



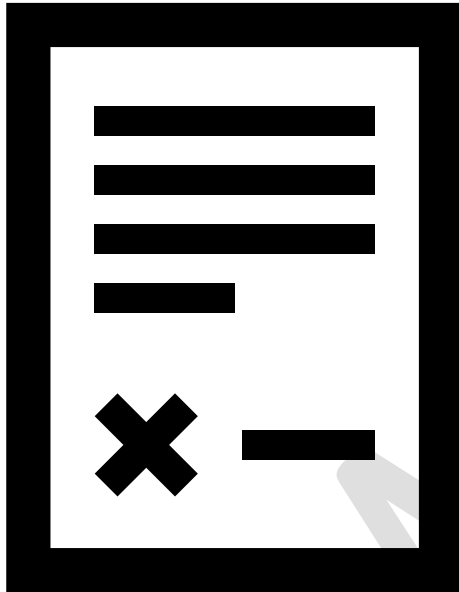
# Stevens, Wells, Waits, Ompompanoosuc & Connecticut River Direct Tributaries Basin 14 Tactical Basin Plan



South Branch Waits River, Bradford

**February 2020 | Draft**

Tactical Basin Plan was prepared in accordance with 10 VSA § 1253(d), the Vermont Water Quality Standards<sup>1</sup>, the Federal Clean Water Act and 40 CFR 130.6, and the Vermont Surface Water Management Strategy.



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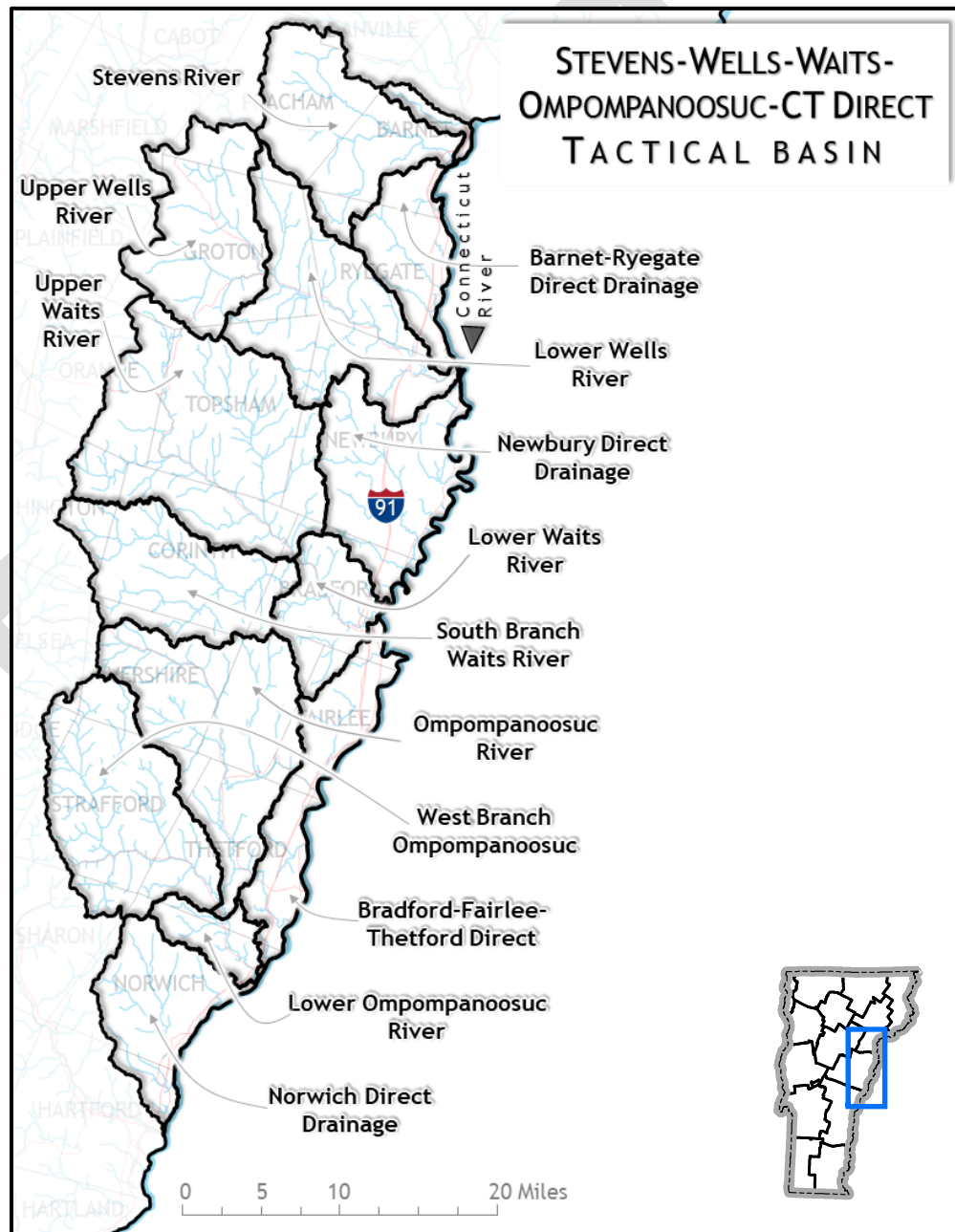


## List of Basin 14 Towns

Barnet	Groton	Peacham	Topsham
Bradford	Hartford	Ryegate	Tunbridge*
Chelsea*	Newbury	Sharon*	Vershire
Corinth	Norwich	Stratford	Washington
Fairlee	Orange	Thetford	West Fairlee

*\*Only a very small area of the town is in the watershed and is covered in more detail in corresponding basin plans.*

## Basin 14 – Towns & Sub-basins



# Basin 14 Tactical Plan Overview

## Contents

Executive Summary.....	1
Target Watershed Areas for Restoration & Protection .....	4
What is a Tactical Basin Plan? .....	6
Chapter 1 – Basin Description and Conditions .....	8
A. Basin 14 Watershed Overview .....	8
B. Land Use and Water Quality .....	9
Chapter 2 – Priority Areas for Surface Water Protection .....	13
A. Surface Water Classification .....	14
Class 1 Wetland Designation .....	17
Warm and Cold-Water Fish Habitat Designations .....	19
Outstanding Resource Waters Designation .....	19
B. Identification of Existing Uses .....	20
Chapter 3 – Priority Areas for Surface Water Restoration .....	20
A. Stressed or Impaired Surface Waters .....	20
B. Basin Specific Total Maximum Daily Loads (TMDLs) .....	24
Chapter 4 – Strategies to Address Pollution by Source Sector .....	26
A. Agriculture .....	27
B. Developed Lands .....	30
C. Wastewater .....	35
D. Natural Resources .....	38
Chapter 5 – The Basin 14 Implementation Table .....	53
A. Progress in Basin 14 .....	53
B. Basin 14 Priority Restoration, Protection, Monitoring & Assessment Actions.....	54
C. Coordination of Watershed Partners.....	66
List of Acronyms.....	67
References .....	69
Appendix A. 2015 Basin 14 TBP Implementation Table Status Update .....	71
Appendix B. Biological Water Quality Monitoring Results .....	94
Appendix C. Municipal Water Quality Protectiveness Table .....	98
Appendix D. Dams in Basin 14 .....	106



## List of Figures

Figure 1. Protection and restoration priorities for the 2020 Basin 14 plan. ....	2
Figure 2. Basin 14 2015 implementation table status. ....	3
Figure 3. Steps in the tactical basin planning process .....	6
Figure 4. The ANR Clean Water Portal is a tool used by watershed partners to identify, assess, and track water quality projects statewide.. ....	7
Figure 5. Basin 14 is located in east central VT and is a 580 square mile watershed; the same size of the island of Oahu in Hawaii where the historic attack on Pearl Harbor took place. ....	8
Figure 6. Land cover estimates for the thirteen sub-basins of Basin 14. The Upper Waits River and Ompompanoosuc River are the largest sub-watershed in Basin 14 .....	11
Figure 7. Recommended widths of shoreline vegetation for protection. ....	12
Figure 8. Actions identified for water quality protection in the 2020 Basin 14 TBP .....	13
Figure 9. Recommended reclassification candidates and priority waters for protection for fishing, aquatic life and wetlands. ....	18
Figure 10. Priority areas for restoration in Basin 14.....	22
Figure 11. Agricultural land cover in Basin 14 shown in solid orange .....	27
Figure 12. Scorecard information for lakes and ponds in Basin 14 .....	39
Figure 13. A gap analysis of river watersheds identified a number of priority areas for biological monitoring during the 2022 sampling rotation for Basin 14.....	45
Figure 14. Geomorphic condition of assessed streams in Basin 14 from reference to poor condition .....	46
Figure 15. Status of the 85 priority actions identified in the 2015 Basin 14 Plan .....	53
Figure B1. Biological monitoring results for fish and macroinvertebrate assessments in the upper half of Basin 14 from 2015-2019 .....	96
Figure B2. Biological monitoring results for fish and macroinvertebrate assessments in the lower half of Basin 14 from 2015-2019 .....	97
Figure C1. Non-historic dams located in Basin 14 .....	107

## List of Tables

Table 1. Eleven priority waterbodies for restoration, their primary stressors and priority actions for remediation .....	4
Table 2. A list of uses that can be placed into each water class in the Vermont Water Quality Standards. ....	15
Table 3. Class A(2) designated public water sources in the Basin 14. ....	15
Table 4. Basin 14 priority waters and pollutants .....	23
Table 5. Completed agricultural practices in Basin 14 funded by AAFM since SFY2016-2019. ...	28
Table 6. Results of agriculture clean water projects funded by State of Vermont agencies completed, SFY 2016-2019 in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed..	29
Table 7. Towns with completed stormwater mapping reports ranked by number of high priority projects identified at the highest level .....	31
Table 8. Status of towns with Road Erosion Inventories, now required by the Municipal Road General Permit .....	33
Table 9. Coarse or default prioritization of municipal road segments based on MRGP road erosion inventory and slope .....	33
Table 10. Results of developed lands clean water projects funded by State of Vermont agencies completed, SFY 2016-2019 in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed..	34
Table 11. Basin 14 wastewater treatment facilities and other facilities subject to NPDES Direct Discharge Permits. ....	35
Table 12. Results of wastewater clean water projects funded by State of Vermont agencies completed, SFY 2016-2019 in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed..	36
Table 13. Results of natural resource clean water projects funded by State of Vermont agencies completed, SFY 2016-2019 in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed..	52
Table 14. Summary implementation actions for the Basin 14 tactical basin plan. ....	55
Table 15. Basin 14 priorities for monitoring and assessment .....	62
Table A1. 2015 Basin 14 report card with 2019 updates from local, state and federal watershed partners.....	71
Table B1. Biological monitoring assessment results from 2015 to 2019. ....	94
Table C1. Municipal Water Quality Protectiveness Table for the Basin 14.....	98
Table D1. Active dams in Basin 14 organized by town name .....	108

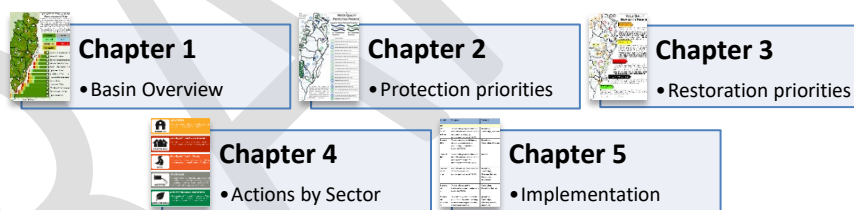
# Executive Summary

The chief challenge facing the future of [water quality statewide](#) and in Basin 14 is [climate change](#). In [Vermont, climate change](#) is causing [increased storm intensity](#) and [total precipitation](#), which leads to land and stream channel erosion and stormwater runoff. Actions like [floodplain](#) and [river corridor protection](#), [forest conservation](#), [wetland restoration](#), [riparian woody vegetation plantings](#), and the application of [green stormwater infrastructure](#) are all key actions prioritized in this plan to help mitigate the effects of climate change and protect our water quality. These actions will decrease the economic impacts to our natural and built infrastructure from erratic weather patterns. Enhancing and protecting Vermont's natural infrastructure is the highest priority and [most economical solution](#) for water quality and natural resource protection.

The Basin 14 Tactical Basin Plan (TBP) provides a detailed description of current watershed condition and identifies actions to protect and restore water quality in its rivers, lakes and wetlands.

The first four chapters in the Basin 14 TBP provide a framework to summarize basin-wide water quality activities and information, and the final chapter provides an updated list of actions for 2020 and a status update of actions identified in the 2015 TBP (see graphic below).

Basin 14 comprises multiple sub-basins including the Stevens, Wells, Waits, and Ompompanoosuc Rivers, and five Connecticut River tributaries. The basin stretches south, from Peacham to Hartford, draining portions of Caledonia, Orange, Windsor, and Washington counties and covers significant areas of 17 individual towns.



Between 2015 and 2019 over 790 water quality monitoring events took place at 34 lakes, 2 reservoirs, 56 rivers, and 10 wetlands in Basin 14. Water quality monitoring is carried out by the Vermont Department of Environmental Conservation (VDEC) and citizen scientists. Biological monitoring of aquatic biota (fish and macroinvertebrates) and plants is carried out by VDEC and the Vermont Department of Fish and Wildlife.

Based on monitoring data, the plan describes priorities to protect surface waters. In this plan, thirty-nine surface waters and wetlands have been identified for protection (Figure 1). Fourteen of the waters identified for protection require additional sampling to determine if they meet reclassification criteria. The nine wetlands identified as potential Class I candidates may require additional assessment. In 2017, the [Peacham Bog Wetland Complex](#) was designated as a Class I wetland.

Based on results from water quality and biological monitoring, most surface waters in Basin 14 meet the VT Water Quality Standards, but despite strong efforts to protect and restore our waters, some



areas of the basin show signs of decline. A total of 26 lakes, ponds, or river segments have been identified for restoration. Three rivers and 10 lakes are stressed, 7 river segments and 2 lakes are impaired, 2 lakes are altered by invasive aquatic species, and 4 river segments and 1 lake have altered flow regimes (Figure 1). **Six primary stressors** that impact water quality in Basin 14 have been identified with the waterbodies they impact below.

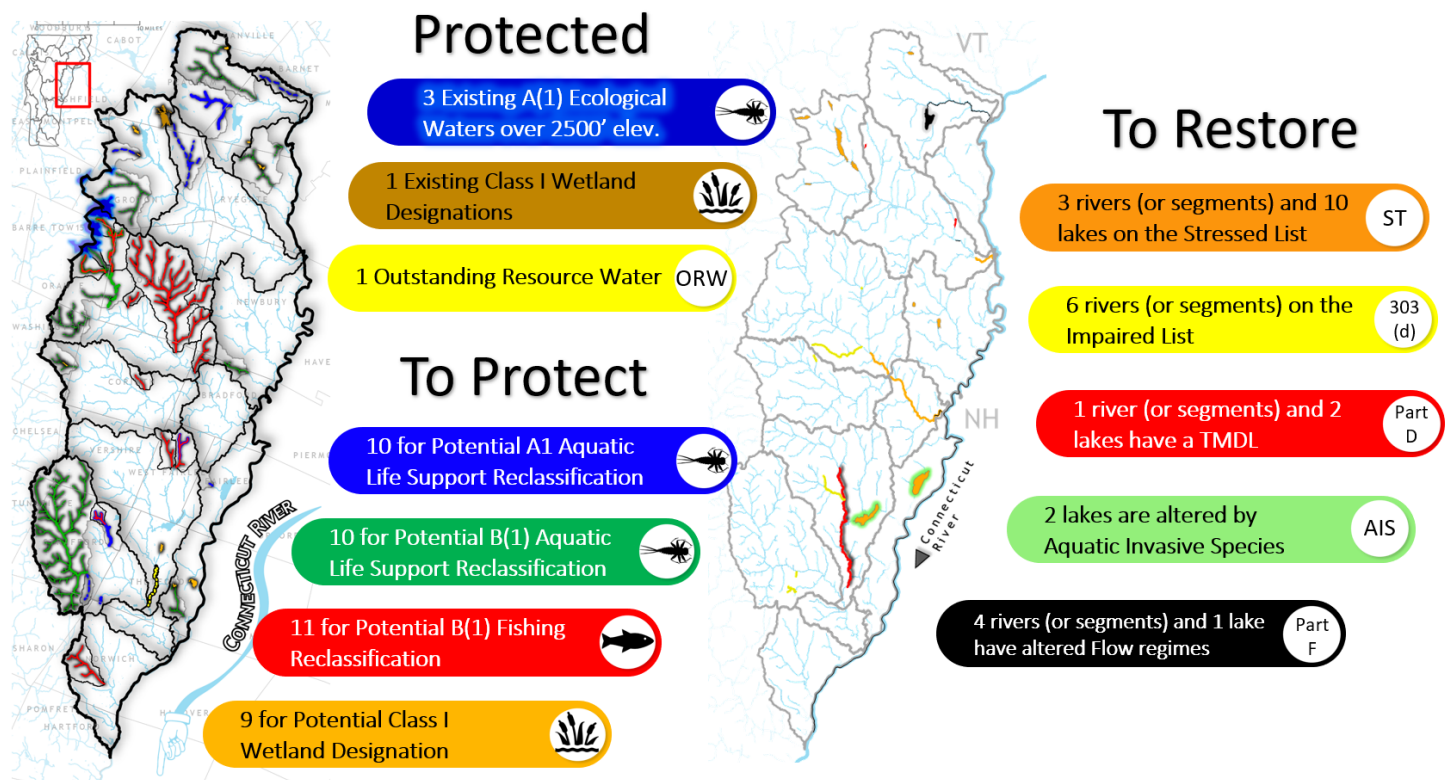


Figure 1. Protection and restoration priorities for the 2020 Basin 14 plan.

1. **Toxic substances** in the form of metals from mining sources (Pike Hill Brook, Schoolhouse Brook, Copperas Brook, Lords Brook, Cookville Brook Tributary #4);
2. **Pathogens** from sources that likely stem from bacterial communities in waste runoff from out-of-date and failed septic systems and domesticated animals and livestock (Ompompanoosuc River);
3. **Non-Erosion Nutrient Loading** caused by unbuffered agricultural activities adjacent to surface waters (Ticklenaked Pond, Tabor Branch Tributary #6);
4. **Acidity** caused by long distant transport and deposition of atmospheric pollutants (commonly referred to as acid rain) and through mining activities (Levi Pond, Ricker Pond, Osmore Pond, Groton Pond, Kettle Pond, Noyes Pond, Cookville Brook);
5. **Stream channel erosion** caused by undersized crossing structures, lack of riparian vegetation for bank stabilization, and unmitigated increases in stormwater flow and volume (Basinwide with focus on the Waits River and South Peacham Brook); and
6. **Thermal Stress** caused by channelization of rivers and the removal of vegetated buffers along lakeshores and riverbanks (Waits River).

The priority actions described to protect and restore Basin 14 surface waters are in the 2020 Implementation Table. These actions are pursued throughout the basin planning cycle by the state and federal government, municipalities, watershed groups, and other watershed stakeholders.

The 2015 plan identified eighty-five actions to address protection and restoration of surface waters in Basin 14. Of the 85 projects identified, 21 are complete, 25 are ongoing, 21 are in progress, 15 are awaiting action, and 3 have been discontinued (Figure 2). This means that 79% of the actions identified in the 2015 TBP are active or complete<sup>1</sup>. The Basin 14 report card in Appendix A includes the 2015 list of strategies with detailed updates on progress.

While water quality improvements are being made in Basin 14, a lack of funding, people resources, and interest are the main challenges to implementation. Although the actions highlighted in the plan are a priority for water quality, they may not be a priority for municipalities, businesses, or individuals that are balancing workloads and budgets. However, making water quality a priority results in increased recreational choices, new and expanded business opportunities, improved property values, expanded educational and research options, and greater peace of mind regarding the condition of the natural heritage we pass on to future generations.<sup>2</sup> Despite these incentives the perceived upfront cost and time commitment for towns and businesses can seem impractical and some landowners express concern with paying taxes on land used for water quality protection that cannot be developed. However, the benefits of restoring and protecting water quality should outweigh the costs in the long run<sup>3</sup>.

Public input was solicited during the development of this plan and the 51 actions identified for priority in the 2020 Basin 14 TBP reflect input from the public, state and federal water quality staff, watershed groups, and regional planning commissions.

**2015 BASIN 14 ACTIONS  
STATUS UPDATE**  
N=85

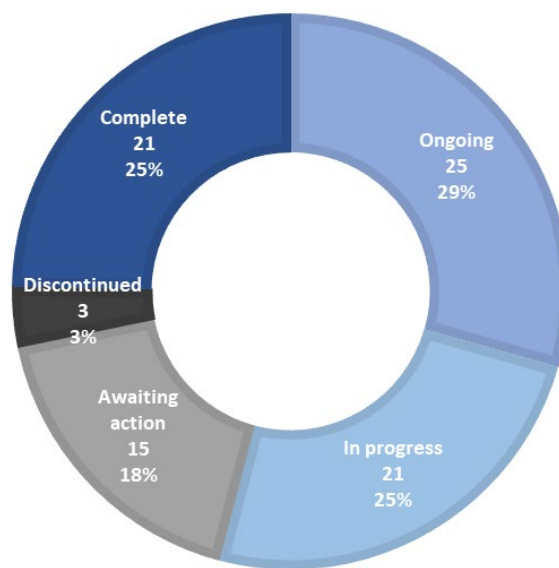


Figure 2. Basin 14 2015 implementation table status.

<sup>1</sup> Actions listed as “complete” are have an explicit start and end point. Actions listed as “in progress” are actively being pursued and have the potential for completion. Actions listed as “ongoing” are in progress programmatic strategies or initiatives that have no defined end date. Actions listed as “awaiting action” have not been initiated for various reasons such as a lack of resources or local support, or low priority (i.e. other projects need to be completed first).

<sup>2</sup> USEPA Costs and Benefits of Water Quality Protection.

<sup>3</sup> Kansas State University. "Freshwater Pollution Costs US At Least \$4.3 Billion A Year." ScienceDaily. ScienceDaily, 17 November 2008. <www.sciencedaily.com/releases/2008/11/081112124418.htm>.

## Target Watershed Areas for Restoration & Protection

Target areas for restoration and protection were identified by evaluating the list of waters identified for protection (Chapter 2), the priority waters list (Chapter 3), monitoring and sector-based assessments (Chapter 4). Associated actions for these priorities are found in [Chapter 5](#).

**Table 1. Fourteen priority actions, watersheds, and water quality issues identified in Basin 14 for restoration and protection.**

Priority Waterbodies and Sub-basins	Priority actions	Water Quality Issues
<b>Ticklenaked Pond</b> in Ryegate	Continue to apply farm, road and shoreline best management practices (BMPs) as identified in the TMDL plan. Continue water quality monitoring on Scotch Burn tributary to the lake to assess agricultural phosphorus contributions. Continue in-lake lay monitoring and cyanobacteria monitoring. Assess condition of previous BMPs and implement maintenance where necessary. Work with municipality where runoff issues are identified on town lands. Implement Lake Wise practices on shoreline properties.	Runoff of phosphorus from roads, rural residential and agricultural lands leading to nutrient pollution that causes toxic cyanobacteria blooms. Internal nutrient loading due to low dissolved oxygen at depth. Affects the swimming and aesthetic uses.
<b>Ompompanoosuc River</b> from West Fairlee to Thetford	Form an <i>E. coli</i> workgroup to review monitoring data and existing conditions and devise recommendations to target the impaired waters and identify sources of <i>E. coli</i> . Carry out monitoring to identify sources if possible. Target outreach to farms on the impaired segment where waste may be running off into waters.	Runoff of pollutants from unidentified sources flowing into the West Fairlee segment of the river contributing to high levels of <i>E. coli</i> . Sources likely stem from agricultural and residential sources of domestic waste. Affects the swimming and other primary and secondary contact recreation uses.
<b>Levi Pond, Ricker Pond, Groton Pond, Kettle Pond, &amp; Noyes Pond</b> in Groton, <b>Osmore Pond</b> in Peacham	Continue to monitor, track, and report on acid stressed and impaired waters through the Vermont Acid Precipitation Monitoring Program of VT Department of Environmental Conservation (VDEC).	Atmospheric acid deposition of sulfur dioxide and nitrogen oxide from electric power plants, coal burning power plants, and vehicle emissions (local source). Affects aquatic life support.
<b>Lake Fairlee</b> in West Fairlee, Thetford, and Fairlee	Focused ag BMP identification and outreach on Middle and Blood Brook. Watershed focus area for Required Agricultural Practice (RAP) inspections. Water quality monitoring on tributaries to Lake Fairlee and continued Lay Monitoring in-lake. Outreach to shoreland owners on Lake Wise BMPs. Road improvements around the lake to minimize runoff. A three-town water quality committee is developing a lake action plan to address phosphorus concerns. Continue aquatic invasive prevention activities.	Land runoff from agricultural land, roads, and developed shoreline leading to increased nutrient pollution. Monitoring shows signs of a negative water quality trend. Has potential to affect primary and secondary recreational uses and aesthetics. Presence of aquatic invasive species affecting recreational, aquatic habitat, and aesthetic uses.
<b>Lake Morey</b> in Fairlee	Continue tributary monitoring in 2020 to establish baseline chemistry inputs into the lake. VDEC to continue support for in-lake volunteer Lay Monitoring and cyanobacteria monitoring. Continue support for aquatic invasive species management. Target Lake Wise outreach and assessments to developed shoreline properties on the lake.	Volunteer Lay Monitoring data has shown a significant increase in summer nutrient levels and shoreland habitat is in fair condition. Potential to affect recreational uses and aesthetics.
<b>Waits River</b> in Topsham, Corinth & Bradford	Pursue strategic wood addition to increase habitat and channel stability. Pursue other restoration opportunities along Waits using the River Corridor plan for reference. Target outreach for riparian restoration (plantings), Conservation Reserve Easement Program (CREP), and River Corridor Easements (RCEs) in this area. VDEC to provide watershed partners with messaging about benefits of wildlife, habitat, pollinators to help explain value of riparian buffers.	Elevated temperatures causing loss of habitat to fisheries. Physical alteration (berming, gravel removal, vegetation mowing) and erosion of river corridor leading to poor geomorphic conditions and loss of habitat for fisheries. Affects fishing use and aquatic habitat.



Priority Waterbodies and Sub-basins	Priority actions	Water Quality Issues
<b>Tabor Branch Tributary #6</b> in Topsham	General outreach to landowners along the tributary to determine BMPs to restore surface waters.	Not meeting state biological and water chemistry standards. Affects aquatic life use.
<b>Harveys Lake &amp; South Peacham Brook</b> in Barnet	Initiate outreach to lakeshore residents about poor shoreland habitat condition rating. Follow with Lake Wise assessment and implementation. Implement high priority road projects for hydrologically connected roads to Harveys Lake and South Peacham Brook. Target outreach to agriculture community along South Peacham Brook and identify practices to protect surface waters. Continue to explore design options for the removal of the dam on South Peacham Brook to lessen stormwater backwash into Harveys Lake and restore stream equilibrium.	The lake has a poor condition rating for shoreland habitat on the VT Lakes Scorecard. Dissolved oxygen levels in lake have decreased over time degrading Lake Trout habitat. Backwash from storm-related floodwaters backing up from the dam on South Peacham Brook deposit stormwater runoff into the outlet of Harveys Lake. Fishing and aquatic habitat uses are affected.
<b>Cookville Brook Trib #4 and Pike Hill Brook</b> in Corinth, <b>Schoolhouse Brook</b> in Vershire, <b>Copperas Brook &amp; Lord Brook</b> in Thetford	Develop remediation plan and define extent of contamination for Cookville Tributary and Pike Hill Brook. Finalize and implement remedial design for clean-up for Schoolhouse and Ely Brooks. Continue monitoring restoration at the Elizabeth Mine for Copperas and Lord Brooks.	Surface waters not meeting water quality standards. Affects aquatic life use, fishing, aesthetics and all contact recreation.
<b>Halls Pond</b> in Newbury	Complete survey in 2020 to confirm presence or absence of variable-leaved milfoil.	Plant survey completed in 2018. Variable-leaved milfoil not present. As a general rule, 5-years absence is considered an eradication success. A more thorough survey can formalize the eradication when staff resources are available.
<b>Fosters Pond</b> in Peacham	Continue to support volunteer Lay Monitoring of pond. Determine why spring nutrient trends are significantly increasing.	Fosters Pond is one of two oligotrophic lakes in Basin 14 but is the only lake with a significantly increasing spring total phosphorus trend. Summer total phosphorus trends remain stable.
<b>All High-Quality Waters identified in the plan</b> in towns with high-quality waters	VDEC to provide support for monitoring and further study of potential high-quality waters. VDEC to provide technical and advisory support for reclassification to towns, landowners, watershed groups, regional planning commissions, and natural resource conservations districts to petition protections for high-quality waters.	Monitoring has shown that many rivers, lakes and wetlands in Basin 14 would benefit from additional protection in the form of reclassification, increased local protection, and land conservation. These waters include A(1) and B(1) candidates for aquatic biota, B(1) candidates for fishing and Class I Wetland candidates, and oligotrophic lakes. Protects all uses of surface waters.
<b>Stevens River, Wells River, Waits River, &amp; Ompompanoosuc River</b>	Revisit River Corridor Plans to evaluate high priority projects for implementation.	Stream Geomorphic Assessments and River Corridor Plans were completed for these surface waters. Many reaches were identified in poor to fair condition. Pursuing and implementing actions identified in these plans will help to restore stream equilibrium.
<b>Basinwide</b> in all towns	Increase Emergency Relief Assistance Fund (ERAF) rating by increasing municipal protections of water resources through local ordinances and the adoption of recommended standards and plans: river corridor protection, national floodplain insurance program, local emergency management plan, and local hazard mitigation plan. Continue to keep these plans up-to-date and implement their recommendations. Protect local wetlands with flood storage and water quality functions by updating wetland mapping. Develop and implement stormwater runoff recommendations identified in Stormwater Mapping Reports and Master Plans.	Increased high intensity rain events leading to flooding, washing of manmade debris and toxic materials into surface waters, and increased stormwater runoff into surface waters. Affects all uses of surface waters.

## What is a Tactical Basin Plan?

Tactical basin planning is carried out for the Vermont Agency of Natural Resources (VANR) by the Water Investment Division (WID) in collaboration with the Watershed Management Division and in coordination with watershed partners. Tactical basin plans (TBPs) are developed in accordance with the [Vermont Surface Water Management Strategy](#) (VSWMS) and the [Vermont Water Quality Standards](#) (VWQS) to protect, maintain, enhance, and restore the biological, chemical, and physical integrity of Vermont's water resources. The basin-specific water quality goals, objectives, strategies, and actions described in the TBPs aim to protect public health and safety and ensure public use and enjoyment of VT waters and their ecological health.

The TBP process allows for the issuance of plans for Vermont's fifteen basins every five years, as required by statute 10 V.S.A. § 1253 (Figure 3). The plans incorporate the U.S Environmental Protection Agency's (EPA) 9-element framework for watershed plans (Environmental Protection Agency) and meet obligations of the Vermont Clean Water Act.

The basin planning process includes:

1. Monitoring water quality
2. Assessing and analyzing water quality data
3. Identifying strategies and projects to protect and restore waters
4. Seeking public comment and developing the plan
5. Implementing and tracking plan priorities (which is ongoing throughout the planning cycle).



Figure 3. Steps in the tactical basin planning process

The plans communicate opportunities for protection by providing a list of recommended waters for special state designations, conservation, and local ordinance protection based on water quality data. They justify opportunities for restoration by providing a list of waters with an explanation of their causes and sources of pollution, and in some cases, identify reductions needed to restore water quality including those necessary to meet Total Maximum Daily Load (TMDL) targets.

One of the most utilized parts of the plan is the implementation table in [Chapter 5](#) that lists targeted actions to meet protection and restoration goals. The 2015 Basin 14 Report Card located in [Appendix A](#) provides a status update for each of the objectives identified in the [previous basin plan](#). These actions target individual projects that are tracked via its online counterpart, the Watershed

Projects Database (WPD). The WPD is found on ANR's [Clean Water Portal](#) and is continuously updated to capture project information from the TBP process, on the ground assessments, and emerging projects due to natural and anthropogenic events.

ANR's [Clean Water Portal](#) is an online platform that houses a variety of clean water tools to assist with project planning, searching existing projects, funding opportunities, and more (Figure 4). Tools on the portal used for watershed planning include:

- Clean Water Project Explorer
- Watershed Projects Database (WPD) Search
- Water Quality Project Screening Tool
- Funding Opportunities Tool

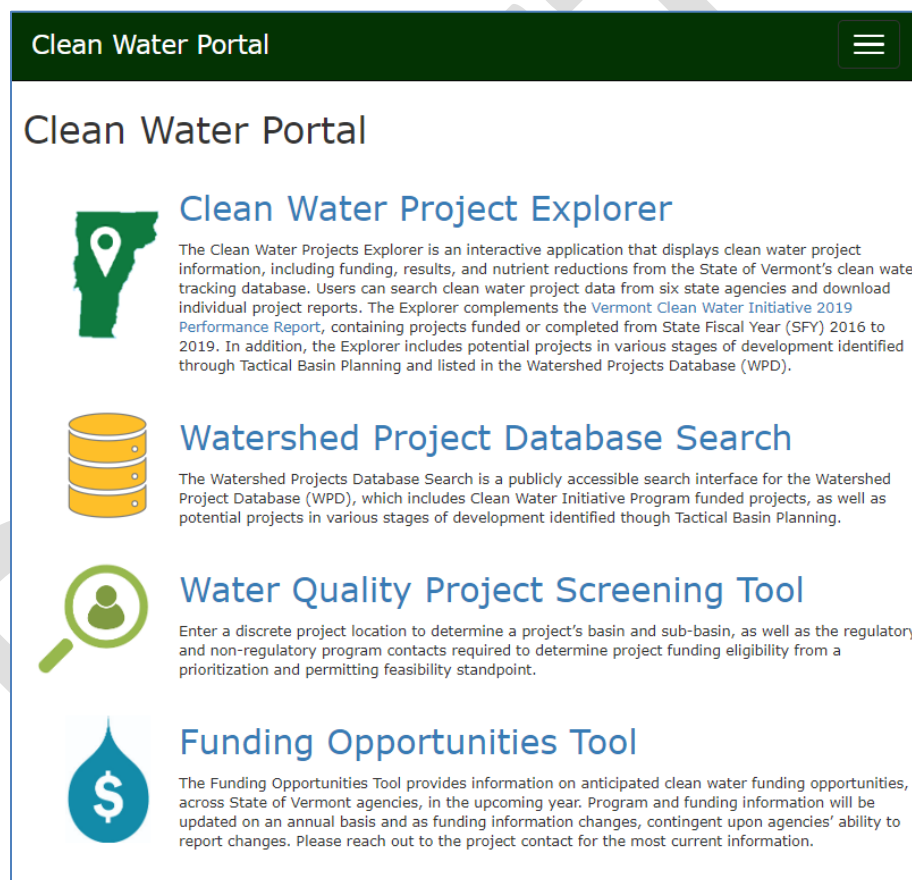


Figure 4. The ANR Clean Water Portal is a tool used by watershed partners to identify, assess, and track water quality projects statewide. Web address: <https://anrweb.vt.gov/DEC/cleanWaterDashboard/>.

TBPs target actions and prioritization of resources to those projects that will have the greatest impact on surface water protection or remediation. As a result, these plans can be considered a strategic guidebook for VANR and watershed partners to protect and restore Vermont's surface waters.



