns	Sector	Status	Explanation (see Acronyms, p.9)
of removal of dams listed in Table 9 of the Basin 6 Tactical Basin Plan					well as alternatives analyses for Mud Creek Dam and Lake Carmi Dam. The East Highgate dam was removed.
Develop LiDAR mapping to map eroding, abandoned and retired forest roads, skid trails and log landings to assist in identification of remediation projects	All	All	Forestry	Complete	UVM remote sensing and DFRP worked to develop maps showing abandoned and retired roads. The next phase of this strategy is the development of a Road Erosion Inventory App for State Forest Roads that is scheduled to be complete in 2020. The inventory completed with this app will list prioritized hydrologically connected forest roads for erosion fixes.
Prioritize work with landowners based on contribution of erosion features on logging roads (see above LiDAR) to water quality impairment. Provide technical and financial assistance	All	All	Forestry	Complete	The DFPR county foresters work with landowners to address this action. The newly revised AMPs will extend the required length of road from stream for improved erosion control.
Provide loggers with access to portable skidder bridges through rental program. Promote building and ownership of bridges by logging as part of their general practices	All	All	Forestry	Ongoing	A portable skidder bridge is still available in Orleans County. The DFPR is currently focused on providing loggers with assistance to build and own their own bridges.
Enhance forest cover to improve watershed health by promoting the use of Ecologically Sensitive Treatment Areas for managed forest in current use.	All	All	Forestry	Ongoing	In comparison of two time periods, 2010 to 2013 and 2014 to present, the number of Franklin County parcels enrolled in ESTA have increased although the total number of acres have decreased. The Franklin county forester believes that two programs targeting landowners with smaller landholdings may be responsible: Cold Hollow to Canada (2009) and Woodlots Program (2013). Partners like the Vermont Land Trust may have been instrumental in encouraging large landowners with VLT easements to participate during the earlier time period. Forest was also enrolled in the ESTA program in Orleans county since 2010, although acreage was not separated out by basin.
Designate wetlands within the basin as	Lower Missisquoi	Swanton	Natural Resources	Not Started	No action to date. Number of landowners and predominance of

Strategies	Priority Subbasin	Priority Towns	Sector	Status	Explanation (see Acronyms, p.9)
Class I: Propose Missisquoi Delta as Class I					farmlands that make up wetland and buffer create barriers to designation
Identify potential wetland restoration sites based on Lake Champlain wetland restoration map and additional resources and restore	Entire Basin	All	Natural Resources	Ongoing	Updated Lake Champlain wetland restoration site prioritization modeling was completed in 2018 utilizing RCPP funds. The updated maps, which identify potential wetland restoration areas with the highest likelihood of phosphorus attenuation are now available on the ANR Atlas and the Wetland Inventory Mapper. Partners such as NRCDs, NRCS, VLT, TNC and DFW are using these maps and a subset of project packets to help target wetland restoration outreach, much of which is currently occurring in the Missisquoi watershed. For example, DFW has initiated a wetland restoration and acquisition initiative with funding from EPA through the Lake Champlain Basin Program. The primary focus of this project is wetland restoration on new and existing DFW acquisitions with a goal of 40% lands restored. Two of the geographic focus areas are in the Missisquoi Bay watershed and the priority mapping is being utilized for outreach.
Implement the Lake Wise Program:				Ongoing	9 BMP were installed at Lake Carmi and 7 were installed at Fairfield Pond.
Promote the Lake Wise Program and associated Lake Leaders training sessions to encourage lake-friendly shoreline property maintenance	Lake Carmi, Fairfield Pond, Lake Champlain	Multiple	Natural Resources	Ongoing	Landowners and others were trained to assess lakeshore. The number of practices implemented rose from 6 in 2016 to 25 in 2018, indicating an increased interest from landowners based ongoing training or other education and outreach events.

ACRONYMS

AAFM – Agency of Agriculture, Food and Markets

AgCWIP - Agricultural Clean Water Initiative Program (AAFM)

BMP – Best Management Practice

CCRPC – Chittenden County Regional Planning Commission

CSFO – Certified Small Farm Operations

DEC – Department of Environmental Conservation

DFPR – Department of Forest, Parks and Recreation

FNRCD - Franklin Natural Resource Conservation District

MRGP – Municipal Road General Permit

NMP – Nutrient Management Plan

NRCS – Natural Resources Conservation Service

NRPC – Northwest Regional Planning Commission

NVDA – Northeastern Vermont Development Association

ONRCD - Orleans Natural Resource Conservation District

REI – Road Erosion Inventory (MRGP)

SWMP – Stormwater Master Plan

TNC – The Nature Conservancy

UVM – University of Vermont

VLT – Vermont Land Trust

Appendix D. Estimated Total Phosphorus Load Reductions by Lake Segment Watershed



Part 2 of this report, “Lake Champlain Progress Report” summarizes the State of Vermont’s progress implementing the *Phosphorus Total Maximum Daily Loads for Vermont Segments of Lake Champlain* (i.e., Lake Champlain TMDL). It presents estimated total phosphorus load reductions achieved by clean water projects, completed SFY 2016-2019, within the context of the Lake Champlain TMDL baseline (2001-2010) and target (2038) phosphorus loads for Vermont segments of the Lake Champlain basin. Total phosphorus load must be reduced by 212.4 metric tons per year from Vermont sources for Lake Champlain to meet State of Vermont water quality standards. The TMDL further allocates phosphorus reduction targets by “lake segment” watershed, which differ slightly from the Tactical Basin Planning watersheds, as shown in Figure 1. This Appendix D presents estimated total phosphorus load reductions achieved each year by lake segment watershed compared to the target reduction. Table 1 summarizes the estimated percentage of required total phosphorus load reduction achieved within the SFY 2016-2019 reporting period by lake segment watershed.¹

Figure 1. Lake segment watershed boundaries as specified in the Lake Champlain TMDL (shaded areas) compared to Tactical Basin Plan watershed boundaries (dark blue outline)

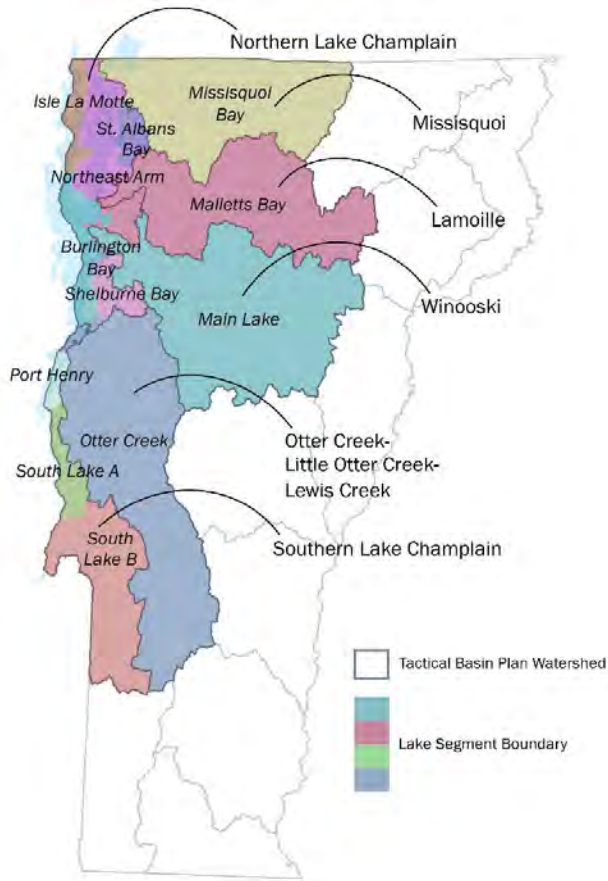


Table 1. Estimated percentage of required total phosphorus load reduction achieved, SFY 2016-2019, by lake segment watershed

Lake Segment	SFY 2016	SFY 2017	SFY 2018	SFY 2019
Burlington Bay	0.00%	0.00%	0.03%	0.07%
Isle La Motte	0.4%	2%	2%	2%
Main Lake	2%	4%	4%	4%
Malletts Bay	4%	4%	6%	9%
Missisquoi Bay	2%	3%	4%	5%
Northeast Arm	11%	36%	36%	39%
Otter Creek	5%	8%	10%	14%
Port Henry	3%	9%	8%	11%
Shelburne Bay	3%	9%	4%	9%
South Lake A	6%	11%	10%	17%
South Lake B	2%	2%	2%	3%
St. Albans Bay	16%	24%	25%	33%
Basin-Wide	3%	5%	6%	8%

¹ Federal funding programs through USDA-NRCS agricultural practice data represent practices applied July 1, 2015 (beginning of SFY 2016) through December 31, 2018 (halfway through SFY 2019). Practice data for the remainder of SFY 2019 will be provided next year in the SFY 2020 Annual Performance Report.

EXPLANATION OF TABLE

Level of progress is variable by lake segment watershed for the following reasons:

1. Lake segment size and level of phosphorus reduction required varies: The TMDL allocated phosphorus loading capacity based on each lake segments land use characteristics and the reduction required for the receiving Lake Champlain segment to meet State of Vermont water quality standards. The level of effort required and the magnitude of phosphorus loading ranges by lake segment. For example, the TMDL requires an 87.7 metric ton reduction for Missisquoi Bay to meet water quality standards while Shelburne Bay requires a 1.2 metric ton reduction. Tactical Basin Plans target clean water efforts to portions of the Lake Champlain basin with the greatest need for phosphorus reduction.
2. Clean water projects are targeted in priority subwatersheds: Given the significant cost of restoring and safeguarding water quality, the state must spend its resources efficiently and effectively. Tactical Basin Plans inform where to prioritize efforts to reduce phosphorus pollution to Lake Champlain. The level of progress in the Northeast Arm and St. Albans Bay lake segment watersheds are notably high compared to other lake segments. These lake segments contain priority subwatersheds where U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) has been targeting agricultural technical and financial assistance to farmers since 2016.
3. Gaps in the state's ability to quantify phosphorus reductions for all projects: The State of Vermont is expanding its ability to quantify phosphorus reductions for all project types; however, some gaps still exist. For example, the State of Vermont can quantify phosphorus reductions associated with most agricultural practices, while significant gaps exist for natural resources restoration projects. This is one reason why lake segments dominated by agricultural efforts will show greater progress than those targeting natural resources restoration. See Appendix F for summary of methods used to estimate pollutant reductions. The Clean Water Service Delivery Act (Act 76 of 2019) requires addressing gaps and publishing methods to estimate phosphorus reductions for clean water projects by November 1, 2021.
4. Programs are ramping up to increase the pace of phosphorus reductions: The Lake Champlain TMDL timeframe began in 2017 and its implementation plan included a “ramping-up” phase of regulatory and financial and technical assistance programs. New regulatory programs are now in place that will drive phosphorus reductions from agricultural sources, developed lands, and roads. Lake segments dominated by developed lands are expected to see the benefits of these programs in the coming years. For example, draft Stormwater General Permit 3-9050 (i.e., “3-acre permit”) will require stormwater treatment from sites with three or more acres of impervious surfaces – hard surfaces such as roofs and roads – that were previously unpermitted or permitted before 2002. This general permit will cover more than 700 projects, all of which are required to have permit coverage by no later than 2023.

