# State of Vermont

## Water Quality Integrated Assessment Report

# 2018

Vermont Agency of Natural Resources
Department of Environmental Conservation
Watershed Management Division

JDeshler

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## Clean Water Act Section 305(b) Report

Vermont Agency of Natural Resources
**Department of Environmental Conservation**
Watershed Management Division
Montpelier, Vermont 05620
www.vtwaterquality.org/watershed

August 2018

*This assessment is issued as a reporting element of the Vermont Surface Water Management Strategy*

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# Executive Summary

Section 305(b) of the federal Clean Water Act requires each state to submit a report on the quality of the state's surface and ground waters to the US Environmental Protection Agency (EPA) on a biennial basis. This 2018 report updates the known water quality conditions using the Vermont Surface Water Assessment and Listing Methodology with data from the 24-month reporting period of January 1, 2016 through December 31, 2017. To access data that supports the listings below, navigate the Vermont Integrated Watershed Information System (VIWIS).

**Federal listing update:** In the 2018 reporting cycle, two streams and four ponds were added to the 303(d) list of impaired waters, and three streams and two lakes were removed from impaired list of waters. One cause parameter associated with a currently impaired water was delisted. And two Total Maximum Daily Loads (TMDLs) were approved for two streams and one TMDL was approved for one lake.

**State listing update:** In the 2018 reporting cycle, one lake and six streams were added to and three streams were removed from the State list of Surface Waters Altered by Flow. Three rivers and three lakes were removed from and nine lakes were added to the list of Waters altered by Invasive Aquatic Species.

**State Identification and Protection of High Quality Waters:** The people of the State of Vermont own 7,100 miles of rivers and streams and 378.5 square miles of surface water. We endeavor to protect this wealth for the people forever. During this reporting period three wetlands (1744 acres) were reclassified to Class 1, earning them the highest level of protection in the State. We have identified several reclassification opportunities for streams and lakes. We have identified fifty wadeable streams that have achieved and maintained conditions necessary to provide Aquatic biota and wildlife consistent with waters in their natural condition. We have identified ninety-four streams that support very good quality cold water salmonid fisheries, whereby providing high quality fishing opportunities (non contact recreation). And we have identified thirty seven high quality lakes that have no aquatic invasive species, have good shoreland and habitat conditions, good trophic conditions, and/or special natural features. Protecting the watersheds of these streams and lakes is a priority of the State of Vermont (Map 1).

## Changes to the 303(d) List of Impaired Waters

*Additions (Map 2)*

**Tenney Brook** (Rutland City) from its mouth upstream one mile does not fully support aquatic life and is now on the 303(d) list of impaired waters. Respectively, the macroinvertebrate and fish community at river miles 1.0 and 0.1 have failed criteria five out of six and four out of six sampling events (Macro) and three out of three and two out of three sampling events (Fish) since the year 2000. The cause parameter for this stream will remain undefined, but preliminary study attributes the cause of impairment to chloride, nutrients, and temperature. 43°36'57.0"N 72°58'59.0"W

**Blanchard Brook** (Montpelier) from its mouth upstream 0.4 miles does not fully support aquatic life and is now on the 303(d) list of impaired waters. The fish community at river mile 0.1 has failed criteria for three consecutive years and the macroinvertebrate community just meets criteria. The cause parameter for this stream will remain undefined, but preliminary study attributes the cause of impairment to turbidity, nutrients, sediment, and chloride. 44°15'20.0"N 72°33'43.3"W

**Halfmoon Pond** (Fletcher), 21 acres, does not fully support the enjoyment of aesthetic conditions and is now on 303(d) list of impaired waters. Total phosphorous and associated chlorophyll-*a* and secchi disk measurements in recent years indicate hyper eutrophic conditions. (TP > 100 µg/l, chlorophyll-*a* > 25 µg/l, Secchi disk depth < 1.0 m). The cause parameter is defined as phosphorus and the source of the cause parameter is defined as agriculture. (Mean TP 484 µg/l, Mean chlorophyll-*a* 64.25, Mean secchi depth (m) 0.70). 44°41'50.0"N 72°55'48.8"W

**Walker Pond** (Coventry), 18 acres, does not fully support the enjoyment of aesthetic conditions and is now on 303(d) list of impaired waters. Total phosphorous and associated chlorophyll-*a* and secchi disk measurements in recent years indicate hyper eutrophic conditions. The cause parameter is defined as phosphorus and the source of the cause parameter is defined as agriculture. (Mean TP 90 µg/l, Mean chlorophyll-*a* 37.4, Mean secchi depth (m) 0.75). 44°55'34.0"N 72°15'32.2"W

**Mud Pond** (Craftsbury), 35 acres, does not fully support the enjoyment of aesthetic conditions and is now on 303(d) list of impaired waters. Total phosphorous and associated chlorophyll-*a* and secchi disk measurements in recent years indicate hyper eutrophic conditions. The cause parameter is defined as phosphorus and the source of the cause parameter is defined as agriculture. (Mean TP 86 µg/l, Mean chlorophyll-*a* 21.8, Mean secchi depth (m) 0.98). 44°38'19.5"N 72°23'39.2"W

**Beaver Pond** (Roxbury), 10 acres, does not fully support aquatic life due to acid deposition from long distance transport of air pollution and is now on the 303(d) list of impaired waters. Recent sampling in 2015 and 2016 reveal alkalinity < 2.5 mg/l $CaCO_3$, the cutoff for "extreme sensitivity" to acidification. 44°03'35.2"N 72°43'14.1"W

*Delistings*

**Little Otter Creek** (New Haven) between river mile 15.4 and 16.4 has not fully supported aquatic life and has been on the 303(d) list of impaired waters since the 1990s due to nutrients and sediment. The most recent macroinvertebrate sampling event (2016) exceeded criteria and is now near reference condition. 44°07'48.6"N 73°07'01.0"W

**Jay Branch and Jay Branch Tributary #9** (Jay) between river mile 7.3 and 9.1 of Jay Branch and the entire tributary #9 have not fully supported aquatic life due to sedimentation from development and have been on the alternative TMDL list of impaired waters. Since reinvigoration the Jay Peak Water Quality Remediation Plan in 2015 and the construction of swales, settling ponds, and road improvements, these streams have shown macroinvertebrate communities meeting criteria for aquatic life support in the Vermont Water Quality Standards (VWQS). 44°56'19.5"N 72°29'32.9"W; 44°56'26.4"N 72°28'54.9"W

**Lily Pond** (Londonderry), 21 acres, has not fully supported aquatic life due to low pH from atmospheric deposition and has been on the 303(d) list of impaired waters. A TMDL was approved by EPA in September 2012. Lily Pond has had Gran alkalinities consistently above 2.5 mg/l $CaCO_3$ since and is now meeting VWQS. 43°14'07.3"N 72°45'07.1"W

**Turtle Pond** (Holland), 27 acres, has not fully supported aquatic life due to low pH from atmospheric deposition and has been on the 303 (d) list of impaired waters. A TMDL was approved by EPA in September 2003. Lily Pond Gran alkalinities have consistently risen above 2.5

mg/l $CaCO_3$ due to reductions in atmospheric pollutants and is now meeting VWQS. 44°59'34.4"N 71°55'17.1"W

**Big Spruce Brook** (Stowe) between river mile 0.2 and 0.8 does not fully support aquatic life and the enjoyment of aesthetic conditions. River mile 0.2 to 0.3 was on the TMDL alternative list of impaired waters due to the cause parameters sediment/siltation and Iron from land development at Stowe Mountain Resort. Several non TMDL remediation actions for both sediment and iron have been implemented but little improvement has been observed. Biological assessment in 2016 indicated sediment/siltation is not a cause parameter and reaffirmed the iron cause parameter. Iron pollution is feeding a bacterial mat that disrupts the trophic structure of the macroinvertebrate community. River mile 0.3 to 0.8 was on the 303 (d) list of impaired waters requiring a TMDL due to the cause parameter Iron. We are now aware that Big Spruce Brook lies upon the Hazens Notch Formation (HNF). The HNF is dominated by rusty weathering schist and gneiss that is leaching Iron and Sulfur to the streams above it. The entire **Big Spruce Brook** is now removed from the 303(d) list of impaired waters due to the reassessment of sediment cause parameter and the identification of a natural source for Iron. 43°41'09.3"N 73°18'42.0"W

**Hubbardton River Tributary #7** (Benson) is below a waste water treatment facility, a large wetland, and substantial agricultural lands. Hubbardton River Tributary #7 does not fully support aquatic life, boating, and related recreation activities. This tributary is on the 303(d) list of impaired waters due to the cause parameters nutrients and temperature. The temperature cause parameter has been reassessed and is now attributed to Strong Swamp, a large, shallow, non-forested wetland upstream of the sampling site. Temperature is now delisted due to the identification of a natural source. Further monitoring and assessment is required to partition the nutrient contributions between the waste water treatment facility and the agricultural lands. 43°41'09.3"N 73°18'42.0"W

## Approved Total Maximum Daily Loads

**Moon Brook and Mussey Brook** (Rutland) between river mile 1.8 and 2.9 and river mile 0.1 and river mile 0.5 respectively do not fully support aquatic life and are on the 303(d) list of impaired waters for the cause parameter temperature from impoundments (Combination Pond and Piedmont Pond) and lack of shading. In 2018, a temperature TMDL was approved by EPA. Implementation of this TMDL includes modifying impoundments and planting of riparian vegetation. 43°36'01.1"N 72°57'57.2"W

**Lake Memphremagog** (Newport), 5966 acres, does not fully support the enjoyment of aesthetic conditions and the use of waters for swimming and other primary contact recreation. Lake Memphremagog is on the 303(d) list of impaired waters for the cause parameter phosphorus and the observed effect of algae growth from non-point source nutrient enrichment. In 2017, a phosphorus TMDL was approved by EPA. Implementation of this TMDL will be done through the development of a tactical basin plan with an update every five years. 44°58'10.2"N 72°13'29.3"W

**Changes to the State list of Waters Altered by Flow Regulation**

*Additions*

**Lake Bomoseen Outlet Stream** (Castleton), 0.4 miles downstream of Lake Bomoseen dam does not fully support aquatic life due to flow fluctuation and no minimum flow. Remediation action expected by 2020. 43°36'15.7"N 73°14'00.1"W

**Missisquoi River** (East Highgate), 15.5 miles below Sheldon Springs project to downstream of lower Swanton Dam does not fully support aquatic life and contact recreation due to artificial flow fluctuation by hydropower production. Federal Energy Regulatory Commission (FERC) license renewal is expected in 2024.

44°54'50.5"N 72°59'21.4"W

**Missisquoi River** (Highgate Falls), 7.3 miles below Highgate Falls project downstream of lower Swanton Dam does not fully support aquatic life and contact recreation due to artificial flow fluctuation by hydropower production. Federal Energy Regulatory Commission (FERC) license renewal is expected in 2024.

44°55'59.1"N 73°03'14.3"W

**Cold Brook** (Wilmington), 0.6 miles below Hermitage snowmaking withdrawal does not fully support aquatic life due to artificial and insufficient flow. A compliance schedule has been established as part of ACT 250 process to bring the withdrawal into compliance. Remediation action expected in 2020. 42°55'36.5"N 72°53'22.7"W

**Seaver Brook** (Craftsbury), 0.3 miles below a withdrawal for private ponds does fully support aquatic life and an instream structure prevents fish passage. DEC and Department of Fish and Wildlife (DFW) are in proceedings to establish minimum flow and to restore fish passage. 44°40'00.1"N 72°19'47.4"W

**Black River** (Springfield), 3.7 miles below North Springfield Reservoir does not fully support aquatic life due to artificial flow regulation by US Army Corps of Engineers. No remediation is planned. 43°18'01.8"N 72°29'03.5"W

**Lake Memphremagog** (Newport), water level fluctuation by hydropower does not fully support aquatic life. DEC is a party to regular meetings which include International Joint Commission, Canadian Environmental Regulatory Authorities, and municipalities to discuss ways to improve the water quality of the lake. 44°58'10.2"N 72°13'29.3"W

***Delistings***

**Tributary to North Branch Deerfield (Jack's Brook)** (Dover), 1.5 miles below withdrawal will fully support aquatic life with alternatives. 42°57'16.1"N 72°53'23.6"W

**North Branch of Deerfield River** (Dover), 11.5 miles below withdrawal will fully support aquatic life with new withdrawal system and designed conservation flows. 42°53'36.4"N 72°51'22.8"W

**Sackett's Brook** (Putney), Putney Paper withdrawal is now in compliance. 42°58'46.6"N 72°31'24.9"W

**Changes to the State list of Waters Altered by Aquatic Invasive Species.**

***Additions***

The following waters do not fully support the enjoyment of aesthetic conditions, aquatic life, contact recreation, and boating due to abundant Eurasian watermilfoil growth:

**Burr Pond** (Sudbury) management: herbicides, Diver Operated Suction Harvesting (DOSH), benthic barriers and hand-pulling. 43°45'55.5"N 73°10'59.8"W

**Echo Lake** (Hubbardton) management: DOSH, benthic barriers and hand-pulling. 43°44'49.8"N 73°10'56.8"W

**Beebe Pond** (Hubbardton) management: herbicides, DOSH, benthic barriers and hand-pulling. 43°44'03.3"N 73°11'04.1"W

**Lily Pond** (Poultney) management: herbicides, DOSH, benthic barriers and hand-pulling. 43°29'43.3"N 73°12'28.1"W

**Indian Brook Reservoir** (Essex Junction) management: herbicides 44°32'05.5"N 73°05'55.7"W

**Deweys Mill Pond** (Hartford) management: benthic barriers and hand pulling 43°38'42.7"N 72°24'05.6"W

**Pinneo Lake** (Hartford) proposed management: herbicides

43°39'06.7"N 72°25'54.3"W

**Lake Willoughby** (Westmore) management: DOSH, benthic barriers and hand-pulling. 44°45'29.8"N 72°03'49.5"W

***Delistings***

**Leicester River** (Leicester)

43°53'07.3"N 73°07'02.2"W

**Brownington Pond** (Brownington)

44°52'39.8"N 72°08'55.8"W

**Lower Winooski River** (Winooski)

44°29'30.8"N 73°08'43.1"W

**Halls Lake** (Newbury)

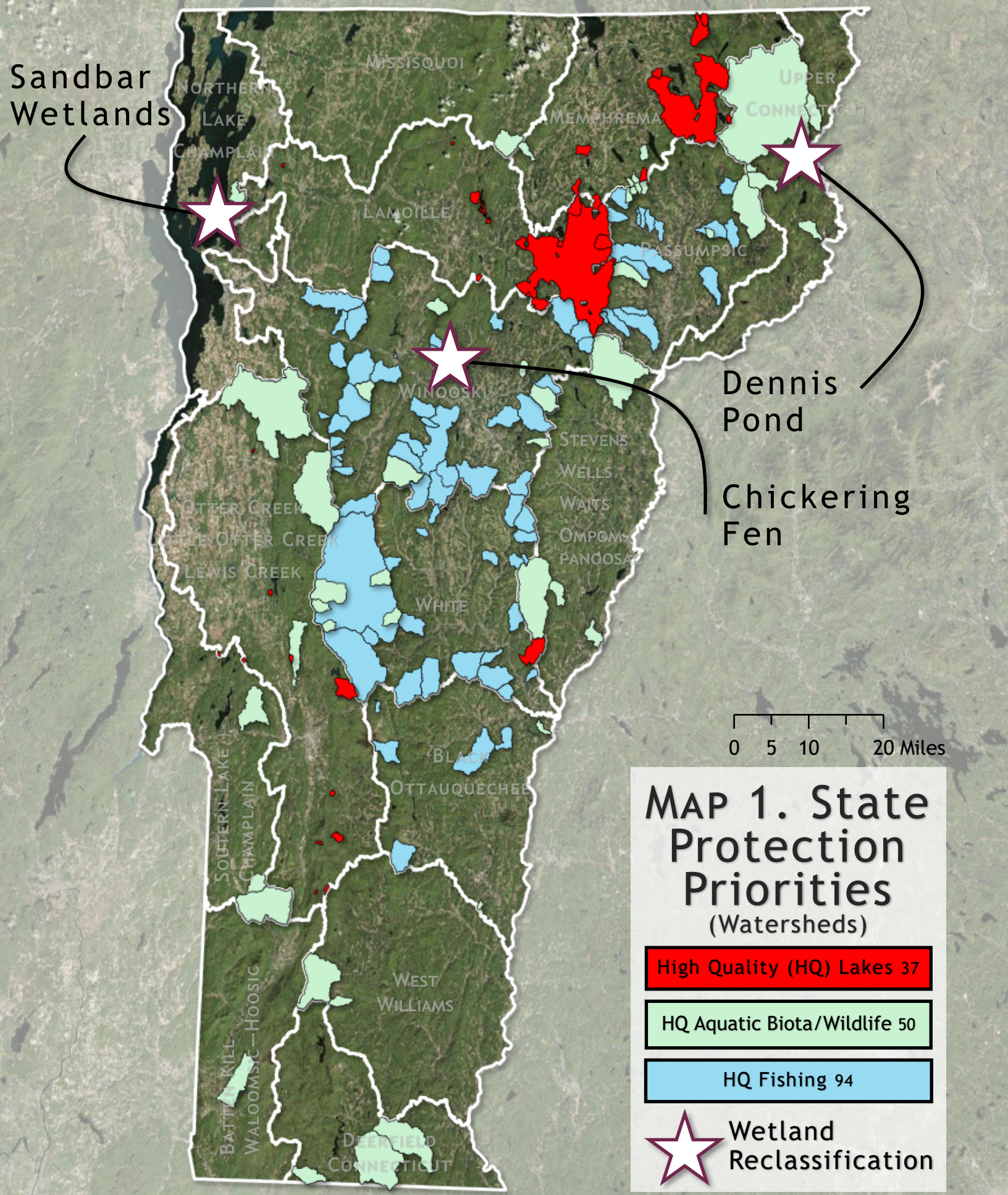
44°05'10.9"N 72°07'24.1"W

**Waterbury Reservoir** (Waterbury)

44°23'49.2"N 72°45'22.7"W

**West River—Retreat Meadows Area** (Brattleboro)

42°51'49.6"N 72°33'43.9"W


Sandbar Wetlands
Dennis Pond
Chickering Fen
Missisquoi
Northern Lake Champlain
Lamoille
Memphremagog
Upper Connecticut
Passumpsic
Winooski
Stevens
Wells
Waits
Ompompanoosuc
Otter Creek
Little Otter Creek
Lewis Creek
White
Black
Ottauquechee
Southern Lake Champlain
West Williams
Battenkill
Walloomsac—Hoosic
Deerfield
Connecticut
0 5 10 20 Miles
Map 1. State Protection Priorities
(Watersheds)
High Quality (HQ) Lakes 37
HQ Aquatic Biota/Wildlife 50
HQ Fishing 94
Wetland Reclassification

## State Protection and Identification of High Quality Waters

*Wetland Reclassification* Class I wetlands have been determined to be, based on their functions and values, exceptional or irreplaceable in its contribution to Vermont's natural heritage and, therefore, merits the highest level of protection. All Class I wetlands are mapped on the Vermont Significant Wetland Inventory (VSWI) maps and listed in the Vermont Wetland Rules. To learn more please visit our Class I wetlands page.

*Protection priorities for aquatic biota and wildlife* are based upon stream biomonitoring assessments of macroinvertebrates and fish communities conducted by the DEC's Biomonitoring and Aquatic Studies staff. Each community type must be sampled at least twice in the last ten years and have a minimum of 3 out of four very good or better assessments. These are based on a statewide assessment.