# Chapter 1 – Basin Description and Conditions

## A. Basin 14 Watershed Overview

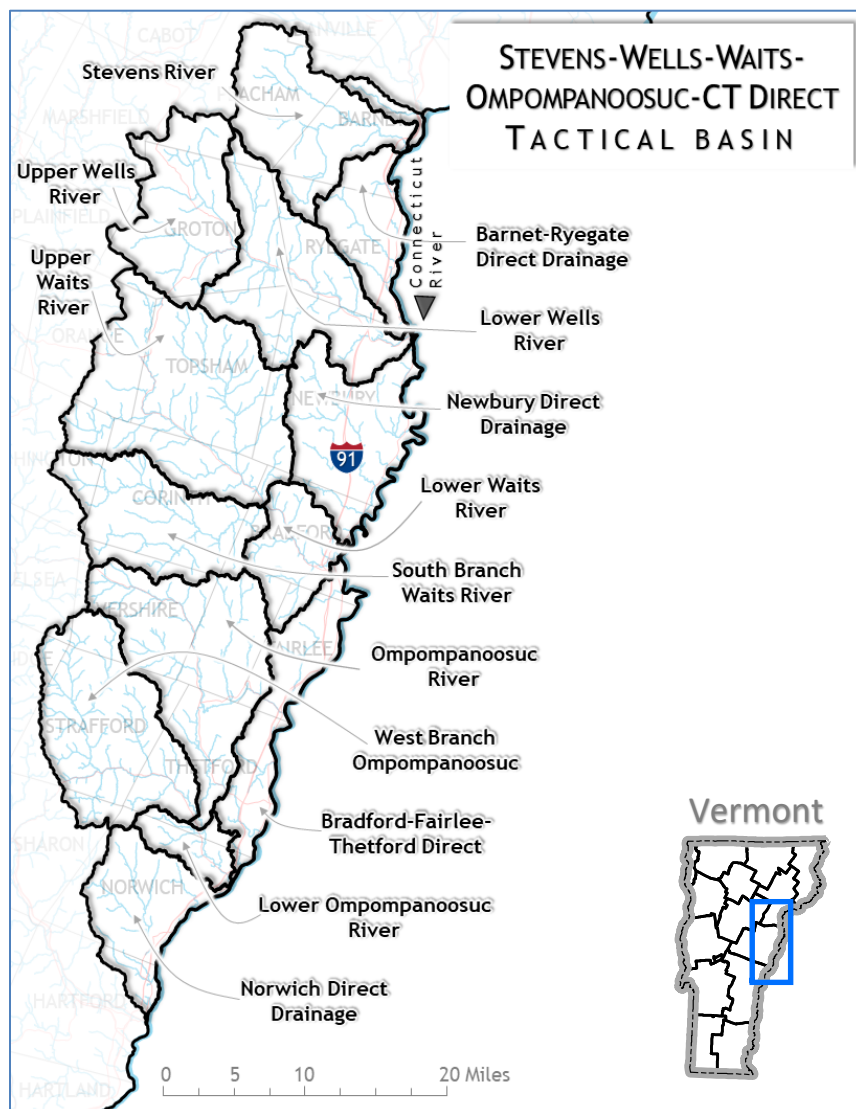


Figure 5. Basin 14 is located in east central VT and is a 580 square mile watershed; the same size of the island of Oahu in Hawaii where the historic attack on Pearl Harbor took place.

Basin 14 encompasses 580 square miles in Vermont, draining portions of Caledonia, Orange, Washington, and Windsor Counties. The watershed<sup>4</sup> comprises thirteen sub-watersheds (Figure 5) which include the Stevens, Wells, Waits, and Ompompanoosuc Rivers, and five Connecticut River tributaries emphatically referred to as the “little rivers”. These rivers are - from north to south - Sutton Brook, Manchester Brook, Peach Brook, Zebedee Brook, and Bloody Brook.

The northern most point of the basin originates in Peacham around the headwaters of the Stevens River and terminates at the furthest south point in Norwich as Bloody Brook flows into the Connecticut River. Looking at Basin 14 from a smaller sub-watershed level helps us to parse out

patterns that are not observable on a larger basinwide scale when looking at specific issues within a section of river, a lake or a wetland. All waters in each of the sub-watersheds flow southeast towards the Connecticut River. Detailed information about each of these rivers can be found in the

<sup>4</sup> A river basin is an area of land drained by a river and its tributaries. The terms ‘basin’ and ‘watershed’ are synonymous. The White River basin or watershed is also referred to as Basin 9.

[individual basin assessment reports](#) for the Stevens, Wells, Waits, Ompompanoosuc Rivers plus Connecticut River tributary watersheds.

Basin 14 is not a lake dense basin, but is home to a number of large and popular lakes including [Harvey's Lake](#) in Barnet where Jacques Cousteau got his start scuba diving, [Groton Pond](#) surrounded by [Groton State Forest](#), one of Vermont's most water resource diverse state lands, [Ticklenaked Pond](#) in Ryegate known far and wide for its unique name, [Lake Morey](#) in Fairlee, home to the [longest ice skating trail](#) (4.5 miles) in the United States, and Lake Fairlee, whose shoreline is shared by three towns, West Fairlee, Fairlee, and Thetford.

Peacham Bog, the only documented “raised bog” in Vermont, is also located in Basin 14 in the Groton State Forest, and is one of only nine [Class I wetlands](#) in the state. Not only is this wetland a biodiversity hotspot, but it provides temporary storage for floodwaters, surface and groundwater protection, and fish habitat draining cold clean waters to Coldwater Brook in the Wells River sub-basin, which supports a wild self-sustaining population of brook trout. Nine additional wetlands have been identified as potential Class I wetlands in this plan in Chapter 3.

The overall condition of lakes, rivers, and wetlands in the watershed are good and the high-quality waters outnumber the waters highlighted for restoration. However, both restoration and protection efforts are required to maintain and improve water quality in Basin 14. Water quality assessments such as stormwater mapping and master planning, stream geomorphic assessments, wetland and stream biological assessments, fisheries assessments, culvert and bridge assessments, and hazard mitigation plans inform the priority actions in this plan. Our work is never complete when it comes to caring for our natural resources.

## **B. Land Use and Water Quality**

Basin 14 is located in the copper belt in the sandy marbles that contain a significant amount of calcareous rock. This bedrock is more susceptible to [karst](#) – a special type of landscape eroded by the dissolution of soluble rocks – which can result in sinkholes and caves. While Basin 14 is not known for its sinkholes or underground caves, micro-karst features allow water to readily move underground and form springs. Closer to the Connecticut River, quartz schist and quartzite dominate along with black graphitic phyllite and Amanoosic volcanics which are less calcareous (Gale).

The geology of a basin relates to water quality through activities that cause water and minerals in bedrock to interact (e.g. weathering of minerals by precipitation, leaching of chemicals into water after mining activities) and water and sediments in surficial geology to interact (e.g. erosion of soils during rain events, erosion of streambanks after gravel extraction). Sometimes this interaction is natural and sometimes it is human caused (e.g. Elizabeth Mine copper pollution). In order to determine background levels of elements in sediment and bedrock, the Vermont Geology Department has been testing bedrock geochemistry for the last 30 years and till geochemistry since 2015, looking at over 40 elements.

The rich sediments deposited by Lake Hitchcock after glaciation and alluvial sedimentation from historic flooding have created river valleys with rich soil better suited for agriculture in the Connecticut River Valley. Because most of the headwaters throughout the basin are heavily forested or narrow, much development and agriculture are located along the rivers where soil is rich and deep, and the topography is flat. This land use pattern can lead to surface water pollution from stormwater runoff close to surface waters and inherently higher flood damage risks from encroachment into the river corridors and floodplains. However, Basin 14 is less susceptible to landslides and gullies in comparison to the White River or Champlain Valley waterways.

The lower density of gullies may be due mostly to a lower population density and less development. However, these unstable gullies are also largely within the portions of the lowlands that were formerly occupied by glacial lakes. As these lowland areas are often the sites of the larger towns, it is somewhat uncertain whether the unstable gullies are more due to the increased density of population, roads, and buildings or to the highly erodible sand and silt/clay deposits that underlie these areas (Springston).

The human population in Basin 14 did not change significantly from 2000 to 2018. Caledonia County's population increased by 2% (+600), Orange County's population increased by 2.7% (+773), while Windsor County's population decreased 3.7% (-2,132). The fastest growing county in Vermont is Chittenden County with a 12.2% increase of 18,001 people. A large increase in population can equate with [increased development resulting in impacts to water quality](#) (Coles), but based on the numbers in Basin 14, a significant population increase is not evident.

Overall land cover in Basin 14 is 1% open water, 3.2% wetlands, 6.1% developed (including the interstate and roads), 9.1% agriculture, and 77.9% forests (Figure 6). An analysis of land use change in the basin comparing land use in 2001 to 2016 did not show significant differences. Basinwide there was a very small decrease in forest cover (<2%) and negligible increases in herbaceous cover (0.5%) and wetland cover (0.2%). When looking at land cover change by sub-watershed, one of the largest shifts was in the Upper Wells River Basin where forest cover changed from 87.6% to 81.9%. This almost 6% change appeared to be due to silvicultural activities based on imagery review where the herbaceous cover increased as a result of what appeared to be [selective cutting practices](#), which tend to be less impactful on water quality especially when Vermont's [Acceptable Management Practices](#) are applied (Fulton and West). The Upper Wells River basin also hosts the largest area of State Forest Land in Basin 14, covering over 50% of the land area, making it unlikely for development.

The forested landscape is largely responsible for the good water quality in upstream areas in the basin. The areas in Basin 14 that are experiencing degraded water quality trends are near concentrated residential and road development (lower Waits River, Ompompanoosuc River, Lake Morey), concentrated agriculture closer to the Connecticut River (Tabor Branch, Ticklenaked Pond, Lake Fairlee), mining activities (Lords Brook, Copperas Brook, Pike Hill Brook, Schoolhouse Brook, Cookville Brook), higher elevation areas with less calcareous bedrock (Ricker Pond, Osmore Pond, Groton Pond, Kettle Pond, Levi Pond), and large dams (South Peacham Brook, Harveys Lake,



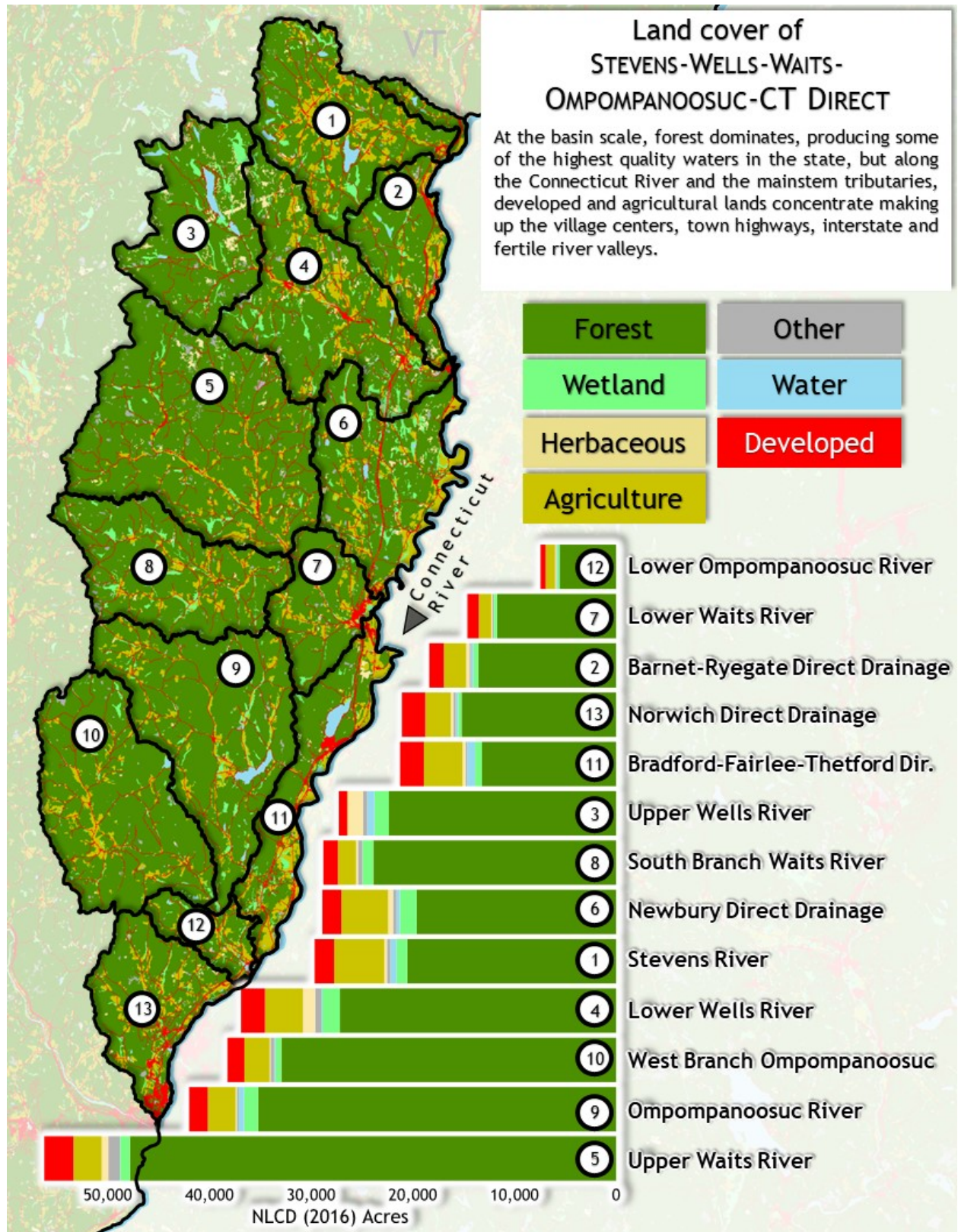


Figure 6. Land cover estimates for the thirteen sub-basins of Basin 14. The Upper Waits River and Ompompanoosuc River are the largest sub-watershed in Basin 14. (Source: 2016 LULC data)

Wells River, Waits River, Connecticut River). Managing land use to reduce discharge of polluted runoff and allowing adequate space for treatment can both improve and protect water quality. Good existing management practices and quality local stewardship may also be responsible for the overall superior water quality of this basin.

Also related to the health of rivers and streams is the infrastructure – bridges and culverts – built to relay the flow of water under transportation corridors. Transportation corridors include state, local, and private roads, large interstates, logging roads, private driveways and railroads. Most of this infrastructure was built before engineers and scientists fully understood the balance required for managing sediment and flow to protect stream channels (and adjacent developed lands). The correct sizing and placement of structures plays a significant role in protecting water quality in Basin 14. Correctly sized structures prevent erosion and scouring upstream and downstream, allow for the passage of fish and wildlife, and reduce impacts from flooding. A 2011 Natural Survey of Fishing, Hunting and Wildlife-Associated Recreation found Vermont second in the nation with 62 percent of our residents involved in outdoor activities. The economic benefit to Vermont was estimated at \$712 million spent by residents and non-residents in pursuit of these activities during 2011.

In addition, [science strongly supports the value of planting trees and shrubs along stream and lake shorelines](#) for both water quality and wildlife habitat (Figure 7). Shoreline vegetation filters and cleans dirty runoff from uphill land uses, provides shoreland and shallow water habitat, stabilizes banks, and increases lake and river aesthetics. New research has also shown that streams in the lower flatter reaches of the watershed are more likely to release carbon dioxide as a byproduct

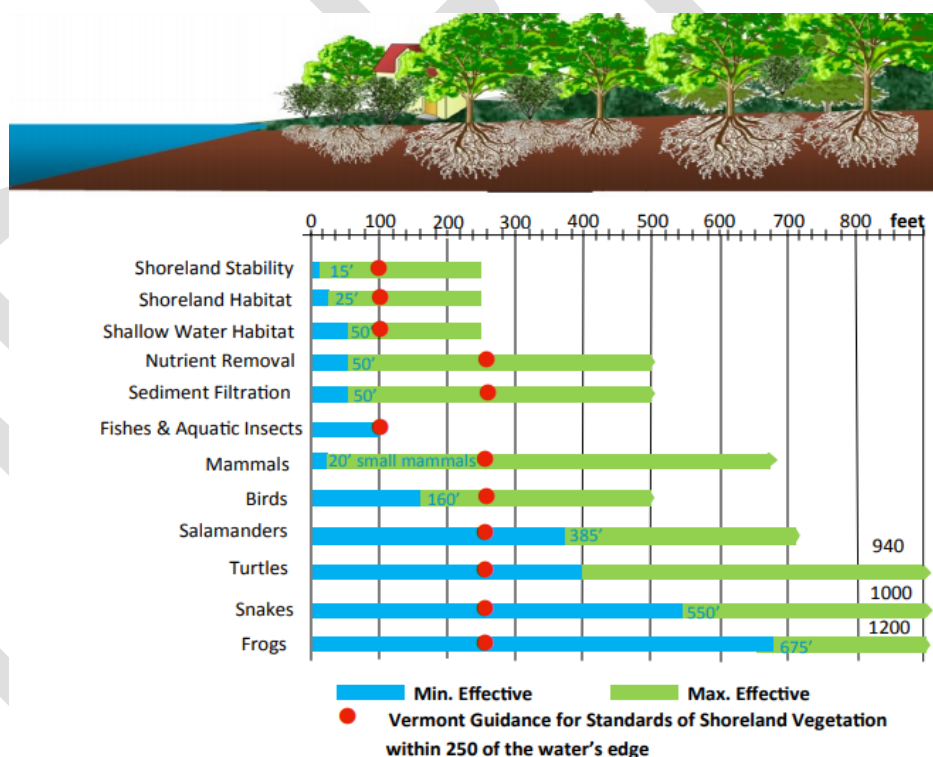


Figure 7. Recommended widths of shoreline vegetation for protection.

Source: [https://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/lp\\_shorewidth.pdf](https://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/lp_shorewidth.pdf)

of ecosystem respiration when temperatures in streams rise compared to streams in steep watersheds (Jankowski and Schindler). Reducing soil erosion to streams by capturing stormwater and stabilizing soils and increasing riparian buffers (vegetation along shorelines) on low elevation streams may help to mitigate temperature increases and their impact on the carbon cycle.

## Chapter 2 – Priority Areas for Surface Water Protection

In order to protect VT surface waters and their designated uses, the VWQS establish water quality classes and associated management objectives. All surface waters are managed to support designated uses valued by the public at a level of Class B(2) (i.e., good condition) or better. Designated uses include: swimming, boating, fishing, aquatic biota, aquatic habitat, aesthetics, drinking water source, and irrigation. This section of the plan identifies surface waters where monitoring data indicate conditions meet or exceed the VWQS objectives and criteria. These high-quality waters may be protected by the [anti-degradation policy](#) of the VWQS or by upward reclassification through one of the following protection pathways:

- [Reclassification of surface waters](#)
- [Class I Wetland designation](#)
- [Outstanding Resource Waters designation](#)
- [Designation of waters as cold-water fisheries](#)
- [Identification of existing uses](#)

In Basin 14 five waters meet criteria for A(1) aquatic biota, three waters meet criteria for B(1) aquatic biota, ten waters meet criteria for B(1) fishing, nine wetlands are recommended for further study as a Class I wetland candidates. Four abandoned A(2) public water sources are recommended for evaluation for reclassification, and fourteen waters have been identified as potential aquatic biota candidates in need of additional monitoring: seven for A(1) and seven as B(1) (Figure 8).



Figure 8. Actions identified for water quality protection in the 2020 Basin 14 TBP. Numbers refer to the number of waterbodies recommended for increased protection.



In addition to the above pathways, tactical basin plans identify opportunities to increase protection of high-quality waters through land stewardship programs, conservation easements, and land acquisition.

The Vermont Water Quality Standards establish water quality classes and associated management objectives. The protection of water quality and water-related uses can be promoted by establishing specific management objectives for bodies and stretches of water. The management objectives describe the values and uses of the surface water that are to be protected or achieved.

The Agency of Natural Resources is responsible for determining the presence of existing uses on a case-by-case basis or through basin planning and is also responsible for classification or other designations. Once the Agency establishes a management goal, the Agency manages state lands and issues permits to achieve all management objectives established for the associated surface water.

Before the Agency recommends management objectives through a classification or designation action: input from the public on any proposal is required and considered. The public may present a proposal for establishing management objectives for Agency consideration at any time, while the Agency typically relies on the publication of basin plans to promote reclassification (10 V.S.A. § 1424a). When the public develops proposals regarding management objectives, the increased community awareness can lead to protection of uses and values by the community and individuals.

Public involvement is an essential component to restoring and protecting river and lake ecology. The Vermont Water Quality Standards indicate that in the basin planning process, *“Public participation shall be sought to identify and inventory problems, solutions, high quality waters, existing uses and significant resources of high public interest.”* Emphasis on the identification of values and expectations for future water quality conditions can only be achieved through public contributions to the planning process. The public, watershed partners and stakeholders are encouraged to make recommendations for additional monitoring and research where very high-quality waters appear to exist.

## A. Surface Water Classification

Vermont’s surface water classification system establishes management goals and supporting criteria for uses in each class of water. The VWQS begin classification with two broad groups based on elevation:

- All waters above 2,500 feet altitude, National Geodetic Vertical Datum, are designated Class A(1) for all uses, unless specifically designated Class A(2) for use as a public water source.
- All waters at or below 2,500 feet altitude, National Geodetic Vertical Datum, are designated Class B(2) for all uses, unless specifically designated as Class A(1), A(2), or B(1) for any use.

Pursuant to Act 79 of 2016, the Vermont General Assembly, recognizing the wide range of quality for Class B waters, created a new intermediary water quality class between B(2) and A(1), now called Class B(1). Act 79 also sets forth the expectation that individual uses of waters (e.g., aquatic biota



and wildlife, aquatic habitat, recreation, aesthetics, fishing, boating, or swimming) may be individually classified, so a specific lake or stream may have individual uses classified at different levels. Act 79 indicates that uses may be reclassified independently to Class B(1) for individual uses if the quality of those uses are demonstrably and consistently of higher quality than Class B(2). The extent of the water being reclassified is subject to review based on documented conditions.

Current classifications of surface waters and their uses are identified through the tactical basin planning process or on a case-by-case basis. The current classification, however, does not signify that the B(1) criterion is not met. Additional waters suitable for reclassification may be identified in the future as some waters have not been monitored. Table 2 lists the possible classes into which each use may be placed.

**Table 2. A list of uses that can be placed into each water class in the Vermont Water Quality Standards.**

Classification (2016)	Applicable Uses
<b>Class A(1)</b>	One or more of: Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, or swimming
<b>Class A(2)</b>	Public water source
<b>Class B(1)</b>	One or more of: Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, or boating
<b>Class B(2)</b>	Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, swimming, public water source or irrigation

## Public Water Sources - A(2)

Five waters are designated as A(2) public water sources in Basin 14. Four of the five waters have been abandoned as public water sources and are recommended to be reclassified to reflect their current condition for each designated use (Table 3).

**Table 3. Class A(2) designated public water sources in the Basin 14.**

Waters	Water Source	Description
<b>South Peacham Brook</b>	Town of Peacham	<b>Abandoned.</b> An artificial impoundment on South Peacham Brook, and all waters within its watershed above the intake.
Charles Brown Brook	Village of Norwich	<b>Abandoned.</b> Charles Brown Brook and all waters within its watershed above the water intake in the Town of Norwich.
Mill Pond Brook	Village of Bradford	<b>Abandoned.</b> Mill Pond Brook and all waters within its watershed above the intake dam in the Towns of Fairlee, Bradford, and West Fairlee. Locally known as the Brushwood Impoundment.
Unnamed tributary to Lake Morey	Village of Fairlee	<b>Abandoned.</b> An unnamed tributary to Lake Morey and all waters in its watershed in the Town of Fairlee to the water intake dam, including a man-made impoundment.
Unnamed Tributary to Connecticut River	Village of Newbury	<b>Emergency.</b> An unnamed tributary to the Connecticut River and all waters within its watershed above the water intake in the Town of Newbury. The tributary is approximately one mile south of Pulaski Mountain. The intake is located approximately 0.7 mile upstream of its confluence with the Connecticut River.

## High-Quality Waters Supporting Aquatic Biota – A(1) & B(2)

Based upon biomonitoring assessments conducted by the VDEC WSMD, eight surface waters in the Basin consistently and demonstrably attain a higher level of quality than Class B(2), meeting Class A(1) or Class B(1) criteria for aquatic biota (Figure 9). The A(1) waters are South Peacham Brook, Mud Pond Brook, Upper Middle Brook, Abbot Brook Tributary #3, and Lords Brook (not including Tributary #2). The B(1) waters are Roaring Brook, West Branch Ompompanoosuc River, and Zebedee Brook. Through the rulemaking process which provides opportunities for public comment and input, these waters are recommended for reclassification to A(1) and B(1).

Fourteen additional sites are recommended for additional sampling to determine eligibility for A(1) and B(1) for aquatic biota. Potential B(1) waters are Peacham Hollow Brook, McIndoe Falls Tributary, Manchester Brook, South Branch Wells River, East Orange Branch Waits River, Waits River mainstem, and Cookville Brook. Potential A(1) waters are Sutton Brook, North Branch Wells River, Red Brook, Beaver Brook, Meadow Brook, Glens Falls Brook, and Sargent Brook.

## Very Good Waters for Recreational Fishing – B(1)

Certain waters in Basin 14 support productive populations of cold-water salmonids. Rivers and streams classified as B(1) recreational fishing waters, support wild, self-sustaining salmonid populations characterized by the presence of multiple age classes and a minimum abundance of 1000 individuals per mile (all species/ages/sizes); and/or 200 large (> 6 inches total length) individuals per mile; and/or 20 pounds/acre (all species/ages/sizes)<sup>5</sup>. The eleven streams that meet B(1) criteria for recreational fishing (§29A-306) are: Waits River (headwaters), Middle Brook (headwaters), Abbot Brook Tributary #3, Riddle Pond Brook, Knox Mountain Branch, Pierson Hill Brook, Center Brook, Bear Notch Brook, Charles Brown Brook, Tabor Branch, and Meadow Brook (Figure 9).

These waters shall be managed to achieve and maintain very good quality fishing. The eleven waters identified may be adjusted in the future based on new and updated surveys and as protocols are refined. Waters that meet the revised criteria in the water quality standards for both B(1) and A(1) fishing use will be continually identified and updated. It is important to note that all waterbodies that would naturally support fish populations are protected and maintained in perpetuity.

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<sup>5</sup> It should be recognized that wild trout populations vary widely from year to year and therefore an individual population may sometimes go below or greatly exceed these values in any given year. The upstream and downstream extent of the stream classification should be based upon consistent or improving water quality, physical habitat quality and land use conditions. The reach should include all upstream habitats which are deemed essential to sustain water quality and physical habitat requirements necessary to support wild salmonid populations at a very good level.

## Class 1 Wetland Designation

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

- **Class I:** Exceptional or irreplaceable in its contribution to Vermont's natural heritage and therefore, merits the highest level of protection
- **Class II:** Merits protection, either taken alone or in conjunction with other wetlands
- **Class III:** Neither a Class II or Class I wetland

Impacts to Class I wetlands may only be permitted when the activity is necessary to meet a compelling public need for health or safety. The VT Wetlands Program has created a Class I website with an [interactive map](#). This website includes the determinations for nine Class I wetlands: Dorset Marsh, Northshore Wetland, Tinmouth Channel, Chickering Fen, Dennis Pond Wetlands, Sandbar Wetlands, Peacham Bog, LaPlatte River Wetlands, and Beaver Meadows Wetland. The last six wetlands were added since 2016.

In 2017 Peacham Bog was designated as a Class I wetland. Nine wetlands have been identified for further study for Class I wetland designation (Figure 9). VDEC supports the further study and petitioning of these nine wetlands. The VT Wetlands Program welcomes recommendations for Class I candidates.

### Wetlands for Further Study for Class I Designation

- Stoddard Swamp – Peacham
- Roy Mountain Swamp – Barnet
- Stillwater Brook Wetlands – Groton
- Beaver Brook Wetlands – Groton
- Lower Symes Pond – Ryegate
- Cookville Swamp – Corinth
- Gillette Swamp – Thetford
- Conant Swamp – Thetford
- Zebedee Brook Wetlands – Thetford

As part of the implementation of this tactical basin plan, the Department will develop and implement procedures and documents to enable submission, evaluation, and implementation of petitions to classify wetlands as Class I. Those wetlands that satisfy criteria for designation may be proposed for such designation through departmental rulemaking authority, and as consistent with the Vermont Wetland Rules.



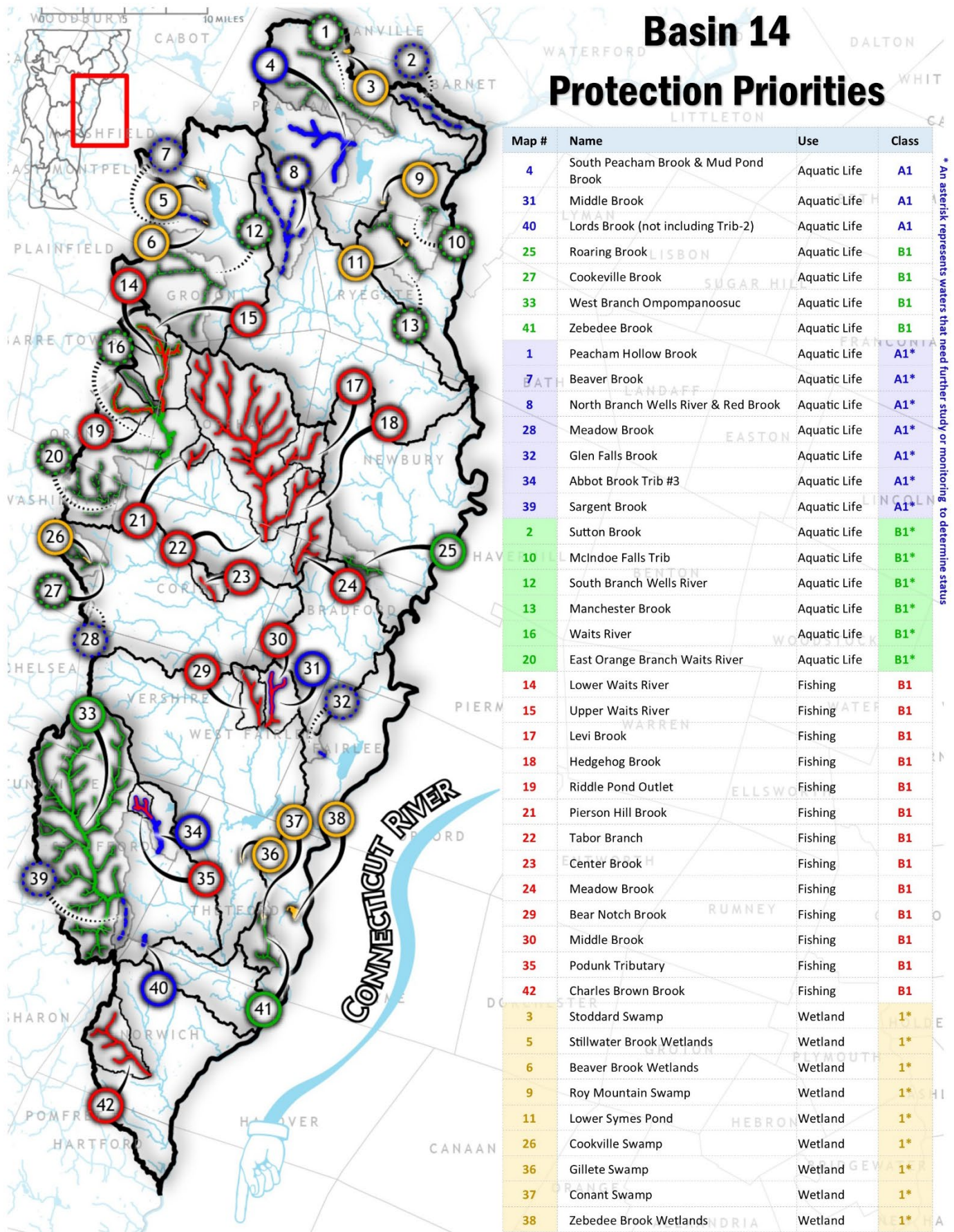


Figure 9. Recommended reclassification candidates and priority waters for protection for fishing, aquatic life and wetlands.



## Warm and Cold-Water Fish Habitat Designations

### Warm Water Fish Habitat

All surface water wetlands and the following waters are designated as warm water fish habitat for purposes of the Vermont Water Quality Standards:

- Halls Lake, Newbury
- Harriman Pond, Newbury
- Lake Abenaki, Thetford
- Lake Morey, Fairlee
- Lower Symes Pond, Ryegate
- Ticklenaked Pond, Ryegate
- Waits River from the CVPS Dam in Bradford to its confluence with the Connecticut River – June 1 to September 30

The WQS specify a lower minimum dissolved oxygen concentration than waters in the remainder of the basin, which are Cold-Water Habitat. There are no proposed changes to warm water fish habitat designations at this time.

### Cold-Water Fish Habitat

All waters not designated as warm water fish habitat above are designated as cold-water fish habitat for Basin 14, as noted in the Vermont Water Quality Standards (Vermont Department of Environmental Conservation).

### Outstanding Resource Waters Designation

Vermont Act 67 (“An Act Relating to Establishing a Comprehensive State Rivers Policy,” 1987) provides protection to rivers and streams that have “exceptional natural, cultural, recreational, or scenic values” through the designation of Outstanding Resource Waters (ORW). ORW designation may protect exceptional waters through permit conditions in stream alterations, dams, wastewater discharges, aquatic nuisance controls, solid waste disposal, Act 250 projects, and other activities. ORWs are waters which can be designated by the VANR through a petition process. There are currently no waters recommended for ORW designation in Basin 14. Although no other waters have been identified as ORW in this plan, there may be waters in the basin which merit this designation and for which ORW status should be pursued. The Agency will support collaborative efforts to develop the materials, and to conduct outreach necessary to support rulemaking for ORW designation of these waters, should there be public interest.

## B. Identification of Existing Uses

The VANR may identify existing uses of waters during the tactical basin planning process or on a case-by-case basis during application reviews for State or federal permits. Consistent with the federal Clean Water Act, the VWQS stipulate that existing uses may be documented in any surface water location where that use has occurred since November 28, 1975. Pursuant to the definition of Class B(1) in Act 79, the VANR may identify an existing use as Class B(1) when that use is demonstrably and consistently attained.

The VANR stipulates that all lakes and ponds in the basin have existing uses of swimming, boating, and fishing. The VANR recognizes that fishing activities in streams and rivers are widespread and too numerous to thoroughly document for Basin 14. In the case of streams too small to support significant fishing activity, the VANR recognizes these as potential spawning and nursery areas, which contribute fish stocks downstream where fishing may occur. These small streams support the use of fishing and therefore, are protected at a level commensurate with downstream areas.

Existing uses in Basin 14 should be viewed as a partial accounting of known existing uses based upon limited information. The list does not change protection under the Clean Water Act or VWQS for unlisted waters. The existing uses in Basin 14 of swimming, boating, fishing, and drinking water supply are found at: <https://dec.vermont.gov/water-investment/watershed-planning/tactical-basin-planning/basin14>. The public is encouraged to recommend waters for existing uses of swimming, boating, fishing, drinking water, and ecological significance given that they provide evidence of such use. New recommendations for existing uses should be sent to the [Basin 14 Watershed Coordinator](#) for review.

For existing uses of waters, the level of water quality necessary to protect those existing uses shall be maintained and protected regardless of the water's classification (VDEC, 2017).

## Chapter 3 – Priority Areas for Surface Water Restoration

### A. Stressed or Impaired Surface Waters

The VDEC monitors and assesses the chemical, physical, and biological status of individual surface waters to determine if they meet the VWQS per the [2016 VDEC Assessment and Listing Methodology](#) (Vermont Department of Environmental Conservation). Surface waters are assessed as: **full support, stressed, altered, or impaired**. To address Section 303(d) of the Federal Clean Water Act, the VDEC develops the 303(d) List of Impaired Waters, which includes impaired lakes, ponds, rivers, and streams that do not meet VWQS.

The State also produces the Priority Waters List, which identifies other waters that do not meet water quality standards, but do not require a TMDL. Sections of that list include: Part B- impaired waters that have other required remediation measures in place; Part D-impaired waters with TMDLs in place; Part

E-waters altered by AIS; and Part F-waters altered by flow modifications. These lists can be viewed on the [Vermont Environmental Atlas](#). For a more detailed description of monitoring results use the [Vermont Integrated Watershed Information System](#) online data portal. Figure 10 and Table 4 show the known stressed, impaired, or altered waterbodies in Basin 14.

A primary goal of the plan is to identify and address pollutants degrading the listed waters (Figure 10 and Table 4) through strategies in the Chapter 5 Implementation Table. The types of actions prescribed are based on the sector-specific practices outlined in the [Vermont Surface Water Management Strategy](#).