This evaluation of progress will help inform “adaptive management” such as where state and federal agencies and its partners continually target future regulatory efforts and financial and technical assistance to ensure adequate progress across all lake segment watersheds and land use sectors.

Figure 2. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “South Lake B” lake segment watershed

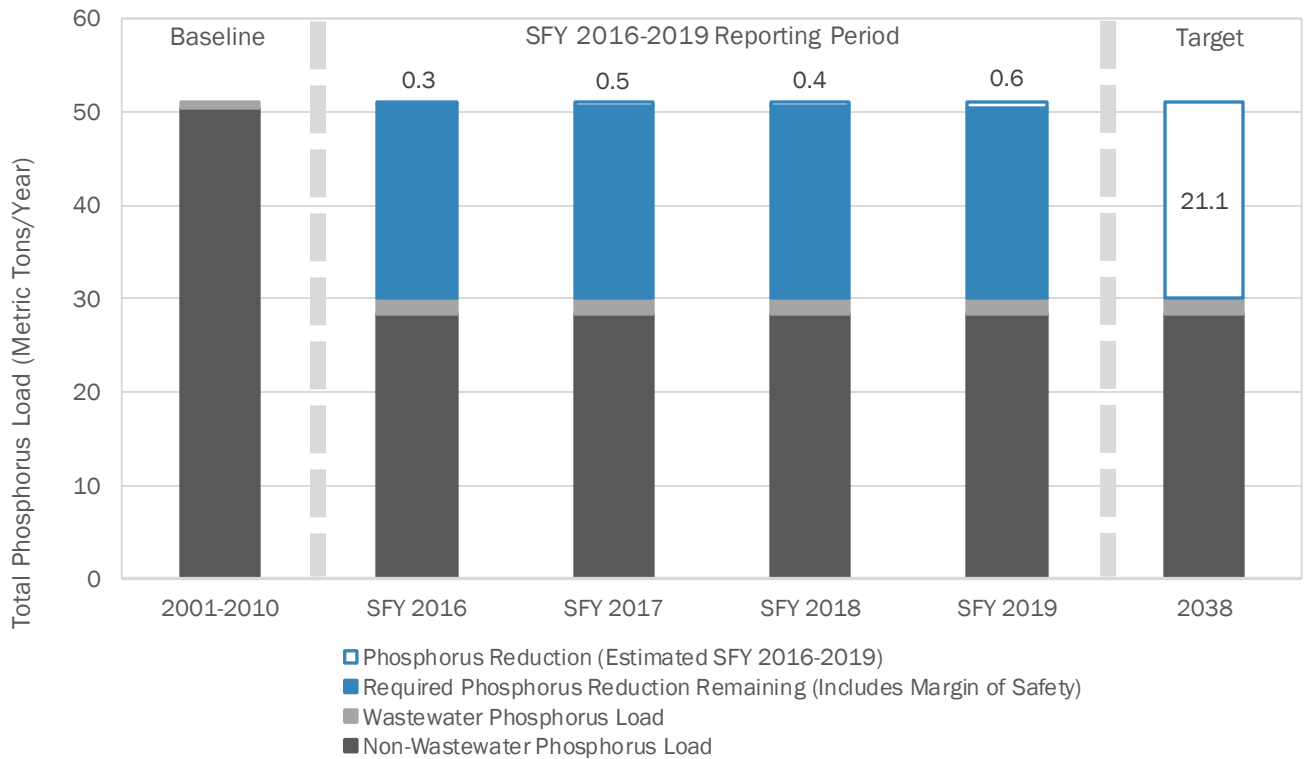


Figure 3. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “South Lake A” lake segment watershed

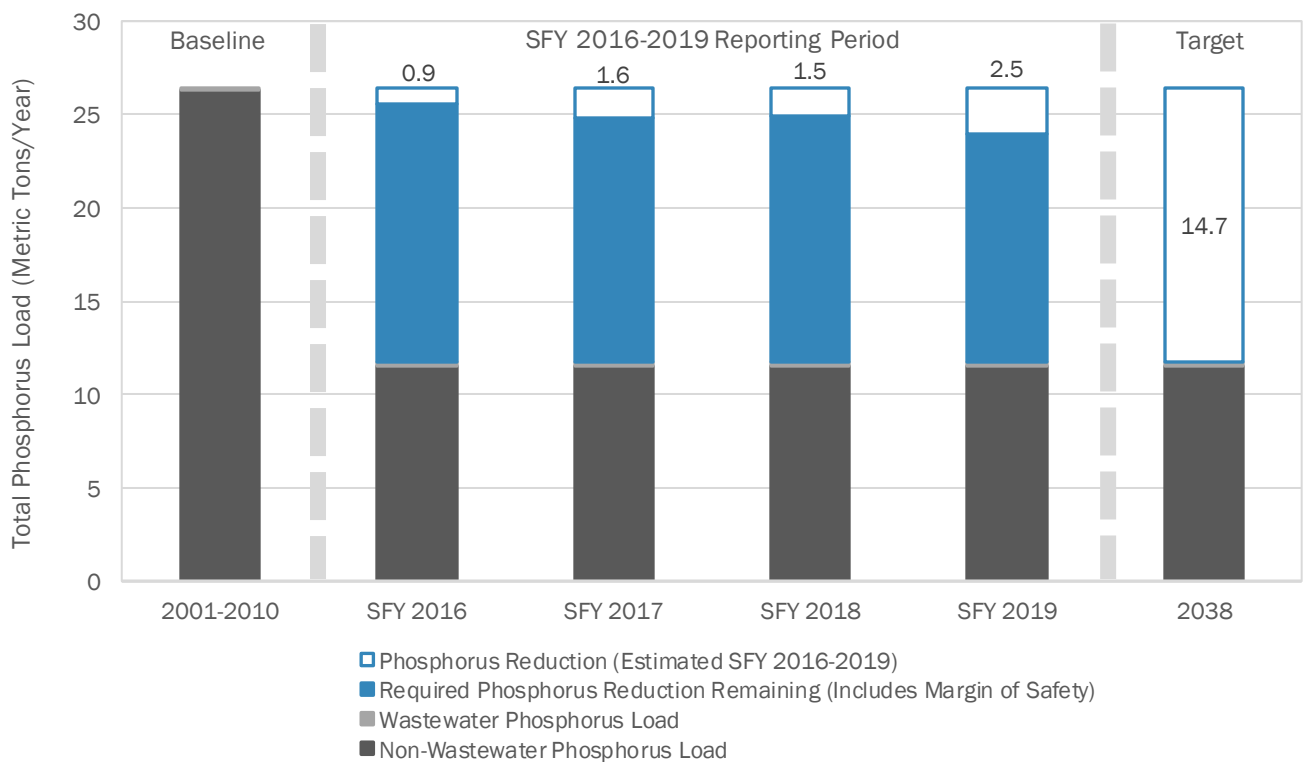


Figure 4. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “Port Henry” lake segment watershed

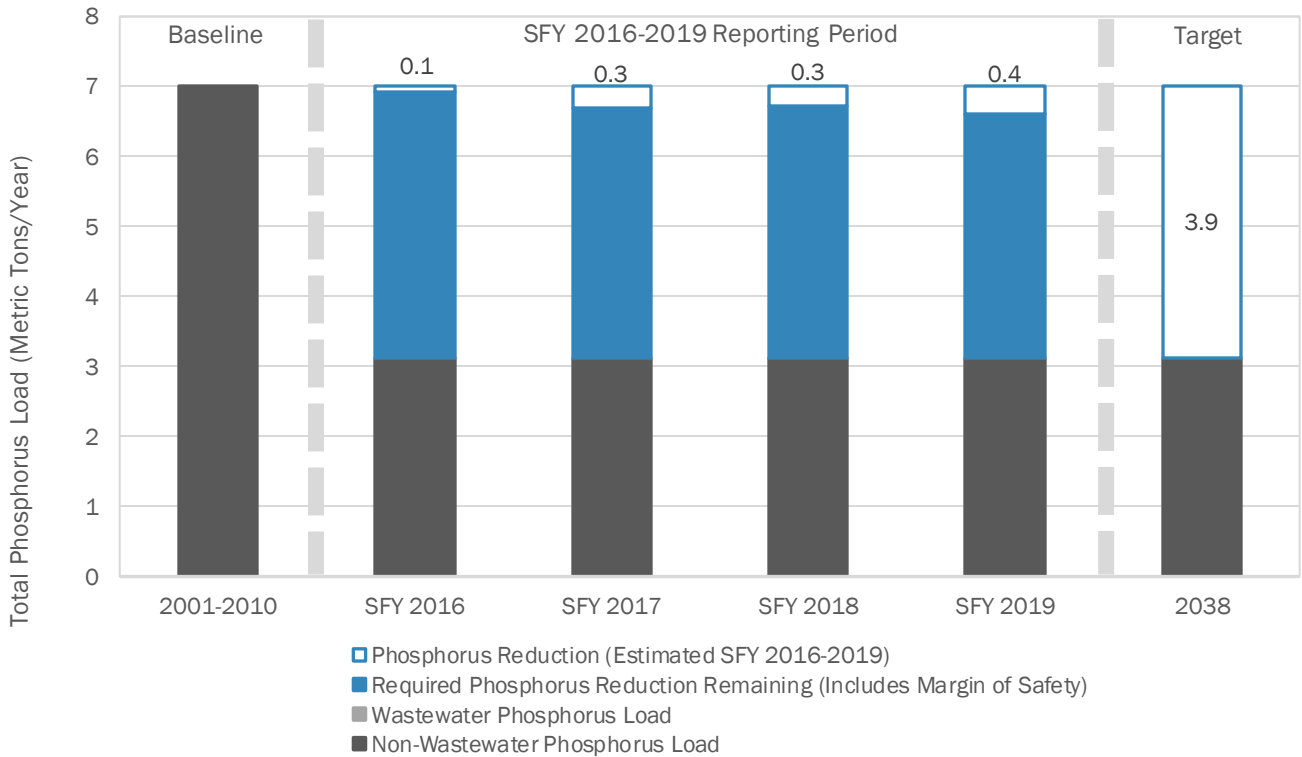


Figure 5. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “Otter Creek” lake segment watershed