*Protection priorities for recreational fishing* are based upon fishery assessments conducted by Vermont Fish and Wildlife. Priorities are defined as fishing waters that 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). These priorities are not based on a statewide assessment.

*Protection priorities for lakes* are based upon aquatic invasive species surveys, lake shore disturbance assessments using the USEPA National Lake Assessment thresholds, and nutrient trend analysis using data from Vermont's Spring Phosphorous and Lay Monitoring Programs. These works are done by the Vermont Lakes and Ponds Program. The scoring of these three elements is illustrated in the Vermont Inland Lake Score Card on page 36. These priorities are not based on a statewide assessment.

For specific information on these protection priorities, see the Tactical Basin Plans coincident with the watersheds in Map 1.


# Map 2. Updates to **Federal** and **State** lists.

# Introduction

The 305(b) Integrated Report is a required report for communicating to EPA and Congress about the progress being made in maintaining and restoring the State's water quality and describing the extent of remaining problems. The extent of remaining water quality problems in the State of Vermont is accounted for in the following lists: impaired, impaired w/ TMDL, impaired w/ TMDL alternative, altered by flow regulation, and altered by aquatic invasive species. The methods used to monitor, assess and list these waters are also online.

The 305(b) Report supports the Federal government in awarding monies to the State of Vermont under the Clean Water Act Section 106. EPA's Watershed Assessment, Tracking and Environmental Results website relies upon information submitted from this Report. Also, the 305(b) reporting process is an important tracking tool for the performance of water quality protection initiatives under the Core Performance Measures of the Performance Partnership Agreements, and the information contained in this report is used to derive Vermont-specific Results Based Accountability metrics required pursuant to State law.

Finally, the 305(b) water quality assessments assist in the identification of impaired waters under Section 303(d) of the Clean Water Act. This report, as well as earlier 305(b) Reports, can be found on the Watershed Management Division's Monitoring, Assessment, and Planning Program website.

# Background Information

## Total Waters

Vermont has 7,100 miles of rivers and streams based on EPA's Total Waters Database which uses 1:100,000 scale maps. Currently, the state of Vermont uses this scale to account for assessed and unassessed stream miles. Vermont has approximately 230,900 acres of lakes, reservoirs and ponds and approximately 300,000 acres of freshwater wetlands (Table 1). Vermont water resources and related spatial data can be accessed on the VT Natural Resource Atlas.

Table 1. Atlas of Vermont

| | |
|---|---|
| State Population (December 01, 2017) | 624594 |
| State population (since 2010) | - 0.2 % |
| State surface area | 9,616 square miles |
| State population density | 65 persons / square mile |
| Miles of perennial rivers & streams | 7,100 |
| Border miles of shared rivers & streams | 262 (238 Connecticut River, 24 Poultney River) |
| Longest river in State, not including the Conn. | 100 miles (Otter Creek) |
| Largest river watershed in the state, not the Conn. | 1080 square miles (Winooski River Watershed) |
| Number of lakes, reservoirs & ponds over 20 acres | 280 |
| Number of lakes, reservoirs & ponds from 10 to 20 acres | 148 |
| Number of significant lakes, reservoirs & ponds less than 5 acres | 206 |
| Deepest in-land lake (Willoughby) | 337 feet |
| Greatest depth of Lake Champlain (Off Thompson's Point) | 394 feet |
| Acres of lakes, reservoirs & ponds | 242,219 acres, including 171,967 VT Lake Champlain |
| Acres of freshwater wetlands | 300,000 |

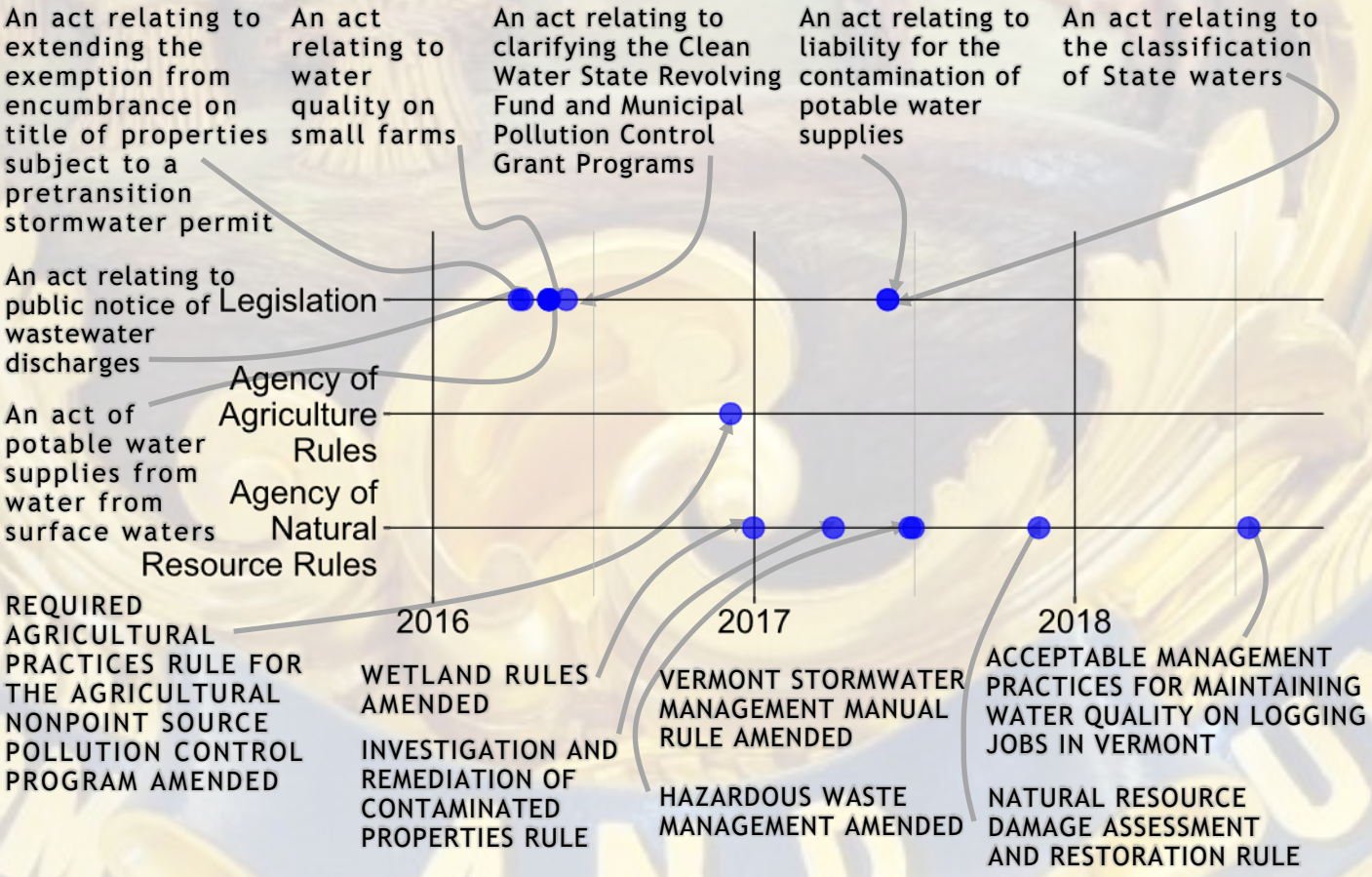
## Water Pollution Control Program

The Vermont Department of Environmental Conservation (DEC) is the designated water quality management agency for the State of Vermont. In 2016 & '17, DEC used **2.4 million** dollars in §319 funds to administrate programs that control pollution from nonpoint sources. An additional **34 million** dollars in State funds was invested on the ground in clean water projects.

An accounting of State monies spent on and benefits reaped from clean water projects can be found in the 2016 and '17 Vermont Clean Water Initiative Investment Reports. Select cost/benefit analysis from the 2017 report is shared below (page 17-20).

Point source pollution control is administered in part through the NPDES permitting programming, including direct discharges and stormwater. Descriptions of all programs that protect and restore the Waters of Vermont can be found here.

Between January 01, 2016 and December 31, 2017 the Governor of the State of Vermont signed seven bills related to water quality into law and the Agency of Agriculture and the Department of Environmental Conservation instituted two rules and amended four others relating to water quality:



**Cost/Benefit Analysis** From Vermont Clean Water Initiative 2017 Investment Report

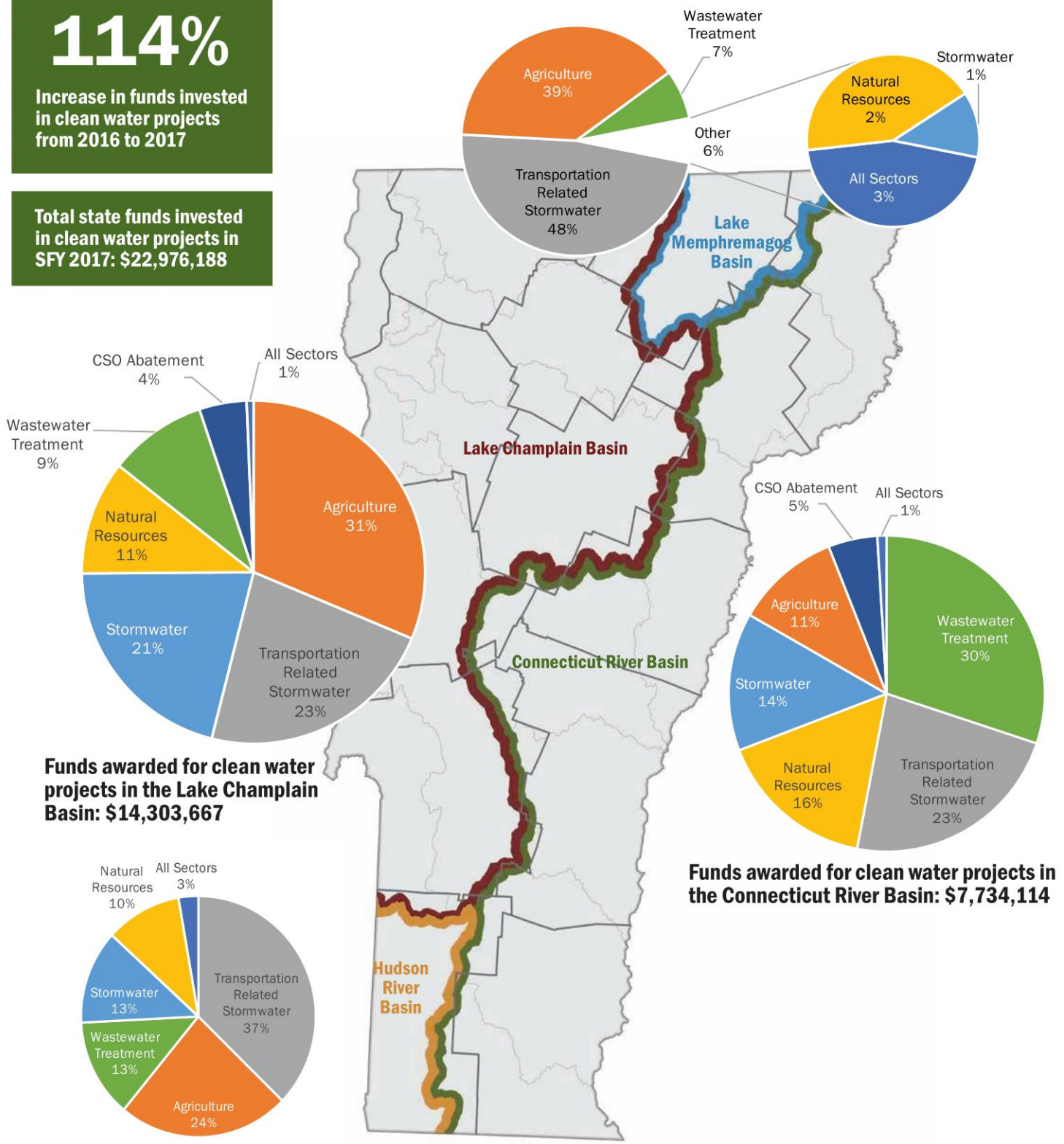
# State Investments in Clean Water

**State funding awarded in SFY 2017, by major basin.**

**114%**

**Increase in funds invested in clean water projects from 2016 to 2017**

**Total state funds invested in clean water projects in SFY 2017: $22,976,188**




**Funds awarded for clean water projects in the Lake Memphremagog Basin: $607,164**




**Funds awarded for clean water projects in the Lake Champlain Basin: $14,303,667**




**Funds awarded for clean water projects in the Connecticut River Basin: $7,734,114**




**Funds awarded for clean water projects in the Hudson River Basin: $331,243**

# Results of Agricultural Projects

**Results of agricultural pollution prevention projects implemented in SFY 2017, statewide.**

| PROJECT RESULTS | | | BENEFITS | | | | | |
|---|---|---|---|---|---|---|---|---|
| Performance Measures | 2016 | 2017 | TMDL[1] Implementation | Act 64 (2015) Implementation | RAP[1] Compliance | Flood Resiliency | Working Landscape | Habitat Function |
| Acres of cropland and pasture treated by annual conservation practices | 3,865 | 2,486* | ✓ | ✓ | ✓ | | ✓ | |
| Acres of cropland and pasture treated by crop rotation and associated practices | 572 | 0* | ✓ | ✓ | ✓ | | ✓ | |
| Acres of cropland and pasture treated by forested buffers | 366 | 178* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Number of barnyard/production area practices installed | 39 | 87 | ✓ | ✓ | ✓ | | ✓ | |
| Acres of water quality protections within conserved agricultural lands | New in 2017 | 89 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

* USDA NRCS prioritized federal funding for field-based practices in SFY 2017, therefore, state-funded field practices decreased relative to SFY 2016, while state-funded barnyard/production area practices increased by more than 50 percent relative to SFY 2016. Federally funded projects are outside the scope of this report.

| POLLUTANT REDUCTION | | | | |
|---|---|---|---|---|
| Total Phosphorus Reduced (Kilograms per Year) | 2016 | 2017 | Cumulative | Extent of Load Reduction Quantified |
| Annual agricultural conservation practices | 443** | 283** | 283** | 53 percent of acres quantified in 2017 (projects in the Lake Champlain basin) |
| Agricultural crop rotation and associated practices | 271 | 0 | 271 | 100 percent of acres quantified (cumulative) (projects in the Lake Champlain basin) |
| Forested riparian buffer restoration on agricultural lands | 199 | 34 | 234 | 69 percent of acres quantified (cumulative) (projects in the Lake Champlain basin) |

** Annual agricultural conservation practices are only considered active for one year. Prior year annual practices do not count toward cumulative values.

**AGRICULTURAL HIGHLIGHTS**

**Updated Required Agricultural Practices (RAPs) regulations became effective December 2016, and are expected to drive demand for additional projects in 2018**

**Before (left) and after (right) installation of livestock exclusion fencing and improved laneway and water crossing in Pawlet, completed by Poultney Mettowee Conservation District with Agency of Natural Resources funding**

1 - Definition of acronyms: Total Maximum Daily Load (TMDL); Required Agricultural Practices (RAP)

**Cost/Benefit Analysis** From Vermont Clean Water Initiative 2017 Investment Report

# Results of Natural Resources Projects

**Results of natural resources restoration projects implemented in SFY 2017, statewide.**

| PROJECT RESULTS | | | BENEFITS | | | |
|---|---|---|---|---|---|---|
| Performance Measures | 2016 | 2017 | TMDL[1] Implementation | Flood Resiliency | Outdoor Recreation | Habitat Function |
| Acres of forested riparian buffer restored through buffer planting | 88 | 16 | ✓ | ✓ | ✓ | ✓ |
| Acres of river corridor conserved through easements | 141 | 209 | ✓ | ✓ | ✓ | ✓ |
| Acres of floodplain restored | 0 | 2 | ✓ | ✓ | ✓ | ✓ |
| Stream miles enhanced and reconnected due to dam removal (also supports aquatic organism passage) | 0 | 98 | ✓ | ✓ | ✓ | ✓ |
| Acres protected for public access, recreation, forest conservation, and water quality | New in 2017 | 4,906 | | ✓ | ✓ | ✓ |
| Acres of water quality protections within conserved land (forested buffer area and wetland protection zones) | New in 2017 | 98 | ✓ | ✓ | ✓ | ✓ |

| POLLUTANT REDUCTION | | | | EXTENT OF LOAD REDUCTION QUANTIFIED |
|---|---|---|---|---|
| Total Phosphorus Reduced (Kilograms per Year) | 2016 | 2017 | Cumulative | |
| Forested riparian buffer restoration on non-agricultural lands | 74 | 12 | 86 | Pollutant reductions quantified for 25 percent of buffer acres in 2016 and 34 percent in 2017 (projects in the Lake Champlain and Memphremagog basins) |

**NATURAL RESOURCES HIGHLIGHTS**

**Natural resources restoration projects reduce nutrient and sediment pollution, as well as improve flood resiliency, support outdoor recreational opportunities, and improve habitat function**


**Before (above, right) and after (below, right) relocation of 1,100 feet of Stowe's Recreation Path outside of the river hazard zone and restoration/planting of two acres of floodplain, completed by Town of Stowe with Agency of Natural Resources funding**

1 - Definition of acronyms: Total Maximum Daily Load (TMDL)

# Results of Transportation Related Stormwater Projects

**Results of transportation related stormwater projects implemented in SFY 2017, statewide.[1]**

| PROJECT RESULTS | | | BENEFITS | | | | | |
|---|---|---|---|---|---|---|---|---|
| Performance Measures | 2016 | 2017 | TMDL[2] Implementation | Act 64 (2015) Implementation | MRGP[2] Compliance | Municipal Stormwater Compliance | Flood Resiliency | Habitat Function |
| Miles of municipal road drainage improvements | 1* | 13** | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Number of municipal road drainage structures installed | 176* | 68 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Number of municipal road drainage and stream culverts replaced | 4* | 109** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Stream miles enhanced and reconnected due to replaced stream culverts (also supports aquatic organism passage) | 27* | 2.4* | | | | | ✓ | ✓ |

* Represents results of ANR-funded projects only, therefore, results are likely underreported. Data were not tracked/reported by VTrans for applicable reporting periods.

** Data available for, and represent, two-thirds of projects completed in SFY 2017.

| POLLUTANT REDUCTION | | | | EXTENT OF LOAD REDUCTION QUANTIFIED |
|---|---|---|---|---|
| Total Phosphorus Reduced (Kilograms per Year) | 2016 | 2017 | Cumulative | Pollutant reductions quantified for 38 percent of municipal road miles improved (projects in the Lake Champlain basin) |
| Road erosion control practices | 4 | 22 | 26 | |

**TRANSPORTATION RELATED STORMWATER HIGHLIGHTS**

**Roadside erosion/nutrient pollution controls required by the Municipal Roads General Permit are expected to drive implementation of additional projects in future years**

**Before (left) and after (right) installation of a stone-lined ditch along Finel Hollow, Highland Gray, and Watkins Hill Roads in Poultney, completed by the Town of Poultney with VTrans funding**

1 - Results of projects completed by VTrans to comply with water quality regulations on state highways and VTrans non-road developed lands are outside the scope of this report.

2 - Definition of acronyms: Total Maximum Daily Load (TMDL); Municipal Roads General Permit (MRGP)

# Surface Water Monitoring & Assessment

**Monitoring Program**

The Vermont Water Quality Monitoring Program Strategy 2011-2020 delineates the who, what, where, and why of water quality monitoring in the State of Vermont and endeavors to integrate monitoring results from non state partners to accomplish two goals:

> ***Goal 1****: To monitor and assess the physical, chemical and biological condition of Vermont's waters to protect and restore their integrity and uses.*
>
> ***Goal 2****: To interpret, analyze and communicate monitoring and assessment results to the Agency of Natural Resources and outside groups to support the development of appropriate management decisions for Vermont surface waters.*

Vermont DEC accomplishes these goals on a rotational basin schedule, monitoring three eight-digit basins per monitoring season (see map 3). A map booklet for the 2018 monitoring season is available.