There are a wide variety of monitoring programs that are supported by the Department and its partners which are described in detail in the [Water Quality Monitoring Program Strategy](#). Monitoring programs in this basin include the Biological and Aquatic Studies Section (BASS) – that focuses on biological monitoring of macroinvertebrate and fish communities as well as targeted chemistry sampling around WWTF or other pollution concerns. This section also supports the LaRosa volunteer water quality monitoring program. The Vermont Fish and Wildlife Department supports fish assessments which are used to understand fish populations – and does temperature monitoring and the evaluation of streams for the need to strategically add wood to restore habitat. The Lakes and Ponds Program supports the spring phosphorus monitoring and lay monitoring programs which evaluate nutrient conditions and trends on lakes, as well as shoreland condition and more in-depth lake assessments in addition to surveys for aquatic invasive species. Finally, the Rivers Program supports stream geomorphic assessments that evaluate geomorphic and habitat conditions on our rivers and the Wetlands programs has a wetlands assessment program.

There are several common goals for monitoring efforts across programs which include:

- 1) The confirmation of waters quality conditions that support reclassification of surface waters to a higher level where there is not sufficient amounts of data or data is too old to support reclassification which is a focus for the BASS with regards to aquatic biota and VFWD program with regard to fishing use.
- 2) Understanding water quality conditions where these are unknown such as streams or lakes that have not been sampled or assessed or where assessments may be out of date.
- 3) Understanding water quality conditions where there is a known water quality problem to evaluate if the problem has gotten worse or to evaluate the effectiveness of restoration efforts.
- 4) Understanding pollution source areas that may be contributing to water quality issues such as nitrogen loading regarding LIS.
- 5) Evaluating water quality changes over time which is supported by sentinel monitoring network on lakes and streams as well as the lay monitoring and spring monitoring programs. Targeted studies can also help to evaluate water quality improvements with the implementation of best management practices.

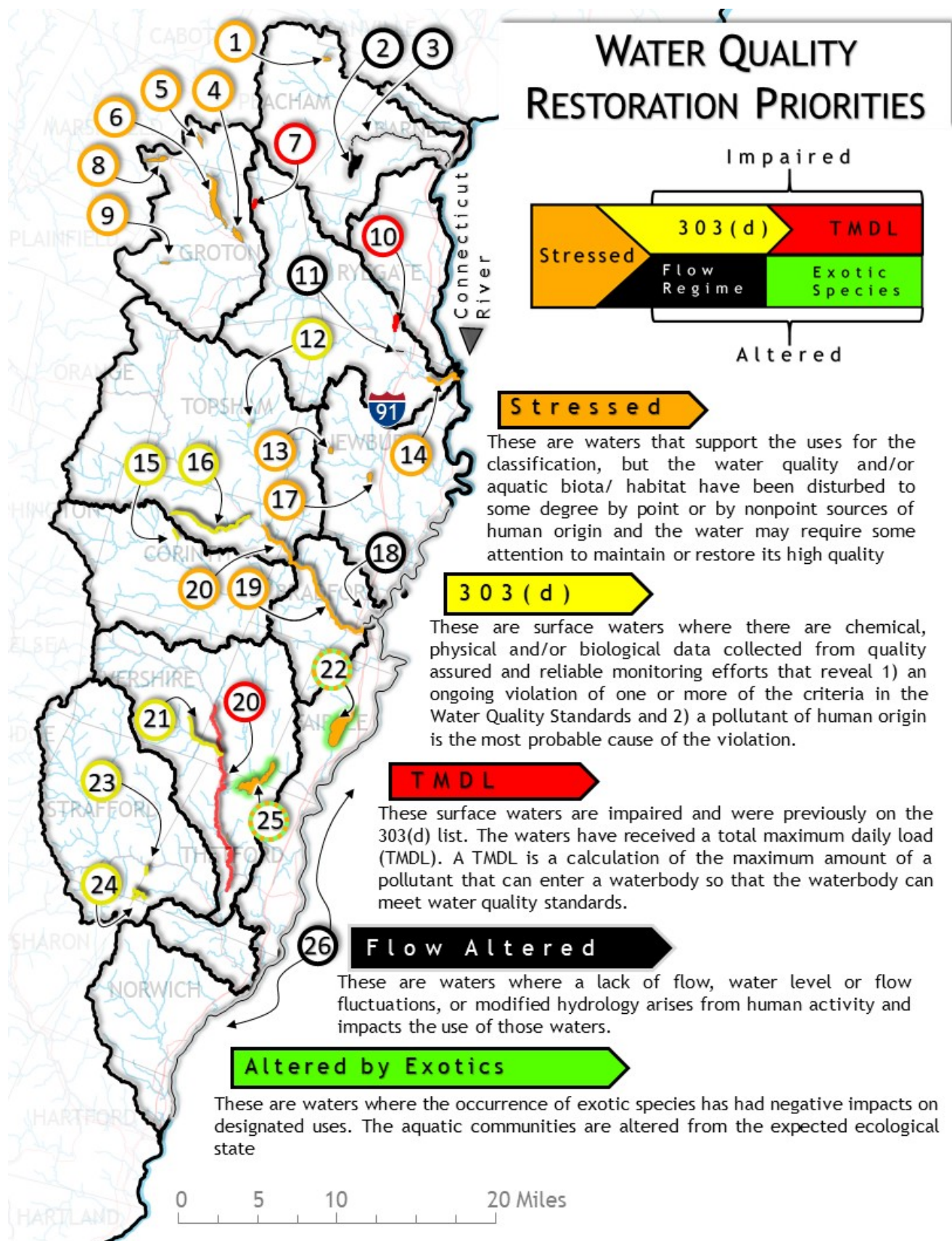


Figure 10. Priority areas for restoration in Basin 14.



Table 4. Basin 14 priority waters and pollutants. This table corresponds with Figure 7.

Stressed			
Map ID	Name	Pollutant/Problem	List
1	Ewell Pond	Nutrient enrichment, anoxic hypolimnion	Stressed
4	Ricker Pond	Low pH, Acid deposition	Stressed
5	Osmore Pond	Low pH, Acid deposition	Stressed
6	Groton Pond	Low pH, Acid deposition	Stressed
8	Kettle Pond	Low pH, Acid deposition	Stressed
9	Noyes Pond	Low pH, Acid deposition	Stressed
13	Round Pond (Newbury)	Eurasian Watermilfoil (EWM)	Stressed
14	Lower Wells River	Metals, iron seeps	Stressed
17	Halls Pond	EWM, sedimentation, Variable-leaved milfoil	Stressed
19	Waits River, South Branch to Tabor Branch	Temperature, physical alteration	Stressed
20	Waits River, Below south branch	Temperature, sedimentation	Stressed
22	Lake Morey	Increasing phosphorus trends, anoxic hypolimnion	Stressed
25	Lake Fairlee	Increasing phosphorus trends, anoxic hypolimnion	Stressed
303(d)			
Map ID	Name	Pollutant/Problem	List
12	Tabor Branch Tributary # 6, Mouth to Rm 0.1	Nutrient enrichment	303(d)
15	Cookville Trib #4, RM 1.0 to 1.7	Acid mine drainage, Pike Hill Mine	303(d)
16	Pike Hill Brook, from mouth to 4 miles upstream	Metals, Pike hill mine drainage	303(d)
21	Schoolhouse Brook and Tributary	Metals, acid mine drainage, Ely Mine	303(d)
23	Copperas Brook	Metals, Elizabeth Mine	303(d)
24	Lords Brook, tributary #2 and #2's trib #1	Metals, "South Cut" and "South Mine"	303(d)
TMDL			
Map ID	Name	Pollutant/Problem	List
7	Levi Pond	Low pH, atmospheric deposition	TMDL
10	Ticklenaked Pond	Phosphorus	TMDL
20	Ompompanoosuc River, USACOE Beach to Brimstone Corner	<i>E. coli</i>	TMDL
Altered by Exotics			
Flow Altered			
Map ID	Name	Pollutant/Problem	List
3	South Peacham Brook, Stevens River	Dam alters aquatic habitat	Flow
2	Harvey's Lake	Dam alters aquatic habitat	Flow
11	Wells River, below dam at Boltonville	Poor flow in dam bypass segment	Flow
18	Waits River, below Bradford Dam	Poor flow in dam bypass segment	Flow
22	Lake Morey	Eurasian Watermilfoil	Exotics
25	Lake Fairlee	Eurasian Watermilfoil	Exotics
26	CT River, Above Wilder Dam to Bradford	Water level fluctuation erodes streambanks	Flow

## B. Basin Specific Total Maximum Daily Loads (TMDLs)

A Total Maximum Daily Load or TMDL is the calculated maximum amount of a pollutant that a waterbody can receive and still meet Vermont Water Quality Standards. In a broader sense, a TMDL is a plan that identifies the pollutant reductions a waterbody needs to meet Vermont's Water Quality Standards and develops a means to implement those reductions. TMDLs can be calculated for reducing water pollution from specific point source discharges or for an entire watershed to determine the location and amount of needed pollution reductions.

TMDLs for Basin 14 include:

- [2004 TMDL for 7 Acid Impaired Lakes in Vermont](#)
- [Vermont Statewide Total Maximum Daily Load \(TMDL\) for Bacteria-Impaired Waters](#)
  - [Bacteria TMDL Ompompanoosuc River](#)
- [Long Island Sound \(LIS\) Dissolved Oxygen TMDL](#)
- [Northeast Regional Mercury Total Maximum Daily Load](#)
- [Ticklenaked Pond TMDL](#)

### Long Island Sound Total Maximum Daily Load

The Long Island Sound Dissolved Oxygen TMDL released in 2000 is designed to address low dissolved oxygen or hypoxia in Long Island Sound bottom waters. It is often referred to as the Connecticut River Nitrogen TMDL because it is linked to an overabundance of nitrogen discharging into the Sound from the Connecticut River and other tributaries. While nitrogen is essential to a productive ecosystem, too much nitrogen fuels the excessive growth of algae. When the algae die, they sink to the bottom, where they are consumed by bacteria. The microbial decay of algae and the respiration of these organisms use up the available oxygen in the lower water column and in the bottom sediments, gradually reducing the dissolved oxygen concentration to unhealthy levels (New York State Department of Environmental Conservation; Connecticut Department of Environmental Protection).

In 2013 a Vermont-specific section, the [Vermont Enhanced Implementation Plan for the Long Island Sound TMDL](#), was added to the LIS-TMDL to address four goals:

1. To identify the Vermont sources of nitrogen as they are currently understood, across broad land use sectors, such as developed, agricultural and forested;
2. To identify the status and trends of important drivers of nitrogen export such as the intensity of agricultural and development activities and investigate how these might have changed since the TMDL baseline period of 1990;
3. To identify the management programs, operating at that time, that address these drivers of nitrogen loading that have a significant effect on reducing or preventing nitrogen export. A part of this is to identify a timeline as to when programs were initiated or enhanced; and

4. Using a weight-of-evidence approach, to assess the combined management programs/projects to develop a qualitative evaluation as to whether management efforts are sufficient to meet the original 2000 TMDL of a 10% non-point source nitrogen reduction and if these actions are sufficient to maintain that control into the future (Vermont Department of Environmental Conservation).

Vermont nitrogen export to LIS is estimated to be about 4% of the total load to the Sound. Modeling estimates the breakdown of nitrogen sources in Vermont. Approximately 21% of Vermont's nitrogen export originates from agricultural areas, 9% from point sources, and 4% from developed areas. Of note is that approximately 65% of the nitrogen exported from Vermont originates as atmospheric deposition (Vermont Department of Environmental Conservation). Efforts to reduce atmospheric deposition has been occurring at the national level through the Clean Air Act and its amendments. Total nitrogen deposition has declined since 1985 (NADP, 2018)

In 2017, EPA embarked on its Nitrogen Reduction Strategy to investigate and better define control actions to reduce nitrogen in the Long Island Sound. Information on the most current developments and strategies can be found in EPA's [Long Island Sound Study](#).

The sources of nitrogen to be addressed in Vermont include wastewater discharges, agricultural lands, developed lands and forest practices. The adoption of Vermont's [Act 64](#) helps implement overarching strategies and steps required to meet loading reductions for the Long Island Sound's TMDL (see [The Vermont Clean Water Act](#) in the previous section for details).

In addition, the [Long Island Sound Watershed Regional Conservation Partnership Program](#) (LISW-RCPP) was created in 2015 across six states to coordinate the development and implementation of a comprehensive working lands program with foci on: 1) nutrient management and soil health, 2) protection of non-industrial forest habitat, biodiversity, and drinking water sources, and 3) stream erosion and flood resiliency improvements on working lands through riparian restoration. In partnership with the Vermont Association of Conservation Districts (VACD), UVM Extension, the Connecticut River Conservancy, The Nature Conservancy and federal, state and local organizations in VT, NH, MA, CT, NY and RI, ten million dollars is being invested in the adoption of best management practices on private working lands, providing both technical and financial assistance (Connecticut Council on Soil and Water Conservation).

## Chapter 4 – Strategies to Address Pollution by Source Sector

Tactical basin plans address water quality by sector as summarized in the following sections which are consistent with the Clean Water Initiative Program’s [2019 Performance Report](#) (Vermont Agency of Natural Resources).



### ***Agriculture***

- Conservation practices that reduce sources of pollution from farm production areas and farm fields.



### ***Developed Lands--Stormwater***

- Practices that reduce or treat polluted stormwater runoff from developed lands, such as parking lots, sidewalks, and rooftops.



### ***Developed Lands--Roads***

- Stormwater and roadside erosion control practices that prevent erosion and treat road-related sources of pollution.



### ***Wastewater***

- Improvements to municipal wastewater infrastructure that decrease pollution from municipal wastewater systems through treatment upgrades, combined sewer overflow (CSO) abatement, and refurbishment of aging infrastructure.



### ***Natural Resource Restoration***

- Restoration of “natural infrastructure” functions that prevent and abate pollution. Natural infrastructure includes: floodplains, river channels, lakeshores, wetlands, and forest lands.





## A. Agriculture

Agricultural land use makes up approximately nine percent of the land cover in Basin 14 (Figure 11). One percent is cultivated crop and eight percent is hay or pasture. The highest concentrations of agricultural land are found in the Connecticut direct tributary watersheds except for the Stevens River watershed. The concentrations range from 11% of total land area used for agriculture to 25%. An analysis comparing implemented field practice acres (FY2016-2019) to agricultural concentrations (LULC 2016) in the sub-basins showed that acreage was highest in the areas with the highest concentrations of agriculture. Two areas with higher agricultural land cover concentrations, but low field practices were the Norwich Direct Drainage and the Barnet and Upper Ryegate Direct Drainage.

The higher level of cumulative agricultural intensity in these sub-basins make them a priority for outreach and implementation of agronomic farm practices for water quality. Additional on the ground assessment through inspections and voluntary farm visits will help to locate areas for targeted action.

There are two large farm operations and five permitted [medium farm operations](#) in Basin 14. These farms are inspected once every three years by the Agency of Agriculture Food and Markets (AAFM). These farms must

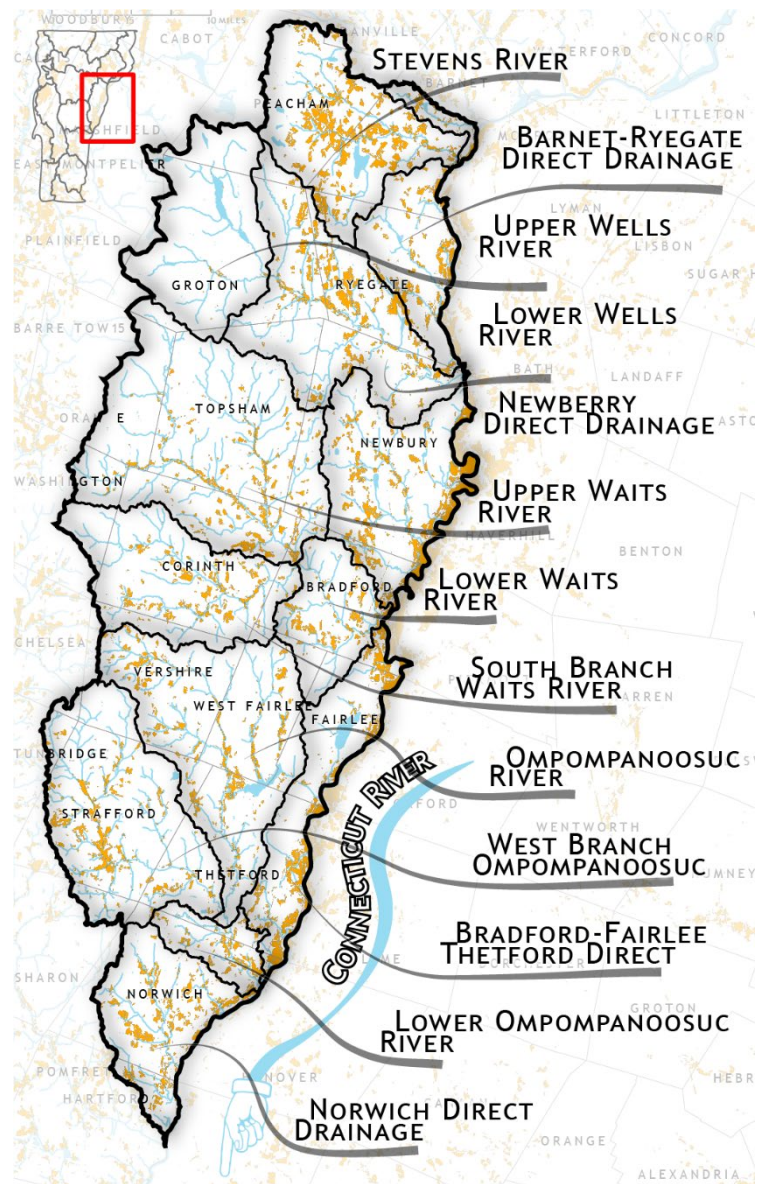


Figure 11. Agricultural land cover in Basin 14 shown in solid orange. For a comparative view of agricultural land cover to other major land cover types, follow this [link](#) to the landcover map in Chapter 1.

comply with Vermont's water quality standards.

There are an estimated 47 small farms in Basin 14. Fourteen of those farms qualify as certified small farm operations (CSFO) that must comply with the Required Agricultural Practices (RAPs). CSFOs required to certify annually with the Agency, will be inspected at least once every 7 years, and need to comply with the RAPs. By the writing of this plan, 12 CSFOs have submitted certifications.

RAP small farms do not receive a routine inspection by the Agency, but still need to comply with the RAPs. There are an estimated 113 water quality points in Basin 14 that indicate areas where farming historically occurred, prior farms that sold, current vegetable farms and other characteristics that imply agricultural use current or historic. These locations if active may fall below the RAP thresholds for CSFOs.

From state fiscal year 2016 to 2019, AAFM dedicated over \$432,000 in Basin 14 to agricultural equipment and pollution prevention implementation through the Capital Equipment Assistance Program (CEAP), Best Management Practice Program (BMP), Farm Agronomic Practice Program (FAPP), and Conservation Reserve Enhancement Program (CREP) (Table 5). Small farm inspections (once every 7 years) that verify compliance with the RAPs started in Basin 14 in x. The goal for each inspector is to inspect at least X certified small farms per field season. Include inspection statistics here when available. Meet and greets with farmers will occur on an on-going basis throughout the year. Outreach will need to continue throughout the watershed to the remaining farms or locations to help landowners understand where they fall within the RAP farm categories and to help them understand the requirements under the RAPs.

**Table 5. Completed agricultural practices in Basin 14 funded by AAFM since SFY2016-2019.**

Practices	Project Count	AAFM Funding
Access Road	1	\$ 7,300
Cover Crop	9	\$ 23,080
Cover Crop and Field Improvement Equipment - No-Till Grain Drill	1	\$ 27,000
Diversification	2	\$ 9,227
Heavy Use Area Protection	4	\$ 115,969
Livestock Exclusion	3	\$ 2,394
Riparian Forest Buffer	4	\$ 19,596
Roof Runoff Management	1	\$ 2,076
Solid/Liquid Waste Separation Facility	1	\$ 68,199
Waste Storage Facility	1	\$ 49,000
Waste Storage Structure	2	\$ 83,992
Waste Treatment - Milk House Waste	3	\$ 24,455*
<b>Grand Total</b>	<b>32</b>	<b>\$ 432,288</b>

AAFM is also coordinating with agricultural partners throughout the watershed to streamline outreach to farmers where multiple resources may be available. This coordination ensures no duplicative actions and reduces confusion for farmers when dealing with multiple organization.

AAFM provides a spectrum of assistance programs and resources (both technical and financial) that are available to farmers to improve agricultural practices that increase farm viability and protect water quality. These resources can be found at: <https://agriculture.vermont.gov/water-quality/assistance-programs>.

The White River (WR) and Caledonia County (CC) Natural Resource Conservation Districts (NRCDS) are strong non-regulatory agricultural partners in Basin 14. Since the last plan was published in 2015 both districts have been actively pursuing actions to improve water quality in the basin in relation to agricultural activities. **Include WRNRCD & CCNRCD accomplishments from 2015-2019 here when available.** WRNRCD works with the Connecticut River Watershed Farmers Alliance, a farmer-based watershed group for the Connecticut River Basin. WRNRCD helps CRWFA manage their No-Till Drill rental program, which has been very successful. CRWFA is a member-based organization that holds workshops on cover cropping, farms tours to observe good stewardship practices, provides resources to help farmers learn more about agricultural topics, and collaborates with related organizations throughout the watershed.

UVM Extension and the Center for Sustainable Agriculture provide farm focused technical assistance related to soil health and water quality in Basin 14. UVM Extension staff also work closely with CRWFA. They perform one on one assistance and offer outreach and workshops. They work on nutrient management planning, crop and soil fertility issues, no till, pest management, and hay ground revitalization. Some water quality monitoring was completed in 2019 in Bradford focusing on tile drainage.

Watershed and agriculture partners in Basin 14 convened to collaborate on agriculture and water quality issues during the development of this plan. Their feedback and recommendations for agricultural actions for watershed health are found in the implementation table in [Chapter 5](#).

## Agricultural Project Outcomes in Basin 14

Agriculture project outputs reported in the 2019 Clean Water Initiative Performance Report from FY2016-2019 for Basin 14 are listed in Table 6.



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					

Table 6. Results of agriculture clean water projects funded by State of Vermont agencies completed, SFY 2016-2019 in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed. Note: Does not include results of projects funded, but not yet completed.



## B. Developed Lands

### Stormwater

This section integrates basin-specific information on stormwater-related water resource impairments, regulatory programs, stormwater master plans, Illicit Discharge Detection and Elimination (IDDE) studies, existing implementation efforts and partnerships to inform strategies to address stormwater-related water resource impairments. The tactical basin planning approach engages local, regional, and federal partners in the development of strategies needed to accelerate adoption and monitoring of stormwater-related BMPs to meet the state’s clean water goals including reductions to support the Long Island Nitrogen TMDL. The section is organized around the 3-acre operational permit, stormwater master planning and IDDE studies which are the primary drivers for voluntary implementation efforts in the basin.

#### *Operational three-acre impervious surface permit program*

The Stormwater Program issued a general permit in 2019 for stormwater from so-called “three-acre sites” which are existing sites with three or more acres of impervious surface that lack a stormwater permit based on the 2002 Vermont Stormwater Management Manual. For the Connecticut River watershed including Basin 14, parcels will need to apply for permit coverage by 2033. Since this date is well beyond the timeframe for this plan, voluntary stormwater efforts through stormwater master planning are likely to be the primary drivers for stormwater implementation efforts for this planning cycle.

#### *Stormwater Mapping and Master Planning*

Stormwater infrastructure mapping projects are completed for municipalities by the Vermont Clean Water Initiative Program to supplement the existing drainage data collected by towns and with the intention of providing a tool for planning, maintenance, and inspection of the stormwater infrastructure. Stormwater mapping reports were completed for significant areas of 12 towns in Basin 14 (Table 7). The reports can be found at: <https://dec.vermont.gov/water-investment/cwi/solutions/developed-lands/idde>.

The reports and maps from each project are meant to provide an overall picture and understanding of the connectivity of the storm system on both public and private properties to raise the awareness of the need for regular maintenance. These reports identify potential priority projects in the study areas and provide information necessary to develop a stormwater master plan. The highlighted



projects can be completed separately or in conjunction with the development of a stormwater master plan.

Projects identified as high priority in the stormwater mapping reports may be implemented by towns with the aid of Regional Planning Commissions or other partners where necessary. Those towns with significant development should consider developing a stormwater master plan, while a multi-town stormwater masterplan can be developed for smaller towns. No Stormwater Master Plans (SWMPs) have been completed in Basin 14. Three towns in Basin 14 – Hartford, Newbury, and Bradford – are recommended to complete SWMPs using the stormwater mapping reports for reference. The remaining eight towns that had projects identified in stormwater mapping reports are recommended for single project implementation (Table 7). These towns should determine which projects they can pursue and move towards completing single or batch preliminary designs for those projects identified in Basin 14.

Table 7. Towns with completed stormwater mapping reports ranked by number of high priority projects identified at the highest level. Towns in bold are recommended for stormwater mastering planning. Click on the town to link to report.

Town Name	Year Completed	Recommendations for Implementation	Number of High Priority Projects Identified	
			Highest	High
<a href="#"><b>Hartford</b></a>	<b>2015</b>	<b>SWMP</b>	<b>9</b>	<b>5</b>
<a href="#"><b>Newbury</b></a>	<b>2014</b>	<b>SWMP</b>	<b>6</b>	<b>5</b>
<a href="#"><b>Bradford</b></a>	<b>2014</b>	<b>SWMP</b>	<b>3</b>	<b>2</b>
<a href="#">Topsham</a>	2018	Single projects	2	0
<a href="#">Strafford</a>	2018	Single projects	2	1
<a href="#">Norwich</a>	2014	Single projects	2	1
<a href="#">Barnet</a>	2017	Single projects	1	0
<a href="#">Ryegate</a>	2014	Single projects	1	0
<a href="#">Corinth</a>	2018	Single projects	1	0
<a href="#">Fairlee</a>	2014	Single projects	1	0
<a href="#">Thetford</a>	2018	Single Projects	1	0
<a href="#">Groton</a>	2014	No projects identified	0	0
<a href="#">West Fairlee</a>	2015	No projects identified	0	0
<a href="#">Vershire</a>	2018	No projects identified	0	0

\*Towns with mapping that do not have stormwater infrastructure in Basin 14 were not included.

**SWMP** = Stormwater Master Plan.

### *Illicit Discharge Detection & Elimination Studies*

In 2000, the Vermont Legislature required VDEC to implement a statewide program to promote detection and elimination of improper or illegal connections and discharges. Illicit discharges are discharges of wastewater or industrial process water into a stormwater-only drainage system. All towns in Basin 14 except Orange and Peacham have completed IDDE reports. The outcomes of these studies are listed in four reports:

- [Detecting and Eliminating Illicit Discharges in the Upper and Middle Connecticut River Basin: Final Report](#) (2017)

- [White River Basin - Illicit Discharge Detection and Elimination Study - Final Report](#) (2018)
- [Statewide Contract No 2 Illicit Discharge Detection and Elimination Study: Final Report](#) (2019)
- Report due on 3/20 to be reported in final draft

In the Basin 14 watershed, problems were found only in Groton and West Fairlee. In Groton, a commercial sewer lateral to stormwater was corrected by the town and a suspect septic was checked by an engineer and found to be okay. In West Fairlee, a suspect pipe was found with high methylene blue active substances assay which indicates a soap discharge. This discharge was investigated, and the investigation was inconclusive. Report problems from 3/2020 report if any.

## Roads

### *Road Erosion Inventories*

[Road Erosion Inventories \(REI\)](#) are used by Vermont municipalities to:

- identify sections of local roads in need of sediment and erosion control,
- rank road segments that pose the highest risks to surface waters, and
- estimate costs to remediate those sites using Best Management Practices.

REI's are required by the [Municipal Roads General Permit](#) (MRGP) as part of the Road Stormwater Management Plan. The MRGP is intended to achieve significant reductions in stormwater-related erosion from municipal roads, both paved and unpaved. Municipalities will implement a customized, multi-year plan to stabilize their road drainage system. The plan will include bringing road drainage systems up to basic maintenance standards, and additional corrective measures to reduce erosion as necessary to meet a TMDL or other water quality restoration effort. The permit is required by the Vermont Clean Water Act (Act 64) and the Lake Champlain Phase I TMDL.

The implementation of the priorities identified in REI's will reduce sediment, phosphorus and other pollutants associated with stormwater-related erosion generated from unpaved municipal roads that contribute to water quality degradation. The inventories are conducted for "hydrologically-connected roads". Hydrologically connected roads are those municipal roads within 100' of or that bisect a wetland, lake, pond, perennial or intermittent stream or a municipal road that drains to one of these water resources. These road segments can be viewed using the "Municipal Road Theme" on the [ANR Natural Resource Atlas](#) and REI results by town can be viewed in the [MRGP Implementation Table](#).

Based on protocols developed by VDEC with the assistance of the regional planning commissions, all of the towns in Basin 14 have completed or plan to complete REIs by 2020 (Table 8).

Table 8. Status of towns with Road Erosion Inventories, now required by the Municipal Road General Permit. Number of very high priority segments in ( ). See table 9 for information on very high priority segments.

REI Status	Complete	Completed 2016 (not in online database)	Planned (2020)
<b>Towns</b>	Hartford (6), Norwich (1), Thetford (3), West Fairlee (1), Topsham (9), Newbury (0), Groton (14), Ryegate (2), Peacham (9), Barnet (27), Orange (9)	Corinth, Strafford	Washington, Bradford

This plan recommends that technical and financial assistance be prioritized for interested towns based on the water quality benefit of a project. Projects that “do not meet standards” and are in sub-basins with sediment impairments related to road runoff are water quality priorities (Tables 1, 4 and Figure 9). Resources available from the Clean Water Fund (e.g. VDEC Grant-in-Aid and VTrans Better Roads grants) assist with development of designs, capital budgets, cost estimates and implementation of road projects. Completion of these projects may be counted towards meeting the requirements of the MRGP. For additional information see the [VDEC Municipal Roads Program](#).

Table 9. Coarse or default prioritization of municipal road segments based on MRGP road erosion inventory and slope. Road segments that do not meet standards and are on a steep slope are priorities for water quality protection.

MRGP Status	0-4% slope	5-9% slope	10%+ slope
<b>Fully Meets</b>	-	-	-
<b>Partially Meets</b>	Low priority	Moderate priority	Moderate priority
<b>Does Not Meet</b>	Moderate priority	High priority	Very High priority*

\*Very high priority sites that are not Class 4 require remediation by 2025; Class 4 roads by 2028

In addition to the MRGP, [Vermont Road and Bridge Standards](#) are required for municipalities under Act 64. Towns can voluntarily adopt the Vermont Road and Bridge Standards. These standards are administered by AOT and go above and beyond MRGP standards. For example, municipalities may adopt MRGP standards for non-hydrologically connected roads. Towns adopting the Vermont Road and Bridge Standards, may be entitled to higher cost share rates in federally declared flood event reimbursements.

Managing for road runoff in the upper catchments will lessen the pressure on the areas receiving larger contributions of runoff. Waters being stressed or impaired lower in the watershed does not negate the need for action high up in the watershed. Lack of good management in the upper parts of the sub-basins can often be the cause of water quality issues further downstream because of cumulative impacts. For this reason, target road BMPs for water quality are recommended basin wide.

## Vermont Green Infrastructure Toolkit

Stormwater runoff from developed lands, including the road network, is one of the greatest threats to water quality in Vermont. Stormwater runoff is any form of precipitation that flows over the land during or after a storm event or because of snowmelt. On undeveloped lands, a portion of this

runoff is absorbed into the ground through infiltration and the rest takes a slow path to nearby rivers, lakes and ponds. On developed lands, however, infiltration is reduced by impervious surfaces such as roads, rooftops, and driveways. This leads to an increased frequency and intensity of flooding as well as a greater likelihood that runoff will become contaminated with pollutants. The result is increased erosion and property damage, degraded aquatic and terrestrial habitats, and threats to public health via recreation sports and contaminated drinking water.

Many of the stormwater issues associated with developed lands can be mitigated and prevented using Low Impact Development (LID) and Green Stormwater Infrastructure (GSI) systems and practices. These emerging concepts strive to manage stormwater and pollutants by restoring and maintaining the natural hydrology of a watershed. Rather than funneling stormwater off site through pipes and infrastructure, these systems (gardens or permeable materials) focus on infiltration, evapotranspiration, and storage as close to the source as possible to capture runoff before it gets to surface waters.

The [Vermont Green Infrastructure Toolkit](#) is a project of the ten Regional Planning Commissions of the Vermont Association for Planning and Development Agencies (VAPDA) and the Vermont Agency of Natural Resources' Watershed Management Division. The toolkit is a clearinghouse of information useful to Vermont municipalities to explore how to promote the adoption of Green Infrastructure policies and practices to combat the problems caused by urban, suburban and rural stormwater runoff.

## Stormwater Projects Outcomes in Basin 14

Water quality projects implemented in Basin 14 between 2016 and 2019 were focused on road projects. No non-road stormwater projects were completed using state funds (Table 10). A total of 60 projects were funded and implemented by the State of Vermont in SFY2016-2019. Fifty-six of those projects were implementation projects and four were for assessment and planning for road erosion and culvert inventories. Corinth was the most active town with twelve projects funded for roads. All towns in Basin 14 have received funding to complete road related water quality projects from the State of Vermont.



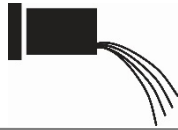
 DEVELOPED LANDS	DEVELOPED LANDS AND ROADS PROJECT OUTPUTS					2016	2017	2018	2019	TOTAL
	Acres of existing impervious surface treated by stormwater practices					-	-	-	-	-
	Miles of municipal road drainage and erosion control improvements					-	0.4	4	7	11
	Number of municipal road drainage and stream 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
 ROADS	DEVELOPED LANDS AND ROADS POLLUTANT REDUCTION									
	Pollutant reductions can currently only be estimated for phosphorus in the Lake Champlain and Lake Memphremagog basins									

Table 10. Results of developed lands clean water projects funded by State of Vermont agencies completed, SFY 2016-2019 in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed. Note: Does not include results of projects funded, but not yet completed.





## C. Wastewater

### Wastewater Treatment Facilities (WWTF)

There are two municipal wastewater treatment facilities that are subject to NPDES discharge permits in the basin (Table 11). These facilities are subject to State of Vermont issued NPDES permits.

An overarching consideration for the issuance of permits in the Basin 14 planning basin is the Long Island Sound TMDL for nitrogen. This multi-state TMDL has been promulgated with interim waste load and nonpoint source nitrogen load allocations. As of the issuance of this Plan, all facilities are operating under permits developed under a nitrogen permitting strategy whereby all Vermont WWTFs ultimately discharging to the Connecticut River must, collectively, discharge no more than 1,727 lbs. TN/day. Each individual facility has a unique total nitrogen (TN) loading limit. In addition to the nitrogen loading limit, WWTFs are required to develop optimization plans for maximizing nitrogen removal and regularly monitor for nitrogen compounds.

As part of an effort to be better informed about potential nutrient impacts, the WSMD, with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions to determine the “reasonable potential” that WWTFs have, to cause or contribute to downstream water quality impairment. Results of these investigations are recorded as part of permit issuance documentation. The municipal wastewater discharge permits in the Basin are shown in Table 11.

**Table 11. Basin 14 wastewater treatment facilities and other facilities subject to NPDES Direct Discharge Permits.**

Facility (permit ID)	Permit effective date	Permit expiration date	Permitted flow (MGD)	IWC* 7Q10 /LMM	Current Percent of Design Flow (2014-2019)	Treatment type	# of CSOs	Receiving water
<b>Bradford 3-1157</b>	March 2016	December 2020	0.137	0.010 /0.004	59%	Extended aeration	0	Waits River
<b>Hartford – WRJ 3-1225</b>	April 2018	March 2023	1.450	0.002 /0.001	58%	Sequencing batch reactor	5	Connecticut River

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

## Facility Specific Information

### Bradford


The Town of Bradford operates an extended aeration, secondary wastewater treatment facility that discharges to the Waits River. Disinfection is accomplished by means of liquid chlorine followed by dechlorination.

### Hartford – White River Junction

In 2014, the Hartford-WRJ WWTF underwent a significant facility upgrade. Previous treatment consisted of an extended aeration process and clarification for secondary treatment and chlorine addition for disinfection. The upgraded and expanded facility now consists of sequential batch reactors (SBR) for secondary treatment with an ultraviolet light disinfection system. The town is actively working on their CSO Long-Term Control Plan (LTCP) as required by the 2016 Vermont CSO Rule.