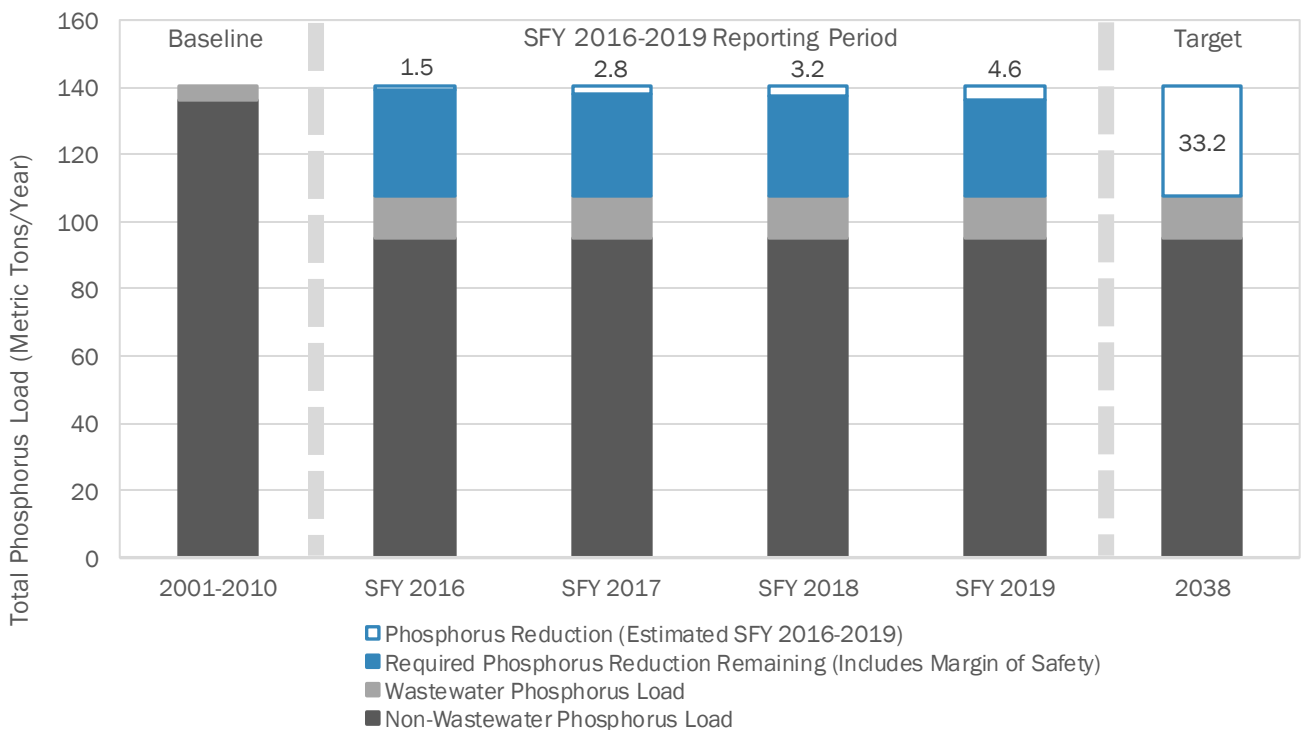


Figure 6. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “Main Lake” lake segment watershed

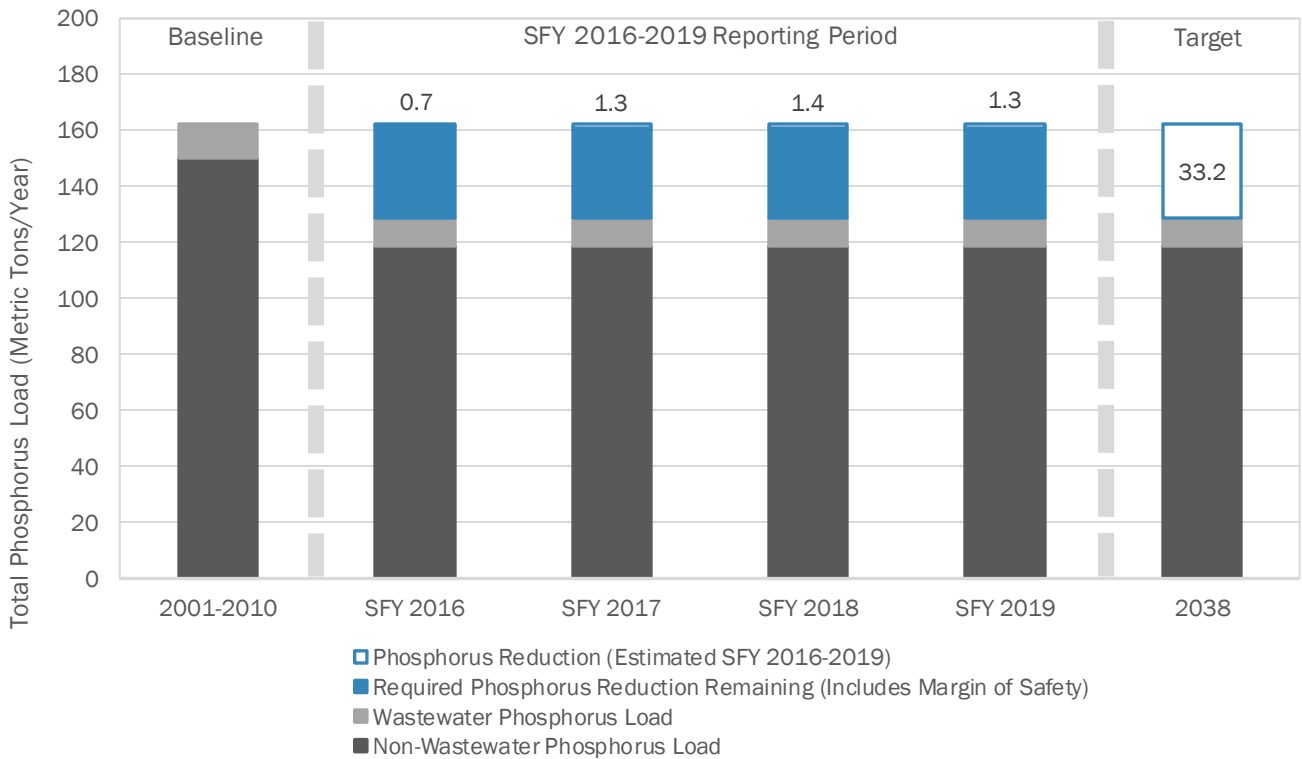


Figure 7. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “Shelburne Bay” lake segment watershed

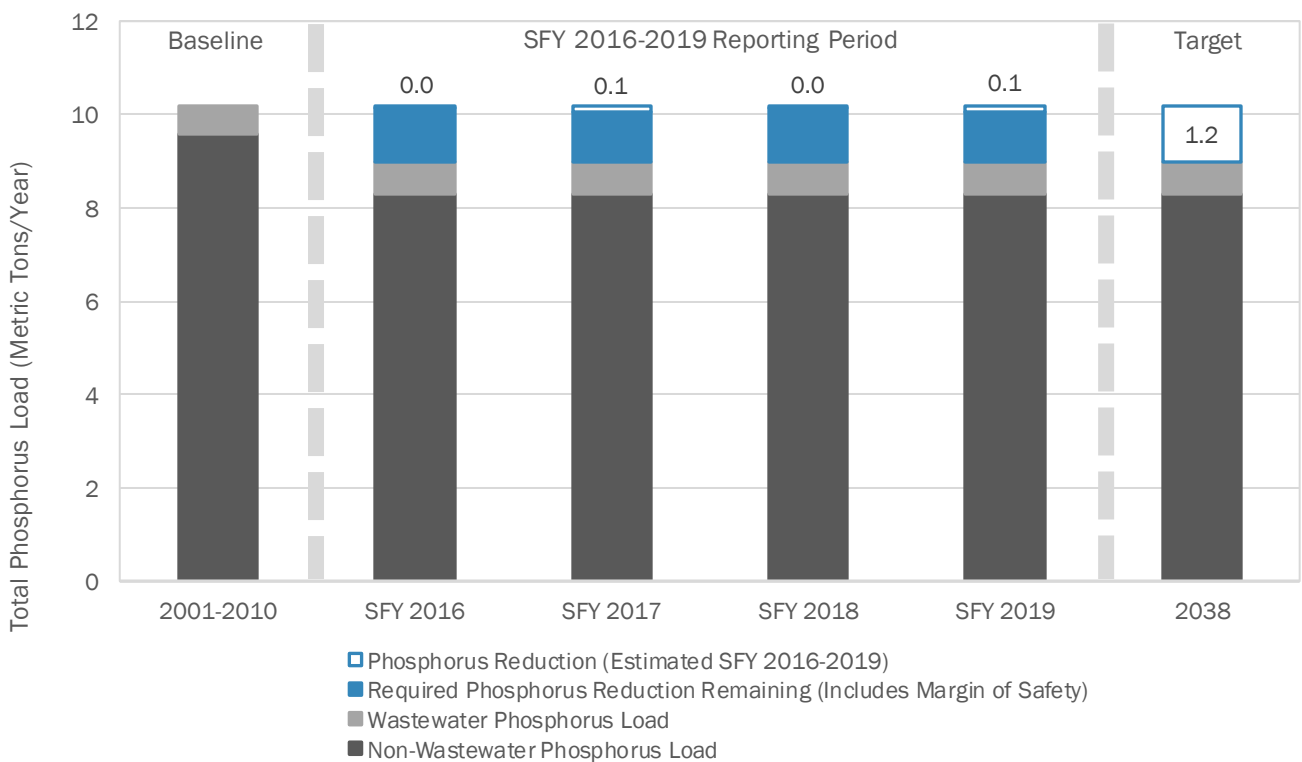


Figure 8. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “Burlington Bay” lake segment watershed