During this reporting period, the DEC has made the following accomplishments, pursuant to agreements with USEPA on the use of supplemental Clean Water Act §106 funding:

**River Biomonitoring:**

i. Continued sampling Vermont rivers using a randomized, rotating-basin probability design to produce a statewide probability assessment while contributing to the overall rotational assessment.

ii. Coordinated with EPA ORD statisticians to redesign probability design beginning with 2018 with a rolling 3 year average. New monitoring design will allow for reporting on state-wide assessments of rivers on a yearly basis beginning in 2021.

iii. Continued upstream-downstream WWTF sampling on identified facilities in the current year basin rotation to better inform reasonable potential determinations for wastewater permits.

iv. Completed National Rivers and Stream Assessment (August 2018).

v. Completed macroinvertebrate biocriteria for wadeable low gradient streams.

vi. Incorporated sampling for the NY/NE Regional Monitoring Network (RMN) to look at long term changes in temperature, hydrology and biology resulting from a changing climate.


Missisquoi
Northern Lake Champlain
Memphremagog
Upper Connecticut
Lamoille
Passumpsic
Winooski
Stevens Wells Waits Ompom-panoosac
Otter Creek Little Otter Creek Lewis Creek
White
Black Ottauquechee
Soutern Lake Champlain
West Williams
Batten Kill Waloomsic–Hoosic
Deerfield Connecticut
Map 3. Monitoring Rotation
2018
2019
2020
2021
2022

**Lake Monitoring:**

i. Completed a phosphorus TMDL for Lake Memphremagog. The program will now transition to focus on TMDL implementation tracking.

ii. Continued to collect data from Vermont's lakes and ponds through our established long-term monitoring programs – Spring P, Summer Assessment, Lake Champlain TMDL monitoring, aquatic macrophyte surveys, invasive species, Acid Lakes.

iii. Continued to work with local citizen volunteers across the State to:
- Monitor water quality on inland lakes and ponds (the Lay Monitoring Program)
- Monitor cyanobacteria on Lake Champlain and smaller inland lakes
- Work with local volunteers to monitor for invasive species and operate boat inspection stations throughout the state

iv. Established and expanded water quality monitoring on Lake Carmi in preparation for the installation of an aeration system to control internal loading.

v. Continued to develop biomonitoring protocols utilizing aquatic macrophytes and diatoms.

vi. Initiated a follow-up inspection protocol for shoreland permitting sites to evaluated compliance with permit requirements.

vii. Continued to monitor for invasive aquatic plants on infested waterbodies through our established aquatic invasive species program, celebrating 31 years.

viii. Continued to monitor for zebra mussels through the Lake Champlain long-term monitoring program and the aquatic invasive species management program. In 2015, monitoring for spiny waterflea on inland lakes was added.

ix. Completed National Lakes Assessment

**Wetland Monitoring:**

i. Completed the second round of the EPA's National Wetlands Condition Assessment, a national-scale assessment of wetland condition, with visits to nine wetlands.

ii. Revised the Vermont Rapid Assessment Method (VRAM) to better assess Vermont wetlands and began trainings on the methodology to policymakers, researchers, and stakeholders.

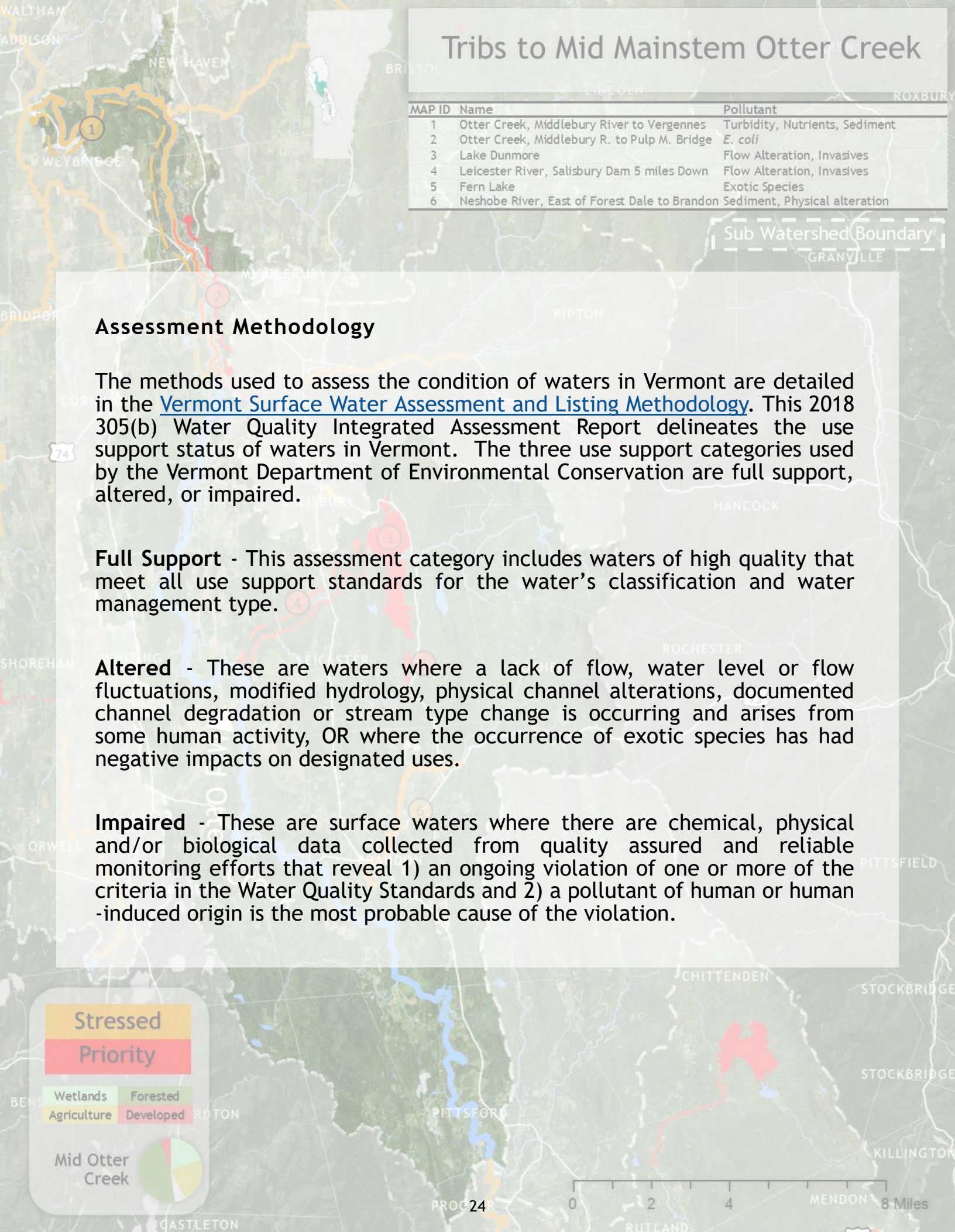
iii. Completed 176 rapid assessments of wetland condition and function using the VRAM

iv. Incorporated Tactical Basin Planning in to site selection processes.

v. Began collaboration with other water quality monitoring programs within the Watershed Management Division.

vi. Refined and adopted a quantitative vegetation monitoring protocol based on methods employed by the VT Natural Heritage Inventory, facilitating cross compatibility with their large existing dataset.

vii. Hired a full-time position to build capacity of the Wetlands Bioassessment program.




## Assessment Methodology

The methods used to assess the condition of waters in Vermont are detailed in the Vermont Surface Water Assessment and Listing Methodology. This 2018 305(b) Water Quality Integrated Assessment Report delineates the use support status of waters in Vermont. The three use support categories used by the Vermont Department of Environmental Conservation are full support, altered, or impaired.

**Full Support** - This assessment category includes waters of high quality that meet all use support standards for the water's classification and water management type.

**Altered** - These are waters where a lack of flow, water level or flow fluctuations, modified hydrology, physical channel alterations, documented channel degradation or stream type change is occurring and arises from some human activity, OR where the occurrence of exotic species has had negative impacts on designated uses.

**Impaired** - These are surface waters where there are chemical, physical and/or biological data collected from quality assured and reliable monitoring efforts that reveal 1) an ongoing violation of one or more of the criteria in the Water Quality Standards and 2) a pollutant of human or human -induced origin is the most probable cause of the violation.

In 2017, DEC renamed seven uses from 2016 305(b) and split one use into two uses to adhere to Vermont's Water Quality Standards. New water uses include:

- *Aquatic biota and wildlife that may utilize or are present in the waters (Aquatic biota, split from **Aquatic biota/habitat**)*
- *Aquatic habitat to support aquatic biota, wildlife, or plant life (Aquatic habitat, split from **Aquatic biota/habitat**)*
- *The use of waters for the enjoyment of aesthetic conditions (**Aesthetics**)*
- *The use of waters for swimming and other primary contact recreation (Contact recreation)*
- *The use of waters for boating and related recreational uses (**Noncontact recreation**)*
- *Fish Consumption*
- *The use of the water for public water source (not reported)*
- *The use of water for irrigation of crops and other agricultural uses (not reported)*

The latter two uses are not reported as they are completely unassessed uses. Determination of use support is made using information gathered by DEC from many sources including water resources staff, fish and wildlife biologists, aquatic biologists, watershed organizations, and other individuals or groups who have qualified data and information.

Vermont is presenting assessment results along with a series of lists that are analogous to EPA's reporting categories. The Vermont Part A list of 303(d) waters impaired by pollutants corresponds to EPA "Category 5" impaired waters. The Vermont Part B list of impaired waters not in need of a TMDL analysis corresponds to EPA "Category 4B or 5A". Vermont Part D is a list of waters that have approved TMDLs, which is analogous to EPA "Category 4A." In Vermont, altered waters are those where water quality impairments exist due to non-pollutants. These occur on the Vermont Parts E and F lists (exotic species and flow altered respectively), and all are analogous to EPA "Category 4C." Fully supporting waters are analogous to EPA "Category 1 or 2."

## Assessment Results (Rivers and Streams)

Table 3. Use support for Vermont rivers and streams (miles).

| USENAME | FULLY† | ALTERED | IMPAIRED | NOTASSESSED† |
|---|---|---|---|---|
| Aesthetics | 5629.5 | 94.7 | 45.7 | 1011.5 |
| Aquatic biota | 5380.9 | 246.9 | 154.8 | 973.7 |
| Aquatic habitat | -* | 52.1 | 3.6 | -* |
| Contact recreation | 5315.0 | 44.0 | 169.1 | 1266.3 |
| Fish consumption | 6728.7 | 0 | 66.2 | 0 |
| Noncontact recreation | 5520.3 | 106.8 | 11.3 | 1156.3 |

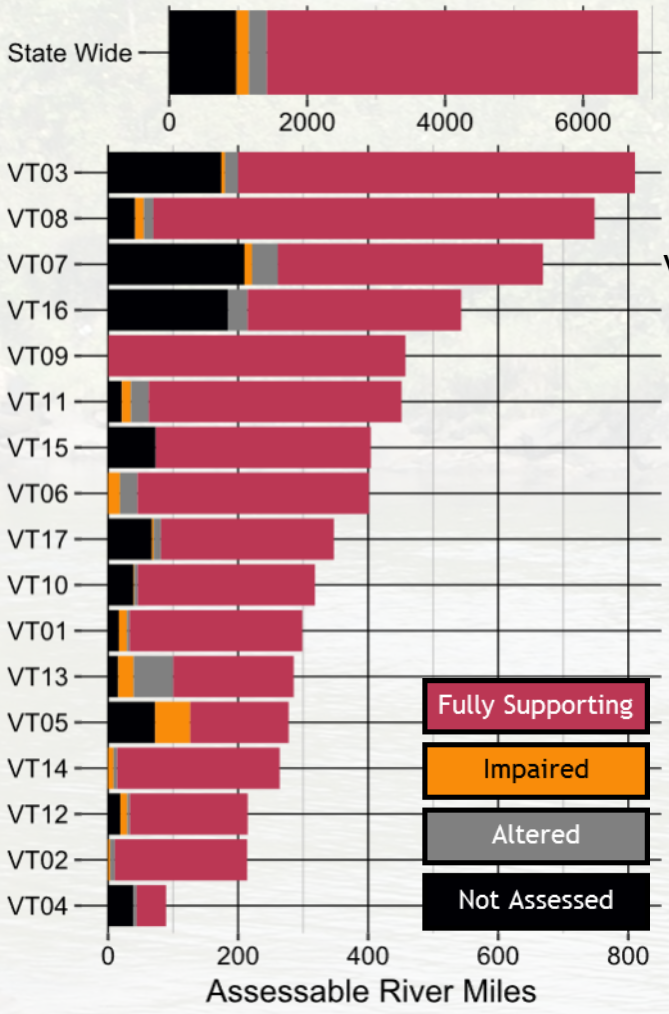
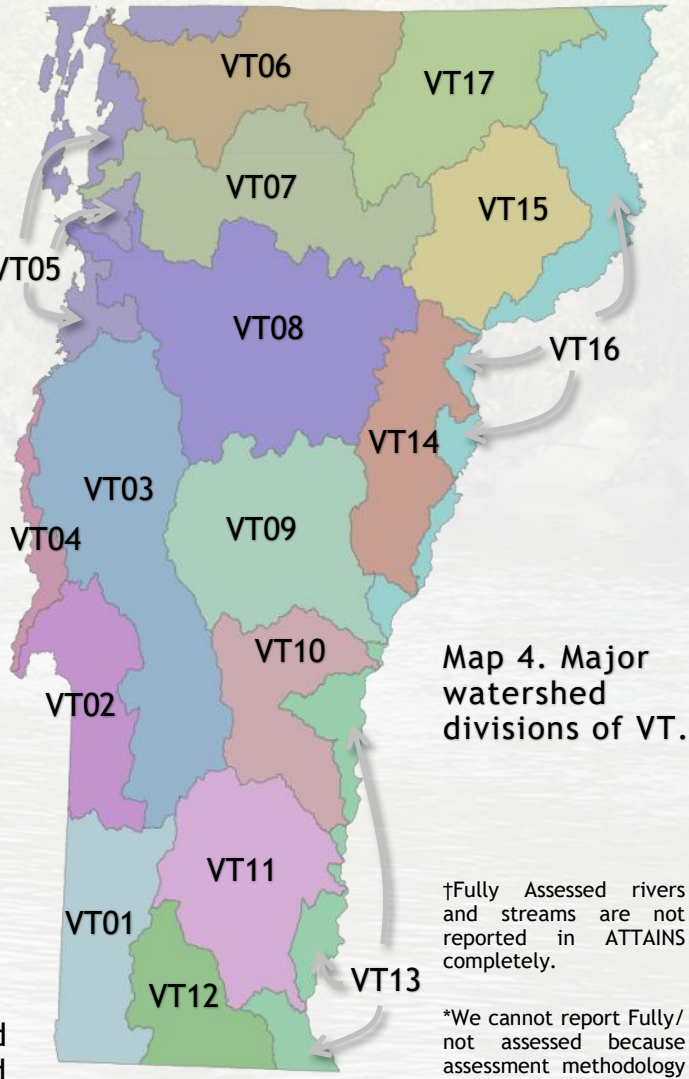



Figure 1. Distribution of **Aquatic biota** and **habitat use** support across the major watershed divisions of VT.




Map 4. Major watershed divisions of VT.

†Fully Assessed rivers and streams are not reported in ATTAINS completely.

*We cannot report Fully/ not assessed because assessment methodology remains in development for aquatic habitat use.

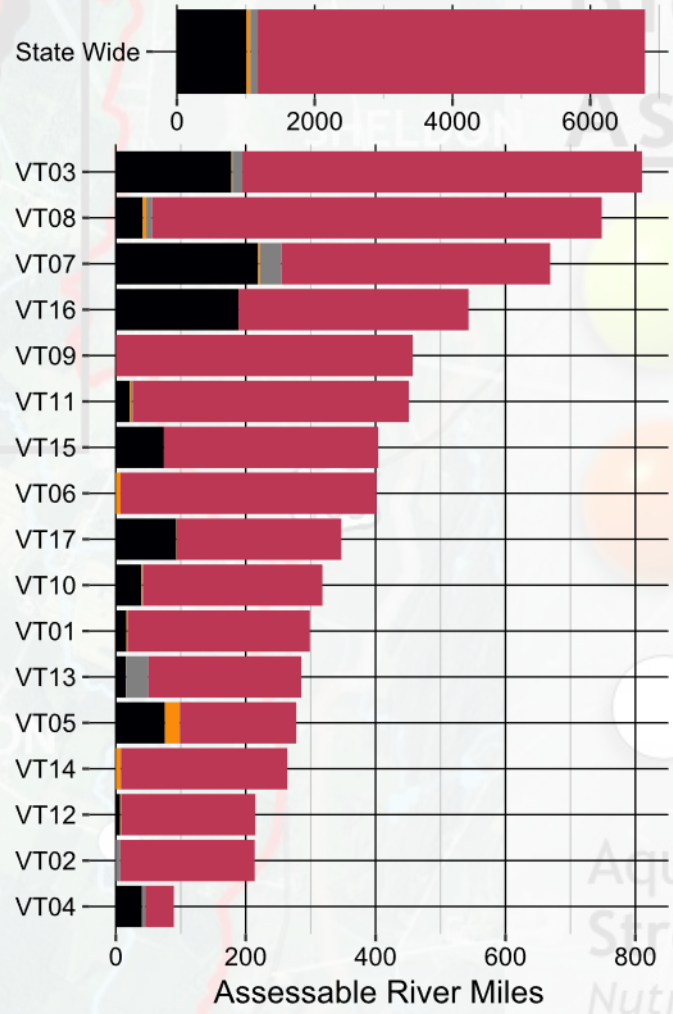



Figure 2. Distribution of aesthetic use across the major watershed divisions of VT.

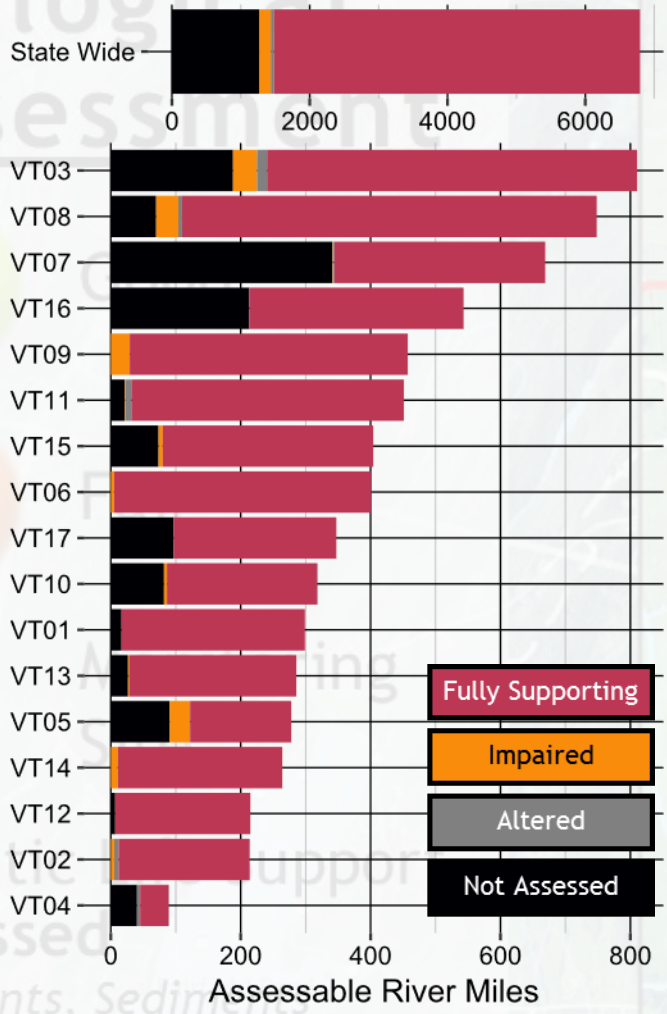



Figure 3. Distribution of contact recreation use across the major watershed divisions of VT.