## Wastewater Projects Outcomes in Basin 14

The town of Ryegate was funded in 2016 and 2018 to complete designs and construction for a wastewater treatment facility refurbishment and wastewater collection system refurbishment (Table 12).



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	-	-	-	-	-

Table 12. Results of wastewater clean water projects funded by State of Vermont agencies completed, SFY 2016-2019 in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed. Note: Does not include results of projects funded, but not yet completed.

## Septic Systems

The State of Vermont adopted, on July 1, 2007, universal jurisdiction over the design, permitting, and installation of all new wastewater systems and potable water supplies including [septic systems](#). All new wastewater systems and potable water supplies need to obtain a [Wastewater System and Potable Water Supply Permit](#) for activities such as: subdivision of land; construction of a new building that needs a wastewater system (often referred to as sewage disposal or a septic system) or water supply; and repair and/or replacement of a failed wastewater system or water supply. Wastewater systems that have wastewater surfacing, backing up into the building or discharging to the waters of the State are considered failed systems. A permit is also required when there is an existing wastewater system and/or potable water supply but there will be an increase in water or wastewater design flows due to either a modification to, or a change in use of, a connected building.

Systems installed before July 1, 2007 and systems installed or receiving increased flows after 2007 that did not receive a permit could potentially discharge into surface waters if the system was not installed correctly and is located in close proximity to a river, lake, or wetland. Failed systems that discharge pollutants into surface waters are difficult to identify without landowner permission and there is no current regulatory tool that requires inspections of pre- or post-2007 wastewater systems on a regular basis unless specified in their permit. If a citizen observes signs of a failed septic system, they should contact their [Town Health Officer](#). There are programs that provide [financial assistance](#) to qualifying homeowners that need to upgrade their systems, but costly upgrades prevents many homeowners from upgrading their systems.

Momentum has been gaining in rural villages to explore options to deal with concerns about pollution from septic systems and growth in village centers that result in a need for centralized shared wastewater systems. A [demonstration project in the town of Warren, Vermont](#) was reported to the US Environmental Protection Agency as a different approach for managing wastewater in rural villages (Stone Environmental, Inc.). Areas with elevated *E. coli* levels like the Ompompanoosuc River in the town of Fairlee could benefit from this type of approach. An *E. coli* workgroup will be formed in 2020 to look at options for source identification, outreach and education, and implementation. Funding is the most common barrier to identifying and remediating *E. coli* sources. People are also concerned about reporting or putting financial strain on their neighbors with potentially failing systems.

## Septic Socials

Concerns around failing septic systems is especially important in lakeshore communities. Many camps along lakeshores were built before July 1, 2007 and many of the camps were built for seasonal occupancy. If a lake is experiencing an increase in nutrients or *E. coli*, it is often difficult to pinpoint the exact sources. Septic systems are usually a target. One way to get people informed about the health of their systems is to host a septic social. Septic socials are neighborhood gatherings where homeowners learn about the options for a well-functioning septic system and good maintenance practices, including household products that are kind to septic systems. The event provides an informal opportunity for people who may never have seen a septic system to learn about them. The host opens the gathering by talking about the importance of water quality protection. A septic system specialist discusses operation and maintenance of septic systems using the host homeowner's system as the demonstration model. Attendees are provided with brochures and other resource materials to take home. Septic socials are best for areas with old septic systems that may be having an impact on water quality. These places are often around lakes with old camps or buildings built for seasonal use that are now seeing more activity year-round. Septic socials can also be held in riverbank communities. More information about septic socials can be found at: <http://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/lake-wise-septic-system-socials>.



## D. Natural Resources

### Lakes

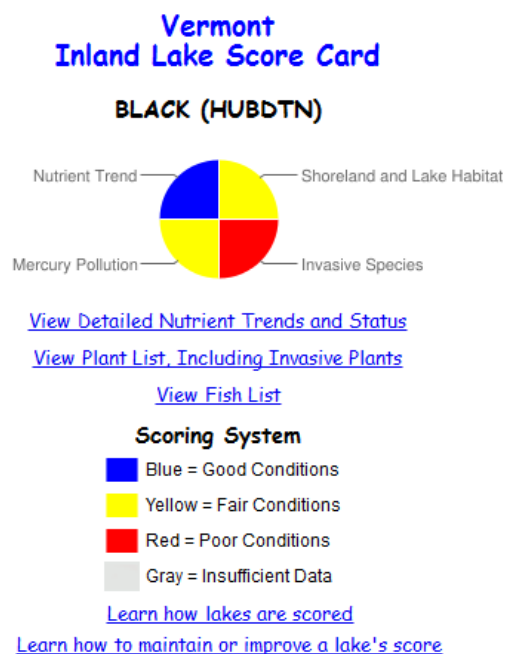
#### *Lakes and Ponds Monitoring and Assessment*

There are a total of 56 lakes and ponds listed in VDEC's lakes database in Basin 14. Thirty-one (55%) are ten acres or greater. All 31 lakes should be in accordance with the Vermont Hydrology Policy and meet the Hydrology Criteria (§29A-304) in the [2017 VT Water Quality Standards](#). Twenty-four of the 31 lakes are 20 acres or greater. The four largest lakes in order from largest to smallest are Lake Morey (549 acres), Lake Fairlee (461 acres), Groton Lake (435 acres) and Harveys Lake (357 acres).

Thirty-one lakes in Basin 14 have at least two ratings on the [VT Inland Lakes Scorecard](#) (Figure 12). The VT Inland Lake Score Card is a user-friendly interface developed by the Vermont Lakes and Ponds Management and Protection Program (VLPP) to share available data on overall lake health with lake users (see adjacent graphic). Lake-specific water quality and chemistry data can be accessed online through the [Vermont Integrated Watershed Assessment Information System \(IWIS\)](#). Of the 31 lakes monitored in Basin 14, poor conditions are reported on only seven lakes. Six poor condition ratings are for invasive species (Martins Pond, Ticklenaked Pond, Round Pond, Halls Lake, Lake Morey, and Lake Fairlee). Two poor conditions ratings are for shoreland and lake habitat (Harveys Lake and Lake Fairlee). One poor condition rating is for nutrient trend (Lake Fairlee). Seven lakes show good conditions for all parameters except for mercury pollution which is reported in fair condition statewide.

Those wishing to better understand the scoring process are encouraged to read the '[How Lakes Are Scored](#)' sections and watch the recorded [webinar](#) on the YouTube channel for the VDEC Watershed Management Division.

Lake users interested in becoming involved in the health of their favorite lake or pond should use the [Lake Score Card Checklist of Lake Protection Actions](#) as a first step to moving toward a healthier lake or pond. The following sections of the plan will provide a summary of the results from the lake scorecard.





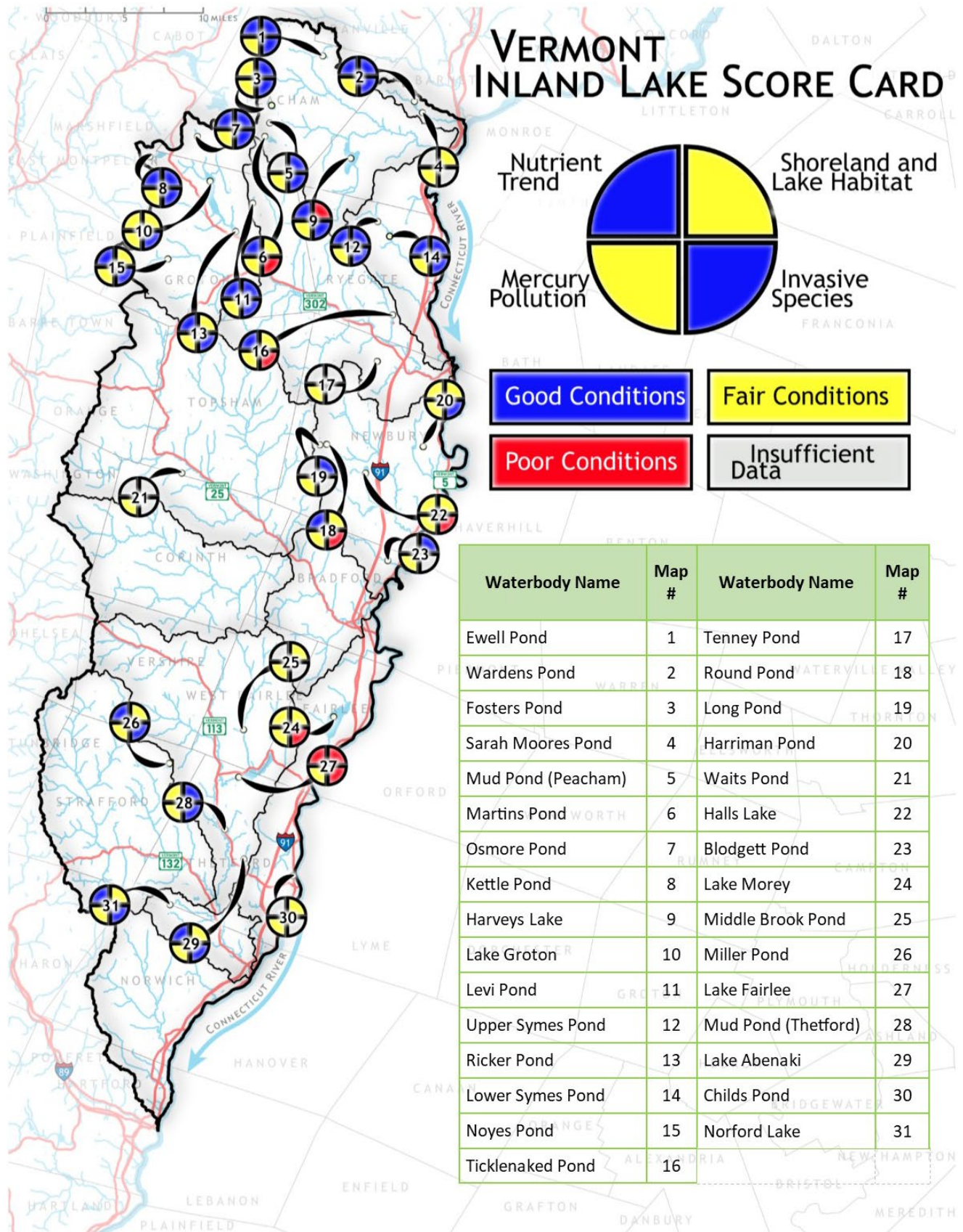


Figure 12. Scorecard information for lakes and ponds in Basin 14. Table shows lakes or ponds over 10 acres (except for Waits Pond which is 6 acres).

## Nutrient Trend

### Continued or Enhanced Monitoring

Six lakes - Fosters Pond in Peacham, Lake Groton in Groton, Harriman Pond and Halls Lake in Newbury, Lake Morey in Fairlee, and Mud Pond in Thetford - report fair conditions for nutrient trends. Fosters Pond and Halls Lake are showing a significant increase in spring total phosphorus (TP) concentrations, but summer TP trends have remained stable. Fosters Pond is considered an oligotrophic waterbody and has a small undeveloped watershed. There is logging activity within the watershed, but the reason for the increasing TP trend is not clear. Harriman Pond and Mud Pond in Thetford are showing a significant increase in spring TP but neither is not monitored in the summer months. The addition of a Lay Monitor for these two lakes would help to understand summer TP concentrations. Lake Morey is showing a significant increase in summer TP, but not spring TP. Lake Groton shows good overall water quality for TP, but the secchi depth is significantly decreasing which indicates a decrease in water clarity. This decrease in water clarity could be due to increased browning from acid-related conditions or increased turbidity. Further study into the decreased clarity is recommended.

### Restoration

One lake in Basin 14 – Lake Fairlee – is exhibiting a poor condition nutrient trend. Spring and summer TP are highly significantly increasing and the summer Secchi trend is significantly decreasing. A three-town committee consisting of representatives from Thetford, Fairlee, and West Fairlee have convened to address water quality concerns in Lake Fairlee. The group coordinated a lake tour with members of the committee, the Lake Fairlee Lay Monitor, WRNRCD, and VDEC water quality staff to discuss the history of lake water quality, land use around the lake, developing outreach and education materials for the communities, and developing a tributary water quality sampling program.

The 2009 [Ticklenaked Pond TMDL](#) continues to be carried out. Many water quality practices have been applied in the watershed to treat runoff from developed and agricultural lands. The alum treatment was applied in 2015 and has so far been successful. One toxic algae bloom was reported in August of 2017 after a particularly rainy summer and storm event in July 2017 that resulted in the discharge of sediment from a beaver pond into Ticklenaked. Overall TP levels in spring and summer have been decreasing since the treatment and **the pond is up for consideration for removal from the impaired waters list to the stressed waters list.** VDEC continues to monitor the pond and to support a lay monitor for the summer months. VDEC has also partner with CCNRCD to monitor the Scotch Burn tributary streams to track agricultural runoff. The Ticklenaked Pond Association has continued to stay engaged about the water quality condition of the lake. VDEC and the VDOH presented to the Ryegate Select Board and coordinated with the town to publish cyanobacteria warnings on their website. The Lake Wise Program will assess sites on the lake in the summer of 2020.

## Protection

Sixteen out of 31 lakes monitored in Basin 14 have a good condition rating for nutrient trend: Ewell Pond, Wardens Pond, Martins Pond, Harveys Lake, Lower Symes, Upper Symes Pond, Ricker Pond, Kettle Pond, Levi Pond, Osmore Pond, Round Pond, Noyes Pond, Ticklenaked Pond, Miller Pond, Lake Abenaki and Norford Lake (Figure 12). Kettle Pond, Levi Pond, Osmore Pond, Upper and Lower Symes Ponds, and Miller Pond have been recommended for protection by the VT Lakes and Ponds Program. Although Fosters Pond exhibits a fair condition for nutrient trends because of increasing TP, it is also one of the two oligotrophic lakes in Basin 14. Because of its oligotrophic status, Fosters is also recommended for water quality protection. This type of protection can be achieved in part by the state regulations for shoreland protection, but increased protection of tributary buffers, Lake Wise adoption by shoreland owners, and conservation of undeveloped lands by local organizations can increase protection of water quality.

## Invasive Species

Aquatic invasive species have been confirmed in six lakes in Basin 14. Lakes with the highest risk potential for invasive species introduction should take preemptive measures to prevent spread. Those lakes and ponds with public access areas (Fish and Wildlife Accesses) are good sites to host spread prevention signage and materials, public greeters, and Vermont Invasive Patrollers (VIP). The priority lakes and ponds for AIS outreach are Martins Pond (VFWD Access Area), Ticklenaked Pond (Town Public Beach and VFWD Access Area), Round Pond (Private Access Areas), Lake Fairlee (VFWD Access Area), Halls Lake and Lake Morey in Fairlee (VFWD Access Area).

## Shoreland Condition

Two lakes in the Basin 14 have a poor shoreland habitat condition: Harveys Lake and Lake Fairlee. Fifteen lakes have a fair shoreland score. Twelve ponds have shorelands in good condition including (Figure 12).

Effective July 1, 2014, the Vermont Legislature passed the Shoreland Protection Act (Chapter 49A of Title 10, §1441 et seq.), which regulates shoreland development within 250 feet of a lake's mean water level for all lakes greater than 10 acres in size. The intent of the Act is to prevent degradation of water quality in lakes, preserve habitat and natural stability of shorelines, and maintain the economic benefits of lakes and their shorelands. The Act seeks to balance good shoreland management and shoreland development.

Shoreland developed prior to July 1, 2014 is not required to retroactively meet standards. The Lake Wise Program, an Agency of Natural Resources initiative that awards lake-friendly shoreland property, including that of state parks, town beaches, private homes and businesses, is available to lakeshore owners and Lake Associations to assess shoreland property for improvements that benefit water quality and wildlife habitat. Lakes with a fair shoreland score will benefit from implementing Lake Wise Program best management practices. More information on the program can be found at: <http://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/what>.

Since 2015, twelve site visits have been conducted by the Lake Wise program to shoreland properties on Lake Fairlee (1), Lake Groton (2), Kettle Pond (1), Lake Morey (6), Noyes Pond (1), and Osmore Pond (1). Only five Lake Wise signs have been awarded to landowners on Lake Groton (2), Lake Morey (1), and Ricker Pond (2) compared to Seymour Lake (38) and Echo Lake (24) in the Memphremagog Basin. Three lakes in Basin 14 are a high priority for Lake Wise: Harveys Lake, Lake Fairlee, and Ticklenaked Pond.

## **Mercury Pollution**

There are two main airborne pollution types that affect lakes and ponds in Vermont: sulfur or nitrogen oxides and mercury. The latter is discussed here. Mercury contamination has resulted in fish consumption advisories in nearly every lake in Vermont and those of nearby states as well – so all lakes in Basin 14 get a fair condition score.

## ***Basin 14 Lake and Pond Fisheries***

Lakes and ponds that provide a quality fishing experience in Basin 14 are Martins Pond and Noyes Pond. Both ponds support naturally reproducing wild brook trout. Martins Pond is one of only five ponds in Vermont to support fishable populations of wild brook trout. Other notable fishing lakes are Lake Groton, Ricker Pond and Ticklenaked Pond for warm water species including smallmouth bass, largemouth bass, chain pickerel, yellow perch, brown bullhead, and sunfish. Lake Fairlee supports a wide diversity of species which provide fishing opportunities for largemouth bass, smallmouth bass, yellow perch, chain pickerel, rainbow smelt, pumpkinseed, rockbass, brown bullhead, rainbow trout (stocked) and brown trout (stocked). Miller Pond is managed with annual stockings of hatchery-reared brook trout and rainbow trout and supports largemouth bass, pumpkinseed and bluegill populations. The CCC Pond in Sharon is a small, shallow pond with abundant aquatic vegetation and supports a marginal largemouth bass and pumpkinseed population. Largemouth bass were illegally introduced to Levi Pond and a population has become established.

## ***Long-Term Monitoring of Acid Sensitive Lakes***

Sulfur and nitrogen oxides are largely transported to Vermont from out of state air emissions and are beyond this plan to address. The TMDL addressing the acid impaired lake in Basin 14 has been approved by EPA. The TMDL can be found at:

[http://dec.vermont.gov/sites/dec/files/documents/WSMD\\_mapp\\_TMDL\\_2004\\_Acid.pdf](http://dec.vermont.gov/sites/dec/files/documents/WSMD_mapp_TMDL_2004_Acid.pdf)

One small waterbody – Levi Pond – in Basin 14 is regularly sampled to ascertain impacts of acid precipitation. Levi Pond in Groton is considered impaired for acidity and is on Part D of the priority list of waters. Additionally, five lakes are considered acid stressed by the VT Lakes and Ponds Program (Table 4).



## Rivers

### *Bioassessment on Streams*

The Watershed Management Division (WSMD) in VDEC assesses the health of a waterbody using biological, chemical and physical criteria as described in the [Vermont Water Quality Monitoring Program Strategy 2011-2020](#) which was updated in 2015. Most of this data can be accessed through the [Vermont Integrated Watershed Information System](#), online data portal. The [biological sampling](#) of streams in VT is carried out by the WSMD using biological indices that measure the health of streams by looking at multiple parameters within macroinvertebrate and fish populations. Biomonitoring is best used for detecting aquatic life impairments and assessing their relative severity. A total of 42 macroinvertebrates and fish sampling events on 35 streams were completed in Basin 14 from 2016 to 2019 ([Appendix B](#)). A gap analysis of watersheds where aquatic life had not been recently assessed provides a list of waters recommended for monitoring in 2022 (Figure 13).

### Macroinvertebrate Monitoring Results

A total of 39 macroinvertebrates assessments were completed between 2016 and 2019.

Twenty-four sampling events exhibited macroinvertebrate communities in *very good* or better condition. Fifteen of those streams exhibited communities in excellent condition. Two streams of note are Mud Pond Brook at river mile 0.6 and Middle Brook at river mile 6.3. The macroinvertebrate and fish communities were both in *excellent* condition. Streams in *very good* or better condition are considered to support aquatic biota at class B(1) or higher.

Six sampling events exhibited macroinvertebrate communities in *good* condition. The following streams meet this condition: South Peacham Brook (2), Cloud Brook (1), Tannery Brook (1), Cookville Brook (1), and Charles Brown Brook (1). Three sites of note are South Peacham Brook, Cloud Brook and Charles Brown Brook. South Peacham Brook shows a better condition upstream of the Harvey Lake Dam. The site in good condition is located below the dam. The decrease in condition may attributed due to particulate export from the dam and a slight enrichment and warming below the dam. Cloud Brook was sampled after a flooding event and landslide. This site will be sampled again in 2022 to track signs of recovery. The Charles Brown Brook site was just above the Norwich Fire District Dam. The dam was removed in 2019. This site will be sampled again in 2022 to track condition. Sites in *good* to *good-very good* condition are considered to support aquatic biota.

Nine sampling events exhibited macroinvertebrate communities in *poor* to *fair* condition. The majority of these waters (8) except mine runoff. Each of these surface waters continue to be monitored before and after restoration efforts are implemented to track recovery.

Sites that are in *poor* condition do not meet water quality standards and require steps for mitigation. Three streams sampled from 2016-2019 were rated *poor*, Pike Hill Brook, Cookville Brook Tributary #4, and Lord Brook Tributary #2.

## Fish Monitoring Results

A total of 16 sampling events at 15 individual sites were sampled for fish in the Basin 14. Four sampling events sampled for fish were unable to be assessed. Two of the unassessed sites were small streams that had no fish, one site was a brook trout only stream, and the equipment failed at one site.

Eight sampling events exhibited fish communities in *excellent* condition: Mud Pond Brook, Tabor Branch Tributary #5, Middle Brook, South Peacham Brook, Roaring Brook, Abbot Brook Tributary #3, East Orange Branch Waits River and South Branch Wells River. Two sampling events exhibited fish communities in *very good* condition: Charles Brown Brook and North Branch Wells River. Streams in *very good* or better condition are considered to support aquatic biota at class B(1) or higher.

Four sampling events exhibited fish communities in *good* condition and one sampling event exhibited a fish community in *poor* condition. The following streams meet this condition: Peacham Hollow Brook below the dam, Waits River, Schoolhouse Brook, and Zebedee Brook showing *good* fish communities and Bloody Brook showing a *poor* fish community. Alternatively, the macroinvertebrate community in Bloody Brook exhibited *excellent* condition. Previous to the sampling effort was a severe flooding event that may have impacted brook trout habitat. This site will be resampled in 2022 to assess recovery. Those exhibiting *poor* condition do not meet water quality standards.

More information about the results of these sampling sites can be found in the Vermont [Integrated Watershed Information System](#) (IWIS).

## Flowing Water Fisheries

Water temperature data is collected by VFWD along several mainstem locations to assess potential impacts of warm summer water temperatures on salmonid populations. Streams recently monitored for temperature were the Ompompanoosuc and the Waits River. A report on stream temperature patterns was released in 2017 by a Dartmouth College graduate student. Reports are available to the public through the VFWD. Streams are also electrofished by VFWD. The results from this monitoring can be found in the list of B(1) streams for fishing (Figure 9).

A second focus of VFWD for fishery stream health is implementing strategic wood additions. This work has been done extensively north of the Basin 14 in state lands and has led to increase in brook trout habitat. Strategic wood additions are being scoped in Basin 14 in the Groton State Forest watershed and the Upper Waits. NRCS has been researching strategic wood addition in the Meadow Brook are in the South Branch Waits watershed starting with baseline temperature monitoring and trout surveys in collaboration with Trout Unlimited.

The Stevens River and tributaries support mostly cold-water fish habitat. The Wells River and tributaries support cold-water fish habitat high up in the watershed. The vast majority of streams within the Waits River watershed provide suitable habitat for naturally reproducing wild brook trout

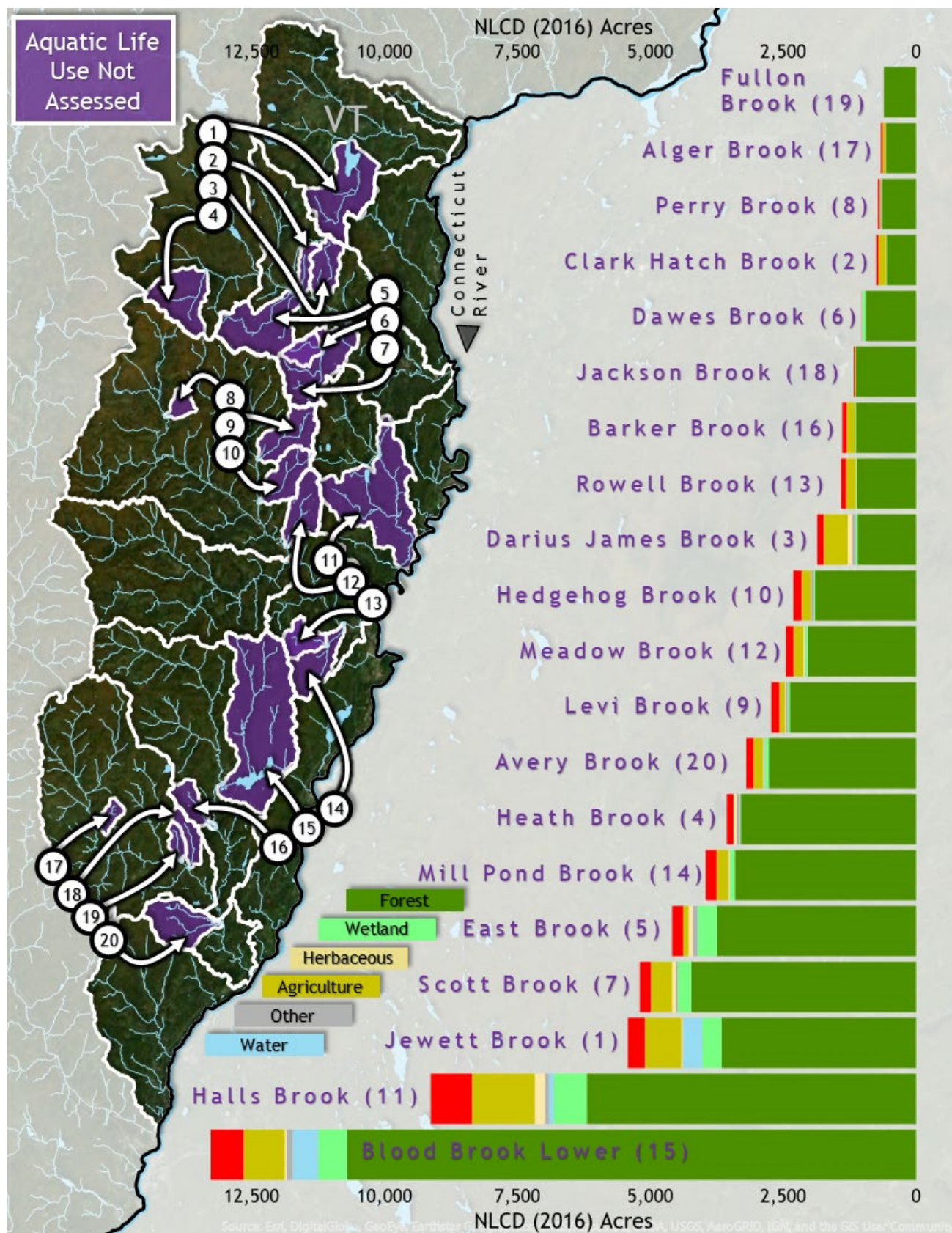


Figure 13. A gap analysis of river watersheds identified a number of priority areas for biological monitoring during the 2022 sampling rotation for Basin 14. Priority areas for monitoring are numbered and highlighted in purple.



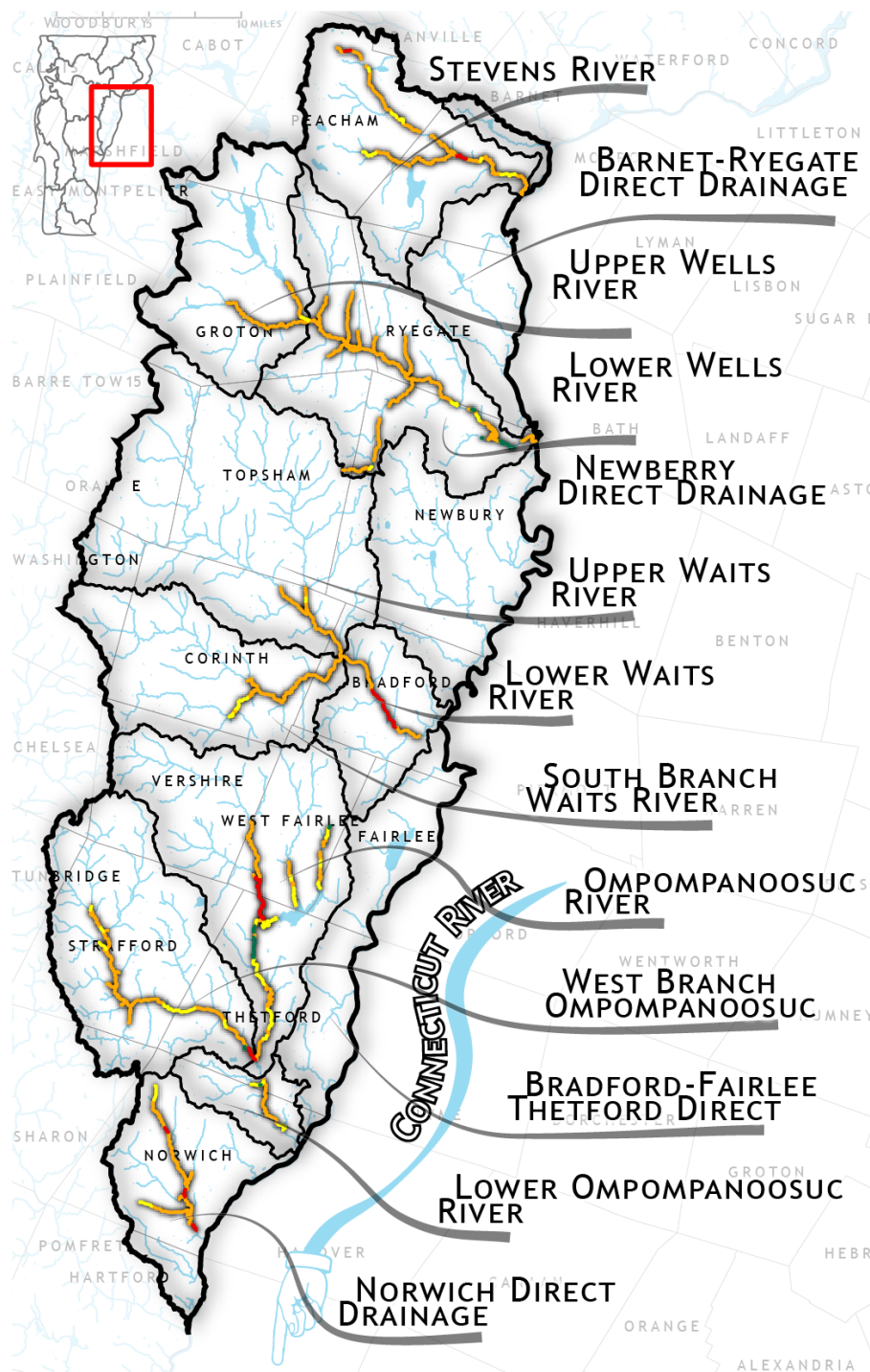
populations. Tributary streams of the Waits River basin are managed as wild trout waters – not stocked with hatchery-reared trout. Naturalized populations of wild rainbow and brown trout are not found in the Ompompanoosuc River despite decades of past stocking. Tributary streams of the Ompompanoosuc River are primarily managed as wild trout waters with the exception of the West Branch in Strafford.

### ***Stream Geomorphic Assessments***

Rivers are in a constant balancing act between the energy they produce and the work that must be done to carry the water, sediment and debris produced in their watersheds. A change in any one of these factors will cause adjustments of the other variables until the river system comes back into equilibrium (balance). These changes can be caused by natural events and by human activity. The impact of which may be seen immediately or for decades after the activity occurred.

The goal of managing toward, protecting, and restoring the equilibrium condition of Vermont rivers is to resolve or avoid conflicts between human investments and river dynamics in a manner that is technically sound, and both economically and ecologically sustainable.

While water quality in Basin 14 is good, the degraded geomorphic condition (Figure 14) of the basin's streams implies impacts to wildlife and



**Figure 14. Geomorphic condition of assessed streams in Basin 14 from reference to poor condition. Reference=green, good=orange, fair=yellow, poor=red.**



fish habitat (e.g. riparian buffer removal that reduces shading and habitat for insects that feed fish, and channel alteration that destroys aquatic habitat), public safety (e.g. loss of floodplains that store floodwaters, accelerated streambank erosion which results in infrastructure damage, and channel straightening that increases flow velocity during rain events) and water quality (e.g. higher *E. coli* populations caused by increased fine sediment resuspension and bank soil erosion, and nutrient and chemical runoff from encroachment of impervious surfaces and agricultural land). Seventy-three percent of assessed streams are in fair geomorphic condition, thirteen percent are in good condition, five percent are in poor condition, and two percent are in reference condition. Major stream alterations following flooding events like Tropical Storm Irene and more recent flooding events are a major driver of degraded geomorphic conditions in the Basin 14. The legacy from Irene and other intense storms will be felt for years to come. Managing towards stream equilibrium is essential for good water quality, healthy aquatic habitat, and flood resilience in the basin and will help to mitigate impacts of increased runoff and streamflow from climate change.

Between 2009 and 2016 six Phase II Stream Geomorphic Assessments (SGAs) were completed in Basin 14. Figure 14 also shows the geomorphic condition for those streams with completed Phase II SGAs. Most of the major sub-basin and their major tributaries have been assessed including the Stevens River, Waits River, Wells River, and Ompompanoosuc River.

A River Corridor Plan (RCP) includes the work completed in the Phase I and II SGAs based on protocols and guidelines developed by the Vermont River Management Program (Redstart Consulting). All SGAs and RCPs can be found at: <https://anrweb.vt.gov/DEC/SGA/finalReports.aspx>.

Where funding, local support, and interest exists, priority projects and objectives identified in these plans should be pursued.

### ***Stream Alteration Permits & Activities***

If an activity will change, alter, or modify the course, current, or cross section of any watercourse within or along the boundaries of VT, that activity may be require a permit. The VDEC Rivers Program issues permits covering three general areas of activities. These three areas are:

- Activities that involve construction or excavation in rivers and streams
- Activities exempt from municipal regulation in flood hazard areas and river corridors
- Activities that involve water withdrawals, dam removal, or hydroelectric power

A total of 135 stream alteration permits or activities were issued in towns in Basin 14 (Tunbridge, Sharon and Chelsea were not included) between 4/2016 and 1/2020. Of the 135 permits issued, 109 were Next Flood activities, 20 were General Permits, and 6 were Title 19 activities. Next Flood activities include those practices that involve protection and stabilization activities like culvert replacement, channel stabilization, structure stabilization, and removal of debris behind stream crossing such as culverts and bridges. These generally happen after flooding events and are in

response to emergency conditions. For example, 40 (30%) Next Flood activities took place in the months of July and August in 2017 after the [July 1, 2017 flooding event](#) in the Upper Valley. Norwich, Strafford, and Thetford convened 20 or more permits or activities during this time period. Of the 135 permits or activities, seven projects involved bridge replacements and 29 projects involved culvert replacement. Oversight on these replacements includes recommendations for the correct sizing of crossing structures to handle passing high waters and debris. Two projects were dam removals and one project was a bridge removal. Eight-four (62%) projects were to repair or protect manmade infrastructure, which provides support for why local zoning and bylaws for floodplain and river corridor protection are important. This plan does not provide estimates for the cost of this work, but assumes these fixes are costly and when culverts and bridges are sized correctly and structures are built in outside of floodplains and river corridors, they are more likely to weather the next storm or flood event.

### ***Local Zoning and Bylaws***

Local zoning, bylaws, and town plan policies can provide community specific protections and guidance to maintain and enhance local water resources. Local protections also afford benefits to downstream communities and water resource users. Although a town may have bylaws or town plan policies it does not mean their resources are afforded the strongest protection. Communities should work with their regional planning commissions to identify opportunities that provide their constituents with the highest level of natural resource protection within their means. Towns with high development pressure, significant impervious surface cover including roads, and significant development within proximity to water resources are a high priority for protection, as well as those areas with deficiencies related to their protective policies, zoning or bylaws.