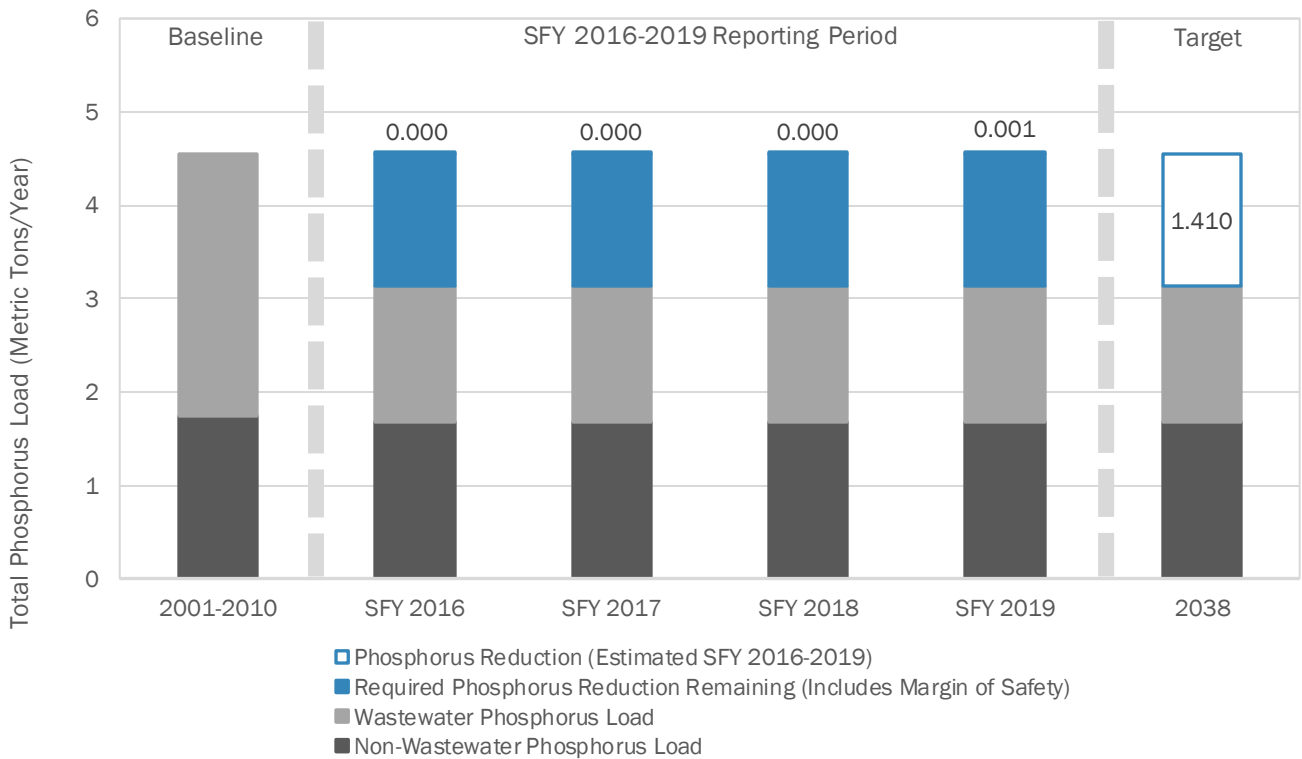


Figure 9. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “Malletts Bay” lake segment watershed

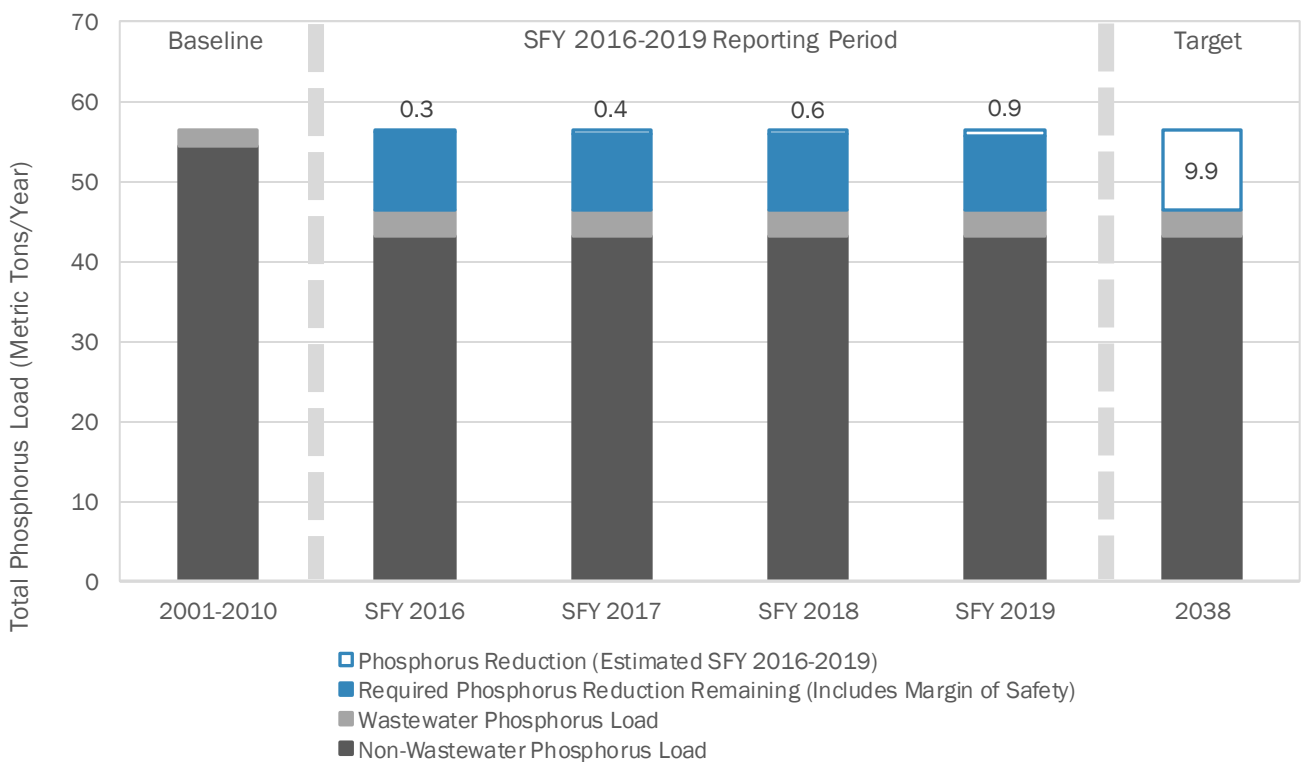


Figure 10. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “Northeast Arm” lake segment watershed

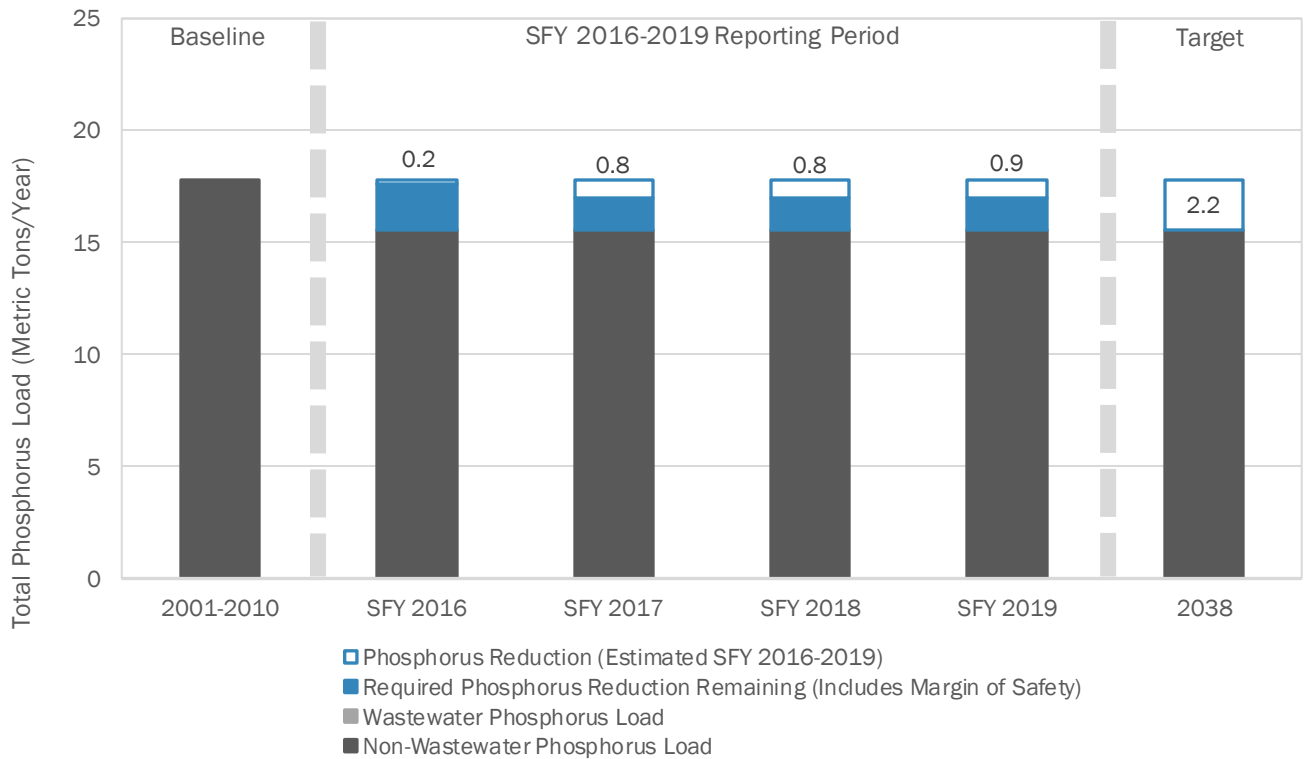


Figure 11. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “St. Albans Bay” lake segment watershed