Table 4. Summary of cause parameters for Vermont rivers and streams (miles).

| Cause Parameter | Length impaired or altered by cause | Cause Parameter | Length impaired or altered by cause |
|---|---|---|---|
| Arsenic | 0.4 | Nutrients | 54.8 |
| Asbestos | 2.3 | Organic enrichment | 1.2 |
| Cause unknown | 2 | PCBs in fish tissue | 7 |
| Chloride | 2.1 | pH, Low | 31.6 |
| Dissolved oxygen | 6 | Stormwater | 33.0 |
| E. coli | 165.6 | Sedimentation/Siltation | 63.1 |
| Eurasian Water Milfoil | 22.5 | Temperature | 13.1 |
| Flow regime modification | 255.4 | Toxicity | 1.9 |
| Iron | 6.2 | Water Chestnut | 10.6 |
| Manganese | 0.4 | Zinc | 0.2 |
| Mercury in fish tissue | 58.2 | | |
| Metals | 9.1 | | |

Table 5. Summary of sources for Vermont rivers and streams (miles).

| Source | Length impaired or altered by Source* |
|---|---|
| Agriculture | 139.3 |
| Atmospheric deposition - acidity | 81.0 |
| Channel instability | 18.0 |
| Channelization | 20.3 |
| Developed land runoff (urban/suburban) | 61.9 |
| Floods (and infrastructure failures etc) | 21.0 |
| Hazardous waste site | 8.0 |
| Impoundment | 41.7 |
| Land development | 33.0 |
| Municipal point sources | 26.8 |
| Recreational activities | 5.3 |
| Removal of riparian vegetation | 72.5 |
| Resource extraction | 15 |
| Streambank modification/destabilization | 97.6 |

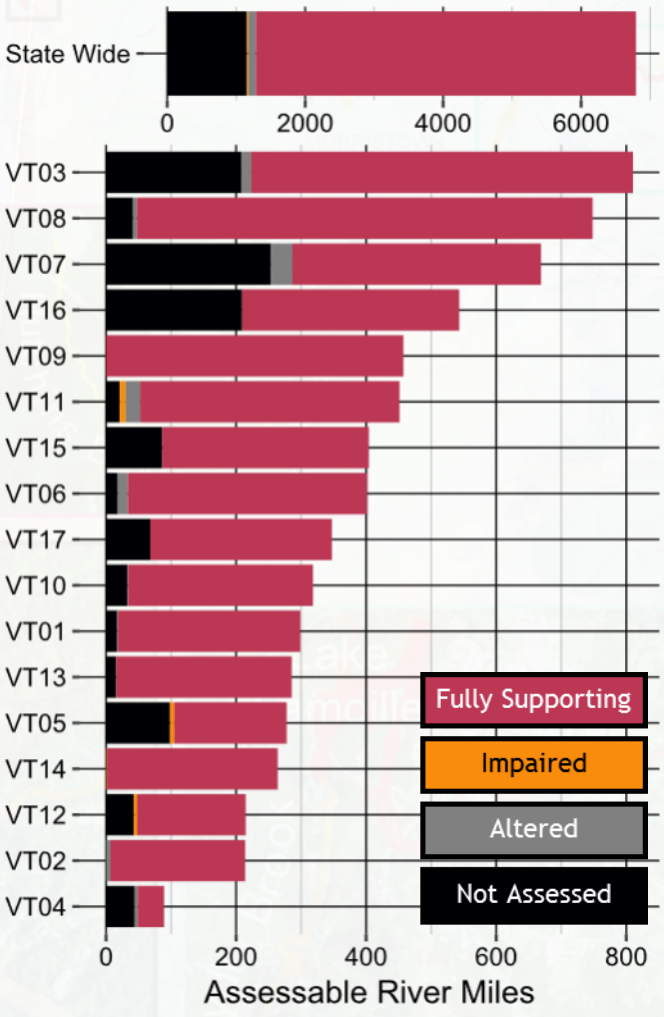



Figure 3. Distribution of non contact recreation use across the major watershed divisions of VT.

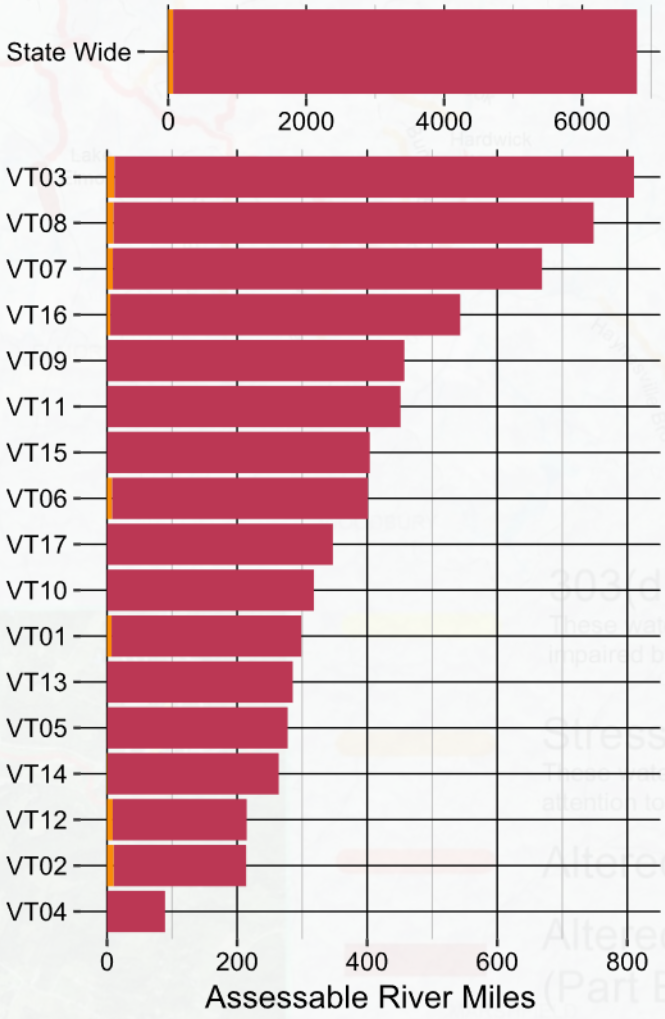


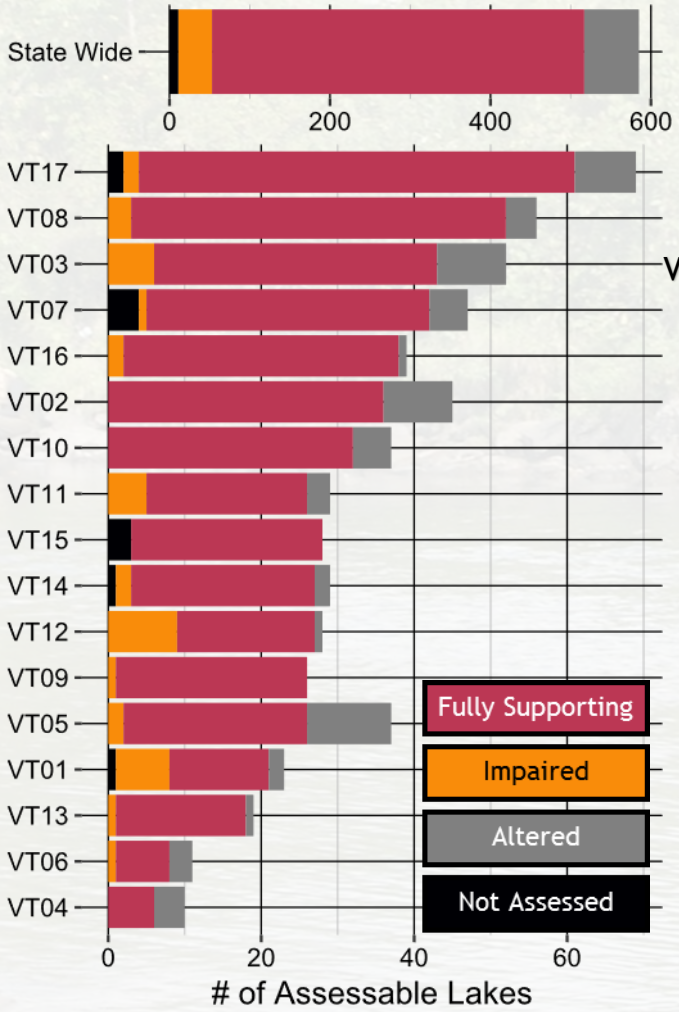

Figure 4. Distribution of fish consumption use across the major watershed divisions of VT.

*Not all sources are identified in ATTAINS

## Assessment Results (Lakes and Ponds)

Table 4. Use support for Vermont Lakes and Ponds (# of Lakes including Lake Champlain units). Lakes are split into distinct assessable units (littoral, open water, etc.) therefore a lake can have multiple use attainments for the same use.

| USE NAME | FULLY | ALTERED | IMPAIRED | NOTASSESSED |
|---|---|---|---|---|
| Aesthetics | 493 | 54 | 19 | 20 |
| Aquatic biota (new) | 464 | 68 | 42 | 11 |
| Aquatic habitat (new) | 464 | 68 | 42 | 11 |
| Contact recreation | 486 | 49 | 16 | 25 |
| Fish consumption | 531 | 0 | 22 | 0 |
| Noncontact recreation | 484 | 54 | 4 | 26 |



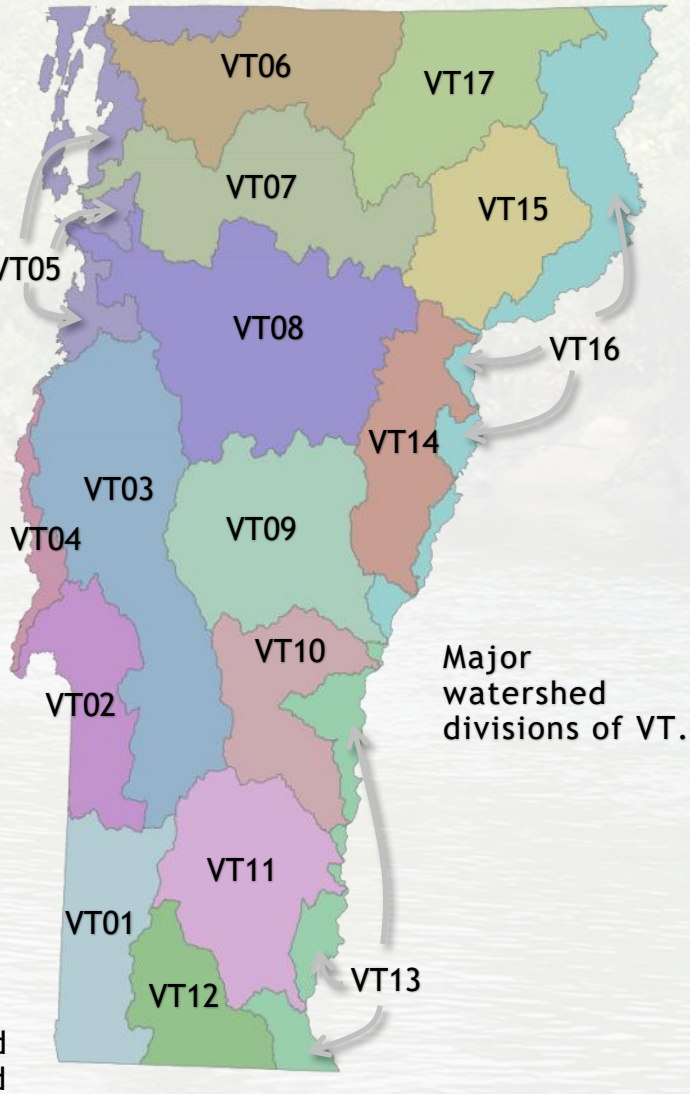




Figure 5. Distribution of **Aquatic biota** and **habitat use** support across the major watershed divisions of VT.

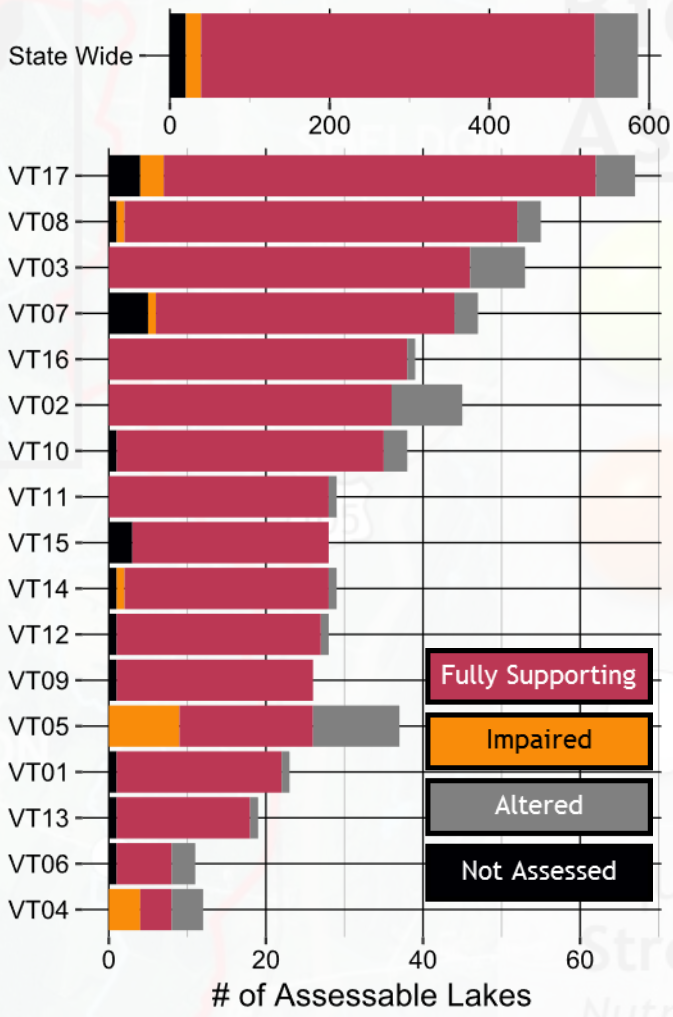



Figure 6. Distribution of aesthetic use across the major watershed divisions of VT.

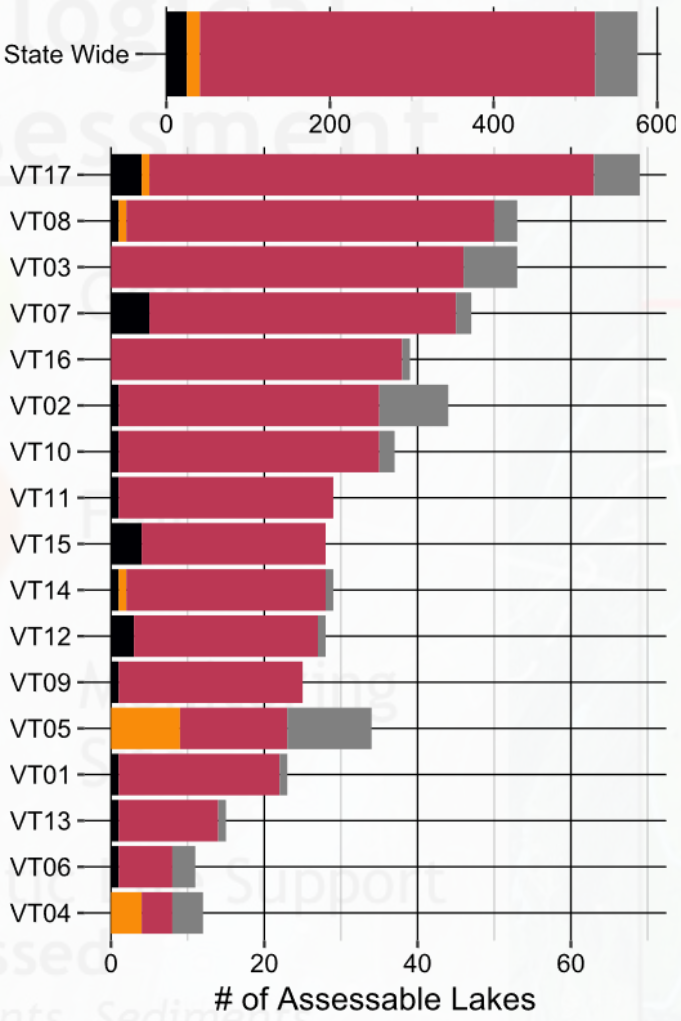



Figure 7. Distribution of contact recreation use across the major watershed divisions of VT.

Table 4. Summary of cause parameters for impaired and altered lakes and ponds (# of Lakes, including Lake Champlain Units with identified cause parameters) (Acreage, not including Lake Champlain (LC) Acreage).

| PARAMETER | # of Lakes | Acreage |
|---|---|---|
| Brittle naiad, *Najas minor* | 3 | 681 |
| Curly-leaf pondweed, *Potamogeton crispus* | 16 | 3456 |
| Eurasian water milfoil, *Myriophyllum spicatum* | 47 | 4922 |
| Flow regime modification | 23 | 13535 |
| Mercury in fish tissue | 22 | 8115 |
| Other non-native aquatic plants | 4 | 1094 |
| PCBS in fish tissue | 10 | LC only |
| PH | 37 | 2360 |
| Phosphorus | 16 | 7874 |
| Sedimentation/siltation | 1 | 100 |
| Turbidity | 1 | 100 |
| Variable-leaved watermilfoil, *Myriophyllum heterophyllum* | 1 | LC only |
| Water chestnut *Trapa natans* | 10 | 1001 |
| Organic compounds | 1 | LC only |
| Zebra mussel, *Dreissena polymorph* | 12 | 472 |

Table 5. Summary of sources for lakes and ponds (# of Lakes, including Lake Champlain Units with identified sources of pollution / Acreage, not including Lake Champlain (LC))

| SOURCE | # of Lakes | Acreage |
|---|---|---|
| Agriculture | 12 | 1520 |
| Animal feeding operations (nps) | 1 | 140 |
| Atmospheric deposition - acidity | 13 | 1825 |
| Atmospheric deposition - toxics | 19 | 4613 |
| Contaminated sediments | 1 | LC only |
| Crop production (non-irrigated) | 2 | 1024 |
| Highway/road/bridge runoff (non-construction related) | 2 | LC only |
| Illegal dumps or other inappropriate waste disposal | 10 | LC only |
| Industrial point source discharge | 1 | LC only |
| Internal nutrient recycling | 1 | 54 |
| Managed pasture grazing | 2 | 1844 |
| Natural sources | 27 | 535 |
| Non-point source | 12 | 6030 |
| AIS Spread | 43 | 3018 |
| Post-development erosion and sedimentation | 3 | 452 |
| Streambank modifications/destabilization | 1 | 100 |

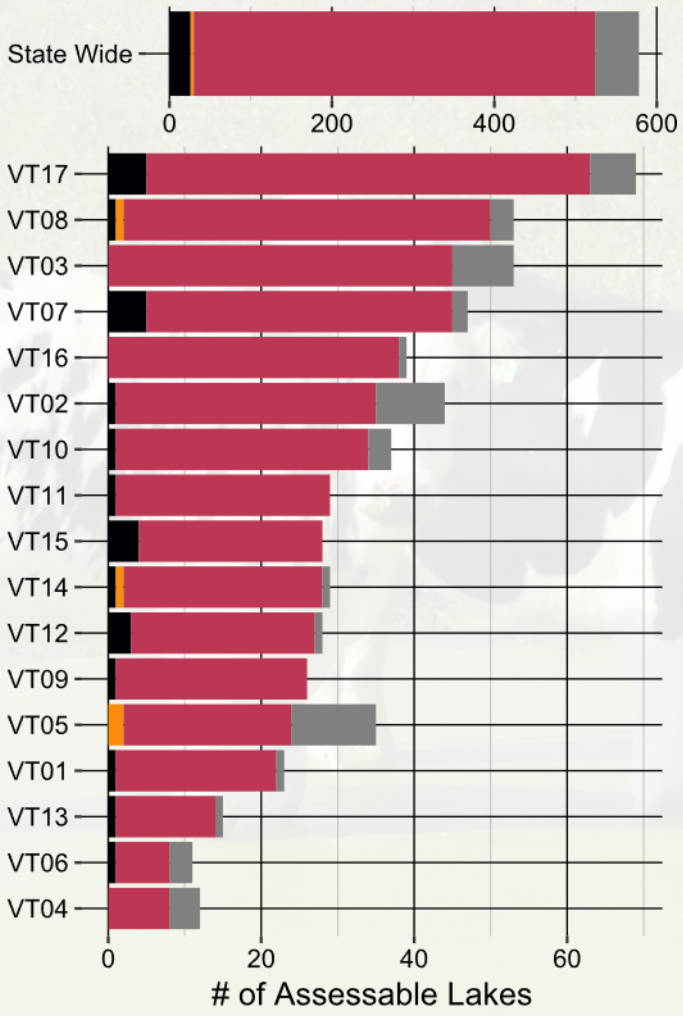



Figure 8. Distribution of non contact recreation use across the major watershed divisions of VT.