- Protecting river corridors helps protect roads and structures from erosive damage, improves water quality, moderates flooding, and enhances wildlife habitat. River corridor protection, limits development close to stream and river channels to allow the channel to establish and maintain a least-erosive path through the valley lessening the need to armor channel edges. In recognition of historic settlement patterns, the DEC [model river corridor bylaw](#) provides for infill and redevelopment in designated centers and densely developed areas provided that new development does not further encroach on the river relative to pre-existing development.
- Local stormwater regulations prevent runoff of pollutants from hard surfaces into wetlands, rivers and lakes. Stormwater management also slows flow into waterbodies during some flood events.
- Smart planning and design for development through Local Hazard Mitigation Plans (LHMP), floodplain bylaws, and ERAF attainment in towns and villages saves money and lowers the risk of significant loss during flood events, while protecting water quality as an added benefit.

- Limiting development on steep slopes, ridgelines, and landslide hazard areas can protect high quality water resources and prevent excessive erosion and sedimentation to streams and lakes that impacts water quality and aquatic habitat.

Recommendations for local water resource protection goals are listed in the Implementation Table in [Chapter 5](#). For detailed information on municipal protectiveness for towns Basin 14, please see [Appendix C](#), Table C1.

### ***VDEC Hazard Area Bylaws and ERAF***

VDEC River Corridor and Floodplain Protection Program has prepared [model flood hazard bylaws](#) to assist municipalities in the development of their flood hazard regulations. These bylaws have been pre-reviewed by the Federal Emergency Management Agency (FEMA) and meet or exceed the requirements of the National Flood Insurance Program (NFIP). In addition, adoption and enforcement of Section D, River Corridors, qualifies communities for enhanced cost share under the Emergency Relief and Assistance Fund (ERAF).

ERAF provides State funding to match Federal Public Assistance after federally declared disasters. Eligible public costs are reimbursed by federal taxpayers at 75%. As of October 23, 2014, the State of Vermont contributes an additional 7.5% toward the costs. For communities that take specific steps to reduce flood damage the State will contribute 12.5% or 17.5% of the total cost. Only six towns in Basin 14 qualify for the 17.5% contribution. Towns that meet ERAF criteria protect water quality while protecting themselves financially. All towns are participating in the National Flood Insurance Program and have adopted the Town Road and Bridge Standards. Six towns do not have a Local Hazard Mitigation Plan, but all of the six are working on a new plan.

Questions regarding the model flood hazard bylaws and ERAF should be directed to the appropriate VDEC Regional Floodplain Manager:  
[https://dec.vermont.gov/sites/dec/files/wsm/rivers/docs/floodplain\\_mngr\\_regions.pdf](https://dec.vermont.gov/sites/dec/files/wsm/rivers/docs/floodplain_mngr_regions.pdf).

### ***Landslide, Rockfall and Erosion Mapping***

The Vermont Geological Survey responds to and monitors landslide and rockfall events, maps areas prone to erosion and landslides, and is working with our partners to implement [landslide hazard mapping protocols](#) (Clift and Springston) from the [State Hazard Mitigation Plan](#). In 2015 the Division began a [program to provide planning-level landslide hazard maps](#) for all Vermont counties, contingent upon funding and availability of Lidar. Landslide hazard susceptibility maps were prepared for Addison County, the Town of Highgate, and Washington County in 2016 - 2017; Chittenden County is in progress in 2018. The maps help Vermont prepare for safer growth and development, develop mitigation and hazard avoidance strategies (FEMA), avoid economic loss, and be prepared (USGS preparedness list) to respond to events.

Anyone can report a landslide to the Vermont Geological by visiting:  
<https://vtanr.maps.arcgis.com/apps/GeoForm/index.html?appid=505af0d19dd44faaa912ef3d5c80a3b6>.

## Wetlands

The VT Wetlands Program plays an integral role in protecting the State's surface water through wetland regulatory, protection, and monitoring activities. Between 2015 and 2019 approximately 160 projects were reviewed by VT Wetland Ecologists in Basin 14. Of those projects, only 21 resulted in permits where a wetland or buffer was altered. Eight were transportation related, two were solar, one was utility, and the remaining fell in no specific category. Projects that did not receive a permit resulted in wetland protection by locating projects outside the Class II wetland and 50-foot buffer and identifying the presence and partial boundaries of Class II wetlands for future reference.

### *Wetland Monitoring*

The Vermont Wetlands Program uses its Bioassessment project to gather data about the health of Vermont wetlands. Based on a 2017 analysis of bioassessment data, the principal factors that correlate with poor wetland condition are:

- presence of invasive species,
- disturbance to the wetland buffer or surrounding area,
- disturbance to wetland soils, and
- disturbance to wetland hydrology (how water moves through a wetland) through ditching (e.g. agricultural), filling (e.g. roads) and draining (e.g. culverts).

Wetlands in remote areas and at high elevations tend to be in good condition, with the most threatened wetlands occurring in areas of high development pressure and exhibiting habitat loss.

The VT Wetlands Bioassessment Project calculates the Coefficient of Conservation (CoC) at each assessed wetland. The CoC is a metric that uses the presence and abundance of plant species to evaluate wetland status. Plant species are identified either within a defined plot or within a single natural community type. Each plant has a designated score to indicate its tolerance of disturbance. These scores are averaged to determine the overall balance of disturbance-tolerant species in the wetland which can offer information on the level of disturbance in the wetland. CoC scores have been calculated from 40 species lists in this basin, with an average score of 4.4 which is on par for the state average. However, the wetlands surveyed may not be representative of the basin.

VRAM, the Vermont Rapid Assessment Method, is a method of rapidly assessing both condition and function of a wetland. Scores can range from 4 to 100. There are 34 VRAM plots in this basin. While these are not evenly distributed through the basin, they do include assessments at several wetland types at varying elevations. Scores range from a minimum of 46 to a maximum of 94 with a mean of 75. Wetlands with high scores tend to be higher in the watershed and often include softwood swamp and/or peatland. Wetlands which scored lower include wetlands in the immediate Connecticut River valley, shrub swamps, and wetlands where the surrounding landscape has been significantly altered by human activity.



Interested organizations and citizens can help build the dataset of wetlands in the White River Basin by conducting VRAM analysis. Individuals or groups interested in learning the VRAM protocol should contact Wetlands scientist Charlie Hohn at [Charlie.Hohn@vermont.gov](mailto:Charlie.Hohn@vermont.gov) for further information.

## ***Wetland Conservation and Mapping***

A new initiative is in progress for the protection of wetlands in Vermont. The state is currently working on a Wetlands Easement calculator to evaluate the value of wetlands for protection through the easement process. River Corridor Easements are used by the state and partner organizations to purchase channel management and development rights in the most sensitive and important areas along stream channels to encourage stream equilibrium, sediment and nutrient attenuation, and flood protection. The wetland conservation easements will be used in a similar way to protect and restore wetlands with significant function and values related to water quality, flood protection, climate change mitigation and wildlife habitat.

## **Forests**

### ***Forestry AMPs and Skidder Bridge Programs***

The Vermont Department of Forest Parks and Recreation (VDFPR) provides temporary steel truck bridge rental opportunities for loggers during timber harvests. When properly installed, used, and removed, portable temporary bridges minimize stream bank and stream bed disturbance as compared with alternative devices, such as culverts or poled fords. Portable skidder bridges are also economical because they are reusable, easy to install, and can be transported from job to job. In addition, these bridges reduce the occurrence of sedimentation, channeling, and any degradation of aquatic habitat, while allowing loggers to harvest timber in compliance with [The Acceptable Management Practices \(AMPs\) for Maintaining Water Quality on Logging Jobs in Vermont](#). For more information on the truck bridge rental program visit: <https://fpr.vermont.gov/forest/managing-your-woodlands/acceptable-management-practices/temporary-bridge-rentals>.

In March 2018, the VDFPR held a temporary skidder bridge lottery and twelve loggers and logging companies were chosen to receive bridges that were constructed by Fontaine Millworks in East Montpelier. The VDFPR will also be offering workshops for building bridges throughout the state. Specifications for building your own skidder bridge can be found here: <https://fpr.vermont.gov/skidder-bridges>.


The VDFPR updated the AMPs for Maintaining Water Quality on Logging Jobs in Vermont effective as of October 22, 2016. Vermont first adopted these rules 1987. The AMPs are intended and designed to prevent any mud, petroleum products and woody debris (logging slash) from entering the waters of the State and to otherwise minimize the risks to water quality. The AMPs are scientifically proven methods for loggers and landowners to follow for maintaining water quality and

minimizing erosion. The [new manual was published in 2019](#) and can be downloaded from VDFPR's website.

In addition to programs like the AMPs and skidder bridge rentals, AMP county foresters are available for consultation when questions arise about practices to protect water quality. A large portion of the headwaters of the northern part of Basin 14 is public land management by the VDFPR and VFWD. VDFPR has replaced and removed a majority of their stream crossing structures under forest roads to restore geomorphic condition of streams.

## Natural Resource Project Outcomes in Basin 14

Only a small number of natural resource projects were funded by the State of Vermont during SFY 2016 through 2019 (Table 13). The projects included evaluation of thermal refugia in the Wells River basin, three dam removal projects, a culvert project for fish passage, *E. coli* education and outreach in the Ompompanoosuc River basin, tree planting along the Wells River, and two river corridor easements. Additional projects have been funded through other mechanisms and are not required to be tracked in the Vermont Watershed Projects Database.



**NATURAL RESOURCES**

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					

Table 13. Results of natural resource clean water projects funded by State of Vermont agencies completed, SFY 2016-2019 in the Ompompanoosuc, Stevens, Waits, Wells Rivers watershed. Note: Does not include results of projects funded, but not yet completed.

## Chapter 5 – The Basin 14 Implementation Table

### A. Progress in Basin 14

The Tactical Basin Plan addresses all impaired, stressed and altered waters in the basin as well as protection needs for high quality waters. The list of actions in the Implementation Table (Table 14) and the Monitoring and Assessment Table (Table 15) cover future assessment and monitoring needs, as well as projects that protect or remediate waters and related education and outreach.

The Implementation Table provides a list of 51 priority actions created with the intention to be used as the go-to guide in the first step toward watershed action. A list of related individual project entries is found in the online [Watershed Projects Database](#) (WPD). The projects vary in level of priority based on the actions outlined in the summary. All projects in WPD are not expected to be completed over the next five years, but each action in the summary is expected to be pursued and reported upon in the following plan and updated in the WPD.

As projects are developed, priority for Clean Water Initiative Program funding will be given to those projects that achieve the highest water quality benefits. Additionally, projects that provide cumulative benefits (i.e. flood resiliency, water quality improvement, water resource protection, aquatic organism passage) will receive additional consideration for prioritization.

The previous Basin 14 was completed in 2015. A total of 85 action items were identified in the plan. Sixty-seven (79%) have been implemented or are in progress by VANR and its watershed partners, fifteen are awaiting action and have been carried over to this plan, and three have been discontinued (Figure 15). A report card for each of the 85 actions can be viewed in [Appendix A](#).

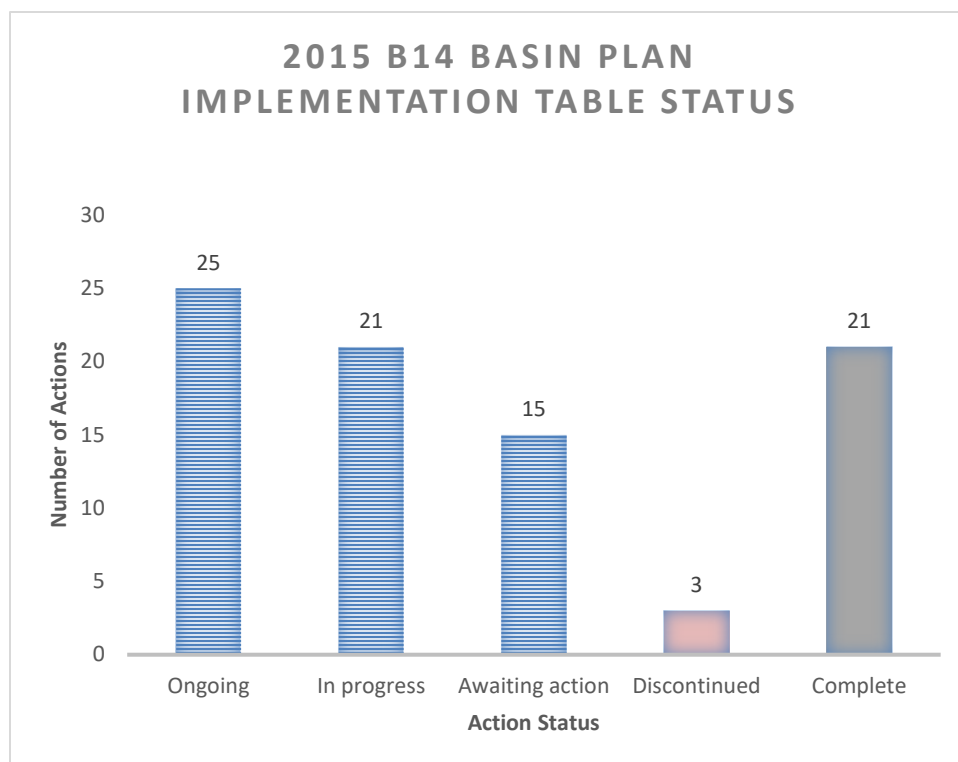


Figure 15. Status of the 85 priority actions identified in the 2015 Basin 14 plan. Sixty-seven (79%) are complete, ongoing, or in progress. Fifteen projects (18%) have been re-evaluated and will be carried over to the 2020 B14 plan.

The 2020 B14 Tactical Basin Plan builds upon those original plan recommendations by promoting specific, geographically explicit actions in areas of the basin that have been identified for intervention, using environmental modeling and on-the-ground monitoring and assessment data where available.

## **B. Basin 14 Priority Restoration, Protection, Monitoring & Assessment Actions**

The process for identifying priority actions is the result of a comprehensive compilation and review of both internal ANR monitoring and assessment data and reports, and those of our watershed partner organizations. The monitoring and assessment reports include, but are not limited to, stormwater mapping reports, geomorphic assessments, river corridor plans, bridge and culvert assessments, Hazard Mitigation Plans, agricultural modeling and assessments, road erosion inventories, biological and chemical monitoring, lake assessments, fisheries assessments, and natural communities and biological diversity mapping.

A summary of priority actions to address water quality in Basin 14 are identified in Table 14. The summary is the guiding list to go to as a first step for watershed action. The actions can be linked to the on-going detailed list of actions in the online [Watershed Projects Database](#).

The following tables serve to identify high priority implementation actions and tasks that provide opportunities for all stakeholders in surface water management across each major river basin to pursue and secure technical and financial support for implementation. For these priorities to be achieved, partners and stakeholders must help to carry out the actions identified in the basin plan.

Table 14, the Implementation Table Summary, provides a summary of strategies and actions to address water quality priorities by sector.

Table 15, the Monitoring and Assessment Table, provides a preliminary list of water quality monitoring priorities to guide monitoring over the next 5 years. This list has more sites than there is capacity to sample and as a result, will need further prioritization. This will occur during a monitoring summit before the 2022 field season.



## Basin 14 Implementation Table Summary

Table 14. Summary implementation actions for the Basin 14 tactical basin plan.

Action	Priority Area or Watershed	Town(s)	Partner(s)*	Funding*
<b>Actions to address runoff from Agricultural Lands</b>				
1. Focus ag BMP outreach and identification on Middle and Blood Brook tributaries to Lake Fairlee. Watershed focus area for RAP inspections.	Middle Brook, Blood Brook	Thetford, Fairlee, West Fairlee	WRNRCD, AAFM	TBPSG, ACWIP, CREP, EQIP, GWFS
2. Identify and remediate possible sources of impairment to the Tabor Branch Tributary, including agricultural sources.	Tabor branch tributary	Topsham	WRNRCD, AAFM	ACWIP, AAFM BMP
3. Continue coordination with agriculture specific workgroup for this watershed. Implement water quality monitoring on farms to measure effectiveness of BMPs and compare with 2012 monitoring data. Install water quality BMPs on farms to decrease runoff. Continue nutrient management planning.	Ticklenaked Pond	Ryegate	CCNRCD, VFWD, VDEC Lakes, NRCS, AAFM, VDEC WPP	TBPSG, ACWIP, CREP, EQIP, AAFM BMP
4. Focus area for RAP inspections. Reach out to farmers to identify WQ issues and work with farmers to fix. Initiate workgroup around source identification and community septic.	Ompompanoosuc River	West Fairlee, Thetford	AAFM, WRNRCD, VDEC WPP, Municipalities, Conservation Commissions	TBPSG, ACWIP, CREP, EQIP, CWI
5. Coordinate with Ag TSPs to determine if there is a gap in outreach and implementation of water quality BMPs along the CT River.	Connecticut River Mainstem	Connecticut River Towns	AAFM, NRCS, CRFWA	TBPSG
6. Extract agriculture focused projects from River Corridor Plans and share with B14 agriculture Technical Service Providers.	Surface Waters that have River Corridor Plans	TBD	DEC WPP	TBPSG, CWI, MEF
7. Develop specific BMP projects for farmers to submit to AAFM for funding.	Basinwide	All towns	AAFM, WRNRCD	ACWIP, AAFM BMPs
8. Develop and support equipment rental library management.	Basinwide	All towns	WRNRCD	ACWIP, CEAP
9. Build capacity of the CRWFA	Basinwide	All towns	CRWFA, WRNRCD	MEF, ACWIP
10. Form farm management teams to provide an organized contact for farmers around technical assistance for water quality protection.	Basinwide	All towns	AAFM, WRNRCD, NRCS, VLT, VHCB, CRC	ACWIP

Action	Priority Area or Watershed	Town(s)	Partner(s)*	Funding*
11. Continue funding for cover crop and no-till.	Basinwide	All towns	AAFM	AAFM FAP
12. Look into the possibility of the development and creation of an inter-seeding machine for cover cropping.	Basinwide	All towns	AAFM, CRFWA	MEF, AAFM CEAP
<b>Actions to address runoff from Developed Lands</b>				
13. Identify and remediate possible stormwater sources of impairment to the Tabor Branch Tributary.	Tabor Branch Tributary #6	Topsham	WRNRCD, AAFM, DEC, Town of Topsham Highway Department, landowners	VAOT MAB, TBPSG, Grant-in-Aid
14. Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping Reports have been completed.	Basinwide	Barnet, Chelsea, Corinth, Fairlee, Norwich, Orange, Peacham, Ryegate, Sharon, Strafford, Thetford, Topsham, Tunbridge, Washington	TRORC, VDEC, Municipalities	CWI, TBPSG, Grant-in-Aid
15. Develop stormwater master plans.	Dothan Brook, Harriman Brook, Connecticut River, Waits River	Hartford, Newbury, Bradford	TRORC, VDEC, Hartford, Newbury, Bradford	CWI, TBPSG, Grant-in-Aid
16. Complete Road Erosion Inventories (REIs) to meet Municipal Road General Permit (MRGP) requirements.	Waits River	Corinth, Strafford	Corinth, Strafford, Better Roads, TRORC, VDEC	VAOT MAB, Better Roads
17. Implement best management practices for high priority road segments identified in REIs to meet MRGP requirements.	Basinwide with a focus on South Peacham Brook in Barnet.	All towns	Municipalities, TRORC, NVDA, VDEC	VAOT MAB, Better Roads, Grant-in-Aid, CWI
18. Address potential erosion sources from municipal winter sand storage area.	Stevens River	Peacham	Peacham, VDEC, NVDA	VAOT MAB
19. Address runoff from the Town of Vershire's road sand storage area.	Vershire	Vershire	Vershire, VDEC, TRORC	VAOT MAB

Action	Priority Area or Watershed	Town(s)	Partner(s)*	Funding*
<b>Natural Resource Protection and Restoration - Wetlands</b>				
20. Conduct studies on potential Class I candidates and local outreach to municipalities and landowners to gauge interest in supporting Class I designations. Provide technical support for parties interested in submitting petitions.	Stoddard Swamp, Roy Mountain Swamp, Stillwater Brook Wetlands, Beaver Brook Wetlands, Lower Symes Pond, Cookville Swamp, Gillette Swamp, Conant Swamp, Zebedee Brook Wetlands	Peacham, Barnet, Groton, Ryegate, Corinth, Thetford	Municipalities, local stakeholders, VDEC, TROPIC, NVDA, VFPR, VFWD	TBPSG, 604(b) funds
21. Update wetland mapping.	Basinwide	All towns	VDEC, Municipalities	Municipal Planning Grants
22. Provide outreach and training to interested communities on conducting Vermont Rapid Assessment Method inventories.	Basinwide	All towns	VDEC, Municipalities	VDEC Wetlands Program, Municipal Planning Grant, VT Watershed Grant
<b>Natural Resource Protection and Restoration - Rivers</b>				
23. Increase Emergency Relief Assistance Fund (ERAF) rating by increasing municipal protections of water resources through local ordinances and the adoption of recommended standards and plans: river corridor protection, national floodplain insurance program, local emergency management plan, and local hazard mitigation plan. Continue to keep these plans up-to-date and implement their recommendations.	Basinwide	All towns	VDEC, Municipalities	Hazard Mitigation Grant, Municipal Planning Grant
24. Implement the Ompompanoosuc bacteria TMDL by identifying and remediating potential agricultural and septic sources, expanding and conserving riparian buffers and floodplains, and promoting septic system maintenance.	Ompompanoosuc River	Vershire, West Fairlee, Thetford	Vershire, West Fairlee, Thetford, VDEC, WRNRCD, CRC	TBPSG, MEF

Action	Priority Area or Watershed	Town(s)	Partner(s)*	Funding*
25. Form workgroup to assess water quality monitoring needs along the CT River. Coordinate with watershed partners to develop a plan on how to address lack of sampling.	Connecticut River Mainstem	Connecticut River Towns	CRC, CRJC, CRWFA, WRNRCD	TBPSG, CWI, MEF
26. Implement strategic wood addition to increase habitat and channel stability. Pursue other restoration opportunities along Waits using the River Corridor plan for reference. Targeted outreach for riparian restoration (plantings), CREP and RCE in this area. Provide technical outreach staff with messaging about benefits of wildlife, habitat, pollinators to help explain value of riparian buffers.	Waits River	Corinth, Bradford, Topsham	WRNRCD, AAFM, NRCS, Municipalities, Landowners, CRC	CREP, RCE Block Grant, Woody Riparian Buffer Block Grant, Act 76
27. Develop high priority actions identified in river corridor plans as the opportunity presents itself and resources are available.	Stevens River, Wells River, Waits River, Ompompanoosuc River, Bloody Brook	Peacham, Barnet, Ryegate, Groton, Newbury, Corinth, Bradford, West Fairlee, Thetford, Strafford, Norwich	VDEC, CRC, VRC, Municipalities, Landowners, NVDA, TRORC, WRNRCD, CCNRCD	TBPSG, CWI, MEF, WISPr
28. Address flow alteration issues and high flow backwash into Harveys Lake associated with the Harveys Lake dam.	South Peacham Brook and Harvey's Lake	Barnet	Town of Barnet, VDEC, Harveys Lake Association, VFWD	CWI, MEF
29. Inventory Groton State Forest lands within the sub-basin and identify streams that would benefit from in-stream habitat restoration practices. Implement these projects as appropriate	Wells & Waits River Headwaters	Peacham, Groton	VFPR, VFWD, TU, VDEC	EQIP, SWG
30. Assess candidates for reclassification on municipal and VFPR lands that have been identified in the 2020 Basin 14 TBP. These headwaters include North Branch of the Wells River, Red Brook, Beaver Brook, the South Branch of the Wells River, and the Waits River headwaters. Additional monitoring is recommended to determine if these waters meet criteria for reclassification for aquatic biota. The Waits River headwaters currently meeting the criteria for B(1) for fishing.	Wells River headwaters, Waits River headwaters	Peacham, Groton, Orange, Topsham, Washington	VDEC, VFPR, Municipalities	
31. Identify flow improvement opportunities associated with the Boltonville Dam and implement as appropriate. Flow demonstration will be conducted as part of Low Impact Hydro certification process which will require the project to meet WQS.	Wells River	Ryegate	VDEC, dam operator, VFWD	VDEC



Action	Priority Area or Watershed	Town(s)	Partner(s)*	Funding*
32. Initiate riparian buffer planting and protection projects along stressed and altered waters in the sub-basins: South Branch Waits, Waits River, Tabor Branch, and Cookville Brook.	South Branch Waits, Waits River, Tabor Branch, Cookville Brook	Corinth, Topsham	WRNRCD, DEC, AAFM, VTrans	CWI, MEF, SWG
33. Track flow improvement implementation associated with the Bradford Dam. Hydro facility is exempt from FERC licensing process. A low bypass has been recommended.	Waits River	Bradford	DEC, FWD, Dam Operator	
34. Determine the feasibility of removal of the Montague Rod and Reel Dams and develop these projects if there is interest and support.	Ompompanoosuc River West Fairlee and Thetford	Thetford	CRC, American Rivers, DEC, FWD, WRNRCD	TBPSG, MEF, CWI
35. Complete a riparian buffer inventory for the CT River corridor in Basin 14 to identify high priority planting sites to intercept runoff.	Mid-CT River and direct tributaries	Barnet, Ryegate, Newbury, Bradford, Fairlee, Thetford, Norwich, Hartford	VDEC	
36. Replace or retrofit high priority stream crossings that have been identified through previously completed or new the bridge and culvert assessment process. Conduct additional assessments as necessary.	Basinwide	All towns	VFWD, VFPR, VDEC, Municipalities, Landowners, VAOT MAB, CRC, CCNRCD, NVDA, TRORC, USFWS, NRCS	ERP, MEF, Better Roads, SWG
37. Assure the implementation of the Environmental Stewardship BMPs to reduce lead shot residue from entering waterways from the Thetford Fish and Game Club shooting range and complete follow-up monitoring.	Unnamed tributaries to Gillette Swamp and Ompompanoosuc River	Thetford	VDEC	
38. Support development for remediation plan for Pike Hill Mine Super Fund Site. WMPD currently coordinating with EPA on the remedial investigation to define the nature and extent of contamination and assessing the potential threats to human health and the environment. Timeline for actual site remediation and restoration of impacted streams and wetlands is 7-10 years.	Pike Hill Brook and Cookville tributary #4	Corinth	EPA, VDEC, VFWD, Landowner, Corinth	EPA Superfund
39. Complete and begin implementing the Ely Mine Implementation Plan. WMPD currently coordinating with EPA on finalizing the remedial design for site cleanup, which will include restoring Ely Brook, its tributaries and the onsite ponds to meet VT Water Quality Standards. Timeline for cleanup is 2-5 years.	Schoolhouse Brook and tributary	Vershire	EPA, VDEC, VFWD, Landowner, Vershire	EPA Superfund

Action	Priority Area or Watershed	Town(s)	Partner(s)*	Funding*
40. Expand and protect riparian buffers within the FERC jurisdictional impoundment associated with Wilder Dam.	CT River main stem riparian buffer (river right, Wilder Dam impoundment area)	Hartford, Norwich	VDEC, Great River Hydro	Great River Hydro
41. Increase conservation flows below the Wilder Dam and reduce the magnitude of peaking operations and water level fluctuations in the impoundment which would improve aquatic habitat in the Connecticut River, as appropriate related to the Wilder Dam on the Connecticut River through the FERC re-licensing and 401 Water Quality Certification process.	CT River main stem above and below Wilder Dam	None	VDEC, FWD, Great River Hydro	
<b>Natural Resource Protection and Restoration - Lakes</b>				
42. Provide technical support to the three-town water quality committee to develop a lake action plan to address phosphorus concerns on Lake Fairlee. Provide education to shoreland owners on Lake Wise BMPs. Implement road improvements around the lake to minimize runoff. Develop water quality monitoring plan for tributaries to Lake Fairlee where resources allow and continue in-lake lay monitoring.	Lake Fairlee & Tributaries	Thetford, Fairlee, West Fairlee	VDEC, VLMP, LPP, Volunteer Monitors	LPP, VLMP
43. Continue WQ monitoring and cyanobacteria monitoring.	Ewell Pond	Peacham	VDEC Lakes, VLMP, DEC WPP, Volunteer Monitor	VDEC, VLMP
44. Continue WQ monitoring, cyanobacteria monitoring and assessment and implementation of Lake Wise water quality BMPs on roads and shoreline properties.	Lake Morey	Fairlee	VDEC, VWID WPP, VLMP, Lake Morey Committee, LPP	LPP, VLMP
45. Continue to support volunteer water quality monitoring on lakes in the basin.	Fosters Pond, Lake Groton, Halls Pond, Harveys Lake, Lake Morey, Ticklenaked Pond	Peacham, Groton, Barnet, Newbury, Ryegate, Fairlee	VDEC Lakes, Lay Monitors	VLMP
46. Build local knowledge of shoreland best management practices among contractors, landscapers, and other shoreland site workers by offering a Shoreland Erosion Control Certification Course annually	Harveys Lake, Lake Morey, Lake Fairlee	Barnet, Fairlee, West Fairlee, Thetford	VDEC Lakes	CWI

Action	Priority Area or Watershed	Town(s)	Partner(s)*	Funding*
47. Continue to implement and support local Access Greeter programs.	Lake Fairlee, Harveys Lake, Lake Morey	Fairlee, West Fairlee, Thetford, Barnet	VDEC, lake Volunteers	ANS Grant
48. Recruit residents to join the Vermont Invasive Patrollers. There are currently no VIPs in this basin.	Kettle Pond, Lower Symes Pond, Mud Pond, Lake Abenaki, Harveys Lake, Halls Lake, Miller Pond, Lake Groton, Norford Lake, and Lake Morey.	Barnet, Bradford, Chelsea, Corinth, Fairlee, Groton, Hartford, Newbury, Norwich, Orange, Peacham, Ryegate, Sharon, Strafford, Thetford, Topsham, Tunbridge, Vershire, Washington, West Fairlee	VDEC, Lake Volunteers	ANS Grant
49. Continue variable-leaved milfoil surveys to confirm eradication. Plant survey completed in 2018. Survey will be conducted again in 2020 by DEC staff.	Halls Lake	Newbury	VDEC	
<b>Natural Resource Protection and Restoration - Forests</b>				
50. Provide outreach, technical assistance and workshops to private forestland owners, foresters, and loggers on AMPs, use of skidder bridges, and voluntary harvesting guidelines.	Basinwide	Barnet, Bradford, Chelsea, Corinth, Fairlee, Groton, Hartford, Newbury, Norwich, Orange, Peacham, Ryegate, Sharon, Strafford, Thetford, Topsham, Tunbridge, Vershire, Washington, West Fairlee	VFPR, VDEC, CCNRCD, WRNRCD	TBPSG, CWI
51. Implement forest infrastructure restoration projects on state lands such as culvert replacements or retrofits, road decommissioning where water quality benefits are identified through assessments and long-range management plans.	State lands in basin	Washington, Sharon, Orange, Groton, Peacham	VFPR, VFWD, TU	CWI, ERP

\*See List of acronyms on page x.

## Basin 14 Monitoring and Assessment Table

Table 15. Basin 14 priorities for monitoring and assessment. Monitoring on private lands requires landowner permission.

Waterbody	Project Description	Location	Partner(s)	Purpose
Lakes and Ponds				
1. Lake Morey	Lay monitor to collect in-lake chemistry	Fairlee	VDEC Lakes & Ponds, Lay Monitoring Volunteer	To identify sources of phosphorus leading to in-lake increased total phosphorus during spring and summer.
2. Lake Fairlee	Lay monitor to collect in-lake chemistry	Fairlee, West Fairlee, Thetford	VDEC Lakes & Ponds, Lay Monitoring Volunteer	Identify source(s) of increasing phosphorus trends and low dissolved oxygen.
3. Ticklenaked Pond	Lay monitor to collect in-lake chemistry	Ryegate	VDEC Lakes & Ponds, Lay Monitoring Volunteer	Continue summer and supplemental monitoring to track trends.
4. Harveys Lake	Lay monitor to collect in-lake chemistry	Barnet	VDEC Lakes & Ponds, Lay Monitoring Volunteer	Continue summer monitoring to track trends.
5. Ewell Pond	Continue WQ monitoring and cyanobacteria monitoring	Peacham	VDEC Lakes & Ponds, Lay Monitoring Volunteer	Monitor increasing phosphorus and decreasing DO levels. Determine the reason for the trend.
6. Miller Pond	Establish Lay Monitor	Strafford	VDEC Lakes & Ponds, Lay Monitoring Volunteer	One of only two oligotrophic lakes in Basin 14. This lake shows no signs of increasing spring TP and would benefit from summer monitoring to determine TP trends.
7. Fosters Pond	Lay monitor to collect in-lake chemistry	Peacham	VDEC Lakes & Ponds, Lay Monitoring Volunteer	Continue summer monitoring to track trends.
8. Lake Groton	Lay monitor to collect in-lake chemistry	Groton	VDEC Lakes & Ponds, Lay Monitoring Volunteer	Continue summer monitoring to track trends.
9. Abenaki Pond	Lay monitor or VDEC to collect in-lake chemistry	Thetford	VDEC Lakes & Ponds, Lay Monitoring Volunteer	Start collecting summer TP to determine if levels are normal.
10. Halls Lake	Complete AIS survey	Newbury	VDEC Lakes & Ponds	Confirm presence or absence of variable-leaved milfoil.
11. Kettle Pond	Monitor presence/absence of aquatic invasive species.	Marshfield, Groton	VDEC Lakes & Ponds, Vermont Invasive Patroller	To identify, track and prevent aquatic invasive species.
12. Lower Symes Pond	Monitor presence/absence of aquatic invasive species.	Ryegate	VDEC Lakes & Ponds, Vermont Invasive	To identify, track and prevent aquatic invasive species.



Waterbody	Project Description	Location	Partner(s)	Purpose
			Patroller	
13. Mud Pond	Monitor presence/absence of aquatic invasive species.	Peacham	VDEC Lakes & Ponds, Vermont Invasive Patroller	To identify, track and prevent aquatic invasive species.
14. Lake Abenaki	Monitor presence/absence of aquatic invasive species.	Thetford	VDEC Lakes & Ponds, Vermont Invasive Patroller	To identify, track and prevent aquatic invasive species.
15. Harveys Lake	Monitor presence/absence of aquatic invasive species.	Barnet	VDEC Lakes & Ponds, Vermont Invasive Patroller	To identify, track and prevent aquatic invasive species.
16. Halls Lake	Monitor presence/absence of aquatic invasive species.	Newbury	VDEC Lakes & Ponds, Vermont Invasive Patroller	To identify, track and prevent aquatic invasive species.
17. Miller Pond	Monitor presence/absence of aquatic invasive species.	Strafford	VDEC Lakes & Ponds, Vermont Invasive Patroller	To identify, track and prevent aquatic invasive species.
18. Lake Groton	Monitor presence/absence of aquatic invasive species.	Groton	VDEC Lakes & Ponds, Vermont Invasive Patroller	To identify, track and prevent aquatic invasive species.
19. Norford Lake	Monitor presence/absence of aquatic invasive species.	Norwich, Thetford	VDEC Lakes & Ponds, Vermont Invasive Patroller	To identify, track and prevent aquatic invasive species.
20. Lake Morey	Monitor presence/absence of aquatic invasive species.	Fairlee	VDEC Lakes & Ponds, Vermont Invasive Patroller	To identify, track and prevent aquatic invasive species.
<b>Rivers and Streams</b>				
21. Scotch Burn – Ticklenaked Pond tributary	Collect total Phosphorus and dissolved phosphorus at pre-determined sites on the Scotch Burn Brook tributary to Ticklenaked Pond	Ryegate	VDEC WID, CCNRCD	To identify current concentrations of phosphorus in Scotch Burn and its tributaries to Ticklenaked Pond. This information will be compared to 2012 sampling events to determine if levels of TP and DP in the streams are lower.
22. Lake Fairlee Tributaries	Collect total Phosphorus and dissolved phosphorus at pre-determined sites to understand phosphorus contributions of major	Fairlee, Thetford, West Fairlee	VDEC, Lake Fairlee Water Quality Committee, VDEC Basin Planner	Identify source(s) of increasing phosphorus trends and low dissolved oxygen.