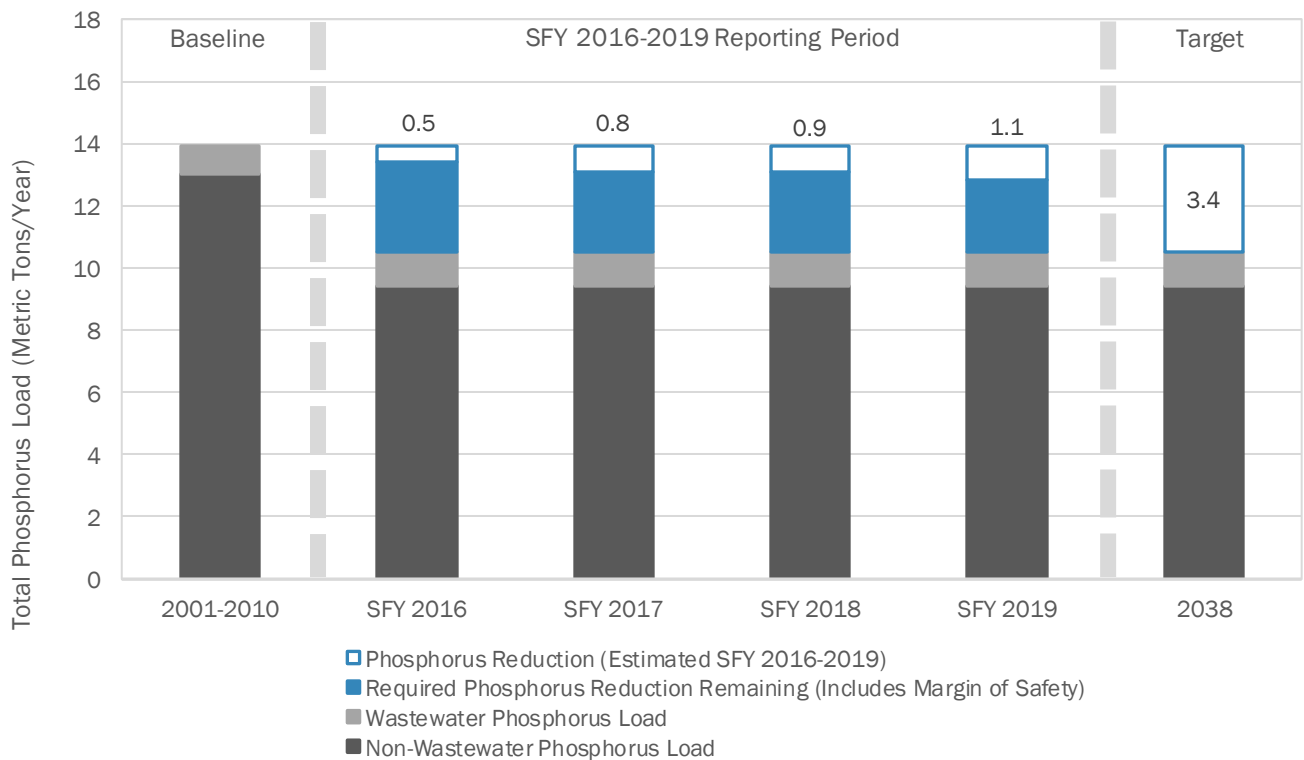


Figure 12. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “Missisquoi Bay” lake segment watershed

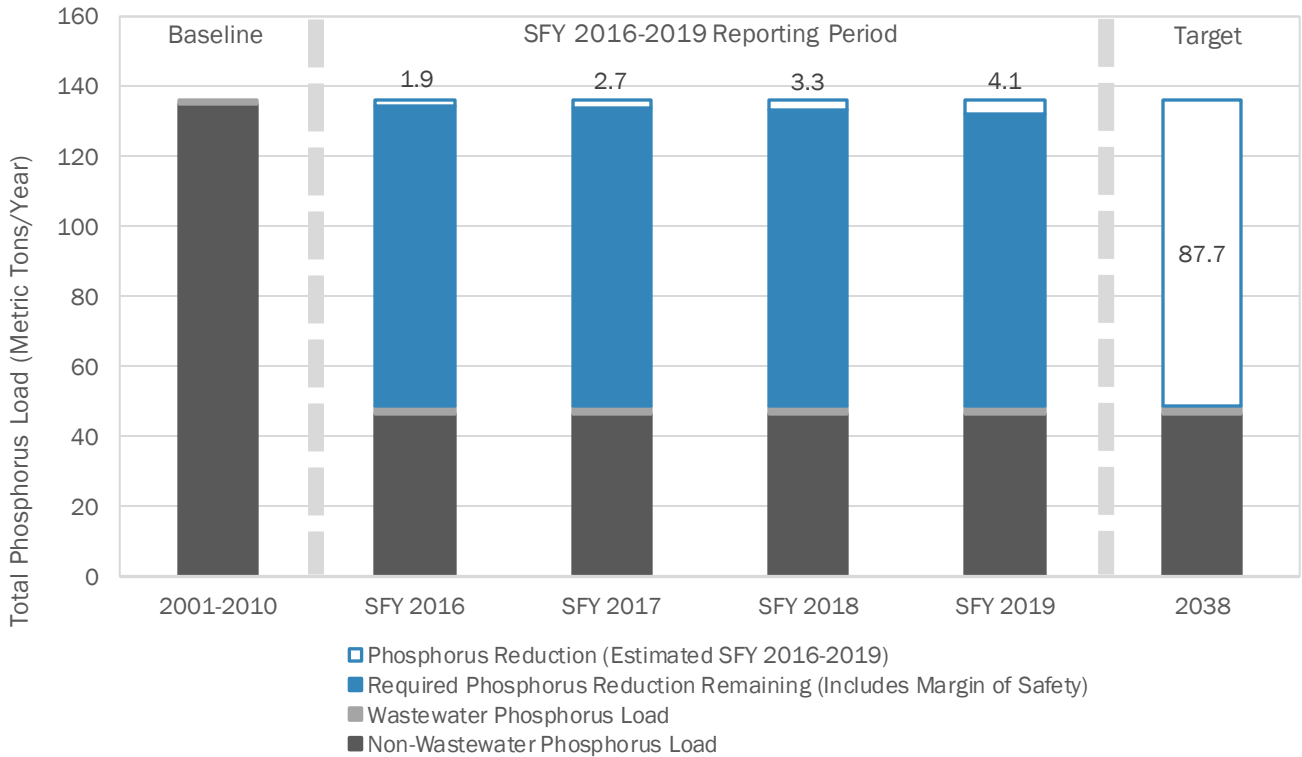
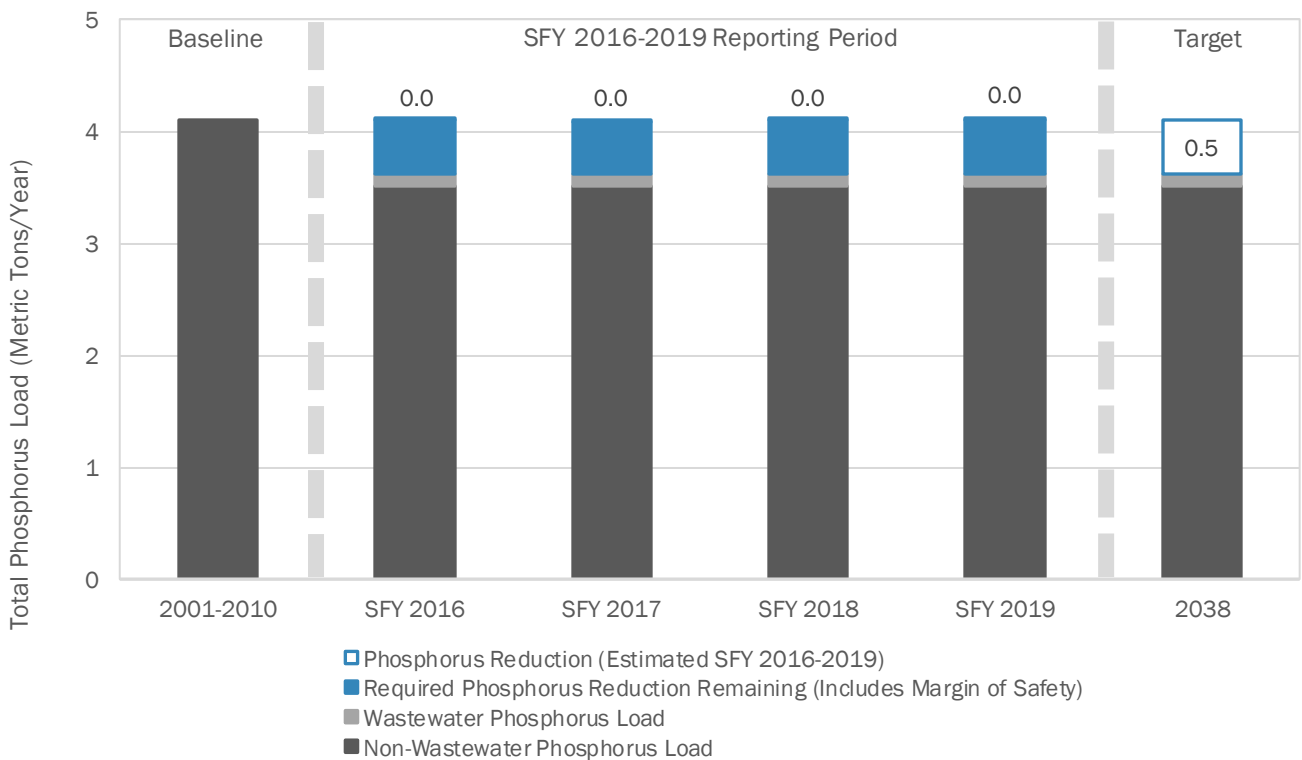


Figure 13. Lake Champlain TMDL total phosphorus load baseline (2001-2010), estimated total phosphorus load reductions achieved (SFY 2016-2019 reporting period), and target phosphorus load (2038) in the “Isle La Motte” lake segment watershed



Appendix E. Results of Operational Stormwater Permits



The purpose of this Appendix is to summarize the contributions that Operational Stormwater permits have made toward meeting Vermont’s water quality goals.

Scope of Data	
Data include:	Stormwater permit data includes new or amended operational stormwater permits issued in State Fiscal Year (SFY) 2018 and 2019. Permits authorize new, redeveloped, and existing impervious surfaces meeting regulatory thresholds. DEC tracks permit issuance, not actual construction of impervious. Actual construction and change in phosphorus load may occur one to several years behind authorization under the permit.
Data does not include:	Phosphorus load data from outside the Lake Champlain and Memphremagog basins.
Future improvements:	More precise tracking of the drainage area and size of each practice is needed to improve the accuracy of the reductions. Permitted retrofit projects should be flagged if funded by a grant program.

Table 1. Stormwater treatment practice types installed to comply with operational stormwater permits in SFY 2018-2019 and average estimated phosphorus removal rates

Practice Tier	Definition and examples	Average Phosphorus Removal	Practices Permitted in SFY 2018 ¹	Practices Permitted in SFY 2019 ²
Tier 1 practices	Infiltrating practices, impervious disconnection	>80%	149	107
Tier 2 practices	Gravel Wetlands and bioretention with underdrains	60-80%	20	37
Tier 3 practices	Wet ponds, filters and dry swales not designed to infiltrate	50-60%	47	18
2002 VSMM ³ practices	Grass lined channels, non-structural credits	<50%	48	0
Total number of practices permitted			264	162
Average total phosphorus load removal of permitted practices ⁴			48% /72% ⁵	70.1%

¹ The stormwater management database tracks if a practice is present in a drainage area, not the number of practices. The real number of practices is higher.