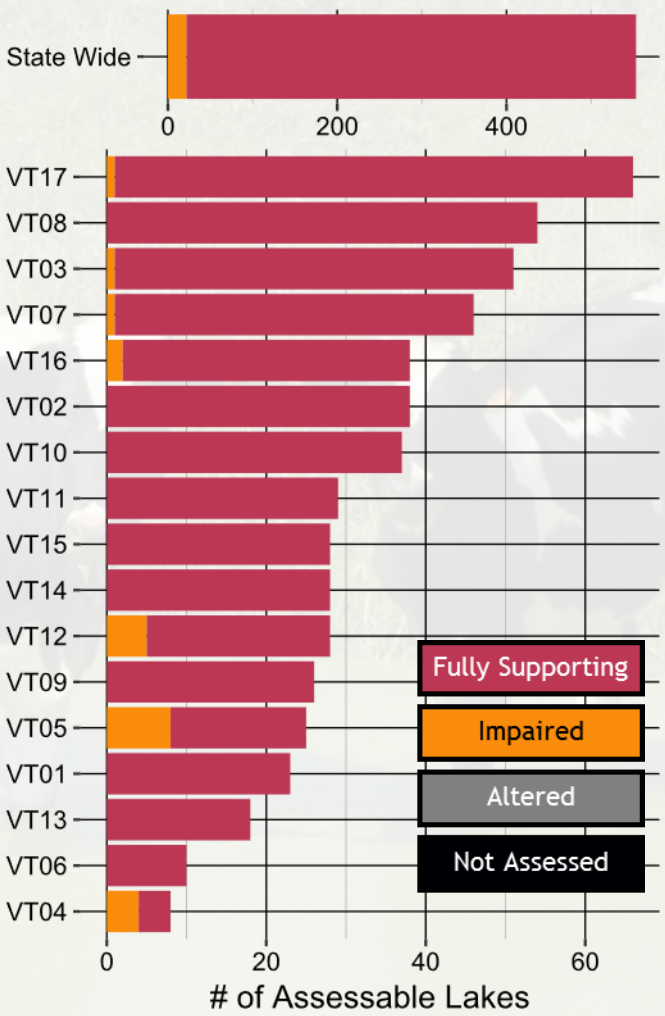



Figure 9. Distribution of fish consumption use across the major watershed divisions of VT.

## Assessment Results (Lake Champlain)

Table 6. Summary of cause parameters (acreage of Lake Champlain)

| USENAME | FULLY | ALTERED | IMPAIRED |
|---|---|---|---|
| Aesthetics | 6 | 17019 | 174169 |
| Aquatic biota (new) | 152666 | 21503 | 6 |
| Aquatic habitat (new) | 152666 | 21503 | 6 |
| Contact recreation | 0 | 21503 | 174175 |
| Fish consumption | 0 | 0 | 174175 |
| Noncontact recreation | 157150 | 17019 | 6 |

Table 7. Summary of cause parameters (acreage of Lake Champlain with identified sources of pollution)

| PARAMETER | Altered or Impaired |
|---|---|
| Eurasian water milfoil, *Myriophyllum spicatum* | 17019 |
| Mercury in fish tissue | 174175 |
| PCBS in fish tissue | 165715 |
| Phosphorus | 174175 |
| Variable-leaved watermilfoil, *Myriophyllum heterophyllum* | 1600 |
| Water chestnut *Trapa natans* | 2525 |
| Organic compounds | 6 |
| Zebra mussel, *Dreissena polymorph* | 16746 |

Table 8. Summary of sources (acreage of Lake Champlain with identified sources of pollution)

| SOURCE | Impaired or Altered |
|---|---|
| Agriculture | 31859 |
| Atmospheric deposition - toxics | 174175 |
| Contaminated sediments | 6 |
| Highway/road/bridge runoff (non-construction related) | 13725 |
| Illegal dumps or other inappropriate waste disposal | 165715 |
| Industrial point source discharge | 4423 |
| Natural sources | 63572 |
| Non-point source | 132053 |
| AIS Spread | 16736 |
| Post-development erosion and sedimentation | 13725 |

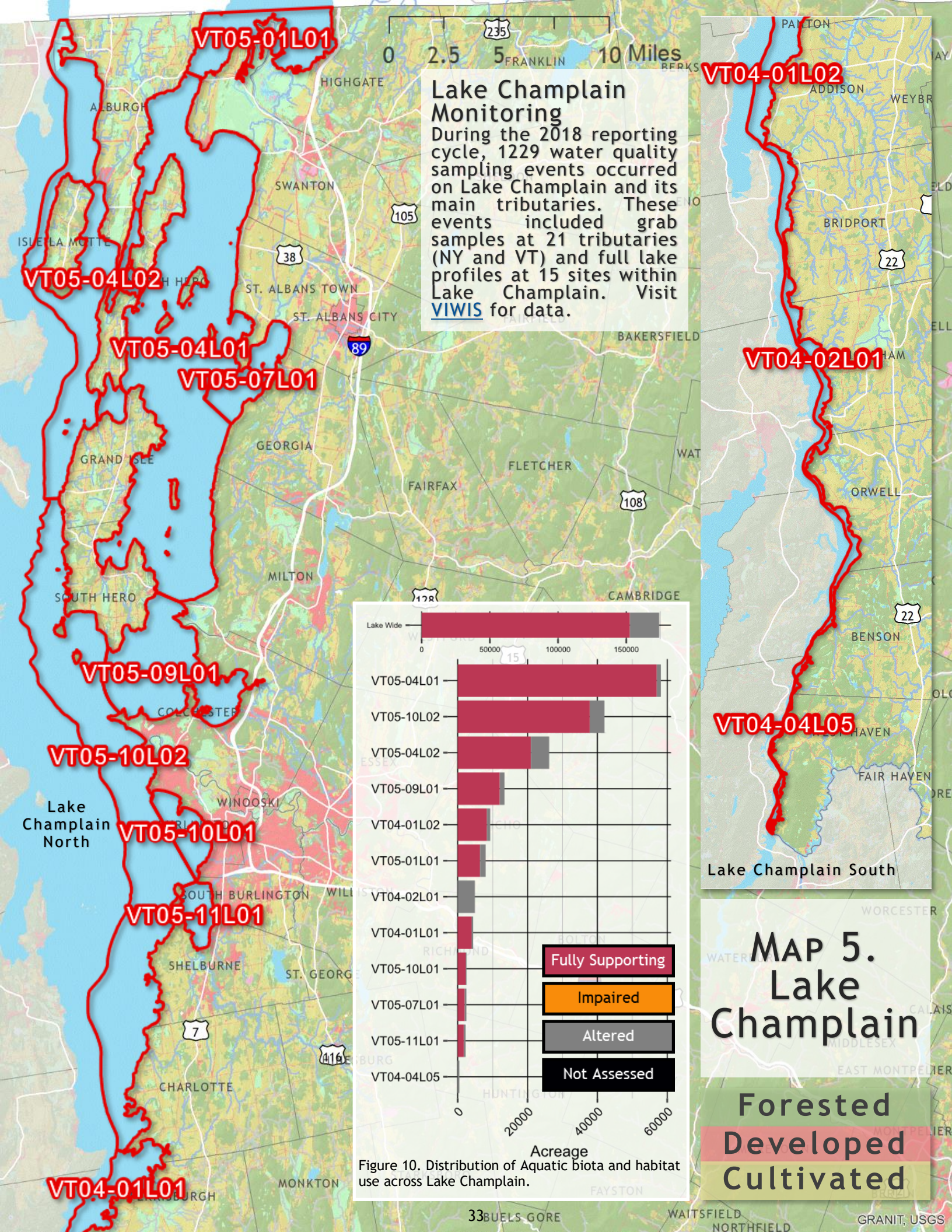
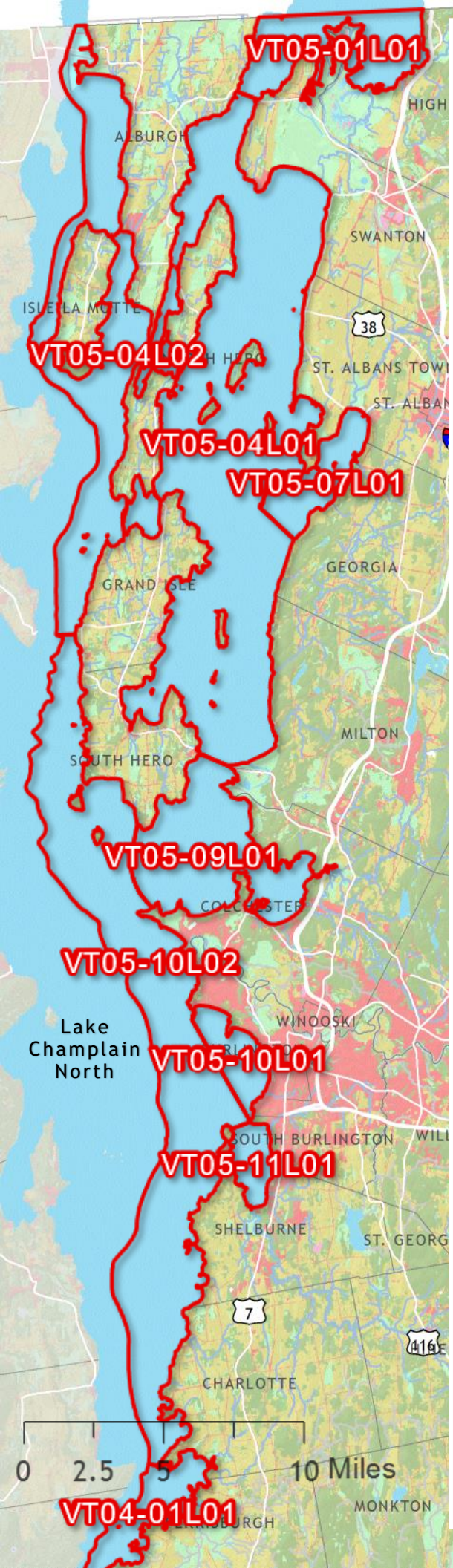



Figure 10. Distribution of Aquatic biota and habitat use across Lake Champlain.



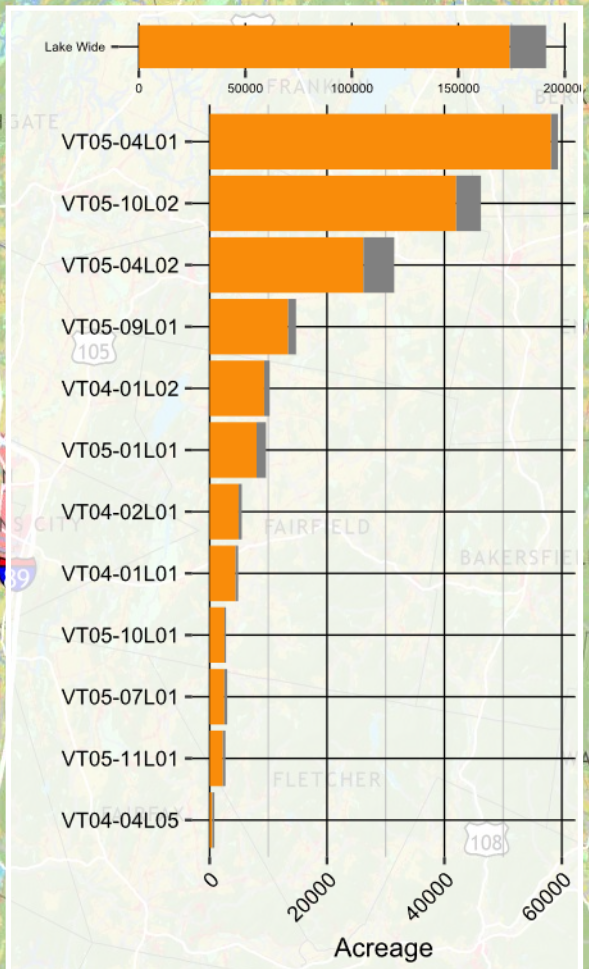




Figure 11. Distribution of Aesthetic use across Lake Champlain.

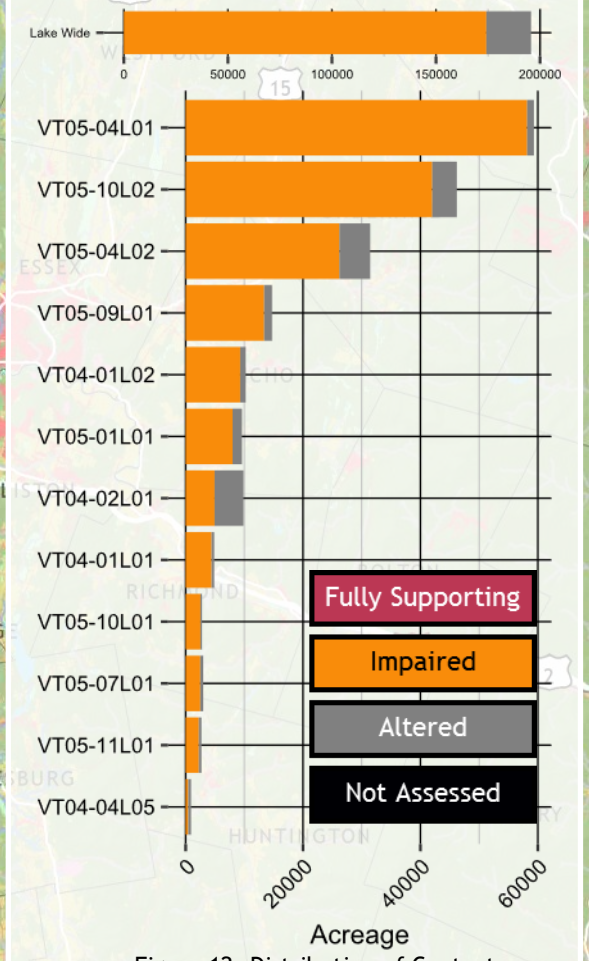
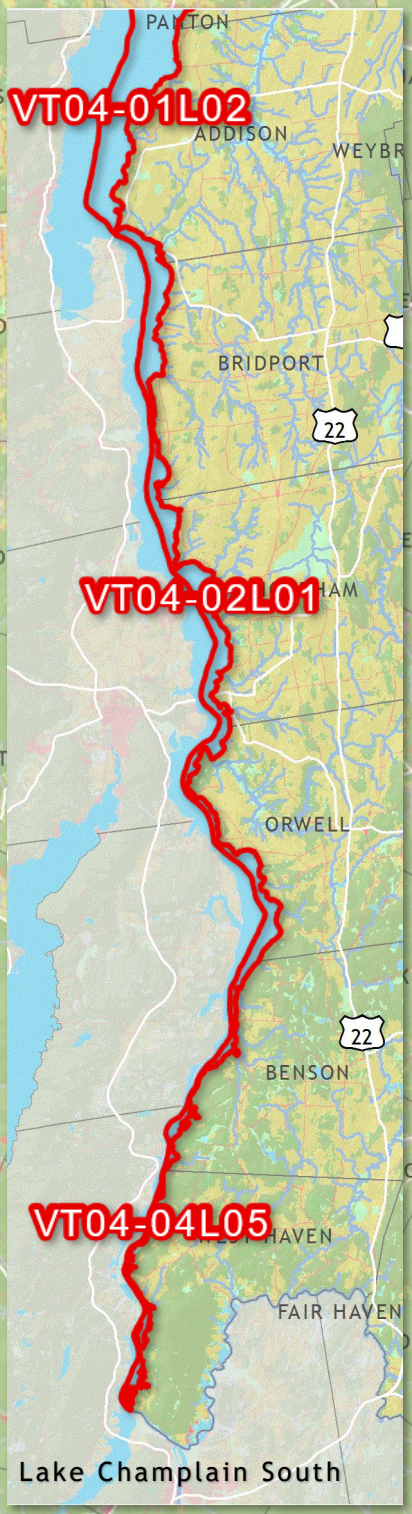



Figure 12. Distribution of Contact recreation use across Lake Champlain.



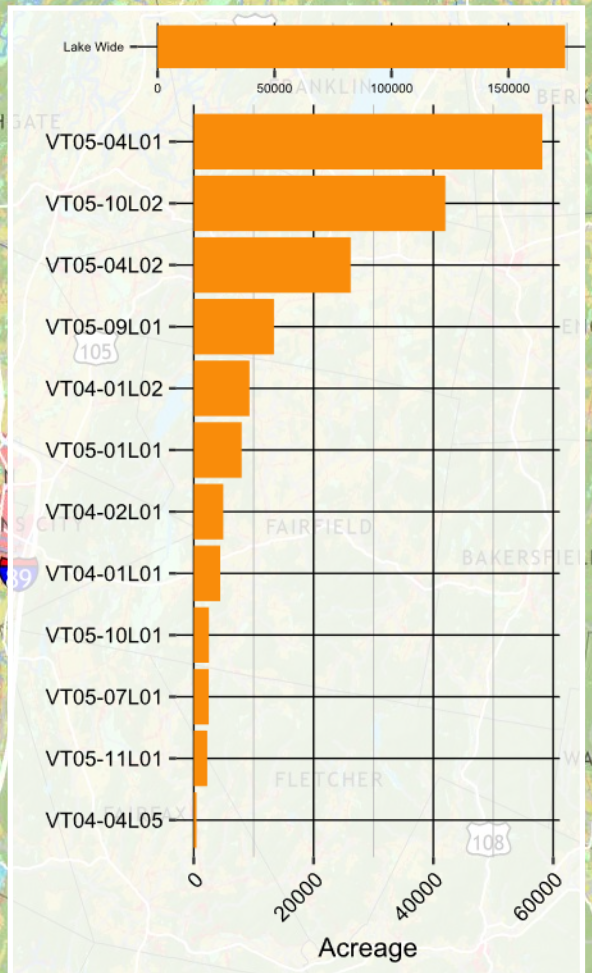




Figure 13. Distribution of Fish Consumption use across Lake Champlain.