Waterbody	Project Description	Location	Partner(s)	Purpose
	tributaries to the lake.			
23. Lake Morey tributaries	Collect tributary samples for one more year to understand phosphorus concentrations during based and freshet flows.	Fairlee	VDEC Lakes & Ponds, Monitoring Volunteer, VDEC Basin Planner	To identify sources of phosphorus leading to in-lake increased total phosphorus during spring runoff.
24. Dothan Brook	Biological and chemical monitoring	Hartford	VDEC MAP	To determine if reports about stormwater runoff are impacting water quality.
25. Charles Brown Brook	Biological and chemical monitoring	Norwich	VDEC MAP	To assess condition after dam removal.
26. Cloud Brook	Biological and chemical monitoring	Barnet	VDEC MAP	To assess condition 5 years after flood event and landslide.
27. Lower Blood Brook	Biological and chemical monitoring	Norwich	VDEC MAP	Data gap. Large watershed with no data.
28. Halls Brook	Biological and chemical monitoring	Newbury	VDEC MAP	Data gap. Large watershed with no data.
29. Jewett Brook	Biological and chemical monitoring	Ryegate, Barnet	VDEC MAP	Data gap. Large watershed with no data.
30. Scott Brook	Biological and chemical monitoring	Newbury	VDEC MAP	Data gap. Large watershed with no data.
31. East Brook	Biological and chemical monitoring	Groton	VDEC MAP	Data gap.
32. Mill Pond Brook	Biological and chemical monitoring	Bradford, Fairlee	VDEC MAP	Data gap.
33. Heath Brook	Biological and chemical monitoring	Groton	VDEC MAP	Data gap.
34. Avery Brook	Biological and chemical monitoring	Norwich, Thetford	VDEC MAP	Data gap.
35. Levi Brook	Biological and chemical monitoring	Topsham	VDEC MAP	Data gap.
36. Meadow Brook	Biological and chemical monitoring	Bradford	VDEC MAP	Data gap. This is a site where NRCS is scoping for strategic wood additions.
37. Darius James Brook	Biological and chemical monitoring	Ryegate	VDEC MAP	Data gap. Small stream with dense agricultural land use.
38. Peacham Hollow Brook	Biological and chemical monitoring	Barnet	VDEC MAP	Determine reclassification status for aquatic biota
39. Beaver Brook	Biological and chemical monitoring	Groton	VDEC MAP	Determine reclassification status for aquatic biota
40. North Branch Wells River	Biological and chemical monitoring	Groton	VDEC MAP	Determine reclassification status for aquatic biota
41. Red Brook	Biological and chemical monitoring	Groton	VDEC MAP	Determine reclassification status for aquatic biota
42. Glenn Falls Brook	Biological and chemical monitoring	Fairlee	VDEC MAP	Determine reclassification status for aquatic biota
43. Abbot Brook Trib #3	Biological and chemical monitoring	Strafford	VDEC MAP	Determine reclassification status for aquatic biota
44. Sargent Brook	Biological and chemical monitoring	Strafford	VDEC MAP	Determine reclassification status for aquatic biota
45. Sutton Brook	Biological and chemical monitoring	Barnet	VDEC MAP	Determine reclassification status for aquatic biota

Waterbody	Project Description	Location	Partner(s)	Purpose
46. McIndoe Falls Trib	Biological and chemical monitoring	Barnet	VDEC MAP	Determine reclassification status for aquatic biota
47. South Branch Wells River	Biological and chemical monitoring	Groton	VDEC MAP	Determine reclassification status for aquatic biota
48. Manchester Brook	Biological and chemical monitoring	Ryegate	VDEC MAP	Determine reclassification status for aquatic biota
49. Waits River	Biological and chemical monitoring	Thetford	VDEC MAP	Determine reclassification status for aquatic biota
50. East Orange Branch Waits River	Biological and chemical monitoring	Washington	VDEC MAP	Determine reclassification status for aquatic biota
<b>Wetlands</b>				
51. Upper and Lower Symes Wetland Complex	Lake-wetland complex bioassessment and biological monitoring.	Ryegate	DEC Lakes & Ponds, VDEC Wetlands	Determine biological condition and if site meets Class I wetland criteria
52. Stoddard Swamp	Bioassessment, WQ monitoring, wetland functions and values assessment	Peacham	VDEC Wetlands, VDEC MAP	Determine biological condition and if site meets Class I wetland criteria
53. Roy Mountain Swamp	Bioassessment, WQ monitoring, wetland functions and values assessment	Barnet	VDEC Wetlands, VDEC MAP	Determine biological condition and if site meets Class I wetland criteria
54. Stillwater Brook Wetlands	Bioassessment, WQ monitoring, wetland functions and values assessment	Groton	VDEC Wetlands, VDEC MAP	Determine biological condition and if site meets Class I wetland criteria
55. Beaver Brook Wetlands	Bioassessment, WQ monitoring, wetland functions and values assessment	Groton	VDEC Wetlands, VDEC MAP	Determine biological condition and if site meets Class I wetland criteria
56. Cookville Swamp	Bioassessment, WQ monitoring, wetland functions and values assessment	Corinth	VDEC Wetlands, VDEC MAP	Determine biological condition and if site meets Class I wetland criteria
57. Conant Swamp	Bioassessment, WQ monitoring, wetland functions and values assessment	Thetford	VDEC Wetlands	Determine biological condition and if site meets Class I wetland criteria
58. Zebedee Brook Wetlands	Bioassessment, WQ monitoring, wetland functions and values assessment	Thetford	VDEC Wetlands, VDEC MAP	Determine biological condition and if site meets Class I wetland criteria
59. Gillette Swamp	Wetland functions and values assessment	Thetford	VDEC Wetlands	Determine biological condition and if site meets Class I wetland criteria

## C. Coordination of Watershed Partners

There are several active organizations undertaking watershed monitoring, assessment, protection, restoration, and education and outreach projects in Basin 14. These partners are non-profit, private, state, and federal organizations working on both private and public lands. Partnerships are crucial in carrying out non-regulatory actions to improve water quality. Caledonia Natural Resources Conservation District (CNRCD), Central Vermont Regional Planning Commission, Connecticut River Conservancy, Northeastern Vermont Development Association, Two Rivers Ottauquechee Regional Commission, US Fish and Wildlife Service, Vermont River Conservancy, White River Natural Resource Conservation District (WRNRCD), lake associations, and municipal groups including local conservation commissions are active in:

- providing outreach and education to local stakeholders, private landowners, and municipalities;
- developing stream and floodplain protection and restoration projects (e.g. river corridor easements, tree plantings, culvert and bridge upgrades, dam removals, stream channel habitat restoration);
- developing stormwater projects (e.g. stormwater master plans, road erosion inventories, implementation of town road BMPs);
- and monitoring water quality (e.g. lay monitoring program on lakes, *E. coli* and nutrient monitoring in rivers).

Partners active in working with farms in the basin developing and implementing BMPs for water quality include Natural Resource Conservation Service (NRCS), Agency Agriculture Food and Markets (AAFM), CNRCD, WRNRCD, VDEC, Connecticut River Farmers Watershed Alliance (CRFWA), and the University of Vermont Extension Service.

The large amount of work that is necessary to meet water quality targets in this basin require collaborations among all these groups to maximize the effectiveness of watershed partners. Without funding or partners, little of this work would be possible.



## List of Acronyms

604(b)	Federal Clean Water Act, Section 604b	NWSC	North Woods Stewardship Center
ACWIP	Agricultural Clean Water Initiative Grant Program	ORW	Outstanding Resource Water
AIS	Aquatic Invasive Species	RAP	Required Agricultural Practices
AMPs	Acceptable Management Practices (for logging)	RCPP	Regional Conservation Partnership Program
ANS	Aquatic Nuisance Species	RMP	River Management Program
AOP	Aquatic Organism Passage	RPC	Regional Planning Commission
BASS	VDEC Biomonitoring and Aquatic Studies Section	SFO	Small Farm Operation
BMP	Best Management Practices	SGA	Stream Geomorphic Assessment
CCNRCD	Caledonia County Natural Resources Conservation District	SWMP	Stormwater Master Plan
CEAP	Capital Equipment Assistance Program	TBP	Tactical Basin Plan
CRC	Connecticut River Conservancy	TBPSG	Tactical Basin Planning Support Grants
CRWFA	Connecticut River Watershed Farmers Alliance	TMDL	Total Maximum Daily Load
CREP	Conservation Reserve Enhancement Program	TNC	The Nature Conservancy
CVRPC	Central Vermont Regional Planning Commission	TRORC	Two Rivers Ottauquechee Regional Commission
CWI	Clean Water Initiative Grant Funding	TS4	Transportation Separate Storm Sewer System General Permit
CWIP	Clean Water Initiative Program	TPL	Trust for Public Lands
CWSRF	Clean Water State Revolving Fund	TU	Trout Unlimited
DWSRF	Drinking Water State Revolving Fund	USDA	United States Department of Agriculture
EBTJV	Eastern Brook Trout Joint Venture	USEPA	United States Environmental Protection Agency
EQIP	Environmental Quality Incentive Program	USFWS	United States Fish and Wildlife Service
ERP	Ecosystem Restoration Program	USGS	United States Geological Survey
FAP	Farm Agronomic Practices	UVA	Use Value Appraisal program, or Current Use Program
GIS	Geographic Information System	UVM Ext.	University of Vermont Extension Service
GSI	Green Stormwater Infrastructure	VAAFM	Vermont Agency of Agriculture, Food, and Markets
IDDE	Illicit Discharge Detection (and) Elimination	VACD	Vermont Association of Conservation Districts
LFO	Large farm Operation	VANR	Vermont Agency of Natural Resources
Lidar	Light Detection and Ranging	VAOT	Vermont Agency of Transportation
LIS	Long Island Sound	VDEC	Vermont Department of Environmental Conservation
LTP	Land Treatment Plan	VDFPR	Vermont Department of Forests, Parks and Recreation

MAB	Municipal Assistance Bureau
MAPP	Monitoring, Assessment and Planning Program
MEF	Upper Connecticut River Mitigation and Enhancement Fund
MFO	Medium Farm Operation
MPG	Municipal Planning Grant
MRGP	Municipal Roads General Permit
NFIP	National Flood Insurance Program
NFWF	National Fish and Wildlife Foundation
NMP	Nutrient Management Plan
NPS	Non-point source pollution
NRCD	Natural Resources Conservation District
NRCS	Natural Resources Conservation Service
NVDA	Northeast Vermont Development Association

VFWD	Vermont Fish and Wildlife Department
VHCB	Vermont Housing and Conservation Board
VIP	Vermont Invasive Patrollers
VLCT	Vermont League of Cities and Towns
VLRP	Vermont Local Roads Program
VLT	Vermont Land Trust
VRC	Vermont Rivers Conservancy
VWQS	Vermont Water Quality Standards
VYCC	Vermont Youth Conservation Corp
WISPr	Water Infrastructure Sponsorship Program
WRNRCD	White River Natural Resources Conservation District

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## Appendix A. 2015 Basin 14 TBP Implementation Table Status Update

Overall, work completed in the watershed since the publication of the previous Tactical Basin Plan has allowed several assessments and efforts to support the implementation of specific actions. This includes mapping and assessing road and stormwater infrastructure, rivers and streams, agricultural land and wetlands. Extensive work has been done in partnership with the Connecticut River Conservancy, Two Rivers-Ottawaquechee Regional Commission, Northern Vermont Development Association, Central Vermont Regional Planning Commission, Caledonia NRCD, White River NRCD, town based organizations, non-profits, and divisions of state and federal government as well as landowners to work towards restoring impaired waters and managing the watershed for healthier rivers, wetlands, and lakes. Conservation projects and especially buffer projects have increased the total land under conservation, and towns and villages throughout the watershed are working to increase flood preparedness, reduce erosion and green their infrastructure for better water quality.

Table A1. 2015 Basin 14 report card with 2019 updates from local, state and federal watershed partners.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 01 - Continue to regularly monitor waters in this basin through the Sample Palooza interstate monitoring program to better determine nutrient load sources as part of the Long Island Sound Nitrogen TMDL implementation.	Basinwide	Gather additional nutrient water quality data to better direct ANR and partners' watershed protection and restoration work in the watershed.	DEC, NH DES, and CRC	Monitoring	Ongoing	Samples were collected and results were published from 2015-2018. Ask Marie for results to create a simple graphical display of averages.
Action 02 - Continue to support volunteer water quality monitoring on lakes in the basin - Fosters, Groton, Halls, Harveys, Morey, Ticklenaked.	Basinwide	Gather additional nutrient water quality data to better direct ANR and partners' watershed protection and restoration work in the watershed.	DEC and local lakes volunteers	Monitoring	Ongoing	All currently monitored. Ticklenaked has a new monitor for next year. Lake Fairlee and Martins Pond is also being monitored. Tributary monitoring on Morey and potentially on Lake Fairlee. Lake monitor on Ricker Pond.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
<b>Action 03 - Hold workshop(s) in the watershed showcasing and demonstrating practices to protect water quality: Findings from the Vermont Timber Harvesting Assessment, AMP Revision, Voluntary Harvesting Guidelines for Vermont Landowners</b>	Basinwide	Promote sustainable timber harvesting practices to control soil erosion and reduce sedimentation to waterways.	FPR, DEC, and Center for Northern Woodlands	Forestry	Ongoing	Along with the work on State Land, FPR continues to do training with Vermont Loggers on properly implementing the AMPs and to actively incentivize loggers to utilize temporary skidder bridges through the availability of cost share programs and low-cost rentals for loggers and landowners. In 2017 there was a LEAP (Logger Education to Advance Professionalism) workshop in Groton where a training was held on AMP implementation, job closeout, the Vermont Wetland Rules, and the proper use of skidder bridges. This workshop was attended by loggers and foresters. The AMPs were updated in 2018. One of the significant changes is improved guidance for installing or repairing permanent culverts on intermittent streams. The new AMP manual will be completed in the summer of 2019.
<b>Action 04 - Assist municipalities in developing Stormwater Master Plans that identify and remediate sources of stormwater-related NPS pollution in Village Centers through educational work sessions.</b>	Basinwide	Remediate impacts of impervious surface-related stressors to waters.	TRORC, DEC, Watershed towns	Stormwater	In progress	Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping has been completed.
<b>Action 05 - Build local knowledge of shoreland best management practices among contractors, landscapers, and other shoreland site workers by offering a Shoreland Erosion Control Certification Course annually</b>	Basinwide	Promote littoral habitat protection on lakes by control of shoreland soil erosion, nutrient loss and sedimentation.	DEC	Lakes & Ponds	Ongoing	Some coordination with WRNRCD, but turnover in staff (loss of local partner). Will try in the next five years to focus shoreland training in Basin 14 and plan to coordinate with NRCD. Focus outreach on camps, businesses, and private landowners. Lake Morey did a septic local 2018 with large turnout.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 06 - Recruit homeowners, recreation area managers, and state parks to demonstration sites showcasing shoreland BMPs.	Basinwide	Promote littoral habitat protection on lakes by control of shoreland soil erosion, nutrient loss and sedimentation.	DEC and FPR	Lakes & Ponds	In progress	Some activity. Check in with Lake Morey - Greg. Informal trainings and discussions on Lake Fairlee. Lake Wise assessment completed on Groton - parking and access sites need work. Kettle Pond - 2017
Action 07 - Continue to support local Access Greeter programs on Lakes Fairlee, Harveys, and Morey	Basinwide	Reduce the spread of invasive species and protect existing biodiversity in basin lakes.	DEC and lake volunteers	Lakes & Ponds	Ongoing	All three lakes maintained Greeter Programs in 2019.
Action 08 - Recruit residents to join the Vermont Invasive Patrollers. There are currently no VIPs in this basin	Basinwide	Reduce the spread of invasive species and protect existing biodiversity in basin lakes.	DEC and lake volunteers	Lakes & Ponds	Awaiting action	No VIPs currently exist in this basin on priority lakes and ponds. Priority areas for VIPs are: Kettle Pond, Lower Symes Pond, Mud Pond, Lake Abenaki, Harveys Lake, Halls Lake, Miller Pond, Lake Groton, Norford Lake, and Lake Morey.
Action 09- Complete agricultural AEM assessments Tier 1 and 2 in the watershed identified by agricultural partners and implement priority BMPs contained within. Focus areas include Peacham Hollow Brook, Stevens River, South Peacham Brook, Cloud Brook, Willow Brook, Unnamed tributary to Harveys Lake (Appendix G.1).	<a href="#">Peacham Hollow Brook, Stevens River, South Peacham Brook, Cloud Brook, Willow Brook, Unnamed tributary to Harveys Lake</a>	Address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	CCNRCD, small farmers, VACD, AAFM, and DEC	Agriculture	Ongoing	In 2017, AAFM water quality staff began conducting outreach and educational visits (equivalent to Tier 1s) in the Basin 14 watershed to small farm and Certified Small Farm Operations (CSFOs) to inform them of the newly revised Required Agricultural Practices (RAPs) regulations, share technical and financial assistance resources, and introduce AAFM water quality staff. During these visits, some CSFOs opted to have an inspection (equivalent to Tier 2s). For other CSFOs, AAFM water quality staff followed up in 2017 and 2018 to conduct water quality inspections. Outreach visits and inspections of all sized farm operations is ongoing in the watershed. AAFM technical and financial assistance (equivalent to Tier 3), such as the Best Management Practices (BMP) program and Farm Agronomic Practices (FAP) program, continues to be available in the Basin 14 watershed. Three

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
						CREP projects have been completed in Basin 14 since 2015, two in the Ompompanoosuc and one in the Wells River.
<b>Action 10 - Prepare road erosion inventories and capital budgets targeting medium and high priority road segments using the ANR Atlas Road Erosion Risk Ranking and implement BMPs accordingly.</b>	Towns of Peacham and Barnet	Address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	Towns of Peacham and Barnet, BBR program, NVDA, and DEC	Stormwater	Ongoing	Peacham and Barnet REI were completed using the 2017 format. These inventories will be converted and available online by Sept 30, 2019. Capital budgets are not part of the current REI deliverables to towns. NVDA is in the process with these towns. Implementation tables and follow up meetings with towns are forthcoming during the Fall of 2019.
<b>Action 11 - Address potential erosion sources from municipal winter sand storage area</b>	Town of Peacham	Address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	Town of Peacham, DEC, and NVDA	Stormwater	Awaiting action	No information on outreach to the town. Recommend that NVDA and Basin Planner reach out to town for discussion.



Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 12- Replace or retrofit high priority stream crossings that have been identified through previously completed or new the bridge and culvert assessment process. Conduct additional assessments as necessary.	<a href="#">Stevens River watershed- 3 high priority structures have been identified (See Appendix J.) for specific crossings</a>	Identify and remediate dams and undersized stream crossings that contribute to stream disequilibrium and/or hinder aquatic organism passage.	Towns of Peacham and Barnet, landowners, VTrans, CRC, CCNRCD, DEC, FWD, and NVDA	Rivers	Ongoing	Many culverts have been identified as geomorphically incompatible (n=39) and a barrier to fish passage (n=445) throughout the basin. In 2019 VFWD completed a survey of culverts statewide to update the database. Because staff resources and funds are limited for culvert and bridge replacement projects, only a small number of these projects can be expected to be completed. However, when funding is available, these projects will be prioritized based on their water quality and habitat benefit on a case-by-case basis. In addition, any structure replacements or retrofits that go through the VT Stream Alteration permit process will automatically be required to be resized to meet geomorphic standards.
Action 13- Develop projects identified in river corridor plan as high priority actions	<a href="#">Stevens River Watershed- 9 high priority reaches have been identified (See Appendix J.)</a>	Restore, maintain, and protect stream equilibrium and floodplain attenuation assets and flood resiliency.	DEC, CRC, CCNRCD, Towns of Barnet and Peacham, landowners, NVDA, and VTrans	Rivers	Ongoing	Coordinated meeting with watershed partners to develop plan for prioritization of projects for development and implementation. Caledonia NRCD and CRC are partners for the Stevens River Watershed. CRC completed a buffer planting in Barnet in 2018 and completed a bioengineering and planting project on the Stevens in Barnet in 2019. Additional plantings are scheduled along both sides of the Stevens River from the crossing of I-91 to the Barnet Village Dam.
Action 14- Address flow alteration issues associated with the Harvey's Lake dam	South Peacham Brook and Harvey's Lake	Address flow alteration issues in the watershed.	Town of Barnet, DEC, Harvey's Lake Association, FWD	Rivers	In progress	Study on dam removal and lake level maintenance completed. Funding currently unavailable to implement new dam at lake outlet with the removal of the existing dam on South Peacham Brook. Funding received for 60% design that will be reviewed and a determination made to bring to 100% design. Town has been advised to cease lake level manipulations of current dam.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
<b>Action 15- Collect additional assessment data for Stoddard Swamp and, if appropriate, support the re-classification of this wetland ecosystem as a Class 1 wetland</b>	Stoddard Swamp	Gather additional water quality data to better direct ANR and partners' watershed protection and restoration work in the watershed.	DEC and FWD NGNH	Protection	Complete	Site visit completed by VT Wetlands Program. Stoddard Swamp is a relatively small wetland but one with several state significant natural community types as well as a good-condition beaver wetland. Plant diversity is high and significant animal habitat is also present. The wetland is owned by the Department of Fish and Wildlife. The wetland does likely meet the criteria for Class I if petitioned by a watershed/conservation group, but the Wetlands program is not planning to petition it at this time.
<b>Action 16- Add additional biological monitoring sites within this sub-watershed to better prioritize watershed protection and restoration measures</b>	South Peacham Brook and tributaries, East Peacham Brook and tributaries	Gather additional water quality data to better direct ANR and partners' watershed protection and restoration work in the watershed.	DEC	Monitoring	Complete	14 data gaps were filled with biomonitoring by VT DEC MAPP including South Peacham Brook and Peacham Hollow Brook.
<b>Action 17- DEC recommends that South Peacham Hollow Brook be re-classified from A2 to B since it is no longer used as a public water supply</b>	South Peacham Hollow Brook	Reclassify waters to better reflect current and future waters management and protection goals.	DEC and the Town of Peacham	Protection	Awaiting action	No information on outreach to the town. Recommend that TRORC and Basin Planner reach out to town for discussion.
<b>Action 18- Complete shoreland and lake habitat surveys to better direct lakeshore protection and restoration efforts</b>	Ewell Pond, Mud Pond (Peacham)	Protect VHQP lakes and ponds and undeveloped lakeshores and important wetland ecosystem complexes.	DEC	Lakes & Ponds	Complete	Lake Assessment and lake shoreland score complete.
<b>Action 19- Protect the ecologically significant Jewett Brook and associated wetland complexes by expanding the Roy Mountain Wildlife Management Area (to include all these areas Figure 2).</b>	Jewett Brook and adjacent lands	Protect VHQP lakes and ponds and undeveloped lakeshores and important wetland ecosystem complexes.	DEC, FWD, LARC	Protection	Awaiting action	The Jewett Brook complex is identified as an important aquatic habitat and species assembly as a priority target for ecologically functional landscape in the Vermont Conservation Design March 2018 report. Protection and improvement or removal of artificial barriers is recommended to maintain its current

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
						function.
Action 20(a)- Continue to implement the Ticklenaked Pond TMDL post-restoration monitoring and remove from the D-List of Waters when and if appropriate.	Ticklenaked Pond	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	DEC	Monitoring	Ongoing	2018 meeting with Ryegate Selectboard on cyanobacteria blooms and risks to public health. Volunteer trained to track cyanobacteria blooms, bloom reports are hosted on town website, monitoring is ongoing with plan to repeat targeted monitoring in 2020, and outreach to Lake Association, private landowners and town completed in 2019 on implementing BMPs on farms, roads and lakeshores. Annual check-in with Lake Association established.
Action 20(b)- Implement high priority agricultural BMPs and protection measures in the Ticklenaked Pond watershed. Two farms have been specifically targeted for additional BMP installation. Practices include barn roof gutters, barnyard management, manure storage, gully stabilization, milk house waste management, and livestock exclusion.	<a href="#">Ticklenaked Pond watershed (See Appendices G.1 and K.)</a>	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	DEC, AAFM, NRCS, White River NRCD and ARS	Agriculture	In progress	Ag Workgroup established to report on actions to meet the TMDL. AAFM BMP program provided technical and financial assistance to implement clean water diversion and management practices on one farm in the Ticklenaked Pond watershed. The farm is currently working with NRCS planners to apply for EQIP assistance to implement additional BMP practices. Livestock exclusion fencing and laneway installed at one farm. Partial barnyard improvements at one farm, but more work needed. Both farms completed Nutrient Management Plans. Corn fields near key tributary seeded down. Manure storage application with NRCS filed for one farm.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 21- Develop a monitoring plan for the Town of Newbury old landfill site	Wells River, Newbury	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	Town of Newbury, DEC	Monitoring	In progress	In 2016 additional site work was completed at existing groundwater monitoring wells to better understand groundwater flow and potential discharge from the Newbury landfill. A revised post-closure plan developed from this work is currently under consideration as part of the post-closure certification application for this site. DEC MAPP attempted to monitor the receiving waters (Wells River) in 2018, but there was not an adequate site for access. Staff will follow up during next monitoring rotation.
Action 22- Develop a revised new monitoring plan for the Newbury Paper Sludge site. Develop and implement a remediation plan to address metal discharges from the site.	Wells River, Newbury	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	DEC Sites Management Program and property owner	Monitoring	Discontinued	2014 water quality sampling of water chemistry and macroinvertebrate communities indicates the receiving water of the leachate seeps meets the VT Water Quality Standards. The macroinvertebrate community is in excellent condition and water chemistry did not show elevated levels of metals associated with the seeps. DEC will continue to monitor this site over time to ensure it continues to meet the VT Water Quality Standards.
Action 23- Complete agricultural AEM assessments Tier 1 and 2 in the watershed identified by agricultural partners and implement priority BMPs contained within	<a href="#">Wells River and tributaries (See Appendices G.1 and K.)</a>	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	CC and White River NRCs, AAFM, VACD, small farmers, and DEC	Agriculture	Ongoing	AAFM outreach, inspections, and technical and financial assistance ongoing. See notes in Action #9. In Fall of 2019 WRNRC is applying for funding to conduct BMP surveys.
Action 24- Prepare road erosion inventories and capital budgets targeting medium and high priority road segments using the ANR Atlas Road Erosion Risk Analysis and implement BMPs accordingly.	Towns of Ryegate, Groton, and Newbury (Capital budget completed for Groton)	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	Towns of Ryegate, Groton, and Newbury, BBR, NVDA, TRORC, and DEC	Stormwater	Complete	All REIs are complete. Implementation plans are complete. NVDA has not reviewed the data with Ryegate and Groton. This is a part of the process that NVDA will carry out in Fall 2019.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 25- Replace or retrofit high priority stream crossings that have been identified through previously completed or new the bridge and culvert assessment process. Conduct additional assessments as necessary.	<a href="#">Wells River watershed- 3 high priority crossings (See Appendix J.)</a>	Identify and remediate dams and undersized stream crossings that contribute to stream disequilibrium and/or hinder aquatic organism passage.	Towns of Ryegate, Groton, Newbury, VTTrans, FPR, landowners, FWD, DEC, USFWS, NRCS, CRC, CC and White River NRCDs, NVDA, TRORC, and DEC	Rivers	Ongoing	5 upsized culverts on Swamp Road within Lower Wells River watershed. Part of a 2018 Grants-In-Aid project. Many culverts have been identified as geomorphically incompatible (n=39) and a barrier to fish passage (n=445) throughout the basin. In 2019 VFWD completed a survey of culverts statewide to update the database. Because staff resources and funds are limited for culvert and bridge replacement projects, only a small number of these projects can be expected to be completed. However, when funding is available, these projects will be prioritized based on their water quality and habitat benefit on a case-by-case basis. In addition, any structure replacements or retrofits that go through the VT Stream Alteration permit process will automatically be required to be resized to meet geomorphic standards.
Action 26- Develop projects identified in river corridor plan as high priority actions	<a href="#">Wells River watershed- 6 high priority reaches have been identified (see Appendix J.)</a>	Restore, maintain, and protect stream equilibrium and floodplain attenuation assets and flood resiliency.	Towns of Ryegate, Groton, and Newbury, DEC, NVDA, TRORC, CC and White River NRCD and CRC.	Rivers	Ongoing	CRC and Caledonia NRCD finalized Phase 2 SGA in 2016 for Ryegate and Groton. Clough River Corridor Easement on ~84 acres of Wells River Corridor in Ryegate, executed in 2016. Buffer Planting was completed in Newbury by CCNRCD. Coordinated meeting with watershed partners to develop plan for prioritization of projects for development and implementation. Caledonia NRCD and CRC are partners for the Stevens River Watershed.



Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 27- Prepare an infrastructure-river conflict management plan and restoration designs for Wells River Village. Implement plan and design recommendations if appropriate.	Wells River within Wells River Village	Restore, maintain, and protect stream equilibrium and floodplain attenuation assets and flood resiliency.	Town of Newbury, Wells River Village, DEC, and TRORC	Protection	Complete	In 2017 the Town of Newbury and the Village of Wells River adopted their 2016 Multi-Jurisdictional Local Hazard mitigation plan. This plan includes hazards analysis, projects and activities, and a map depicting critical facilities, town infrastructure, the NFIP designated floodway, and 100-year and 500-year floodplain additions. The Town will monitor, evaluate, and update the Local Hazard Mitigation Plan at Selectboard meetings and after every federally declared disaster directly impacting the Town.
Action 28- Implement the removal of Groton Village Number 9 dam	Wells River, Groton	Improve in-stream aquatic habitat and passage.	CRC, American Rivers, USFWS, FWD, DEC, Town of Groton, TU, and landowner	Rivers	Complete	Dam was removed in 2015.
Action 29- Inventory Groton State Forest lands within the sub-basin and identify streams that would benefit from in-stream habitat restoration practices. Implement these projects as appropriate	Waters within Groton State Forest	Improve in-stream aquatic habitat and passage.	FPR, FWD, TU, and DEC	Rivers	In progress	FWD is currently working to identify areas for instream aquatic habitat restoration.
Action 30- Further protect the important functions and values of Peacham Bog by re-classifying the wetland ecosystem from Class 2 to Class 1	Peacham Bog	Reclassify waters to better reflect current and future waters management and protection goals.	DEC and FPR	Protection	Complete	Peacham Bog Wetland was re-classified as a Class I wetland in 2017.
Action 31- Pending. *Referred to Chapter 3, page 56, paragraph 3 in 2015 plan. Correct reference is Chapter 3, page 48 paragraph 3).	Wells River headwaters	Reclassify waters to better reflect current and future waters management and protection goals.	DEC and FPR	Protection	In progress	Waterbodies that are candidates for reclassification on FPR lands have been identified in the 2020 Basin 14 TBP. These headwaters include North Branch of the Wells River, Red Brook, Beaver Brook, and the South Branch of the Wells River. Additional monitoring is recommended to

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
						determine if these waters meet criteria for reclassification for aquatic biota.
<b>Action 32- Add new biomonitoring sites in this Sub-watershed to potentially to better prioritize watershed protection and restoration measures. Includes Beaver Brook, Osmore Brook, Stillwater Brook, Red Brook, North Branch, Coldwater Brook, Tannery Brook, Wells River (update RM 4.4 and 10.5).</b>	Beaver Brook, Osmore Brook, Stillwater Brook, Red Brook, North Branch, Coldwater Brook, Wells River (update RM 4.4 and 10.5).	Gather additional water quality data to better direct ANR and partners' watershed protection and restoration work in the watershed.	DEC	Monitoring	In progress	14 data gaps were filled with biomonitoring by VT DEC MAPP including Red Brook.
<b>Action 33- Identify flow improvement opportunities associated with the Boltonville Dam, and implement as appropriate,</b>	Wells River, Ryegate	Address flow alteration issues in the watershed.	DEC, dam operator, FWD	Rivers	In progress	Flow demonstration will be conducted as part of Low Impact Hydro certification process which will require the project to meet WQS.
<b>Action 34(a) - Implement high priority recommendations included within the Wells River Stormwater Infrastructure Mapping Reports</b>	<a href="#">Wells River (Watersheds 9 and 12- top priority 11-second priority)</a>	Remediate impacts of impervious surface-related stressors to waters.	TRORC, Wells River (Newbury), and DEC	Stormwater	Awaiting action	Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping has been completed.
<b>Action 34(b) - Implement high priority recommendations included within the Boltonville Stormwater Infrastructure Mapping Report.</b>	<a href="#">Boltonville (Watersheds 2 and 3)</a>	Remediate impacts of impervious surface-related stressors to waters.	TRORC, Boltonville (Newbury), and DEC	Stormwater	Awaiting action	Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping has been completed.
<b>Action 34(c) - Implement high priority recommendations included within the Ryegate Stormwater Infrastructure</b>	<a href="#">East Ryegate (Watershed 8)</a>	Remediate impacts of impervious surface-related stressors to waters.	NVDA, Ryegate, and DEC	Stormwater	Awaiting action	Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping has been completed.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Mapping Report.						
Action 34(d) - Implement high priority recommendations included within the Groton Stormwater Infrastructure Mapping Report.	<a href="#">Groton Village (Watershed 6)</a>	Remediate impacts of impervious surface-related stressors to waters.	NVDA, Groton, and DEC	Stormwater	In progress	Groton will be developing HMGP starting in October. NVDA will look at the SW mapping in the process.
Action 35- Complete shoreland and lake habitat surveys to better direct lakeshore protection and restoration efforts on Ricker Pond, Levi Pond, Noyes Pond, Kettle Pond, and Osmore Pond.	Ricker Pond, Levi Pond, Noyes Pond, Kettle Pond, and Osmore Pond	Protect VHQP lakes and ponds and undeveloped lakeshores and important wetland ecosystem complexes.	DEC, FPR, FWD	Monitoring	Complete	Lake Assessment and lake shoreland score complete. No FWD access, only FPR.
Action 36- Identify and remediate possible sources of impairment to the Tabor Branch Tributary, including agricultural and road-related sources.	Tabor Branch watershed	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	WRNRCD, AAFM, DEC, Town of Topsham Highway Department, landowners	Monitoring	In progress	Monitoring will be carried out in spring and summer of 2020. Recommend focused outreach by ag technical service provider. Water quality inspections are ongoing with AAFM.
Action 37- Initiate riparian buffer planting and protection projects along stressed and altered waters in the sub-basins: South Branch Waits, Waits River, Tabor Branch, and Cookville.	<a href="#">South Branch Waits, Waits River, Tabor Branch, Cookville (see appendix G.1 and K)</a>	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	WRNRCD, DEC, AAFM, VTrans	Rivers	Ongoing	Riparian projects through AAFM are ongoing. TRORC reports two culverts upsized and one culvert added on Ben Dexter Road which crosses Tabor Branch. Updates were a part of 2017 Grants-In-Aid project. No direct stream crossings but culverts are within floodplain.
Action 38- Determine the feasibility of improving in-stream aquatic habitat and implement if appropriate on the Waits River mainstem downstream of South Branch Confluence.	Waits River main stem-downstream of South Branch confluence	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	FWD, DEC, CRC, WRNRCD	Rivers	In progress	Focus will be prioritized on headwaters for both in-stream aquatic habitat restoration and riparian protection and restoration. Restoration on lower sections of the Waits will be based on interest and feasibility. Temp logger data from 2007 and 2019 will be synthesized in a report by VFWD.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 40- Develop a remediation plan for Pike Hill Mine Super Fund Site.	Pike Hill Brook and Cookville tributary number 4 watersheds	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	EPA, DEC, FWD, and landowner	Other	In progress	WMPD currently coordinating with EPA on the remedial investigation to define the nature and extent of contamination and assessing the potential threats to human health and the environment. Timeline for actual site remediation and restoration of impacted streams and wetlands is unknown but for planning purposes 7-10 years. Sampled in 2014 and 2019 for fishing by VFWD.
Action 41- Complete agricultural AEM assessments Tier 1 and 2 in the watershed identified by agricultural partners and implement priority BMPs contained within: Waits River, South Branch, and Tabor Branch.	<a href="#">Waits River, South Branch, Tabor Branch (see appendices G.1 and K)</a>	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	WRNRCD, VACD, AAFM, and DEC	Agriculture	Ongoing	AAFM outreach, inspections, and technical and financial assistance ongoing. See notes in Action #9.
Action 42- Prepare road erosion inventories and capital budgets targeting medium and high priority road segments using the ANR Atlas Road Erosion Risk Ranking and implement BMPs accordingly in Bradford, Corinth, Topsham, and Washington.	Waits	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	TRORC, CVRPC, DEC, BBR, Bradford, Corinth, Topsham, and Washington	Stormwater	Ongoing	BMPs funded by Better Roads in Orange. Corinth REI completed in 2017. Topsham REI planned for 2019 (funding secured). REI for Washington and Orange scheduled for summer 2019. Bradford REI & culvert inventory planned for 2020 (funding secured).
Action 43- Develop projects identified in river corridor plan as high priority actions in Waits River watershed high priority reaches.	<a href="#">Waits River watershed- 30 high priority reaches have been identified (See Appendix J)</a>	Restore, maintain, and protect stream equilibrium and floodplain attenuation assets and flood resiliency.	CRC, DEC, WRNRCD, TRORC, watershed towns	Rivers	Ongoing	Bank stabilization buffer in Bradford. CRC completed root wad and buffer planting project in 2015.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 44- Replace or retrofit high priority stream crossings that have been identified through previously completed or new the bridge and culvert assessment process. Conduct additional assessments as necessary.	<a href="#">Waits River watershed- 20 high priority structures have been identified (Appendix J)</a>	Identify and remediate dams and undersized stream crossings that contribute to stream disequilibrium and/or hinder aquatic organism passage.	Watershed towns, VTrans, FPR, landowners, FWD, DEC, USFWS, NRCS, CRC, CC and White River NRCD, TRORC, and DEC	Rivers	Ongoing	Culvert Replacements completed through VTrans Grant-in-Aid projects: multiple culvert replacements and upsizing in South Branch Waits River watershed, multiple replacements in Lower Waits River watershed, and replacements and added culverts in the Tabor Branch watershed. CRC replaced a high priority culvert on Abbott Brook in Strafford with the help of VFWD in 2016. Many culverts have been identified as geomorphically incompatible (n=39) and a barrier to fish passage (n=445) throughout the basin. In 2019 VFWD completed a survey of culverts statewide to update the database. Because staff resources and funds are limited for culvert and bridge replacement projects, only a small number of these projects can be expected to be completed. However, when funding is available, these projects will be prioritized based on their water quality and habitat benefit on a case-by-case basis. In addition, any structure replacements or retrofits that go through the VT Stream Alteration permit process will automatically be required to be resized to meet geomorphic standards.
Action 45- Pending. *Referred to Chapter 3, page 56, paragraph 3 in 2015 plan. Correct reference is Chapter 3, page 48 paragraph 3).	Waits River headwaters	Reclassify waters to better reflect current and future waters management and protection goals.	DEC and FPR	Protection	In progress	Waterbodies that are candidates for reclassification on FPR lands have been identified in the 2020 Basin 14 TBP. These include the Waits River headwaters and tributaries. Additional monitoring is recommended to determine if these waters meet criteria for reclassification for aquatic biota. These waters currently meet the criteria for B(1) fisheries.



Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 47- Implement high priority recommendations included within the Bradford Stormwater Infrastructure Mapping Reports.	<a href="#">Bradford Village - Watershed's first priority - 26, 18, 22 second priority - 20 and 21 third priority 16 and 32</a>	Remediate impacts of impervious surface-related stressors to waters.	Town and Village of Bradford, TRORC, DEC	Stormwater	Awaiting action	Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping has been completed.
Action 48- Implement the Ompompanoosuc bacteria TMDL by identifying and remediating potential agricultural and septic sources, expanding and conserving riparian buffers and floodplains, and promoting septic system maintenance.	East Branch Ompompanoosuc	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	Towns of Vershire, West Fairlee, and Thetford, DEC, WRNRCD, CRC, and UVLT	Other	Ongoing	Monitoring, outreach and education completed by town of Fairlee. Outreach and education are ongoing and opportunities are being explored as they arise to improve private wastewater systems and agricultural practices. More Ag outreach should be focused in the high <i>E. coli</i> areas.
Action 49- Develop a better understanding of current water quality conditions of the bacteria impaired reach of the Ompompanoosuc with additional water quality monitoring	Impaired section of the East Branch Ompompanoosuc and tributaries	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	Towns of Vershire, West Fairlee, and Thetford, DEC, WRNRCD, CRC, and UVLT	Monitoring	Ongoing	WRNRCD partnered with West Fairlee CC to conduct a septic social and received a DEC grant to do septic education. WRNRCD funded the printing of septic awareness brochures. Most of the households that could potentially be contributing to the water quality impairment cannot afford to remediate the problem and there is no available cost share. WRNRCD is hoping to develop an educational program by the elementary school in West Fairlee.
Action 50- Continue the implementation of the Elizabeth Mine Remediation Plan and monitoring – evaluate feasibility of developing Use Attainability Analysis for aquatic habitat in Copperas Brook.	West Branch Ompompanoosuc, Lord Brook, Copperas Brook	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	EPA, DEC, Towns of Strafford and Thetford	Monitoring	Complete	Elizabeth Mine remediation mostly completed. Treatment switched from active to passive. Monitoring will follow.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 51- Complete and begin implementing the Ely Mine Implementation Plan	Schoolhouse Brook and tributary	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	EPA, DEC, FWD, Town of Thetford	Other	In progress	WMPD currently coordinating with EPA on finalizing the remedial design for site cleanup, which will include restoring Ely Brook, its tributaries and the onsite ponds to meet VT Water Quality Standards. Timeline for cleanup is 2-5 years.
Action 52(a)- Assure the implementation of the Environmental Stewardship BMPs to reduce lead shot residue from entering waterways from the Thetford Fish and Game Club shooting range.	Unnamed tributary to Gillette Swamp, Thetford	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	Town of Thetford, Fish and Game Club, DEC WMPD, and FWD	Other	Ongoing	The Environmental Management Plan was developed in 2016 in coordination with the DEC Waste Management and Prevention Division and included a calendar of actions for completion.
Action 52(b)- Conduct monitoring at the Thetford Fish and Game Club to determine efficacy of BMP implementation at this shooting range.	Unnamed tributary to Gillette Swamp, Thetford	Identify and remediate stressors responsible causing water quality impairments and stressed waters.	DEC WMD and WMPD	Monitoring	Complete	Previous monitoring showed that surface waters in the watershed met Vermont Water Quality Standards, but levels were elevated. Post sampling should be completed in 2022 to confirm efficacy of Environmental Management Plan.
Action 53- Complete agricultural AEM assessments Tier 1 and 2 in the watershed identified by agricultural partners and implement priority BMPs contained within	<a href="#">Ompompanoosuc watershed, with a focus on the East Branch watershed (See Appendices G.1 and K.)</a>	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	WRNRCD, VACD, AAFM, and DEC	Agriculture	Complete	Assessments completed. AAFM outreach, inspections, and technical and financial assistance ongoing. See notes in Action #9.
Action 54(a)- Prepare road erosion inventories and capital budgets targeting medium and high priority road segments using the ANR Atlas Road Erosion Risk Ranking and implement BMPs accordingly.	Vershire, West Fairlee, Thetford and Strafford	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	TORC, DEC, BBR, Vershire, West Fairlee, and Strafford	Stormwater	Complete	Vershire REI & culvert inventory completed; West Fairlee REI completed with culvert inventory and high priority segment determination currently in progress; Thetford REI on track to be finished this year (TRORC not doing this REI); Strafford REI completed. Vershire, West Fairlee, Thetford and Strafford are all currently implementing BMPs through Grants-in-Aid projects.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 54(b)- Address runoff from the Town of Vershire's road sand storage area.	Vershire	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	Vershire, DEC, TRORC	Stormwater	Awaiting action	No information on outreach to the town. Recommend that TRORC and Basin Planner reach out to town for discussion.
Action 55- Develop projects identified in river corridor plan as high priority actions, both active and passive, and determine feasibility of implementation	<a href="#">Ompompanoosuc River (See Appendix J.)</a>	Restore, maintain, and protect stream equilibrium and floodplain attenuation assets and flood resiliency.	DEC, TRORC, WRNRCD	Rivers	Ongoing	Two river corridor easements completed in 2017. CRC and White River NRCD completed a buffer planting in 2017.
Action 56- Design and implement high priority recommendations included in the Town of West Fairlee Stormwater Infrastructure Mapping Report and complete IDDE survey of the Village.	<a href="#">Town of West Fairlee - Watershed 1 and 2 (ANR, 2015)</a>	Remediate impacts of impervious surface-related stressors to waters.	Town of West Fairlee, TRORC, and DEC	Stormwater	Complete	Stormwater Infrastructure Mapping and IDDE study complete. Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping has been completed.
Action 57- Determine the feasibility of removal of the Geer and Montague Rod and Reel Dams and develop these projects if appropriate	Ompompanoosuc River West Fairlee and Thetford	Improve in-stream aquatic habitat and passage.	CRC, AM, DEC, FWD	Rivers	In progress	Geer Dam removed in 2017. Montague Rod and Reel Lower Dam removed, and upper dam breached. Watershed partners currently involved in outreach to town and landowners to determine interest in removal.
Action 58- Complete shoreland and lake habitat surveys to better direct lakeshore protection and restoration efforts on Abenaki Pond and Miller Pond.	Abenaki Pond, Miller Pond	Protect VHQW lakes and ponds and undeveloped lakeshores and important wetland ecosystem complexes.	DEC	Lakes & Ponds	Complete	Lake Abenaki was assessed in 2012. Miller Pond was assessed in 2018.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 59- Use the Critical Source Area (CSA) "lite" agricultural runoff model maps to better identify potential sources of nitrogen from agricultural sources as part of the LI Sound N TMDL. Target high erosion potential polygons for BMP outreach and implementation.	<a href="#">Mid-CT River and direct tributaries watershed (Appendix K.)</a>	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	DEC, NRCS, and AAFM	Agriculture	Discontinued	This action is being replaced through the implementation of the Required Agricultural Practices by the Agency of Agriculture, Farm & Markets (AAFM).
Action 60- Develop a comprehensive wetland inventory and restoration prioritization and restore and protect high priority wetland ecosystems	Mid- CT River and direct tributaries watershed	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	DEC, CRC, and TRORC	Protection	Complete	VT Wetlands Program has hired a full-time monitoring and assessment position to work on wetland assessment statewide. Restoration prioritization has taken place in the Connecticut River basin through NRCS. Monitoring by the Wetlands program occurred in this watershed in 2017. 28 rapid assessments and 15 vegetation releves were conducted, with 10 sets of water samples collected. Inventory and mapping of the area continue.
Action 61- Complete a riparian buffer inventory for the CT River corridor, river right, and downstream most reaches of direct tributaries and implement high priority projects.	Mid-CT River and direct tributaries	Identify and address significant sources of sediment, nutrients, and bacteria entering waters in the watershed.	DEC, CRC, and TRORC	Rivers	In progress	A riparian buffer analysis will be completed for the entire basin.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 62- Replace or retrofit high priority stream crossings that have been identified through previously completed or new the bridge and culvert assessment process.	<a href="#">Middle Connecticut River watershed (See Appendix J.)</a>	Identify and remediate dams and undersized stream crossings that contribute to stream disequilibrium and/or hinder aquatic organism passage.	FWD, DEC, towns	Rivers	Ongoing	One culvert on Upper Turnpike Rd upsized in 2018 Grants-In-Aid project. Many culverts have been identified as geomorphically incompatible (n=39) and a barrier to fish passage (n=445) throughout the basin. In 2019 VFWD completed a survey of culverts statewide to update the database. Because staff resources and funds are limited for culvert and bridge replacement projects, only a small number of these projects can be expected to be completed. However, when funding is available, these projects will be prioritized based on their water quality and habitat benefit on a case-by-case basis. In addition, any structure replacements or retrofits that go through the VT Stream Alteration permit process will automatically be required to be resized to meet geomorphic standards.
Action 63- Initiate a new portable skidder bridge rental program in this sub-watershed	Fairlee or other suitable location	Identify and remediate dams and undersized stream crossings that contribute to stream disequilibrium and/or hinder aquatic organism passage.	FPR, WRNRCD, and DEC	Forestry	Discontinued	Through discussions with other Districts the rental program has come to an end. Instead, the focus is on finding a way to cost share with loggers in owning them. The Senate of Ag committee first brought up this idea and is discussing it with the Districts. Rentals are infrequent, and many loggers simply want to buy them. See Action 3.
Action 64- Implement high priority actions within the Bloody Brook River Corridor Management Plan and stream crossing assessment	<a href="#">Bloody Brook watershed – (See Appendix J.)</a>	Restore, maintain, and protect stream equilibrium and floodplain attenuation assets and flood resiliency.	Town of Norwich, DEC. TRORC,	Rivers	In progress	Were the two high priority culverts replaced on Marsh Hill and Godfrey Road. Projects will be implemented where there is interest and funding available.



Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 65(a) - Implement high priority recommendations included within the Norwich Stormwater Infrastructure Mapping Report.	<a href="#">Towns of Norwich - Watersheds 1 and 4 are top priority and 18 is second priority (ANR, 2014)</a>	Remediate impacts of impervious surface-related stressors to waters.	Town of Norwich, TRORC, CRC, and DEC	Stormwater	Awaiting action	Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping has been completed.
Action 65(b) - Implement high priority recommendations included within the Fairlee Stormwater Infrastructure Mapping Report.	<a href="#">Fairlee - Watershed 3 (ANR, 2014)</a>	Remediate impacts of impervious surface-related stressors to waters.	Town of Fairlee, TRORC, CRC, and DEC	Stormwater	Awaiting action	Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping has been completed.
Action 65(c) - Implement high priority recommendations included within the Newbury Village Stormwater Infrastructure Mapping Report.	<a href="#">Newbury Village - Watershed 1 (ANR, 2014)</a>	Remediate impacts of impervious surface-related stressors to waters.	Newbury Village, TRORC, CRC, and DEC	Stormwater	Awaiting action	Work with watershed partners and municipalities to prioritize stormwater projects in Basin 14 where Stormwater Mapping has been completed.
Action 65(d) - Implement high priority recommendations included within the Hartford Stormwater Infrastructure Mapping Report.	<a href="#">Hartford (ANR, 2014)</a>	Remediate impacts of impervious surface-related stressors to waters.	Town of Hartford, TRORC, CRC, and DEC	Stormwater	In progress	Coordination meeting with town of Hartford in 2017 to discuss applying for funding to complete a SWMP. Town is interested, but staffing is a concern. Will continue to work with the town to accomplish this.
Action 66- Determine sources of erosion to Dothan Brook and implement protection and restoration measures accordingly.	Dothan Brook	Remediate impacts of impervious surface-related stressors to waters.	Town of Hartford, TRORC, and DEC	Monitoring	Awaiting action	No information on outreach to the town. Recommend that TRORC and Basin Planner reach out to town for discussion.
Action 67(a) - Complete IDDE surveys for Norwich.	Norwich Village	Remediate impacts of impervious surface-related stressors to waters.	DEC	Other	Complete	Completed in January 2017. Detecting and Eliminating Illicit Discharges in the Upper and Middle Connecticut River Basin: Final Report.
Action 67(b) - Complete IDDE surveys for Fairlee.	Fairlee Village	Remediate impacts of impervious surface-related stressors to waters.	DEC	Other	Complete	Completed in January 2017. Detecting and Eliminating Illicit Discharges in the Upper and Middle Connecticut River Basin: Final Report.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Action 67(c) - Complete IDDE surveys for Hartford.	Hartford (including Wilder and WRJ)	Remediate impacts of impervious surface-related stressors to waters.	DEC	Other	Complete	IDDE study completed in 2018.
Action 68- Add additional biological monitoring sites in this sub-watershed to better prioritize watershed protection and restoration measures on Sutton Brook, Manchester Brook and unnamed tributaries north of Manchester Brook.	Sutton Brook, Manchester Brook and unnamed tributaries north of Manchester Brook	Gather additional water quality data to better direct ANR and partners' watershed protection and restoration work in the watershed.	DEC	Monitoring	Complete	Sutton Brook sampled in 2017. Macroinvertebrate assessment excellent and all water quality parameters collected meet water quality standards. Manchester Brook sampled in 2017. Macroinvertebrate assessment very good and all water quality parameters collected meet water quality standards.
Action 69- Expand and protect riparian buffers within the FERC jurisdictional impoundment associated with Wilder Dam.	CT River main stem riparian buffer (river right, Wilder Dam impoundment area)	Address flow alteration issues in the watershed.	DEC and TransCanada	Rivers	Awaiting action	This action should be considered mitigation as part of the 401 or a settlement. It is still too early to discuss this with Great River Hydro.
Action 70- Increase conservation flows below the Wilder Dam and reduce the magnitude of peaking operations and water level fluctuations in the impoundment which would improve aquatic habitat in the Connecticut River, as appropriate related to the Wilder Dam on the Connecticut River through the FERC re-licensing and 401 Water Quality Certification process.	CT River main stem above and below Wilder Dam	Address flow alteration issues in the watershed.	DEC, FWD, TransCanada	Rivers	In progress	Wilder Project is still in the FERC relicensing process. ANR continues to discuss and finalize the habitat-flow study with Great River Hydro before they file revise their FERC license application.
Action 71- Complete shoreland and lake habitat survey to better direct lakeshore protection and restoration efforts on	Harriman Pond, Lake Morey	Protect VHQP lakes and ponds and undeveloped lakeshores and important wetland	DEC	Lakes & Ponds	Complete	Lake Assessment and lake shoreland score complete. Volunteer monitoring is being conducted on Lake Morey to identify need for restoration efforts.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Harriman Pond and Lake Morey.		ecosystem complexes.				
<b>Action 72- Protect the ecologically significant Symes Pond lakeshore and associated wetland complexes by expanding the Roy Mountain Wildlife Management Area to include all these areas (Figure 10).</b>	Symes Pond and adjacent lands	Protect VHQQ lakes and ponds and undeveloped lakeshores and important wetland ecosystem complexes.	DEC, FWD, and LARC	Protection	Awaiting action	The Symes Pond complex is identified along with Manchester Brook as an important aquatic habitat and species assembly as a priority target for ecologically functional landscape in the Vermont Conservation Design March 2018 report. Protection and improvement or removal of artificial barriers is recommended to maintain its current function.
<b>Action 73- Continue variable-leaved milfoil surveys to confirm eradication.</b>	Halls Lake	Raise awareness of aquatic invasive plants, animals, and pathogens spread prevention.	DEC and Halls Lake Association	Lakes & Ponds	Ongoing	Plant survey completed in 2018. Variable-leaved milfoil not present. Survey will be conducted again in 2020 by DEC staff. As a rule, 5-years absence is considered an eradication success. A more thorough survey can formalize the eradication when staff resources are available.
<b>Action 74(a)- Improve canoe access areas between McIndoe Falls to Dodge Falls and in Norwich.</b>	McIndoe Falls impoundment, downstream of Dodge Falls, Connecticut River near Norwich	Improve recreational boating opportunities in the Middle Connecticut River.	VRC, VYCC, CRC	Recreation	Complete	In 2017 TransCanada (now Great River Hydro) completed improvements at McIndoe Falls, rehabilitating the portage and access. The town of Norwich has also improved the access ramp off Route 5.
<b>Action 74(b)- Expand canoe-accessible river camping sites.</b>	Between North Thetford and Norwich on the Connecticut River	Improve recreational boating opportunities in the Middle Connecticut River.	VRC, VYCC, CRC	Recreation	Ongoing	New campsites were established at McIndoe Falls (Stephan's Island). The Horse Meadow Campsite (in North Haverhill, NH) has also been reestablished in partnership with the Thetford Academy, and Patchen Point in Norwich was formally designated as a campsite. Work along the river continues as part of a larger paddlers trail effort focused on the entire Connecticut River.

Project Description	Target Area(s)	Objective	Potential Project Partners	Sector	Status	Update or Recommendation for 2020 TBP
Actions 39 & 46- Identify flow improvement opportunities associated with the Bradford Dam, and implement as appropriate.	Waits River, Bradford	Address flow alteration issues in the watershed.	DEC, FWD, Dam Operator	Rivers	In progress	The hydro-electric facility is exempt from FERC licensing process. A low bypass has been recommended.

## Appendix B. Biological Water Quality Monitoring Results

The Ambient Biomonitoring Network (ABN) program was established by the Vermont DEC in 1985 to:

- monitor long-term trends in water quality as revealed in changes over time to ambient aquatic fish and macroinvertebrate communities
- to evaluate site-specific impacts of point and non-point discharges to aquatic biological communities, and
- to establish baseline data to assist the Department in establishing Vermont-specific biological criteria for water quality classification attainment determinations in rivers and streams.

Biological monitoring methods are used to assess impacts of waste water treatment plants on streams but also impacts from logging, acid rain, drawdowns on lakes, agricultural practices, removal of stream side vegetation and the effects of exotic species on natural populations.

The composition and density of organisms in aquatic communities responds proportionately to a range of impact. The greater the disturbance source is, the greater the response of the community. The monitoring data from 2016-2019 in Basin 14 is illustrated in the following table and figures. This information is used to develop actions for the Implementation Table (Table x) and Monitoring Tables (Table x).

**Table B1. Biological monitoring assessment results from 2015 to 2019.**

Map #	Stream Name	Year	Macroinvertebrate Assessment Rating	Fish Assessment Rating
1	Peacham Hollow Brook	2017	Excellent	
2	Sutton Brook	2017	Excellent	
3	Peacham Hollow Brook	2017	Excellent	Good
4	South Peacham Brook	2017	Good	Very Good
4	South Peacham Brook	2017	Good	
5	South Peacham Brook	2017	Ex-Very good	Excellent
6	Mud Pond Brook	2017	Excellent	Excellent
7	Cloud Brook	2017	Good	
8	Stevens River	2017	Excellent	
9	McIndoe Falls Trib	2017	Ex-Very good	
10	Beaver Brook	2017	Excellent	
11	Red Brook	2017	Excellent	
12	Manchester Brook	2017	Very good	
13	North Branch Wells River	2017		Very Good
14	Tannery Brook	2017	Good	
15	South Branch Wells River	2017		Excellent
16	East Brook	2017	Fair	
17	Wells River	2017	Excellent	
18	Tabor Branch Trib 5	2017	Excellent	Excellent
19	Waits River	2017	Excellent	Good
20	East Orange Branch Waits River	2017	Very good	Excellent



Map #	Stream Name	Year	Macroinvertebrate Assessment Rating	Fish Assessment Rating
21	Tabor Branch	2017	Very good	
22	Pike Hill Brook	2017	Fair	
23	Pike Hill Brook	2017	Poor	
24	Pike Hill Brook	2017	Fair	
25	Cookville Brook Trib # 4	2017	Poor	
26	Roaring Brook	2017	Ex-Very good	Excellent
27	Cookville Brook	2017	Good	
28	Cookville Brook	2017	Ex-Very good	
29	South Branch Waits River	2017	Ex-Very good	
30	Meadow Brook	2017	Excellent	
31	Middle Brook	2017	Excellent	Excellent
32	Glen Falls Brook	2017	Excellent	
33	Schoolhouse Brook	2017	Fair	Good
34	Abbot Brook Trib #3	2016	Ex-Very good	Excellent
35	Sargent Brook	2017	Excellent	
36	Copperas Brook	2019	Fair	
36	Copperas Brook	2017	F-Poor	
37	Lord Brook Trib 2	2019	Poor	
38	Zebedee Brook	2016		Good
39	Bloody Brook	2017	Excellent	Poor
40	Charles Brown Brook	2017	Good	Very Good

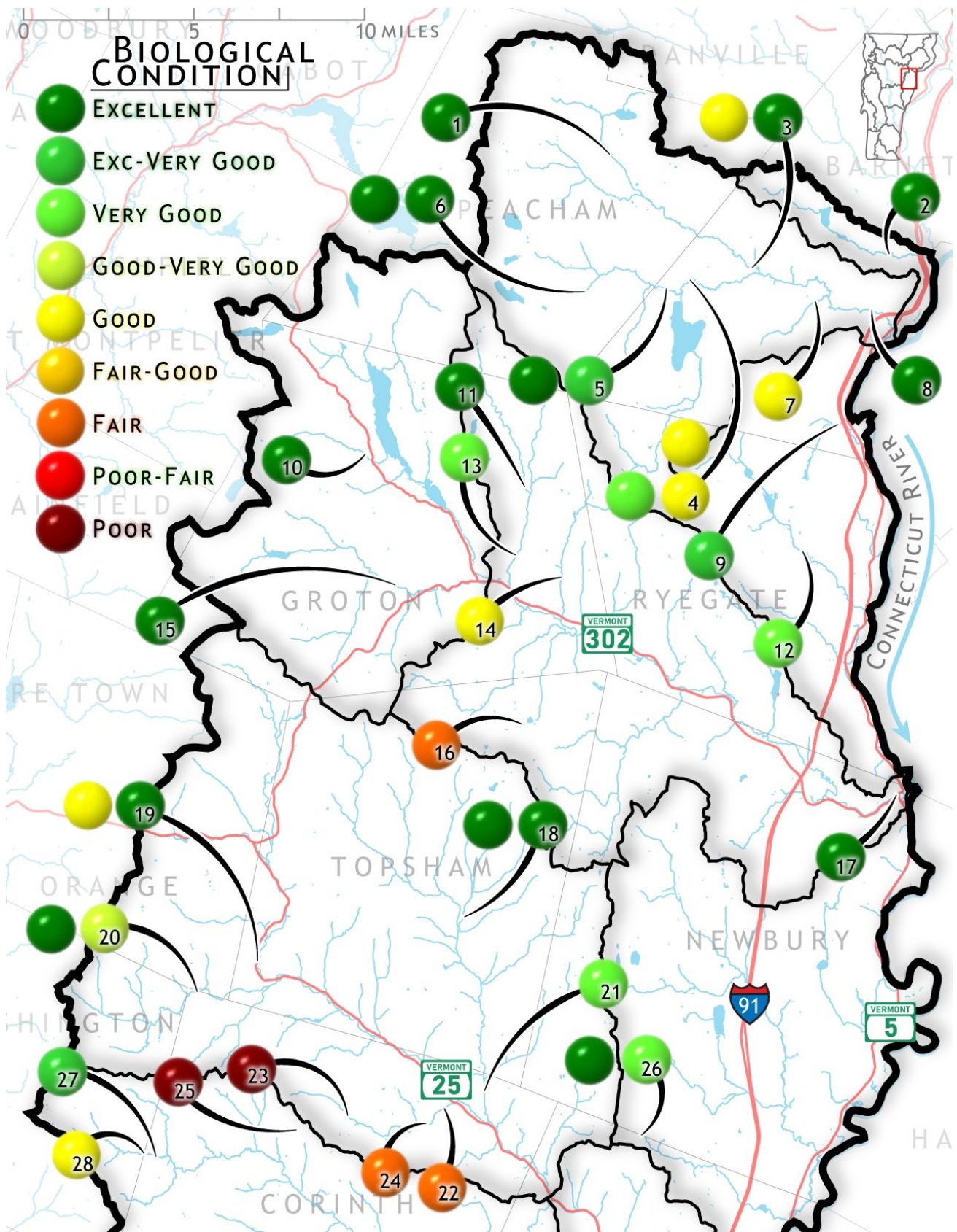


Figure B1. Biological monitoring results for fish and macroinvertebrate assessments in the upper half of Basin 14 from 2015-2019. Where two assessment ratings are shown, the fish assessment result is on the left and macroinvertebrate is on the right.



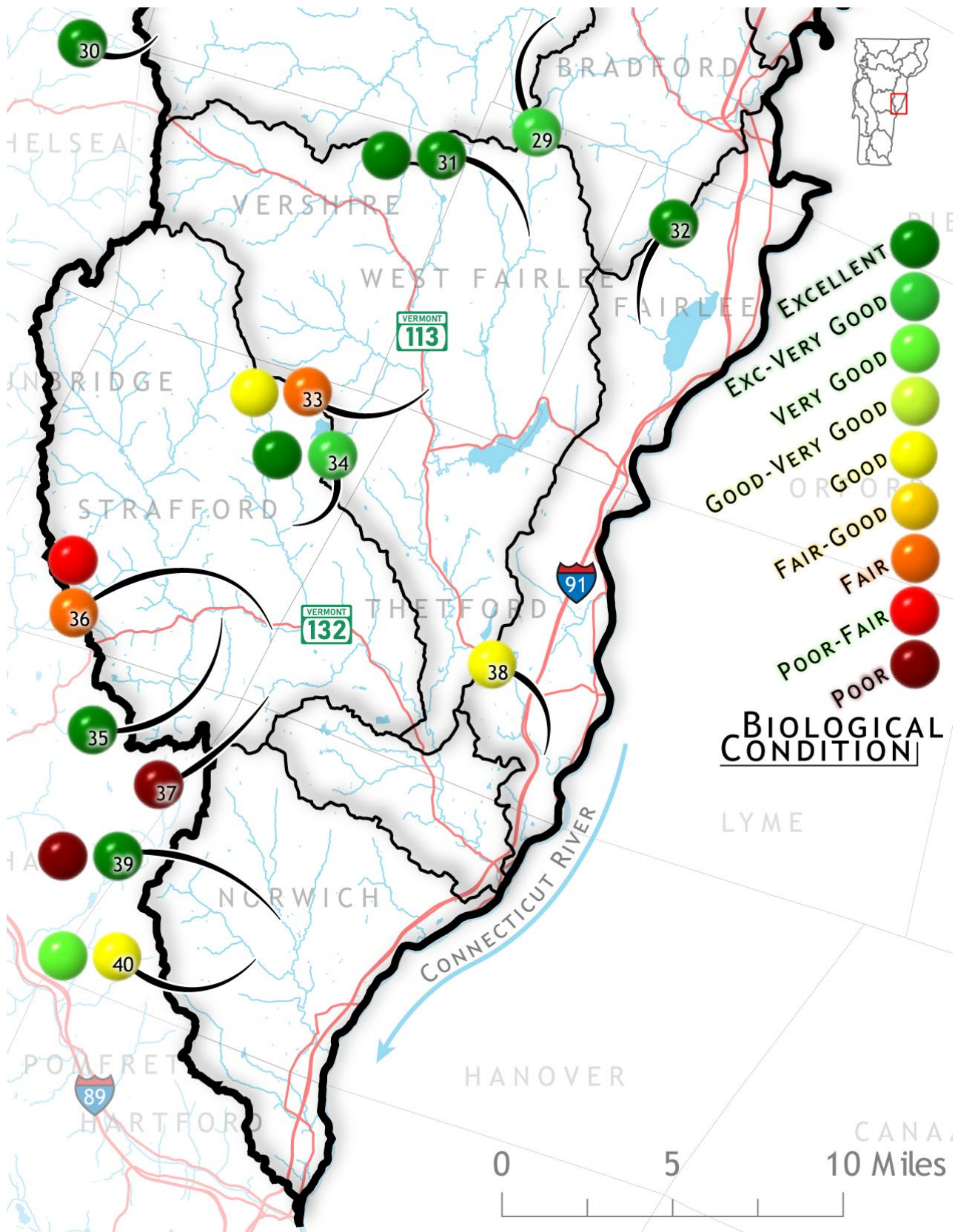


Figure B2. Biological monitoring results for fish and macroinvertebrate assessments in the lower half of Basin 14 from 2015-2019. Where two assessment ratings are shown, the fish assessment result is on the left and macroinvertebrate is on the right.

Appendix C. Municipal Water Quality Protectiveness Table

Table C1. Municipal Water Quality Protectiveness Table for the Basin 14.

Town	ERAF Rate (%)	NFIP	Road and Bridge Standards	Local Emergency Management Plan	Local Hazard Mitigation Plan	River Corridor Protection	LHMP Expired?	Year LHMP Completion Expected	Flood Regulations	Floodway Conditions	Special Flood Hazard Area Conditions	Flood Regulations Last Updated	Flood Resiliency Element in Town Plan	Streambank Setback	Steep Slope/Ridgeline Development	Stormwater/LID Requirements
Barnet	7.5	Yes	Yes	No	No	No	Yes	NA	Yes	Prohibited activities in the floodway include new structures, storage, small accessory structures, and fill. Permitted activities include recreational vehicles. Exempted activities include road maintenance, open space recreation, forestry, and agriculture. All other uses require a conditional use determination.	Prohibited activities in the flood hazard area include new structures, storage, and fill. Permitted uses include improvements to existing structures, small accessory structures, at grade parking, and recreational vehicles. Exempted activities include road maintenance, open space recreation, forestry, and agriculture. All other uses require a conditional use determination.	2018	Yes	No	No	No
Bradford	17.5	Yes	Yes	Yes	Yes	Interim	No	-	Flood Hazard Area Bylaw & Zoning Bylaw	Development above grade and less than one foot above the base flood elevation, are prohibited unless hydrologic and hydraulic analyses are performed and certify that development will not increase flood levels during base flood and not increase risk to surroundings.	New structures, both residential and non-residential, and storage are prohibited in the Special Flood Hazard Area, as is fill (except as needed to elevate existing structures). Improvements to existing structures and utilities are either permitted or subject to conditional use review. Accessory structures and at grade parking are permitted.	2014	Yes	Streambank Conservation Provision in Zoning Bylaws: All buildings and structures erected from the effective date of these Bylaws shall be setback 35 feet from the upper edge of the streambank. Dumping and filling within the setback area is also prohibited.	Wetlands and Excessively Steep Slopes District within Zoning Bylaws: Building development prohibited on sites in excess of 25% grade. Access roads across a slope exceeding 25% permitted if road doesn't have above 15% slope and adequate erosion control plans in place.	Not discussed in Town Plan, Flood Hazard Area Bylaw or Zoning Bylaw.
Chelsea	12.5	Yes	Yes	Yes	Yes	No	No	-	Flood Hazard Area Bylaw & Zoning Bylaw	Development prohibited except for minor improvement to existing structures within building footprint or relating to bridges, culverts, roads, stabilization projects, public utilities, or health and safety measures.	All development shall be reasonably safe from flooding and shall not decrease the distance between any existing primary buildings' footprint and streams. New residential principal structures and net fill are prohibited unless it has been demonstrated through hydrologic and hydraulic analyses that it would not increase flood levels during base flood discharge. See document for further conditions on residential and non-residential development as well as subdivisions.	2017	Yes	Streambank Conservation Provision in Zoning Bylaws: All buildings and structures erected from the effective date of these Bylaws shall be setback 35 feet from the upper edge of the streambank.	Not discussed in Town Plan, Zoning Bylaws, or Flood Hazard Area Bylaws.	Not discussed in Town Plan, Zoning Bylaws, or Flood Hazard Area Bylaws.
Corinth	17.5	Yes	Yes	Yes	Yes	Yes	No	-	Flood Hazard Area Bylaw	Development above grade and less than one foot above the base flood elevation, are prohibited unless hydrologic and hydraulic analyses are performed and certify that development will not increase flood levels during base flood and not increase risk to surroundings.	New structures, both residential and non-residential, and storage are prohibited in the Special Flood Hazard Area, as is fill (except as needed to elevate existing structures). Improvements to existing structures, including storage tanks, are either permitted or subject to conditional use review. Accessory structures and at grade parking are permitted.	2015	Yes	Not discussed in Town Plan or in Flood Hazard Area Bylaw.	Town Plan policy: "To minimize conflicts with scenic values, telecommunication tower designs and construction shall follow these guidelines whenever possible:... Towers shall avoid breaking the silhouette of peaks and ridges by locating downslope whenever feasible.	Not discussed in Town Plan or in Flood Hazard Area Bylaw.