² The stormwater management database tracks if a practice is present in a drainage area, not the number of practices. The real number of practices is higher.

³ VSMM is defined as Vermont Stormwater Management Manual.

⁴ Phosphorus removal efficiencies were assigned to each practice assuming that it was sized to meet the water quality volume. See Appendix F for phosphorus removal efficiencies.

⁵ Average Phosphorus removal was 48% for treatment practices permitted under the 2002 Vermont Stormwater Management Manual (VSMM) and 72% for treatment practices permitted under the 2017 VSMM.

Figure 1: Percent stormwater treatment practices by tier for new operational stormwater permits issued in SFY 2019.

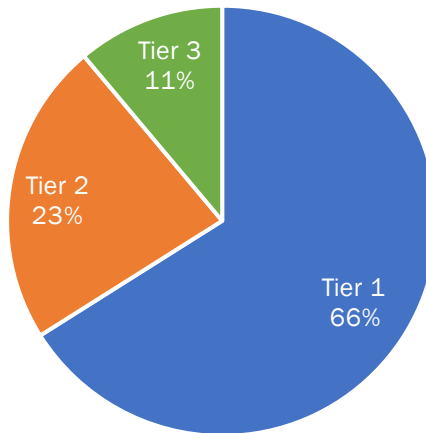


Table 2. Impervious surface area covered by operational stormwater permits issued in SFY 2018-2019 by large basin

Permitted Impervious Surface Type	Lake Champlain		Lake Memphremagog		Other Drainage Areas	
	SFY 2018	SFY 2019	SFY 2018	SFY 2019	SFY 2018	SFY 2019
New impervious (acres)	127.9	87.6	10.2	1.1	28.1	26.1
Redeveloped impervious (acres)	20.6	24.0	3.2	0	9.5	8.0
Existing impervious (acres)	19.6	0.8	1.5	0	20.7	3.1
Total impervious (acres)	168.1	112.3	14.9	1.1	58.3	37.1
Percent of impervious permitted	70%	74.6%	6%	0.8%	24%	24.7%

Table 3. Estimated change in total phosphorus load associated with operational stormwater permits in the Lake Champlain and Memphremagog basins (kilograms/year), SFY 2018-2019

Estimated Change in Total Phosphorus Load	Lake Champlain		Lake Memphremagog	
	SFY 2018	SFY 2019	SFY 2018	SFY 2019
Increase in phosphorus from operational permits, prior to treatment ⁶ (kilograms/year)	103.3	90.7	42.6	1.5
Phosphorus reduced by treatment practices (kilograms/year)	101.6	115.2	30.0	0.8
Net change in phosphorus of operational permits (kilograms/year)	0.5	-26.7 ⁷	12.6	0.7

⁶ Permitted impervious and phosphorus load calculations include both new and amended permit authorizations. For amended permits, only the increased impervious acres and phosphorus load relative to the previous permit are summarized here. Phosphorus increase from new development assumed that the permitted area was forested prior to development. Redeveloped and existing impervious does not result in a phosphorus change.

⁷ A net reduction in phosphorus in Lake Champlain is likely due to treatment of redeveloped impervious.

Appendix F. Summary of Methods used to Estimate Pollutant Reductions



Estimating nutrient pollution reduced by clean water projects requires two key pieces of data and information:

1. Data are needed on the area of land draining to a practice or project and the average rate of nutrient pollution from different land uses.

With these data, the state can estimate the total nutrient load treated by a project or practice based on the area of land treated. These pollutant loading rates are currently available for the Lake Champlain and Lake Memphremagog basins.

2. Information is needed on the average annual performance of specific project types in reducing nutrient pollution.

This information is based on research of project performance relevant to conditions in Vermont. Project performance is expressed as an average annual percentage of nutrient pollution reduced.

The average annual performance of the project is applied to the nutrient pollution load delivered from the land draining to the project to estimate the annual average pollutant reduction. The ability to estimate the pollutant reduction of a project can be limited by lack of data on nutrient pollution loading rates for the land treated and/or lack of information on the performance of a project in treating nutrient pollution. Table 1 summarizes the State of Vermont's current ability to quantify nutrient load reductions by basin and project type.

Tables 2-4 contain project types for which the State of Vermont currently quantifies nutrient load reductions. The table defines project categories and minimum standards that must be met for pollutant reductions to apply, minimum data needed to quantify pollutant reductions, and the average annual pollutant reduction assigned to the project type (i.e., efficiency).

Table 1. Summary of Vermont’s ability in SFY 2019 to account for nutrient pollution reductions by project type, basin, and nutrient of concern

Key			
Currently have ability to account for nutrient pollution reduction			
Do not currently have ability to account for nutrient pollution reduction			
Project Type	Lake Champlain	Lake Memphremagog	Connecticut River
Agricultural cropland/pasture conservation practices	Phosphorus	Phosphorus	Nitrogen
Agricultural riparian buffers	Phosphorus	Phosphorus	Nitrogen
Barnyard and production area management practices	Phosphorus	Phosphorus	Nitrogen
River and floodplain restoration	Phosphorus	Phosphorus	Nitrogen
Riparian buffer restoration	Phosphorus	Phosphorus	Nitrogen
Lakeshore restoration	Phosphorus	Phosphorus	Nitrogen
Wetland restoration	Phosphorus	Phosphorus	Nitrogen
Forest erosion control practices	Phosphorus	Phosphorus	Nitrogen
Stormwater treatment practices	Phosphorus	Phosphorus	Nitrogen
Road erosion control practices	Phosphorus	Phosphorus	Nitrogen
Wastewater treatment upgrades	Phosphorus	Phosphorus	Nitrogen
Combined sewer overflow abatement	Phosphorus	Phosphorus	Nitrogen
Summary of status to expand methods to estimate nutrient pollutant reductions	Clean Water Service Delivery Act (Act 76 of 2019) requires addressing gaps and publishing methods to estimate phosphorus reductions for clean water projects implemented in the Lake Champlain basin by November 1, 2021.	Act 76 of 2019 requires addressing gaps and publishing methods to estimate phosphorus reductions for clean water projects implemented in the Lake Memphremagog basin by November 1, 2021.	U.S. EPA-supported efforts are underway to develop methods to estimate nitrogen reductions for clean water projects implemented in the Long Island Sound basin. Act 76 of 2019 requires setting a schedule to publish methods for other (i.e., non-phosphorus) impairments by November 1, 2023.

Table 2. Agricultural clean water project types, definitions, minimum standards and data required to quantify pollutant reductions, and average annual total phosphorus load reduction efficiency (if available)¹

Project Type	Definition and Minimum Standards to Quantify Pollutant Reductions	Data Required to Quantify Pollutant Reductions	Total Phosphorus Load Reduction Efficiency (%)
Barnyard/Production Area Management	Exclusion of clean water runoff from the production area and management of the remaining runoff in a way that minimizes its pollution. Production area includes barnyards, heavy-use areas, waste storage, feed storage, and access roads. Production areas must divert clean water runoff and manage the remaining runoff in a way that minimizes pollution. This involves complete containment and/or control and management of all wastes, including covered barnyards and/or diversion of runoff/silage waste to manure storage facilities. To be assessed via AAFM inspections.	Production area acres Vermont water quality/premises ID Compliance status Date of inspection Size operation of premises HUC12 watershed location	80%
Livestock Exclusion	Exclusion of livestock from surface waters by installing fence or other barrier. May include acceptable alternatives such as structures providing limited access for watering or fencing to limit access for livestock stream crossing.	Acres of pasture excluded HUC12 watershed location Field HSG (optional) Field average slope (optional)	55%
Forested Riparian Buffer	Areas of woody vegetation (shrubs and trees) located adjacent to surface waters that filter out pollutants from runoff. Minimum 25-foot width, no manure application, no gully erosion or channelized flow.	Field land use (default cropland) Buffer acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	40% plus reduction from converting cropland to forest
Filter Strip Riparian Buffer	Areas of grasses or hay located adjacent to surface waters that filter out pollutants from runoff. Minimum 25-foot width, no manure application, no gully erosion or channelized flow.	Field land use (default cropland) Buffer acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	40% plus reduction from converting cropland to grass/hay
Forested Ditch Buffer	Areas of woody vegetation (shrubs and trees) located adjacent to drainage ditches that filter out pollutants from runoff. Minimum 10-foot width, no manure application, no gully erosion or channelized flow.	Field land use (default cropland) Buffer acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	24% plus reduction from converting cropland to forest

¹ Represents annual average total phosphorus load reduction based on project types' expected performance.

Project Type	Definition and Minimum Standards to Quantify Pollutant Reductions	Data Required to Quantify Pollutant Reductions	Total Phosphorus Load Reduction Efficiency (%)
Filter Strip Ditch Buffer	Areas of grasses or hay located adjacent to drainage ditches that filter out pollutants from runoff. Minimum 10-foot width, no manure application, no gully erosion or channelized flow.	Field land use (default cropland) Buffer acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	24% plus reduction from converting cropland to grass/hay
Conservation Crop Rotation, Change in Crop Rotation, Strip Cropping	Land that is managed to change crop types cyclically over time with the intention of reducing soil erosion and/or improving long-term soil health and quality, typically between an annual crop (e.g., corn, soybeans) and a perennial crop (e.g., hay). May involve change from continuous cropland to crop rotation or extending duration of perennial crop in existing crop rotation.	Field land use (default cropland) Practice acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	Default 25% (depends on land use, soil, and slope)
Conservation Tillage, Reduced Till, No Till	Any tillage and planting system that leaves a minimum of 30% of the soil surface covered with plant residue after the tillage or planting operation (e.g., reduced till, no-till). For silage corn, this could involve required application of a cover crop or use of zip-till, zone-till or minimum tillage equipment.	Field land use (default corn) Practice acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	Default 20% (depends on soil and slope)
Cover Crop, Nurse Crop	Establishing a seasonal cover on annual cropland for soil erosion reduction and conservation purposes. Seasonal cover consists of a crop of winter rye or other herbaceous plants seeded at a minimum rate of 100 lbs/ac or at the highest recommended rate to provide effective soil coverage. When categorized as nurse crop, accounted for as cover crop, but typically used to begin crop rotation and often accounted for as a system with crop rotation.	Field land use (default corn) Practice acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	Default 28% (depends on slope)
Forage and Biomass, Corn to Hay	Conversion of cropland to hay. Typical Forage and Biomass duration 5 years.	Field land use (default cropland) Practice acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	Default 80% (depends on slope)
Manure Injection	Applying liquid manure below the soil surface.	Field land use Practice acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	Under development