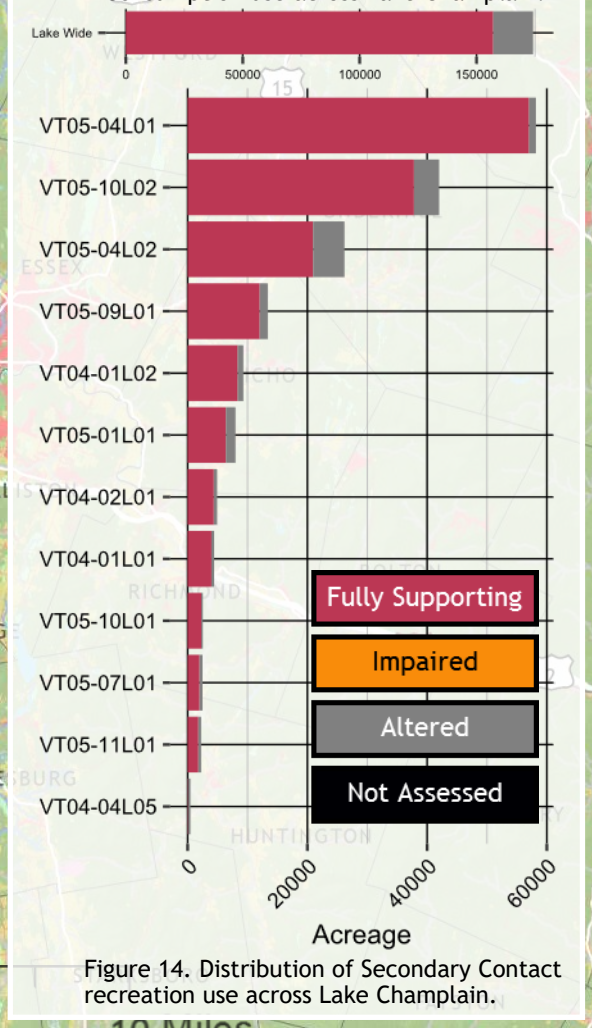
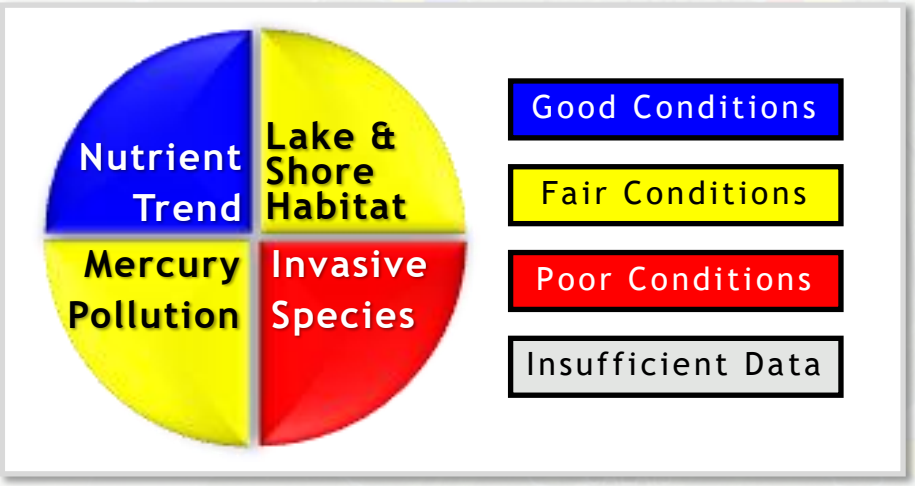


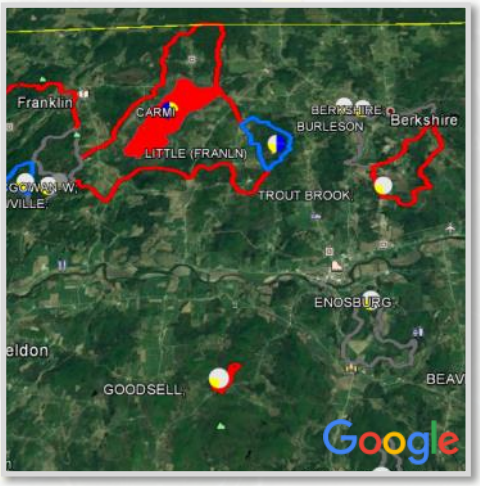

Figure 14. Distribution of Secondary Contact recreation use across Lake Champlain.

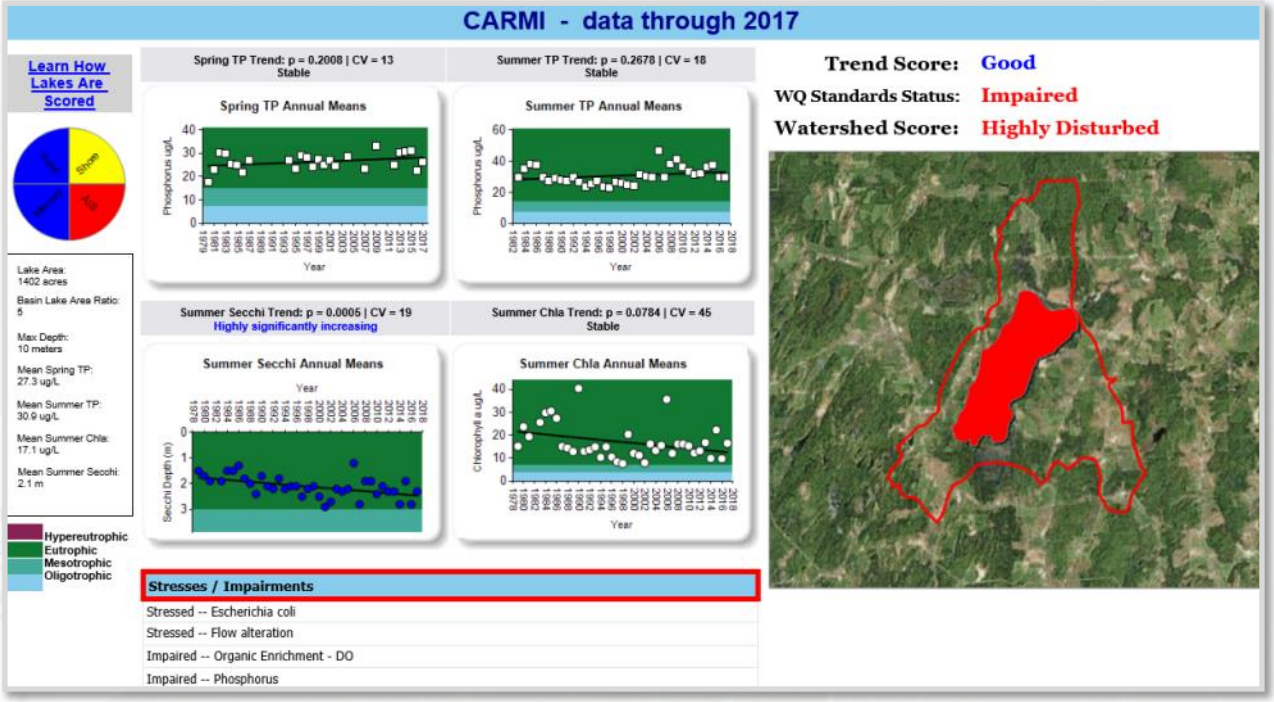
# The Vermont Inland Lake Score Card

The Vermont Inland Lake Score Card is an interface developed by the Vermont Lakes and Ponds Management and Protection Program (VLPP) to share data on lake health with the public. Using Google Earth, you can select a lake and learn about four aspects of that lake's health: nutrients, aquatic invasive species, shoreland and lake habitat, and mercury pollution. Links embedded in the Score Card point to more data as well as steps you can take to protect the lake. Open the latest version of the Lake Score Card in Google Earth.

For information on the scoring process read the 'How Lakes Are Scored' and watch the recorded webinar on the YouTube channel for the VTDEC Watershed Management Division. To protect a lake's 'good' score or wish to restore a 'fair' or 'poor' score read 'Checklist of Lake Protection Actions.'



# Summary of Vermont Inland Lake Score Card

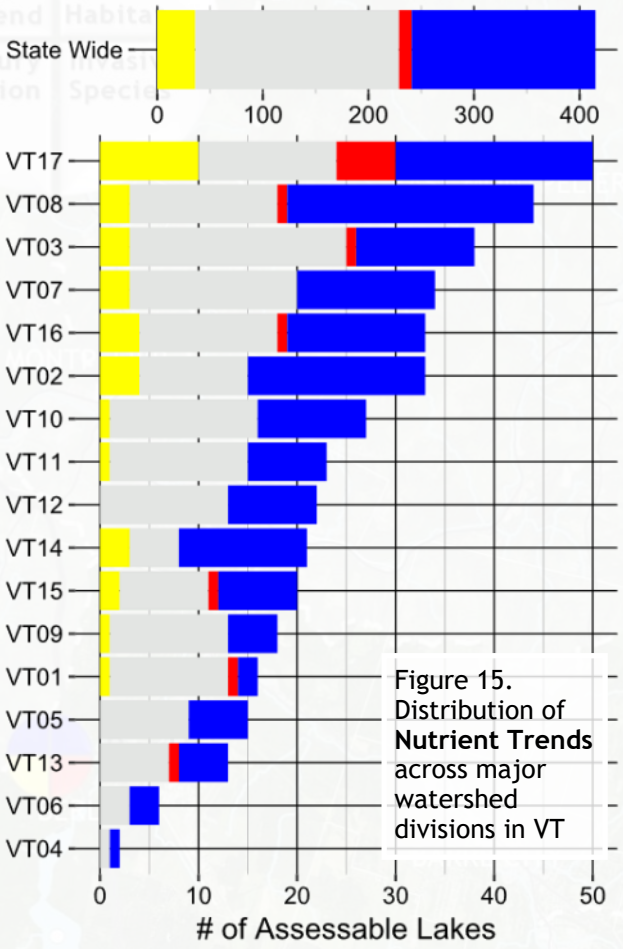



Figure 15. Distribution of **Nutrient Trends** across major watershed divisions in VT

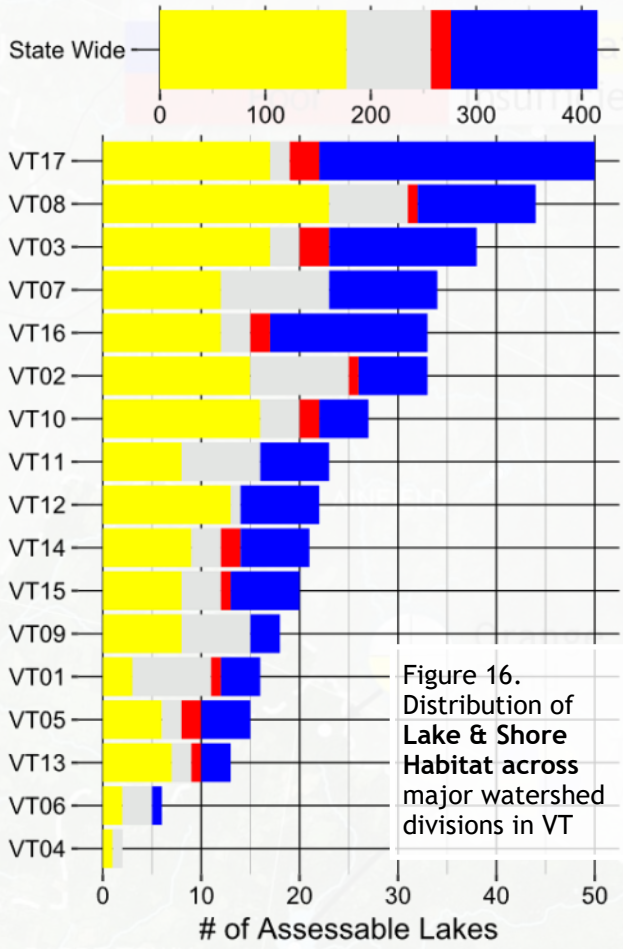



Figure 16. Distribution of **Lake & Shore Habitat across** major watershed divisions in VT

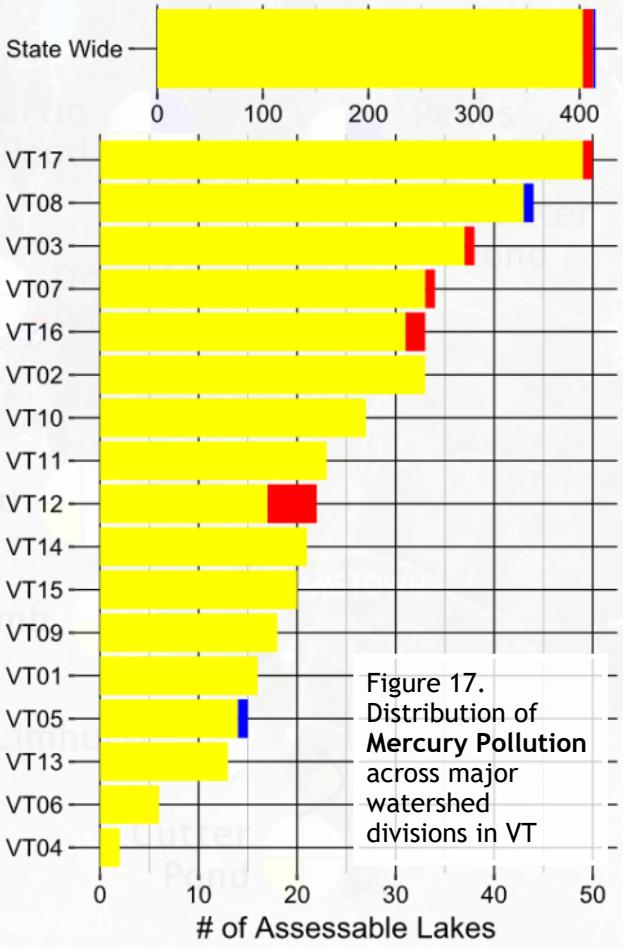



Figure 17. Distribution of **Mercury Pollution** across major watershed divisions in VT

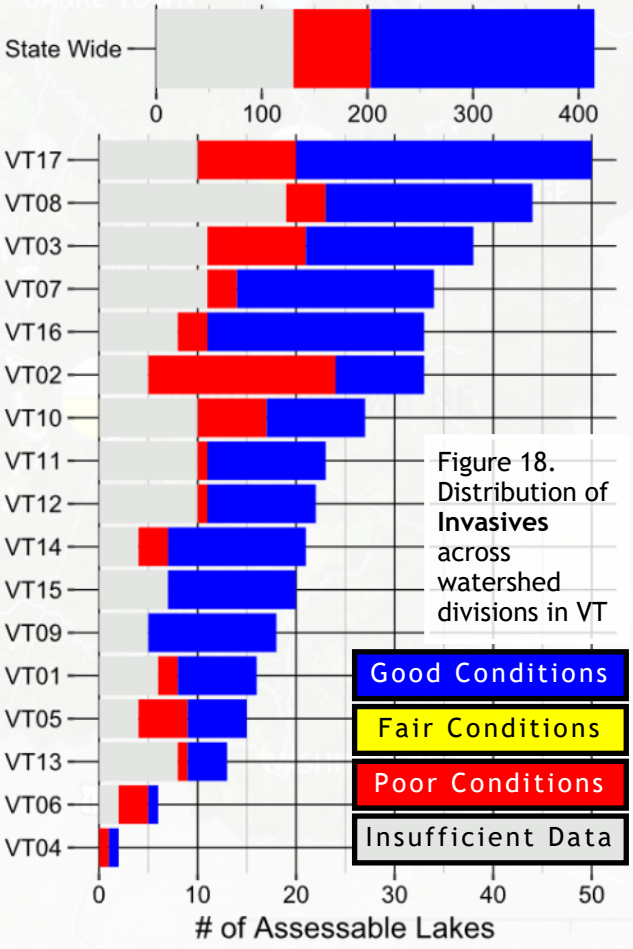



Figure 18. Distribution of **Invasives** across watershed divisions in VT

Good Conditions

Fair Conditions

Poor Conditions

Insufficient Data

## Wetlands

The Vermont Wetlands Program is responsible for identifying and protecting wetlands and the functions and values they provide. Activities to achieve these goals include project review and permitting, enforcement, education and outreach, and bioassessment.

The state defines functions and values of wetlands as:
1) water storage for flood water and storm runoff,
2) surface and groundwater protection,
3) fish habitat,
4) wildlife habitat,
5) exemplary wetland natural community,
6) rare, threatened and endangered species habitat,
7) education and research in natural sciences,
8) recreational value and economic benefits,
9) open space and aesthetics, and
10) erosion control through binding and stabilizing the soil.

The State of Vermont protects wetlands which provide significant functions and values and also protects a buffer zone directly adjacent to these wetlands. Wetlands in Vermont are classified as Class I, II, or III based on the significance of the functions and values they provide. Class I and Class II wetlands provide significant functions and values and are protected by the Vermont Wetland Rules. Class I wetlands have been determined to be, based on their functions and values, exceptional or irreplaceable in its contribution to Vermont's natural heritage and, therefore, merit the highest level of protection. New Class I wetlands in 2016-17 include Sandbar Wetlands, Chickering Fen and Dennis Pond.