Town	ERAF Rate (%)	NFIP	Road and Bridge Standards	Local Emergency Management Plan	Local Hazard Mitigation Plan	River Corridor Protection	LHMP Expired?	Year LHMP Completion Expected	Flood Regulations	Floodway Conditions	Special Flood Hazard Area Conditions	Flood Regulations Last Updated	Flood Resiliency Element in Town Plan	Streambank Setback	Steep Slope/Ridgeline Development	Stormwater/LID Requirements
Fairlee	7.5	Yes	Yes	No	Yes	Yes	No	-	Unified Development Bylaw	Development above grade and less than one foot above the base flood elevation, are prohibited unless hydrologic and hydraulic analyses are performed and certify that development will not increase flood levels during base flood and not increase risk to surroundings.	New structures, including residential and non-residential, and storage are prohibited in the Special Flood Hazard Area, as is fill (except as needed to elevate existing structures). Improvements to existing structures are either permitted or subject to conditional use approval. Small accessory structures and at grade parking are permitted.	2018	Yes, but TP expired	Unified Development Bylaw: Development regulations also apply to River Corridors as published by VT ANR, including Statewide River Corridors. Where river corridors are not mapped, the standards shall apply to the area measured as 50 feet from the top of bank or slope of perennial streams. In River Corridors, new structures, storage and fill (unless needed to elevate existing structures) are prohibited.	Not addressed in Unified Development Bylaw or discussed in Town Plan.	Unified Development Bylaw: Stormwater run-off and treatment shall be dealt with on-site.
Groton	7.5	Yes	Yes	Yes	No	No	Yes	-	Yes	Zoning permit is required for all development in Floodway. A zoning permit may be issued for residential accessory structures and minor residential building improvements. Conditional use approval is required for new construction, the substantial improvement of existing buildings or any other development within the floodway.	Zoning permit is required for all development in Special Flood Hazard Areas. A zoning permit may be issued for residential accessory structures and minor residential building improvements.	2005	YES	No	No	No
Groton Village	7.5	Yes	Yes	Yes	No	No	Yes	see Groton	see Groton	see Groton	see Groton	see Groton	see Groton	see Groton	see Groton	see Groton
Hartford	7.5	Yes	Yes	Yes	No	No	Yes	2021	Flood Hazard Area Regulations & Zoning Bylaw	Development is prohibited unless hydrologic and hydraulic analyses certify that development will not increase the flood levels during the occurrence of the base flood.	New development and substantial improvements must elevate lowest floor 1 ft above BFE. All development shall be reasonably safe from flooding: designed and anchored to prevent flotation, collapse, and movement of the structure; constructed with materials resistant to flood damage; construction methods that minimize flood damage; and service facilities located in areas to prevent water from entering.	2007	Yes	Protection of Surface Waters in Zoning Bylaws: Riparian buffer shall be maintained for 100ft from TOB of the CT, Ottauquechee, & White Rivers or for 30ft from edge of stream or any other surface water ID'd in Hartford GIS Natural Resources Map. No development, excavation, filling, clearing or grading without Conditional Use approval from Zoning Board of Adjustment.	Hartford's Zoning Ordinance contains the Rural Lands, Agricultural Lands, and Wildlife Connector Overlay District which state that development should be located down-slope of ridgelines and prominent hills in areas where ridgelines and hillsides are easily visible from existing roadways, and development shall be considered relative to the availability of less visible locations on-site.	Applications for Conditional Use approval under the Surface Water Zoning Bylaw must include a description of practices used to protect water quality of project generated stormwater runoff per the "Low Risk Site Handbook for Erosion Prevention and Sediment Control" as well as an erosion control plan.



Town	ERAF Rate (%)	NFIP	Road and Bridge Standards	Local Emergency Management Plan	Local Hazard Mitigation Plan	River Corridor Protection	LHMP Expired?	Year LHMP Completion Expected	Flood Regulations	Floodway Conditions	Special Flood Hazard Area Conditions	Flood Regulations Last Updated	Flood Resiliency Element in Town Plan	Streambank Setback	Steep Slope/Ridgeline Development	Stormwater/LID Requirements
Newbury	12.5	Yes	Yes	Yes	Yes	No	No	-	Unified Zoning and Subdivision Regulations	Development above grade and less than one foot above the base flood elevation, are prohibited unless hydrologic and hydraulic analyses are performed and certify that development will not increase flood levels during base flood and not increase risk to surroundings.	Flood Hazard Overlay (which includes SFHA): Principal residential and non-residential structures, storage, net fill (except as necessary to elevate existing structures), and critical facilities are all prohibited. Non-substantial improvements (that do not increase footprint), development related to existing permitted on-site septic or water supply, building utilities, and at grade parking are all permitted. Non-substantial improvements (that do increase footprint) and substantial improvements are all subject to conditional use review.	2017	Yes	Streambanks in Unified Zoning & Subdivision Regulations: Outside of village districts, no land disturbance is allowed within a riparian buffer extending 35ft from TOB of all second order streams except for agricultural and forestry practices, road and driveway crossings, permitted septic repairs, utility crossings, crossings by recreational trails, removal of invasive species, stream restoration projects, and maintenance of existing structures. In village districts, all structures must be setback 25ft from TOB of streams. In all other districts, residential structures must be 50ft from TOB of streams, and commercial structures must be 100ft from TOB.	No new slopes may be created with a grade above 1:3. Disturbance of steep slopes (over 25%) shall be minimized. Subdivision on slopes greater than 25% may require licensed professional engineer to certify that they do not pose a landslide or erosion risk.	To receive Conditional Use approval from the DRB: No increase is allowed in off-site stormwater runoff in terms of volume or peak discharge. Sites creating more than half an acre of impervious surface will be required to submit an engineered stormwater plan. Sites disturbing more than an acre and/or creating an acre of impervious surface require a state stormwater permit in addition to local permits.
Norwich	12.5	Yes	Yes	Yes	Yes	No	No	-	Zoning Regulations	Development, except for minor improvements to existing structures or relating to bridges, culverts, roads or stabilization projects, within the regulatory floodway is prohibited. Such exceptions require conditional use approval prior to permitting and must comply through hydrologic and hydraulic analyses performed that certify that development will result in no increase in flood levels during base flood.	Flood Hazard Overlay District (Includes Special Flood Hazard Areas): New principal structures residential or non residential, fuel and hazardous materials storage, and major development in floodway (above 500 sq ft) are not allowed.	2009	Yes	Shoreline Protection Overlay (SPO) District in Zoning Regulations: The Primary Shoreline Protection Area is measured from TOB as defined below - 100ft for CT & Ompomp. Rivers; 100ft for Blood Brook from CT River to New Boston Rd; 50ft for Streams & Lakes on the SPO Map; 25ft for Streams not shown on the SPO Map. See document for specific prohibited, permitted and conditional uses.	Norwich 2009 Zoning Regulations state that an erosion control plan must be developed for excavation and filling in areas to be disturbed with slopes greater than 15%. Excavation, filling and development in areas in excess of 25% slope is not allowed except for the installation of utility lines.	Applications for Site Plan & Conditional Use Review must include a grading and drainage plan that includes a provision for stormwater management. Additionally, DRB is allowed to impose safeguards/conditions regarding stormwater management including LID stormwater management practices, upon Site Plan review as well.
Orange	17.5	Yes	Yes	Yes	Yes	Interim	No		No zoning. Stand alone Inundation Hazard Area Regulations	No new structures in the floodway, including storage, small accessory structures, and fill.	Goes above NFIP minimum, no new structures in floodplain, no storage structures and no fill. Does allow small accessory structures with permit.	2014	Yes	No	No	No
Peacham	17.5	Yes	Yes	Yes	Yes	Interim	No	2024	Yes	Prohibited activities in the Special Flood Hazard Area, Floodway, and FEH Zone are new structures, storage, and fill. Prohibited activity in the floodway is small accessory structures. Other uses may be permitted, exempted or require a conditional use review	Prohibited activities in the Special Flood Hazard Area, Floodway, and FEH Zone are new structures, storage, and fill. Prohibited activity in the floodway is small accessory structures. Other uses may be permitted, exempted or require a conditional use review	2013	YES	No	No	No

Town	ERAF Rate (%)	NFIP	Road and Bridge Standards	Local Emergency Management Plan	Local Hazard Mitigation Plan	River Corridor Protection	LHMP Expired?	Year LHMP Completion Expected	Flood Regulations	Floodway Conditions	Special Flood Hazard Area Conditions	Flood Regulations Last Updated	Flood Resiliency Element in Town Plan	Streambank Setback	Steep Slope/Ridgeline Development	Stormwater/LID Requirements
Ryegate	7.5	Yes	Yes	No	No	No	Yes	-	Yes	Prohibited activities in the Floodway are new structures, storage, small accessory structures, and fill. Permitted activities in the Floodway are recreational vehicles. Exempted activities are road maintenance, outdoor recreation, forestry and agriculture. All other uses require a conditional use determination.	Prohibited activity in the Special Flood Hazard area is fill. Permitted activities are small accessory structures, at grade parking, and recreational vehicles. Exempted activities are road maintenance, outdoor recreation, forestry and agriculture. All other uses require a conditional use determination.	2017	YES	No	No	No
Sharon	17.5	Yes	Yes	Yes	Yes	Interim	No	-	Flood Hazard Area Bylaw & Subdivision Regulations	Development above grade and less than one foot above the base flood elevation, are prohibited unless hydrologic and hydraulic analyses are performed and certify that development will not increase flood levels during base flood and not increase risk to surroundings.	New residential or non-residential structures are prohibited from the Special Flood Hazard Area, Fluvial Erosion Hazard Zone, and stream buffer.	2010	Yes	Subdivision Regulations (Applies to all subdivisions): No building envelopes shall be placed within 100ft of the TOB of any perennial stream or edge of any wetland. No ground disturbance or removal of healthy vegetation will be allowed within 50ft of such boundaries except for permitted crossings. This may not be waived.	Subdivision Regulations (Applying to all subdivision): No new slopes may be created with a grade greater than 1:3. Disturbance of steep slopes (over 25%) shall be avoided. Subdivisions on slopes greater than 25% may require a licensed professional engineer to certify that it does not pose a landslide or erosion risk. What is listed above may not be waived. The Sharon Town Plan states that locating buildings at the top of ridgelines or at the brows of hills where land is open and sites would be highly visible from nearby public roads is prohibited. It is the policy of Sharon to restrict land development on ridgelines and that any structures or buildings shall be located away from ridgelines, and shall be built lower on the hillsides, hidden within wooded areas.	Subdivision Regulations (Applies to all subdivisions): Stormwater shall be handled by an erosion control plan prepared by a licensed professional engineer for control of erosion, sediment, and stormwater runoff during and following development. The above may be waived by the Sharon Planning Commission. Sharon Town Plan: It is the policy of the town to limit encroachments on the riparian corridor by limiting and by careful siting and setback of roads, paved paths, parking lots, buildings and structures where streamside vegetation exists or has reasonable potential for restoration and maintenance.

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<a href="#">Strafford</a>	12.5	Yes	Yes	Yes	Yes	No	No	-	Flood Hazard Area Zoning Ordinance	Development in the Floodway is prohibited unless a registered professional engineer certifies that the proposed development will not result in any increase in flood levels during the occurrence of the base flood. Until a regulatory floodway is designated, no new construction, substantial improvement, or other development (including fill) shall be permitted within zones A1-A30 and AE on the Town's FIRM unless the cumulative effect of the proposed development will not increase the water surface elevation of the base flood more than 1ft at any point within the town.	In "Fringe Areas," new residential construction and existing buildings to be substantially improved, shall have the lowest floor elevated to at least 1ft above base flood elevation, as shall new non-residential development. Existing, non-residential buildings to be substantially improved shall have the lowest floor elevated to at least 1ft above base flood elevation or be designated to be watertight below the base flood elevation. Permits are required for all of the above types of development.	1993	Yes	Town Plan Policy: Preservation of the natural state of streams should be encouraged by maintenance of existing stream bank and buffer vegetation including trees, together with wildlife habitat. Town Plan Recommendation: The Town should update the Strafford Flood Zoning Ordinance to ensure that it meets the standards required by the Federal Emergency Management Agency so that Strafford may continue to participate in the National Flood Insurance Program (NFIP). The reviewed ordinance should consider prohibiting new development in the Special Flood Hazard Area (excluding small ancillary structures).	Town Plan policy: To encourage preservation of open land, farms, forests, wetlands, scenic ridgelines, wildlife habitat, and outdoor recreation. Town Plan recommendation: Planning Commission should consider adding language to the Strafford Bylaw which addresses lighting, viewsheds, and residential construction on ridgelines.	Not addressed in the Town Plan or in Flood Hazard Area Zoning Ordinance.
<a href="#">Thetford</a>	17.5	Yes	Yes	Yes	Yes	Interim	No	-	Flood Hazard Area Zoning Bylaw	Development, except for minor improvements to existing structures or relating to bridges, culverts, roads or stabilization projects, within the regulatory floodway is prohibited. Such exceptions require conditional use approval prior to permitting and must comply through hydrologic and hydraulic analyses performed that certify that development will result in no increase in flood levels during base flood.	All development shall be reasonably safe from flooding and: designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure during the occurrence of the base flood; constructed with materials resistant to flood damage; constructed by methods and practices that minimize flood damage; and constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding. Existing residential buildings in Zones A, A1-A30, and AE shall have the lowest floor, including basement, elevated to at least one foot above base flood elevation. Existing non-residential buildings in the above zones shall have the lowest floor, including basement, elevated to at least one foot above base elevation, or together with attendant utility and sanitary facilities, be designed so that below the base flood elevation, the structure is watertight.	2008	No & TP expired	Zoning Bylaw: No structures shall be allowed within the setback distance as follows: For first order streams the setback shall be 50ft. For second order streams, the setback shall be 75ft. For third order streams or higher, the setback shall be three channel widths from the center of channel. Setbacks shall be measured from top of bank. For steep-sided streams where little or no floodplain is evident, setback shall be measured from top of slope.	Town Plan policy: "Slopes greater than 25 percent should be left undeveloped because of high erosion potential and difficulty for development. Slope considerations should be added to the Zoning Ordinance. (PRIORITY)." "Consider adding subdivision regulations to exclude very steep slopes and wetlands from the calculation of lot size when determining minimum lot sizes or when calculating allowable density for cluster and multi-unit development." "To the extent possible, the Town Planning Commission and Development Review Board should discourage ridgeline development and should take an active role in site determinations where such development is to proceed. Consider ridgeline zoning."	Not addressed in Town Plan or in Flood Hazard Area Zoning Bylaw.

Town	ERAF Rate (%)	NFIP	Road and Bridge Standards	Local Emergency Management Plan	Local Hazard Mitigation Plan	River Corridor Protection	LHMP Expired?	Year LHMP Completion Expected	Flood Regulations	Floodway Conditions	Special Flood Hazard Area Conditions	Flood Regulations Last Updated	Flood Resiliency Element in Town Plan	Streambank Setback	Steep Slope/Ridgeline Development	Stormwater/LID Requirements
Topsham	12.5	Yes	Yes	Yes	Yes	No	No	-	Flood Hazard Ordinance	Development within the regulatory floodway is prohibited unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice by a registered professional engineer certifying that the proposed development will result in no increase in flood levels during the occurrence of the base flood.	Until a regulatory floodway has been designated, no new construction, substantial improvements, or other development shall be permitted in the area of the special flood hazard unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing development and anticipated development will not increase the water surface elevation of the base flood more than 1ft at any point within the community. In areas where a regulatory floodway has been designated, both residential and non-residential development, existing and new, in Zones A, A1-A30, AE and AH shall have the lowest floor, including basement, elevated to at least 1ft above base flood elevation.	2008	TP expired but did have a Floodplain element. Adopted before Flood Resiliency requirement was in place.	Town Plan Principle: "Preservation of the natural state of streams should be encouraged by maintenance of existing stream bank and buffer vegetation including trees, together with wildlife habitat."	Not addressed in Town Plan or in Flood Hazard Ordinance.	Not addressed in Town Plan or in Flood Hazard Ordinance.
Tunbridge	12.5	Yes	Yes	Yes	Yes	No	No	-	Flood Hazard Area Ordinance	Development above grade and less than one foot above the base flood elevation, are prohibited unless hydrologic and hydraulic analyses are performed and certify that development will not increase flood levels during base flood and not increase risk to surroundings.	All structures shall be designed to minimize flood damage to development; to provide adequate drainage; shall be designed/anchored to resist flotation, collapse, or lateral movement; constructed with materials and methods that minimize flood damage; and the flood carrying capacity within any altered or relocated portion of a watercourse shall be maintained. The lowest floor of new buildings shall be elevated 1 foot or more above BFE. Fully closed areas below BFE and subject to flooding shall be used solely for parking of vehicles, storage, building access.	2014	Yes	Town Plan Policy: Preservation of the natural state of streams should be encouraged by maintenance of existing stream bank and buffer vegetation including trees, together with wildlife habitat. Town Plan Recommendation: Planning Commission should consider creating a policy regarding development and riparian buffer zones in future versions of [the Town] plan. Act 250 Requirement regarding commercial development along Route 110: Maintain trees and existing vegetation adjacent to Route 110. A generously landscaped buffer (using native plants and trees) shall be part of any new construction adjacent to Route 110.	Act 250 Lot Layout: Locating buildings at the top of ridgelines or at the brows of hills where land is open, and sites would be highly visible from nearby public roads is prohibited.	Town Plan Policy: Developments, and their associated stormwater discharges, that are adjacent to wetlands should be planned so they do not cause undue disturbance to wetland areas. Maintenance of a naturally vegetated buffer strip between a wetland and the project site is encouraged to prevent groundwater pollution and direct discharges into a wetland.

Town	ERAF Rate (%)	NFIP	Road and Bridge Standards	Local Emergency Management Plan	Local Hazard Mitigation Plan	River Corridor Protection	LHMP Expired?	Year LHMP Completion Expected	Flood Regulations	Floodway Conditions	Special Flood Hazard Area Conditions	Flood Regulations Last Updated	Flood Resiliency Element in Town Plan	Streambank Setback	Steep Slope/Ridgeline Development	Stormwater/LID Requirements
Vershire	7.5	Yes	Yes	No	Yes	No	No	-	Flood Hazard Bylaw	Development or encroachments, except for improvements to existing structures or relating to bridges, culverts, roads or stabilization projects, within the regulatory floodway is prohibited. Such exceptions require conditional use approval prior to permitting and must comply through hydrologic and hydraulic analyses performed that certify that development will result in no increase in flood levels during base flood.	Until a regulatory floodway has been designated, no new construction, substantial improvements, or other development shall be permitted in the area of the special flood hazard unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing development and anticipated development, will not increase water surface elevation of the base flood at any point within the community. Additionally, new residential construction and existing buildings to be substantially improved in Zones A, A1-A30, and AE, shall have the lowest floor elevated to at least 1ft above base flood elevation, as shall new non-residential development. Existing, non-residential buildings to be substantially improved in Zones A, A1-A30, and AE shall have the lowest floor elevated to at least 1ft above base flood elevation or together with attendant utility and sanitary facilities be designed so that below base flood elevation, the structure is watertight.	2010	Yes	Streambank Conservation in Zoning Ordinance: All buildings and structures erected from the effective date of this ordinance shall be setback 35 feet from the upper edge of streambank on a perennial stream and 50ft from the edge of a state designated wetland.	Natural Resource Limitations within Zoning Ordinance: Building development on slopes in excess of 25% grade is prohibited. Access roads across a slope exceeding 25% may be permitted provided the road itself does not have a slope in excess of 15% and that adequate erosion control measures are followed.	Not specifically addressed in Zoning Ordinance or Town Plan.
Washington	7.5	Yes	Yes	Yes	No	No	Yes	2020	Flood Hazard Area Regulations	No development in floodway unless certified by PE that no increase in base flood elevation; Junkyards and storage facilities prohibited	Flood fringe: Development required to be designed to minimize flood damage to proposed development and to public utilities and facilities and to provide adequate drainage. Development shall be floodproofed to withstand hydrostatic pressure certified by a professional engineer or architect. See flood hazard bylaws for more details. <a href="http://centralvtplanning.org/wp-content/uploads/2012/03/Washington-Flood-1998.pdf">http://centralvtplanning.org/wp-content/uploads/2012/03/Washington-Flood-1998.pdf</a> .	1998	No, 2020 Update	Wetland, stream and lakeshore setback of 50 feet	Development on slopes >15% needs a conditional use permit from the Town.	No
Wells River Village	7.5	Yes	No	Yes	Yes	No	No		see Newbury	see Newbury	see Newbury	see Newbury	see Newbury	see Newbury	see Newbury	see Newbury



Town	ERAF Rate (%)	NFIP	Road and Bridge Standards	Local Emergency Management Plan	Local Hazard Mitigation Plan	River Corridor Protection	LHMP Expired?	Year LHMP Completion Expected	Flood Regulations	Floodway Conditions	Special Flood Hazard Area Conditions	Flood Regulations Last Updated	Flood Resiliency Element in Town Plan	Streambank Setback	Steep Slope/Ridgeline Development	Stormwater/LID Requirements
West Fairlee	7.5	Yes	Yes	Yes	No	No	Yes	2020	Flood Hazard Area Zoning Ordinance	Development within the floodway is prohibited unless a registered professional engineering certifies that the proposed development will not result in any increase in flood levels during the occurrence of the base flood. No new construction or substantial development shall be permitted within zones A1-A30 and AE on the Town's FIRM unless the development will not increase the water surface elevation of the base flood more than one foot at any point within the town. This applies until a regulatory floodway is designated.	Unless a regulatory floodway is designated, no new construction, substantial improvement, or other development (including fill) shall be permitted within zones A1-A30 and AE on the town's FIRM unless the proposed development will not increase the water surface elevation of the base flood more than 1ft at any point within the town. Additionally, in "Fringe Areas" the lowest floor of all new buildings shall be at or above base flood elevation, as shall existing buildings to be substantially improved for residential purposes.	1990	Yes	Town Plan policies: "Preservation of the natural state of streams and, to the extent possible, Lake Fairlee, shall be encouraged by:...Maintenance of existing stream bank and buffer vegetation including trees, together with wildlife habitat." "New development within the limits of the 100-year floodplain is strongly discouraged. Improvements to existing structures in the floodplain are acceptable, provided that careful planning is done to ensure against unnecessary loss of property or public endangerment." "Consistent with the guidance of the VT ANR, a buffer zone of 50ft must be maintained contiguous to all rivers and streams."	Town Plan Policies & Recommendations: "Construction and careless or destructive use of vehicles and machinery in areas of shallow soils, steep slopes or high water table is strongly discouraged." "All commercial or housing development projects or proposals in areas of shallow soils, steep slopes, or high-water table must include detailed plans for avoiding or preventing soil erosion. It shall be the responsibility of owners who develop in these areas to restore all soils lost to erosion, all water bodies or waterways contaminated, and wildlife habitats negatively impacted as a consequence of development." "The Selectboard, the Planning Commission and the Conservation Commission should work together to do all they can to safeguard the integrity of West Fairlee's soils by monitoring land use and ensuring sound building practices and careful use of machinery on the land, especially in areas of shallow soils, steep slopes or high water table."	Town Plan Recommendation: "Promote future land use planning that facilitates sustained hazard mitigation efforts, including:... defining critical areas for upland storm water runoff limitation and management."

## Appendix D. Dams in Basin 14

There are approximately 60 dams of different types, sizes, and condition in Basin 14. While dams provide renewable energy and recreational opportunities such as boating, fishing, and swimming, they can also:

- impede a stream's ability to transport flow and sediment;
- cause streambank erosion and flooding problems;
- degrade and alter fisheries habitat;
- create barriers to fish movement and migration;
- alter downstream temperature
- degrade water quality; and
- impede river-based recreational activity.

Of the 60 inventoried dams, 53 are in-service, 1 is fully breached, 4 are partially breached, and 2 are not active. The 57 active in-service and partially breached dams constrict the stream channel enough to reduce sediment transport, prevent lateral movement, and inhibit aquatic organism passage (AOP). The remaining 3 dams have been breached to a point that they are not causing considerable constriction of the stream channel or impediments to AOP. A detailed list of known non-historic dams in the watershed can be found in Table C1.

Two dams were removed in Basin 14 by the Connecticut River Conservancy between 2015 and 2019: Norwich Fire District Dam on Charles Brown Brook and the Groton-9 dam on the Wells River. CRC has also been working on preliminary design for the Harveys Lake Dam removal.

On January 18, 2018, H.554 or Act 161, the Dam Safety bill, passed the Vermont House of Representatives and received final approve on May 10<sup>th</sup> of the same year. The bill was developed collaboratively with the VDEC, Vermont Natural Resources Council, Vermont Trout Unlimited, the Vermont Section of the American Society of Civil Engineers, and other partners. The bill addresses gaps in inspection requirements for hundreds of small dams. Under the bill, VDEC will be required to maintain an inventory of all dams in the state and develop rules that will require all dams to be regularly inspected.

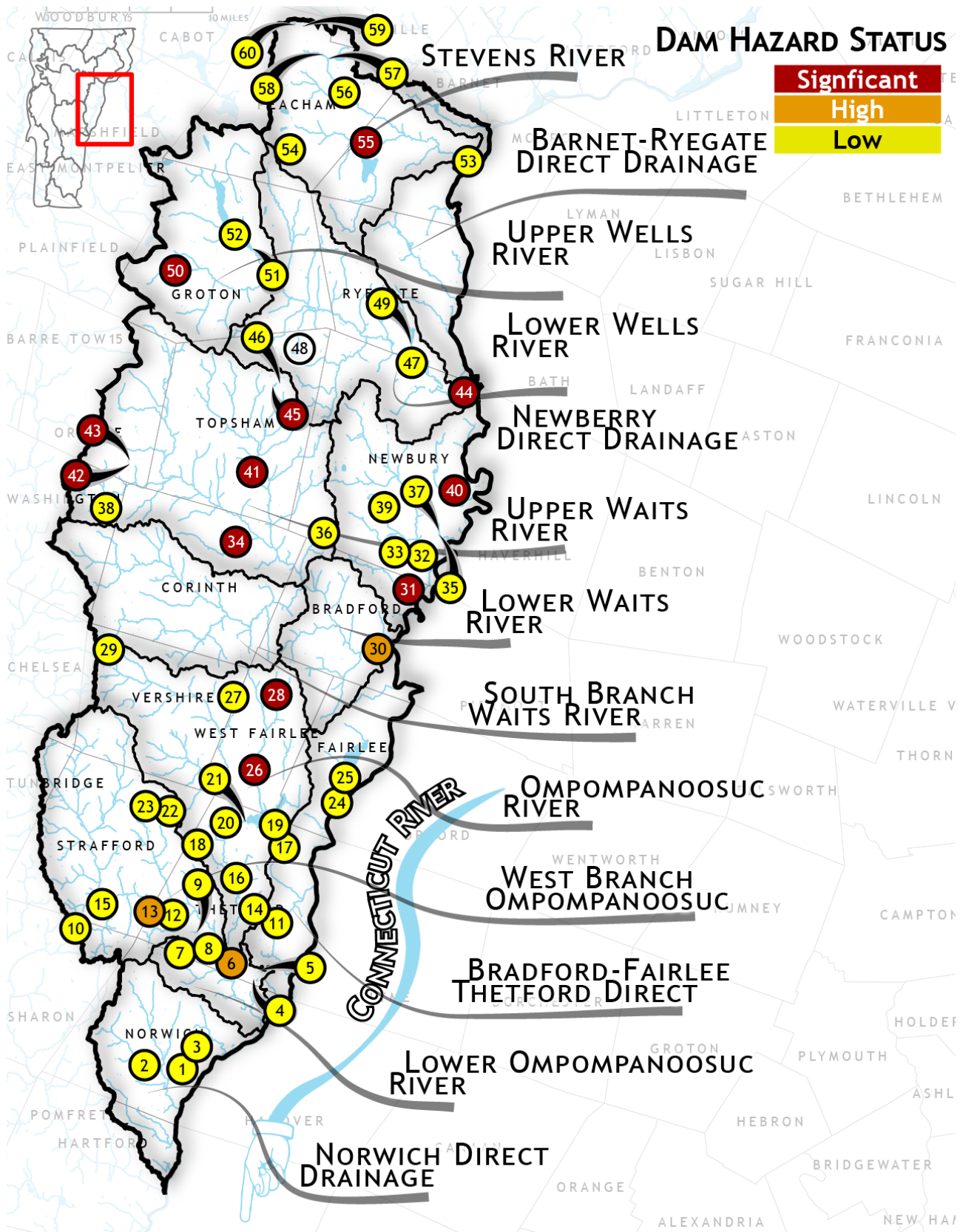


Figure D1. Non-historic dams located in Basin 14. Map #'s in table C1 correlate with the numbers in this map.

Table D1. Active dams in Basin 14 organized by town name. These dams are either in service, partially breached, or deleted. Dams that are not “in-service” are in italics.

Map #	Dam Name	Town	Stream	Owner Type	Surface Acres	Drainage (m²)	Dam Status	Purposes	Year Built	Original Purpose	State Reg	Fed Reg
1	Noonan	Norwich		Private	0.1		In Service				None	None
2	<i>Norwich Reservoir</i>	<i>Norwich</i>	<i>Charles Brown Brook</i>	<i>Local Government</i>	0	5.2	<i>Breached</i>	<i>Other</i>	1920	<i>Water Supply</i>	<i>None</i>	<i>None</i>
3	Hunt Griswold	Norwich	Connecticut River-TR	Private	1.92		In Service	Recreation	1959	Recreation	None	None
4	Thetford-23	Thetford	Ompompanoosuc River-TR	Private	0		In Service				None	None
5	Thetford-22	Thetford	Ompompanoosuc River-TR		2.14		In Service				None	None
6	Union Village	Thetford	Ompompanoosuc River	Federal	805	126	In Service	Flood Control	1950	Flood Control	None	USACOE
7	Norford Lake	Thetford	Avery Brook-TR	Private	18	1.03	In Service	Recreation	1925	Recreation	VDEC	None
8	Payson	Thetford	Ompompanoosuc River-TR	Private	20	0.27	In Service	Recreation	1975	Recreation	VDEC	None
9	<i>Manchester</i>	<i>Thetford</i>	<i>Ompompanoosuc River-TR</i>	<i>Private</i>	3	0.39	<i>Breached (Partial)</i>				<i>VDEC</i>	<i>None</i>
10	CCC Pond	Sharon	Ompompanoosuc River-TR	State	9	0.28	In Service	Recreation	1935	Recreation	VDEC	None
11	Thetford-21	Thetford	Connecticut River-TR		1.23		In Service				None	None
12	Gove Hill Christian Association	Thetford	Lord Brook-TR	Private	3	0.07	In Service	Recreation	1968		VDEC	None
13	Elizabeth Mine TP-1	Strafford	West Branch Ompompanoosuc Riv.	Private	42	0.43	In Service	Tailings	1958	Tailings Pond	VDEC	None
14	Lake Abenaki	Thetford	Ompompanoosuc River-TR		44	1.01	In Service	Recreation	1900		VDEC	None
15	Strafford Recreation	Strafford	W Branch Ompompanoosuc Riv.-TR		0.7		In Service				None	None
16	Mud Pond	Thetford	Ompompanoosuc River-TR	Private	13	1	In Service	Recreation	1940		VDEC	None
17	Thetford-24	Thetford	Roaring Brook	Private	1.7		In Service				None	None
18	Thetford-20	Thetford	Barker Brook-TR		2.66		In Service				None	None
19	Fin n' Feather	Thetford	Lake Fairlee-TR	Private	5	0.79	In Service	Recreation	1956		VDEC	None
20	<i>Montague Rod and Reel Co. (Upper)</i>	<i>Thetford</i>	<i>Ompompanoosuc River</i>	<i>Private</i>	0.5		<i>Breached (Partial)</i>				<i>None</i>	<i>None</i>
21	Lake Fairlee	Thetford	Ompompanoosuc River-TR	Local Government	463	20.28	In Service	Recreation	1939	Water Level Reg.	VDEC	None
22	Miller Pond	Strafford	Abbot Brook-TR	State	63	1.04	In Service	Recreation	1960	Recreation	VDEC	None
23	<i>Malmquist</i>	<i>Strafford</i>	<i>Abbot Brook-TR</i>	<i>State</i>	2	0.59	<i>Breached (Partial)</i>				<i>VDEC</i>	<i>None</i>
24	Bancroft Mill	Fairlee	Connecticut River-TR	Private	4	9.6	In Service	Recreation		Mill Power	VDEC	None
25	Lake Morey	Fairlee	Connecticut River-TR	State	506	7.26	In Service	Recreation	1897		VDEC	None
26	Middle Brook	West Fairlee	Middle Brook	Private	17	9.5	In Service	Recreation	1948	Recreation	VDEC	None
27	<i>Powell</i>	<i>Vershire</i>	<i>Ompompanoosuc River-TR</i>		10	0.98	<i>Deleted</i>		1970		<i>VDEC</i>	<i>None</i>
28	Keefe Site 2	West Fairlee	Middle Brook	Private	4	1.53	In Service	Recreation	1965	Recreation	VDEC	None
29	Vershire-6	Vershire	Meadow Brook-TR	Private	1.9		In Service				None	None
30	Bradford	Bradford	Waits River	Public Utility	91	153	In Service	Hydroelectric	1908	Hydro Power	PSB	FERC
31	Blodgett	Bradford	Roaring Brook	Private	14	4.84	In Service	Recreation	1965	Recreation	VDEC	None
32	Old Stone	Newbury	Halls Brook	Private	0	20	In Service	Hydroelectric	1838	Mill Power	PSB	FERC
33	Cole	Newbury	Halls Brook-TR		2	0.15	In Service	Recreation			VDEC	None
34	Holland	Corinth	Pike Hill Brook-TR	Private	3	0.22	In Service	Recreation	1966	Recreation	VDEC	None
35	Newbury Water Supply (Lower)	Newbury	Connecticut River-TR	Local Government	2.15	0.94	In Service	Water Supply	1890	Water Supply	VDEC	None

Map #	Dam Name	Town	Stream	Owner Type	Surface Acres	Drainage (m²)	Dam Status	Purposes	Year Built	Original Purpose	State Reg	Fed Reg
36	Victory in Jesus	Newbury	Meadow Brook-OS	Private	0.37		In Service		2006		None	None
37	Newbury Water Supply (Upper)	Newbury	Connecticut River-TR	Local Government	0.6	0.85	In Service	Water Supply		Water Supply	None	None
38	Green	Washington	East Orange Branch-TR	Private	2.4	2.01	In Service	Recreation	1971	Recreation	VDEC	None
39	Halls Lake	Newbury	Halls Brook	Private	84	0.88	In Service	Recreation			VDEC	None
40	The Fish Pond	Newbury	Connecticut River-TR	Private	5	0.47	In Service	Recreation	1973	Recreation	VDEC	None
41	Blake	Topsham	Tabor Branch-TR	Private	3	0.62	In Service	Recreation	1972	Wildlife/Recreation	VDEC	None
42	East Orange (Lower)	Orange	East Orange Branch-TR	Private	0.9	0.18	In Service	Recreation			None	None
43	East Orange (Upper)	Orange	East Orange Branch-TR	Private	0.81	0.18	In Service	Recreation			None	None
44	Adams Paper Co.	Newbury	Wells River	Private	11	98	In Service	Hydroelectric	1912		PSB	FERC
45	Clark Site No. 2	Topsham	Tabor Branch-TR	Private	8	0.2	In Service	Recreation	1974	Recreation	VDEC	None
46	Clark Site No. 1	Topsham	Tabor Branch-TR	Private	0.9		In Service				None	None
47	Boltonville No. 11	Newbury	Wells River	Private	2	94	In Service		1928	Hydro Power	PSB	FERC
48	<i>Morse</i>	<i>Topsham</i>	<i>East Brook</i>		<i>0</i>						<i>None</i>	<i>None</i>
49	Ticklenaked Pond	Ryegate	Wells River-TR	Private	48	2.26	In Service	Recreation			VDEC	None
50	Noyes Pond	Groton	South Branch Wells River	State	39	3.76	In Service	Recreation	1934	Recreation	VDEC	None
51	Ricker Pond	Groton	Wells River	State	92	21.09	In Service	Recreation	1900	Mill Storage	VDEC	None
52	Lake Groton	Groton	Ricker Pond-TR	State	414	18.75	In Service	Recreation	1968	Recreation	VDEC	None
53	Barnet No. 14	Barnet	Stevens River	Private	0	48	In Service	Hydroelectric			PSB	FERC
54	Martins Pond	Peacham	Stevens River-TR	State	77	1.25	In Service	Recreation	1958	Recreation	VDEC	None
55	Harveys Lake	Barnet	Stevens River	Local Government	409	20	In Service	Recreation	1970	Recreation	VDEC	None
56	East Peacham Pond	Peacham	Peacham Hollow Brook-OS	Private	5	0.37	In Service	Recreation	1948		VDEC	None
57	<i>Ewell Pond</i>	<i>Peacham</i>	<i>East Peacham Brook-TR</i>	<i>Private</i>	<i>50</i>	<i>3.1</i>	<i>Breached (Partial)</i>	<i>Recreation</i>	<i>1930</i>	<i>Mill Storage</i>	<i>VDEC</i>	<i>None</i>
58	Dawson	Peacham	Peacham Hollow Brook	Private	3	0.59	In Service	Recreation			VDEC	None
59	Aiken	Peacham	Peacham Hollow Brook-TR	Private	2	0.73	In Service	Recreation	1969	Recreation	VDEC	None
60	Tinkers Pond	Peacham	Rake Factory Brook-TR	Private	7	0.08	In Service	Recreation	1908		VDEC	None



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