Project Type	Definition and Minimum Standards to Quantify Pollutant Reductions	Data Required to Quantify Pollutant Reductions	Total Phosphorus Load Reduction Efficiency (%)
Grassed Waterways	Stabilizing areas prone to field gully erosion by establishing grass-lined swales.	Field land use Practice acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	To be reviewed (method to determine acres treated)
Hay Field Riparian Buffer	Area of grasses or hay located adjacent to surface waters that filter out pollutants from hay field runoff. Minimum 25-foot width, no manure application, no gully erosion or channelized flow. Effectively a manure spreading setback on a hay field, but categorized as a buffer, as this practice would be considered a filter strip riparian buffer if field land use is converted to cropland.	Field land use Buffer acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	To be reviewed
Reduced Phosphorus Manure, Nutrient Management Plan Implementation	A 20% reduction of the total phosphorus content applied to fields, through either manure or fertilizer. This can be accomplished by reducing the amount of manure/fertilizer applied or by altering livestock feed formulation or treating manure prior to application.	Field land use Practice acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	To be reviewed
Manure Spreading Setback	Area of field adjacent to riparian or ditch buffer where manure is not spread for purposes of enhancing performance of the riparian or ditch buffer and reducing total phosphorus content applied to fields.	Field land use Practice acres HUC12 watershed location Field HSG type (optional) Field average slope (optional)	To be reviewed

Table 3. Stormwater treatment clean water project types (including road erosion controls), definitions, minimum standards and data required to quantify pollutant reductions, and average annual total phosphorus load reduction efficiency (if available)²

Project Type	Definition and Minimum Standards to Quantify Pollutant Reductions	Data Required to Quantify Pollutant Reductions	Total Phosphorus Load Reduction Efficiency (%)
Infiltration trench	Provides storage of runoff using the void spaces within the soil, sand, gravel mixture within the trench for infiltration into the surrounding soils.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume Infiltration rate	Average 90% (depends on storage volume and infiltration rate)
Subsurface Infiltration	Provides storage of runoff using the combination of storage structures and void spaces within the washed stone within the system for infiltration into the surrounding soils.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume Infiltration rate	Average 90% (depends on storage volume and infiltration rate)
Surface Infiltration	Provides storage of runoff through surface ponding (e.g., basin or swale) for subsequent infiltration into the underlying soils.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume Infiltration rate	Average 93% (depends on storage volume and infiltration rate)
Rain Garden, Bioretention (no underdrains)	Provides storage of runoff through surface ponding and possibly void spaces within the soil, sand, washed stone mixture that is used to filter runoff prior to infiltration into underlying soils.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume Infiltration rate	Average 93% (depends on storage volume and infiltration rate)
Rain Garden, Bioretention (with underdrain)	Provides storage of runoff by filtering through an engineered soil media. The storage capacity includes void spaces in the filter media and temporary ponding at the surface. After runoff passes through the filter media it discharges through an under-drain pipe.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume	Average 47% (depends on storage volume)

² Represents annual average total phosphorus load reduction based on project types' expected performance.

Project Type	Definition and Minimum Standards to Quantify Pollutant Reductions	Data Required to Quantify Pollutant Reductions	Total Phosphorus Load Reduction Efficiency (%)
Gravel Wetland	Provides surface storage of runoff in a wetland cell that is routed to an underlying saturated gravel internal storage reservoir (ISR). Outflow is controlled by an orifice that has its invert elevation equal to the top of the ISR layer and provides retention of at least 24 hours.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume	Average 61% (depends on storage volume)
Porous Pavement (with infiltration)	Provides filtering of runoff through a filter course and temporary storage of runoff within the void spaces of a subsurface gravel reservoir prior to infiltration into subsoils.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume Infiltration rate	Average 90% (depends on storage volume and infiltration rate)
Porous Pavement (with impermeable underlining or underdrain)	Provides filtering of runoff through a filter course and temporary storage of runoff within the void spaces prior to discharge by way of an underdrain.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume Filter course depth	Average 70% (depends on storage volume and filter course depth)
Sand Filter (with underdrain)	Provides filtering of runoff through a sand filter course and temporary storage of runoff through surface ponding and within void spaces of the sand and washed stone layers prior to discharge by way of an underdrain.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume	Average 47% (depends on storage volume)
Wet Pond	Provides treatment of runoff by routing through permanent pool.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume	Average 53% (depends on storage volume)
Extended Dry Detention Basin	Provides temporary detention storage for the design storage volume to drain in 24 hours through multiple outlet controls.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume	Average 12% (depends on storage volume)
Grass Conveyance Swale	Conveys runoff through an open channel vegetated with grass. Primary removal mechanism is infiltration.	Latitude, longitude Developed impervious acres treated Developed pervious acres treated Storage volume	Average 19% (depends on storage volume)

Project Type	Definition and Minimum Standards to Quantify Pollutant Reductions	Data Required to Quantify Pollutant Reductions	Total Phosphorus Load Reduction Efficiency (%)
Road Erosion Remediation on Gravel and Paved Open Drainage (Uncurbed) Roads	Installation of a suite of practices to correct road related erosion problems for gravel and paved roads and road drainage culverts. Practices may include drainage ditch installation and upgrades, turnouts, removal of high road shoulders, and stabilization of drainage culverts.	Road segment ID Road type (paved, unpaved) Hydrologic connectivity Project length Municipal Roads General Permit compliance status before and after implementation	Not → partially compliant: 40% Partially → fully compliant: 40% Not → fully compliant 80%
Road Erosion Remediation on Class 4 Roads	Correction of gully erosion on Class 4 road surface and shoulder.	Road segment ID Hydrologic connectivity Project length Volume of gully erosion Municipal Roads General Permit compliance status before and after implementation	Average 30% (depends on erosion volume and road slope)
Catch Basin Outlet Stabilization on Paved, Curbed Roads	Correction of erosion at catch basin outlet by stabilizing flow path from outlet to surface waters.	Catch basin outlet ID Volume of erosion Municipal Roads General Permit compliance status before and after implementation	Calculated based on volume of erosion prior to stabilization

Table 4. Natural resources restoration clean water project types (including forest erosion control), definitions, minimum standards and data required to quantify pollutant reductions, and average annual total phosphorus load reduction efficiency (if available)³

Project Type	Definition and Minimum Standards to Quantify Pollutant Reductions	Data Required to Quantify Pollutant Reductions	Total Phosphorus Load Reduction Efficiency (%)
Forested Riparian Buffer Restoration (Non-Agricultural)	Restoration of riparian buffer along rivers and lakeshores. Buffers consist of native woody vegetation (trees and shrubs) with a minimum of 300 stems per acre and a minimum width of 35-feet.	Latitude, longitude buffer endpoints Buffer acres Buffer length Buffer average width	50%
River Channel and Floodplain Restoration	Restoration of river channel and or floodplain to its least erosive condition (i.e., equilibrium condition). Restoration work includes removing/retrofitting river corridor and floodplain encroachments and instream structures, dam removal, and establishing river corridor easements.	Stream reach ID Project length Percent increase of annual flood volume that can access floodplain	Under development
Wetland Restoration	Implementation of wetland and buffer area restoration and protection projects to promote water quality benefit, encourage flood resiliency, and provide habitat benefits.	To be reviewed	Under development
Forest Erosion Control	Implementation of forest logging road, trail, and/or stream crossing Acceptable Management Practices (AMPs) project(s) to address erosion to control nutrient and sediment pollution at prioritized locations.	To be reviewed	Under development
Lakeshore Restoration	Implementation of lake shoreland habitat restoration projects and/or lakeshore nutrient/sediment pollution reduction practices at priority locations.	To be reviewed	To be reviewed

³ Represents annual average total phosphorus load reduction based on project types' expected performance.

Appendix I. SFY 2019 Ecosystem Restoration Grant Program Projects

This table displays clean water projects funded through Vermont Department of Environmental Conservation's Clean Water Initiative Program grants and contracts in SFY 2019, including Ecosystem Restoration Grants. Grants and contracts were included in the SFY 2019 reporting period if agreements were executed/signed in SFY 2019.

Sector Key

Ag	Agricultural pollution prevention project	Roads	Developed lands road erosion remediation
All	Cross sector (project spans multiple sectors)	SW	Developed lands stormwater treatment
NR	Natural Resource Project	WW	Wastewater treatment

Counties	Towns	Partner	Summary Title	Sector	State Funds	Watersheds
Addison	Bristol	Bristol Town	Bristol Stormwater Master Plan	SW	\$24,637	Otter Creek
Addison	Starksboro	Vermont Land Trust	River Corridor Easement Grant- Lewis Creek- Briggs	NR	\$137,377	Otter Creek
Addison	Starksboro	Vermont Land Trust	River Corridor Easement Grant- Lewis Creek, Clifford	NR	\$117,832	Otter Creek
Addison, Bennington, Chittenden, Franklin, Orange, Windsor	Enosburgh, Fairfax, Granville, Hancock, Hinesburg, Pownal, Randolph, Richford, Rochester, Stockbridge	Vermont Youth Conservation Corps	Work Crew Partnership 2018- VYCC- Buffer Planting	NR	\$31,579	Batten Kill, Walloomsac and Hoosic, Lamoille, Missisquoi Bay, North Champlain, White
Addison, Caledonia, Chittenden, Franklin, Washington	Multiple Towns	Watershed Consulting	Stormwater Assessments for Schools with more than 3 acres of impervious-Green Schools	SW	\$87,138	Lake Champlain
Addison, Chittenden, Franklin, Grand Isle, Lamoille, Rutland, Washington	Multiple Towns	Hoyle, Tanner & Associates, Inc.	Wastewater Treatment Facility Optimization to Reduce Effluent Phosphorus	WW	\$130,000	Lake Champlain
Addison, Chittenden, Franklin, Grand Isle, Lamoille, Rutland, Washington	Multiple Towns	Milone & MacBroom, Inc.	2019 Prioritization Mapping to Restore Stream and Floodplain Connectivity- Champlain Basin	Roads	\$100,000	Lake Champlain