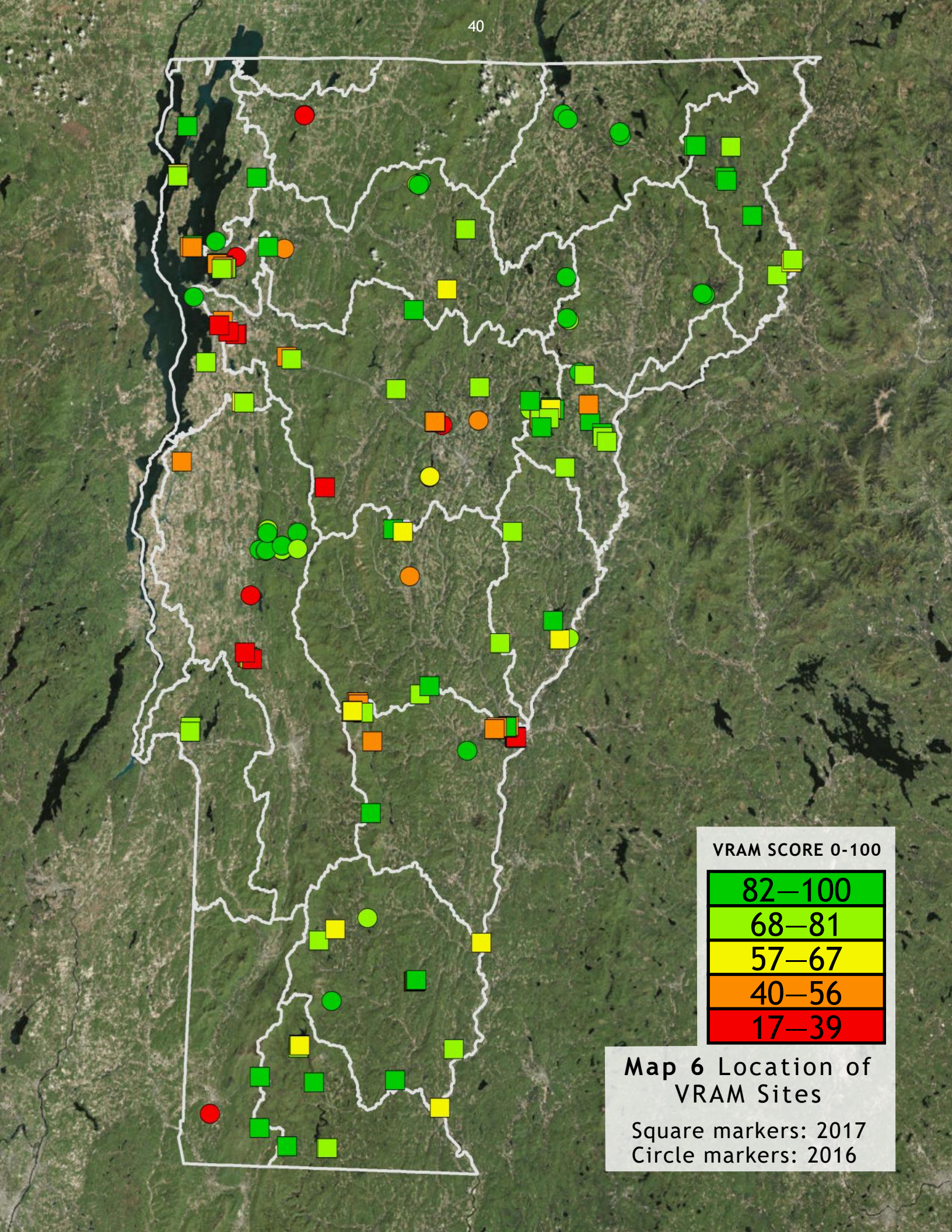
The goal of the Vermont Wetlands Program is to have no net loss of wetland function, value or acreage. In state fiscal years 2016-17 (SFY16-17), the program issued 224 permits for encroachments into wetlands or their buffer zones. Permit holders are required to report on when construction has completed. Using these reports the Program is able to quantify actual wetland losses and gains for 2016-17 for Class I and II wetlands. In these years, 2.95 acres of wetland was filled, and 5.8 acres of wetland was enhanced or conserved. These numbers do not account for the loss of wetland due to lack of state jurisdiction, or wetland fill violations, or permits which were completed without yet reporting. These numbers also do not account for the passive or voluntary restoration efforts taking place throughout the state which are not associated with a wetlands permit. Maintaining or strengthening our Wetland Rules will help protect our wetlands and allow them in turn to continue reducing the impacts of issues such as floods and poor water quality.

The Vermont Wetlands Bioassessment Program assesses the health of Vermont’s wetlands to inform planning and regulatory activities, monitor the effectiveness of restoration and rehabilitation projects and monitor long-term trends in wetland health. The goal of the bioassessment program is to build a pertinent and practical methodology to determine biological integrity of a wetland as well as assessing the overall ecological condition and surface water characteristics of Vermont’s wetlands.

Bioassessment staff collect detailed data on wetland condition and function according to the division-wide 5-year rotational basin schedule (See Map 3).

The Bioassessment Program uses 3 levels of wetland assessments modeled off the EPA's approach to monitoring. Level I is a desktop assessment done at a landscape scale and considers surrounding land use, topography and stressors of a target wetland. Level II is an on-the-ground rapid assessment of a target wetland to gather basic ecological, hydrologic and physical information. This assessment employs the Vermont Rapid Assessment Method for wetlands (VRAM), a methodology developed by the Bioassessment Program and which has been applied to 300 wetlands from 2008-2017 (See Map 6). VRAM is intended to be calibrated and validated by Level III intensive biological assessments which looks at biological, chemical and physical parameters to provide data on wetland condition and function. Level II assessments may also include qualitative collection of plant species data and mapping of natural communities within the wetland.

Level III bioassessment uses vegetation, water quality and soils parameters for an in-depth look at wetland health. Level III vegetation surveys involve identifying vegetation to the species-scale to employ Coefficient of Conservation values and calculate a Floristic Quality Assessment Index. These numbers provide a score that indicates the extent to which the wetland is tolerating and recovering from disturbance based on the plant species occurring within the assessment area. Additionally, these data collection methods are in-line with those employed by the Natural Heritage Inventory, allowing for data integration between programs. These data are being used to develop vegetation -related metrics of wetland biological integrity. Level III water quality monitoring employs a suite of grab samples and in-situ field measurements to determine how wetlands are interacting with environmental and anthropogenic substances such as those found in polluted runoff. Level III soil monitoring methods involve a modified Army Corps of Engineers soil characterization , specifically looking for hydric soil type and redoximorphic features. This integrated assessment yields a large body of data that can be used to monitor environmental changes, measure success of restoration projects and draw correlations between water quality, soils and vegetation metrics.




**Map 6** Location of VRAM Sites

Square markers: 2017
Circle markers: 2016

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Wetland bioassessment in Vermont is conducted across a condition gradient and across all wetland natural community types to determine a representative view of wetland condition throughout the state. In 2016-17, 39 vegetation plots and 17 sets of water samples were conducted. Additionally, in 2016-17, 176 Level II assessments were conducted including a VRAM at each Level II site. While the dataset is still growing, the following takeaway messages are surfacing:

1. Wetlands in remote areas, on conserved land, and at high elevation are generally in very good condition, but wetlands in areas of more intensive human landscape use are experiencing heavier impacts.
2. VRAM and CoC effectively show poor scores when wetlands are visibly in poor condition, and low VRAM scores correlate strongly with low CoC scores, verifying the validity of rapid assessments in gaging wetland condition. Human-created wetlands receive much lower scores than natural wetlands.
3. When protected from disturbance to the wetland or buffer, wetlands usually remained in good condition even when occurring in association with pollutants such as sedimentation and phosphorous. When allowed to do so, our wetlands are effectively filtering pollutants from waterways.
4. Wetlands that have more diverse water input types, habitat types, and topography are more resistant to disturbance, even if they are small. Wetlands in good condition are more likely to support endangered species.
5. Wetlands with road salt and other pollutants are in worse condition than those without. However, it is unclear if the pollutants themselves are the main cause for the poor wetland condition, or if both are due to disturbances such as nearby roads.
6. Invasive plants are a significant threat to Vermont wetlands, but this threat is made worse by other factors such as disturbance to a wetland's soil and drainage patterns, loss of the wetland's protective buffer, and loss of species diversity.

## Statewide Probabilistic Survey Results or Progress (streams)

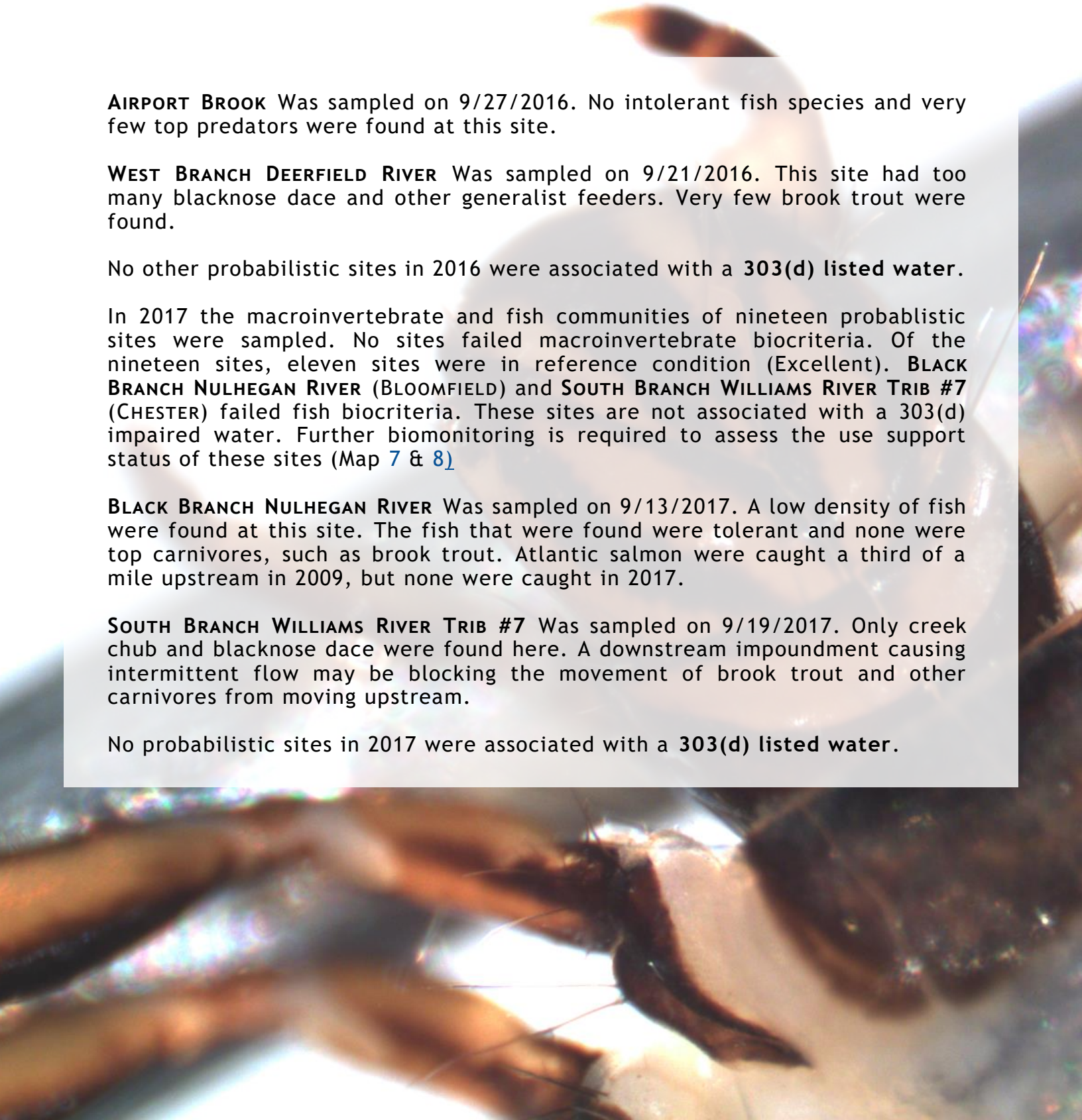
Vermont biomonitoring resources are divided into two categories, targeted and probabilistic monitoring. Targeted monitoring is directed towards streams of management interest. For example, we monitor impaired streams undergoing remediation; we monitor compliance below discharges and development; and we conduct long term monitoring at reference sites. In 2016 and 2017, DEC biomonitored 154 and 165 targeted sites respectively. Targeted monitoring allows DEC to evaluate management and conservation efforts, but does not give a clear assessment of the overall condition of Vermont's flowing waters.

To answer the question "what is the overall biological condition of Vermont's flowing waters", DEC's Biomonitoring and Aquatic Studies (BASS) staff have implemented probability-based surveys. Probability-based surveys represent a subset of randomly selected wadeable stream reaches (1st-4th order) throughout the state. The biomonitoring program used a rotational sampling schedule where the watersheds of the state are monitored over a 5-year period (Map 3). The location and assessment of probabilistic sites sampled for macroinvertebrates and fish in 2016 and 2017 are presented in Maps 2 and 3. As of 2018, BASS no longer samples probabilistic streams on this schedule. We now conduct these surveys on sites statewide regardless of the targeted rotation schedule. A new statewide assessment will include a 3 year rolling average beginning in 2021.

In 2016 the macroinvertebrate and fish communities of eighteen probabilistic sites were sampled. **Jewett Brook** (St. Albans Town) failed macroinvertebrate biocriteria, and **Roaring Brook** (Killington) received an intermediate macroinvertebrate score. An intermediate score indicates the site is neither failing nor passing macroinvertebrate biocriteria. Both sites are associated with 303(d) impaired waters. **Airport Brook** (Clarendon) and **West Branch Deerfield River** (Readsboro) failed fish biocriteria. These sites are not associated with a 303(d) impaired water. Further biomonitoring is required to assess the use support status of these sites (Map 7 & 8)

**Jewett Brook** Was sampled on 10/11/2016. This site had few sensitive Ephemeroptera, Odonata, Trichoptera taxa (5). Most taxa present were tolerant of nutrient enrichment. For example, 28.53% of the invertebrate community was composed of Oligochaete worms. Water chemistry parameters suggest cause for this highly tolerant community; conductivity was 860 uS, and TP was 161 ug/L. Alkalinity was also high. The fish community scored poorly due to absence of intolerant species and benthic insectivores, and too many generalist feeders. This stream is listed in the **303(d) list of impaired waters** with the cause parameters nutrients and sediment.

**Roaring Brook** Was sampled on 9/13/2016. This site was dominated by collector gather, *Baetis tricaudatus*, which is known to be a rapid colonizer in streams experiencing scour. The fish community was not able to be assessed. This site is downstream of a reach that is listed in the **303(d) list of impaired waters** with the cause parameter stormwater.



**AIRPORT BROOK** Was sampled on 9/27/2016. No intolerant fish species and very few top predators were found at this site.

**WEST BRANCH DEERFIELD RIVER** Was sampled on 9/21/2016. This site had too many blacknose dace and other generalist feeders. Very few brook trout were found.

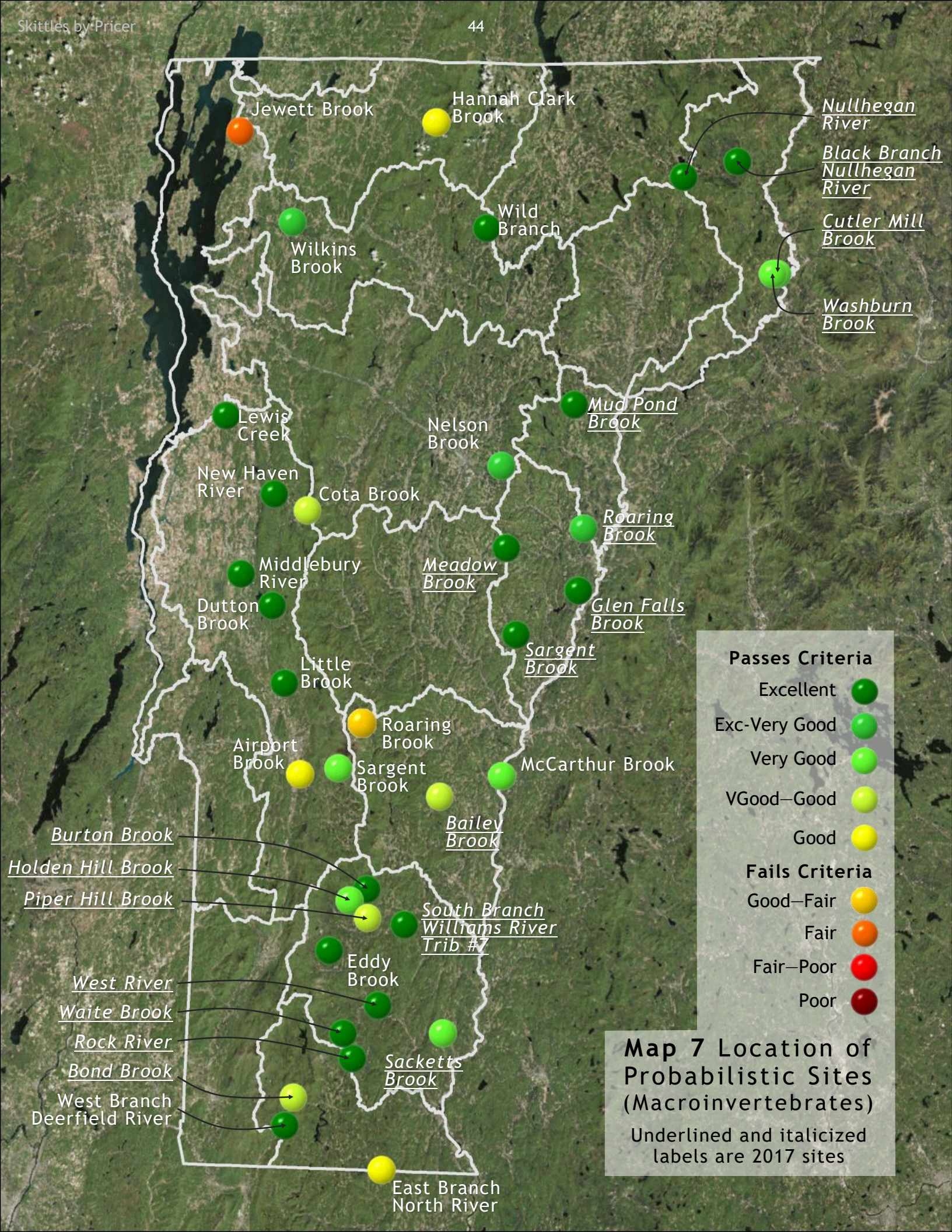
No other probabilistic sites in 2016 were associated with a **303(d) listed water**.

In 2017 the macroinvertebrate and fish communities of nineteen probablistic sites were sampled. No sites failed macroinvertebrate biocriteria. Of the nineteen sites, eleven sites were in reference condition (Excellent). **BLACK BRANCH NULHEGAN RIVER** (BLOOMFIELD) and **SOUTH BRANCH WILLIAMS RIVER TRIB #7** (CHESTER) failed fish biocriteria. These sites are not associated with a 303(d) impaired water. Further biomonitoring is required to assess the use support status of these sites (Map 7 & 8)

**BLACK BRANCH NULHEGAN RIVER** Was sampled on 9/13/2017. A low density of fish were found at this site. The fish that were found were tolerant and none were top carnivores, such as brook trout. Atlantic salmon were caught a third of a mile upstream in 2009, but none were caught in 2017.

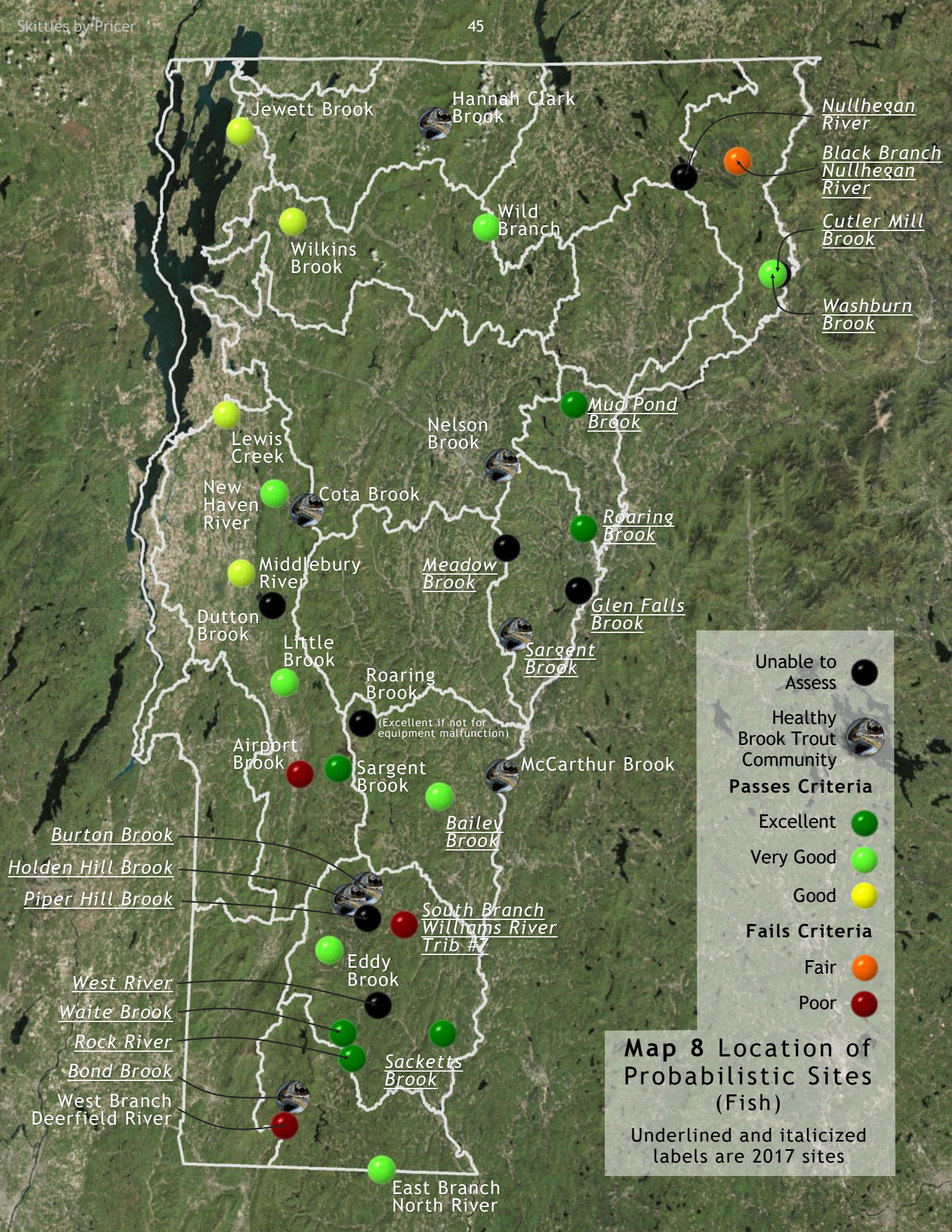
**SOUTH BRANCH WILLIAMS RIVER TRIB #7** Was sampled on 9/19/2017. Only creek chub and blacknose dace were found here. A downstream impoundment causing intermittent flow may be blocking the movement of brook trout and other carnivores from moving upstream.