Counties	Towns	Partner	Summary Title	Sector	State Funds	Watersheds
Addison, Chittenden, Franklin, Grand Isle, Lamoille, Rutland, Washington	Multiple Towns	Vermont Rural Water Association	Municipal Wastewater Treatment Facility Technical Assistance to Optimize for Nutrient Treatment	WW	\$103,000	Lake Champlain
Addison, Chittenden, Franklin, Grand Isle, Lamoille, Rutland, Washington	Multiple Towns	Watershed Consulting Associates LLC	Municipal Stormwater Assessment (Public-Private Partnership)	SW	\$225,000	Lake Champlain
Bennington	Manchester	Bennington County Regional Commission	Lye Brook Berm Removal Alternatives Analysis	NR	\$15,000	Batten Kill, Walloomsac and Hoosic
Bennington	Pownal	Bennington County Conservation District	Pownal Hay Mulcher	Roads	\$5,080	Batten Kill, Walloomsac and Hoosic
Bennington, Caledonia, Essex, Franklin, Grand Isle, Lamoille, Orleans, Windham	Multiple Towns	Vermont Natural Resources Council	Tactical Basin Planning Services - NRCD 2019	Other	\$80,000	Black and Ottauquechee, Otter Creek, South Champlain, White, Winooski
Bennington, Windham	Multiple Towns	Stone Environmental	Stone – Illicit Discharge Detection and Elimination-Basin 1&12	Other	\$44,444	Batten Kill, Walloomsac and Hoosic, Deerfield
Caledonia	Hardwick	Caledonia County Natural Resources Conservation District	Hazen Union School Stormwater Retrofit - Hardwick	SW	\$50,964	Lamoille
Caledonia	Lyndon	Caledonia County Natural Resources Conservation District	Northern Vermont University Gravel Wetland Design	SW	\$10,680	Passumpsic

Counties	Towns	Partner	Summary Title	Sector	State Funds	Watersheds
Caledonia	St. Johnsbury	Caledonia County Natural Resources Conservation District	Pearl Street Parking Lots Stormwater Retrofit	SW	\$17,020	Passumpsic
Caledonia, Essex, Orange, Windham, Windsor	Multiple Towns	Vermont Natural Resources Council	Woody Buffer Block Grant- NRCC 2019	NR	\$82,424	Batten Kill, Walloomsac and Hoosic, Black and Ottauquechee, Deerfield, Northern Connecticut, Passumpsic, Stevens, Wells, Waits and Ompompanoosac, West, Williams and Saxtons, White
Caledonia, Lamoille, Orleans	Multiple Towns	Vermont Fish and Wildlife Department	Development of Vermont Fish and Wildlife Riparian Lands Enhancement and Acquisition	NR	\$25,210	Lamoille, Memphremagog
Chittenden	Burlington	City of Burlington	Using Green Stormwater Infrastructure (GSI) to address Combined Sewer Overflow (CSO) Mitigation	SW	\$1,030,509	North Champlain
Chittenden	Charlotte	Lewis Creek Association	Southern Chittenden County River Watch Program	Other	\$5,145	Lake Champlain
Chittenden	Colchester	Vermont Department of Fish and Wildlife	Goad Wetland Restoration Malletts Creek Wildlife Management Area	NR	\$30,000	North Champlain
Chittenden	Colchester	Vermont Natural Resources Council	Mill Pond Dam Removal	NR	\$100,000	North Champlain
Chittenden	Hinesburg	The Nature Conservancy	LaPlatte Headwaters Town Forest Floodplain/Wetland Restoration	NR	\$63,647	North Champlain
Chittenden	Milton	Chittenden County Regional Planning Commission	Milton Stormwater Planning and Implementation	SW	\$24,881	Lamoille

Counties	Towns	Partner	Summary Title	Sector	State Funds	Watersheds
Chittenden	South Burlington	South Burlington City	Helen Ave Cul de Sac	SW	\$23,000	North Champlain
Chittenden	Westford	Vermont Youth Conservation Corps	Work Crew Partnership 2018- VYCC	NR	\$7,895	Lamoille
Chittenden	Williston	Williston Town	Williston Commons Pond Upgrade	SW	\$87,987	Winooski
Franklin	Multiple Towns	United States Army Corps of Engineers	St Albans Bay Wetland Restoration and Phosphorous Management Study	Other	\$180,653	North Champlain
Franklin	Multiple Towns	University of Vermont	2019 Agronomy and Conservation Practice Assistance Services	Ag	\$200,000	Missisquoi Bay
Franklin	Franklin	Armstrong Construction, Inc.	Lake Carmi - Inspections Services 2019	NR	\$8,500	Missisquoi Bay
Franklin	Franklin	EverBlue Lakes - Lake Savers, LLC	Lake Carmi Aeration - Implementation	NR	\$935,462	Missisquoi Bay
Franklin	Franklin	Franklin Watershed Committee	Lake Carmi Watershed Sampling Program	Other	\$7,335	Missisquoi Bay
Franklin	Franklin	Franklin Watershed Committee	Towle Neighborhood Road Culvert Stabilization	Roads	\$21,293	Missisquoi Bay
Franklin	Franklin, Highgate	Friends of Northern Lake Champlain, Inc.	Rock River Monitoring	Other	\$3,000	Missisquoi Bay
Franklin	Georgia, St. Albans Town	United States Army Corps of Engineers	St Albans Bay Wetland Restoration and Phosphorous Management Study	NR	\$180,653	North Champlain
Franklin	Highgate	Northwest Regional Planning Commission	Highgate Elementary School Stormwater Mitigation Project	SW	\$23,210	Missisquoi Bay
Franklin	Sheldon	Vermont Land Trust, Inc.	Parent M&P Sheldon Wetland Easement and Restoration	NR	\$105,701	Missisquoi Bay
Franklin	Swanton	Northwest Regional Planning Commission	Swanton Elementary School Stormwater Mitigation	SW	\$21,130	Missisquoi Bay

Counties	Towns	Partner	Summary Title	Sector	State Funds	Watersheds
Franklin, Lamoille, Rutland, Washington, Windsor	Castleton, Elmore, Fairfield, Poultney, Waterbury, Wilmington	Vermont Youth Conservation Corps	Work Crew Partnership 2018- VYCC- Lakeshore Stabilization	NR	\$39,474	Deerfield, South Champlain, Winooski
Lamoille	Eden	Lamoille County Conservation District	Lake Eden Watershed Assessment	NR	\$28,605	Lamoille
Lamoille, Washington, Windsor	Barre Town, Belvidere, Hartford, Montpelier	Vermont Youth Conservation Corps	Work Crew Partnership 2018- VYCC- Roads	Roads	\$71,053	Lamoille, White, Winooski
Orange, Windsor	Bethel, Brookfield, Randolph, Royalton, Williamstown	White River Partnership	River Corridor Plan - Second Branch - Basin 9	NR	\$58,671	White
Orange, Windsor	Bethel, Randolph, Royalton	White River Partnership	White River Tributaries Monitoring Program	Other	\$5,663	White
Orleans	Multiple Towns	Orleans County Natural Resources Conservation District	Lake Memphremagog Watershed Monitoring Program	Other	\$9,967	Memphremagog
Orleans	Charleston	Charleston Town	Town of Charleston Shoulder Retriever/Reclaimer	Roads	\$2,900	Memphremagog
Orleans	Lowell, Newport Town, Troy, Westfield	Missisquoi River Basin Association	Upper Missisquoi and Mud Creek Monitoring Program	Other	\$3,760	Missisquoi Bay
Orleans	Newport City	Memphremagog Watershed Association	Newport Marine Services Drainage Stormwater Treatment	SW	\$27,531	Memphremagog
Orleans	Newport Town	Chaput	Wetland Incentive Payment - Chaput	NR	\$52,087	Missisquoi Bay
Rutland	Multiple Towns	Poultney-Mettowee Natural Resources Conservation District	Flower and Wells Brook Monitoring Program	Other	\$8,000	South Champlain
Rutland	Poultney	Poultney-Mettowee Natural Resources Conservation District	Lewis Brook Riparian Buffer Restoration at Saltis Farm- Poultney VT	NR	\$13,889	South Champlain

Counties	Towns	Partner	Summary Title	Sector	State Funds	Watersheds
Rutland	Rutland City	Vermont River Conservancy	Dunklee Pond Dam Removal	NR	\$73,802	Otter Creek
Rutland	Wallingford	Vermont River Conservancy	Wallingford Rutland County Wetlands Easement	NR	\$100,000	Otter Creek
Washington	Middlesex	Winooski Natural Resources Conservation District	Shady Rill Road Stormwater Design	SW	\$10,420	Winooski
Washington	Montpelier	Friends of the Winooski River	Four Rivers Water Quality Monitoring Program	Other	\$3,542	Winooski
Washington	Plainfield	Central Vermont Regional Planning Commission	Plainfield Health Center	SW	\$22,839	Winooski
Windham	Dummerston	Windham Regional Commission	Crosby Brook Dam Removal - off Tucker Reed Rd. Final Engineering Design Plans	NR	\$17,117	West, Williams and Saxtons
Windsor	Hartford	Connecticut River Conservancy	Lull's Brook Riparian Buffer Restoration	NR	\$15,113	Black and Ottauquechee
Windsor	Springfield	Southern Windsor County Regional Planning Commission	Dam removal - Valley Street, Springfield	NR	\$26,431	Black and Ottauquechee
Windsor	Springfield	Southern Windsor County Regional Planning Commission	Springfield Lincoln Street Stormwater Infrastructure	SW	\$7,771	Black and Ottauquechee
Windsor	Springfield	Southern Windsor County Regional Planning Commission	Springfield Stormwater Master Plan	SW	\$23,696	Black and Ottauquechee

Counties	Towns	Partner	Summary Title	Sector	State Funds	Watersheds
Statewide	Statewide	Chittenden County Regional Planning Commission	Tactical Basin Planning Services - 2019- RPCs	Other	\$230,000	Deerfield, North Champlain, Otter Creek, Passumpsic, Stevens, Wells, Waits and Ompompanoosuc, White, Winooski
Statewide	Statewide	Vermont Department of Forests Parks and Recreation	2019 FPR Water Quality Assistance Program -Skidder Bridges	NR	\$50,000	Statewide
Statewide	Statewide	Vermont Natural Resources Council	Conservation Districts Project Development Block Grant	Other	\$55,460	Statewide
Statewide	Statewide	Watersheds United Vermont	Partnership Project Development Block Grant- WUV & WRP	Other	\$44,850	Statewide
Statewide	Statewide	Watersheds United Vermont	Woody Buffer Block Grant- WUV 2019	NR	\$132,576	Statewide