No probabilistic sites in 2017 were associated with a **303(d) listed water**.




**Map 7** Location of Probabilistic Sites (Macroinvertebrates)

Underlined and italicized labels are 2017 sites




**Map 8** Location of Probabilistic Sites (Fish)

Underlined and italicized labels are 2017 sites

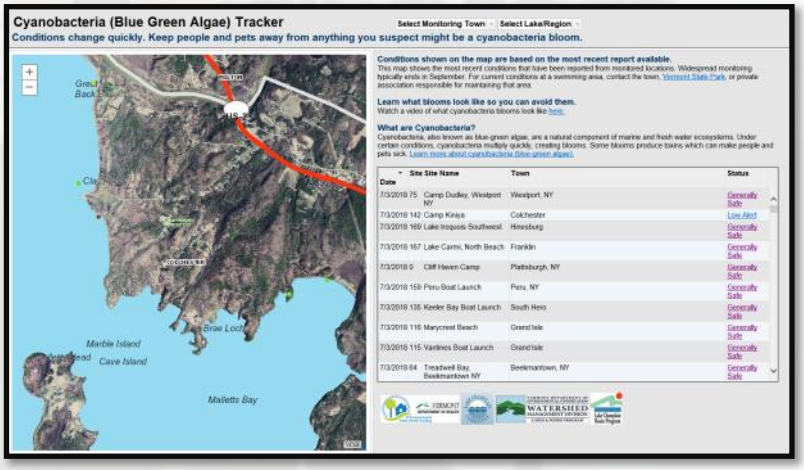
## Public Health Issues

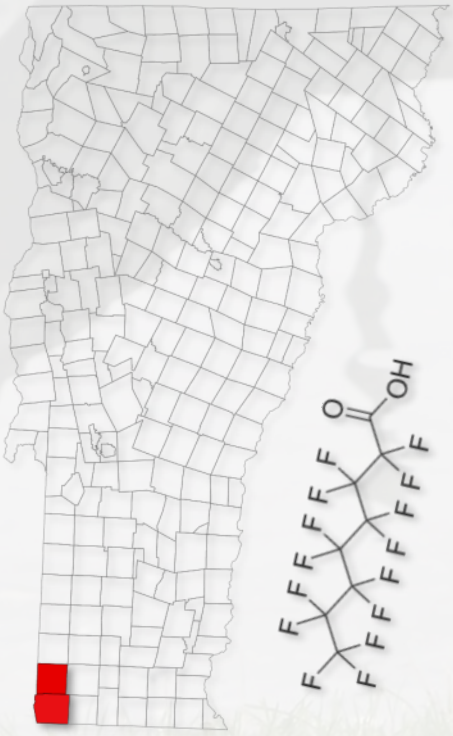
*Mercury and Fish Consumption*

During the reporting period no assessment units have been added to the list of impaired waters for failing to support fish consumption nor has the 2016 consumption advisory from the Vermont Department of Health been altered. For more information on mercury and fish consumption in Vermont see the Lake Champlain Basin Program and the Lake Champlain Committee.

*Cyanobacteria*

A data collaboration between the Department of Health, the Department of Environmental Conservation, and the Lake Champlain Committee has produced the Cyanobacteria Tracker Map which allows the public to check recent lake reports (Not limited to Lake Champlain), search by region or town, view latest results by test site, and observe site alerts.



*Perfluoroalkyl substances (PFAS) in Well Water*

Extensive testing conducted in February 2016 revealed PFAS, specifically Perfluorooctanoic acid (PFOA), exceeded levels recommended by the Department of Health in 300 wells across **North Bennington, Bennington, and Pownal** areas. A closed St. Gobain-owned manufacturing facility which used PFOA-containing chemicals in the treatment of fabric was identified as a source. An agreement between St. Gobain and the State initiated the installation of treatment systems on wells contaminated above 20 ppt. Homes west of the site will be connected to municipal water by fall 2018. Since February 2016, DEC has investigated numerous sources of PFAS using a strategic sampling strategy. A report published by DEC in July 2018 provides an overview of the findings of the sampling.

# Groundwater Monitoring and Assessment

The Groundwater Coordinating Committee (GWCC) met monthly during the 2016 and 2017 biennial. The GWCC was established through legislation (Chapter 48: Groundwater Protection, 1985) with committee representation from the DEC, Department of Forests, Parks and Recreation, Agency of Agriculture, Food and Markets, Department of Health, along with representatives of other State and Federal agencies and the private sector.

The GWCC advises the Secretary of the Agency of Natural Resources (the Secretary) on the development and implementation of the groundwater management program. The administrative functions of the Committee are performed by the Drinking Water & Groundwater Protection Division (DW&GPD) within the Department of Environmental Conservation includes:

- Developing a groundwater strategy and integrating the groundwater management strategy with other regulatory programs administered by the Secretary, including incorporation of the doctrine of groundwater as a resource held in the public trust.

- Cooperating with other government agencies in collecting data on the quantity and quality of groundwater and location of aquifers.

- Investigating and mapping groundwater currently used as public water supply sources and groundwater determined by the Secretary as potential future public water supply sources,

- Providing technical assistance to municipal officials, classifying the groundwater resources, and adopting technical criteria and standards for the management of activities that may pose a risk to their beneficial uses.

- Developing public information and education materials, and

- Cooperating with federal agencies in the development of programs for protecting the quality and quantity of the groundwater resources.

In carrying out these duties, the Secretary gives due consideration to the recommendations of the GWCC. The GWCC has been instrumental in the development of the Vermont Groundwater Management Plan -2018 along with the adoption of the Groundwater Protection Rule and Strategy Chapter 12 (adopted February 1988, revised September 2005) and currently under revision. The committee's interaction with the Secretary has most recently been to provide comment on the revision of the Groundwater Protection Rule and Strategy and with the reclassification of two contaminated groundwater areas to Class IV Groundwater.

*Groundwater Class IV Areas:*

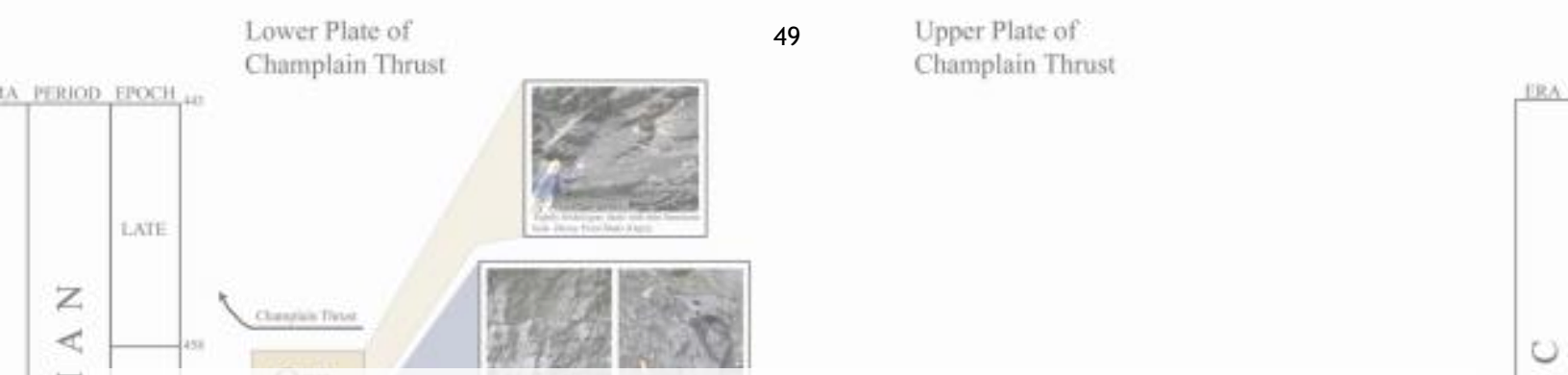
These are areas of groundwater that are contaminated above Vermont groundwater enforcement standards for one or more chemical constituents. As a means to protect human health in Class IV groundwater areas, there is a prohibition on drilling any drinking water supplies within its boundaries, unless specific conditions are met. Under the new Investigation and Remediation of Contaminated Properties Rule (effective 2017) and following a LEAN event (process improvement), the Class IV reclassification process has been shifted to become one of several methods available under a Correction Action Plan. The role of the GWCC has been changed to that of "stakeholder" that can provide comment on proposed reclassifications.

The contamination in the Bennington area will likely result in one or more areas proposed to be reclassified to Class IV in this year or next.

The findings for these reclassifications are based on the considerations outlined in Section 12-403 of the Vermont Groundwater Protection Rule and Strategy, effective February 1, 2005. A copy of the rule is available online at www.vermontdrinkingwater.org or by contacting the Department of Environmental Conservation, Drinking Water and Groundwater Protection Division, One National Life Drive, Main 2, Montpelier, VT 05603-3521or at 1-800-823-6500 in-state or 802-828-1535.

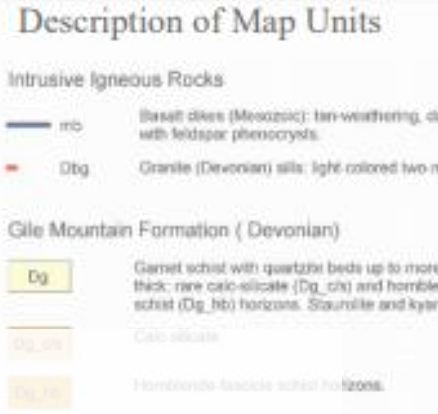
*Groundwater Protection Rule & Strategy:*

Revisions to the above rule have been examined during the biennial period and are expected to be noticed for public comment in the near future. The rule articulates the State's groundwater policy which is to protect its groundwater resources to maintain high




quality drinking water and in the proposed revision will include the statute required public trust doctrine. It shall manage its groundwater resources to minimize the risks of groundwater quality deterioration by reviewing and permitting activities that present unreasonable risks to groundwater in the vicinities of such activities. The state's groundwater policy shall be balanced with the need to maintain and promote a healthy and prosperous agricultural community. This policy is further reinforced by legislation that states that groundwater in Vermont is a public trust resource. Efforts continue to incorporate the groundwater trust doctrine in the Groundwater Protection Rule & Strategy, with a draft nearly ready to start the formal rule adoption process. State statute, 10 V.S.A. Chapter 48 establishes four classes of groundwater in the state:

- Class I. Suitable for public water supply. Character uniformly excellent. No exposure to activities which pose a risk to its current or potential use as a public water supply.
- Class II. Suitable for public water supply. Character uniformly excellent but exposed to activities which may pose a risk to its current or potential use as a public water supply.
- Class III. Suitable as a source of water for individual domestic water supply, irrigation, agricultural use and general industrial and commercial use. Waters not classified as Class I, II, or IV are by default Class III groundwater, unless reclassified by the Secretary.
- Class IV. Not suitable as a source of potable water but suitable for some agricultural, industrial and commercial use, provided the Secretary may authorize, subject to conditions, use as a source of potable water supply or other use under a reclassification order issued for the aquifer

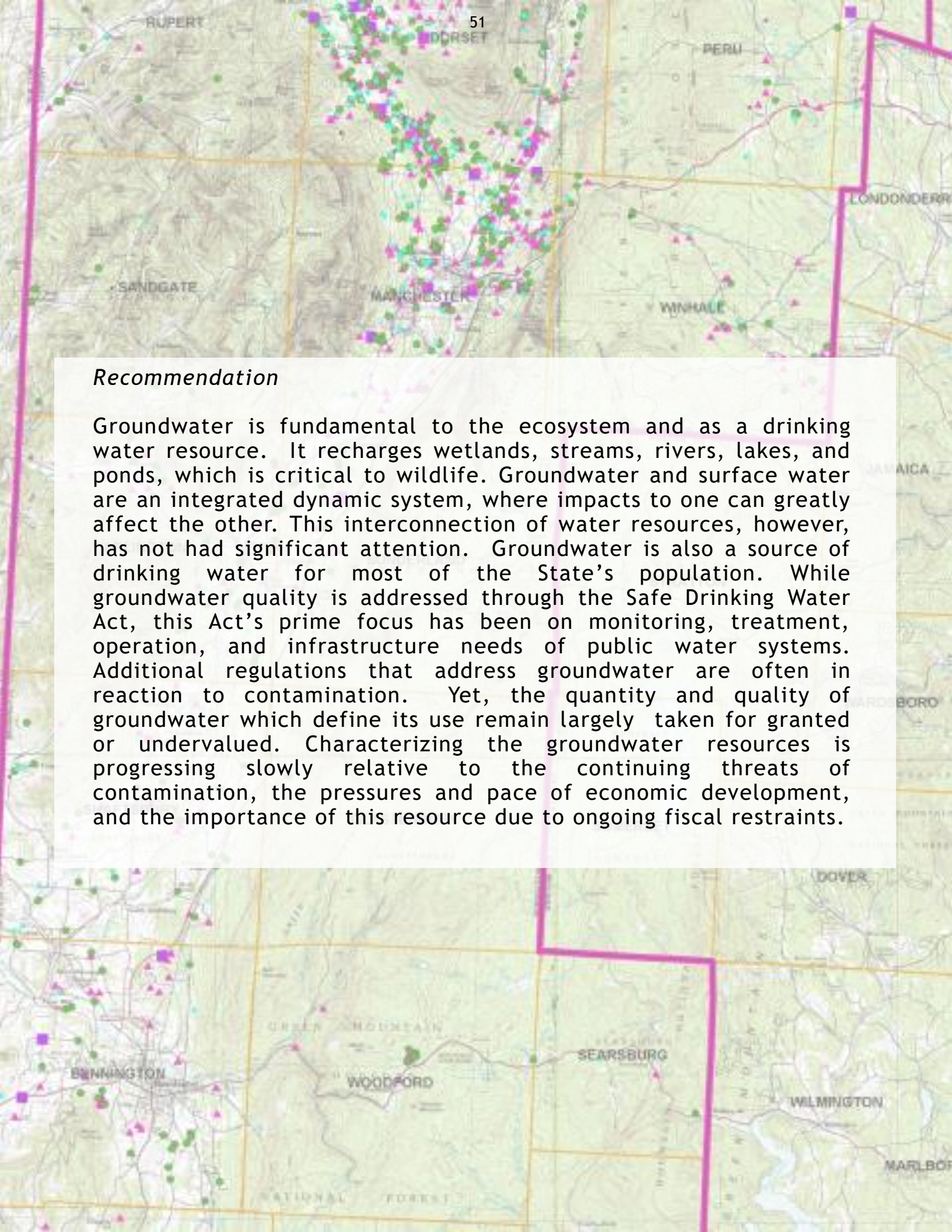



*Information & Public Education*

Each reclassification of groundwater and each delineation of public community or non-transient non-community drinking water source protection areas (SPA) includes a public notice. The town, residents or property owners in these areas, and officials of the water system are contacted. An opportunity for a hearing regarding the area is also provided. The outcome of both processes includes the identification of the groundwater resources along with the development of a rapport with concerned citizens at the town level. Groundwater planning at the local level can be better applied through such efforts. Such processes will go a long way towards educating the public and protecting the resource. Class II and IV Groundwater Areas as well as SPAs are posted on ANR's GIS website.

The DW&GPD annually sponsors Drinking Water Week at different locations throughout the State. The event provides a number of exhibits that explains the importance of drinking water and its protection. Attendance often includes students, the general public, interested parties, and members of the legislature.

The Vermont Department of Health (VDH) toll-free phone line and its website have assisted well owners in better understanding the quality of their water. Also, when there is a confirmed exceedance of a groundwater enforcement standard, whether naturally occurring or due to nearby land activities, there is technical assistance available outlining treatment options to help minimize a family's risk of exposure. VDH has also been present at Home Shows and realtor meetings regarding water quality sampling and testing. Similarly, the DW&GPD's well driller's searchable database is available on ANR's website for information on wells drilled in the state since 1966 along with the ANR Atlas that provides geographic and geological information to the public – everything from identified wetlands, hazardous waste sites, public water supply Source Protection Areas, landfills, and more.




*Recommendation*

Groundwater is fundamental to the ecosystem and as a drinking water resource. It recharges wetlands, streams, rivers, lakes, and ponds, which is critical to wildlife. Groundwater and surface water are an integrated dynamic system, where impacts to one can greatly affect the other. This interconnection of water resources, however, has not had significant attention. Groundwater is also a source of drinking water for most of the State's population. While groundwater quality is addressed through the Safe Drinking Water Act, this Act's prime focus has been on monitoring, treatment, operation, and infrastructure needs of public water systems. Additional regulations that address groundwater are often in reaction to contamination. Yet, the quantity and quality of groundwater which define its use remain largely taken for granted or undervalued. Characterizing the groundwater resources is progressing slowly relative to the continuing threats of contamination, the pressures and pace of economic development, and the importance of this resource due to ongoing fiscal restraints.

# Public Participation

A “Solicitation for Water Quality Data & Information” press release was released on November 13, 2017 by Vermont Department of Environmental Conservation Watershed Management Division. The public was given until December 20, 2017 to provide any data and information for consideration for the 2018 305(b) integrated reporting process and 303(d) listing process. No data was received although a number of water quality monitoring reports from lay monitoring groups that have been generated in the last two years were used for the 305(b)/303(d) reporting and listing.

The draft 2018 Part A 303(d) List of Impaired Waters as well as an interim list showing the waters proposed for de-listing have been compiled and made available to the public for review and comment. At the same time, the 2018 draft Priority Waters Lists that contain: impaired waters that have a TMDL; impaired waters that don’t need a TMDL; waters altered due to exotic species quantities; and waters altered due to flow regulation or modification, were also released for review.

Following receipt of public comments, a response summary will be developed that describes how the comments were addressed. Once approved, the Part 303(d) List will be posted on the Vermont ANR DEC Watershed Management Division.