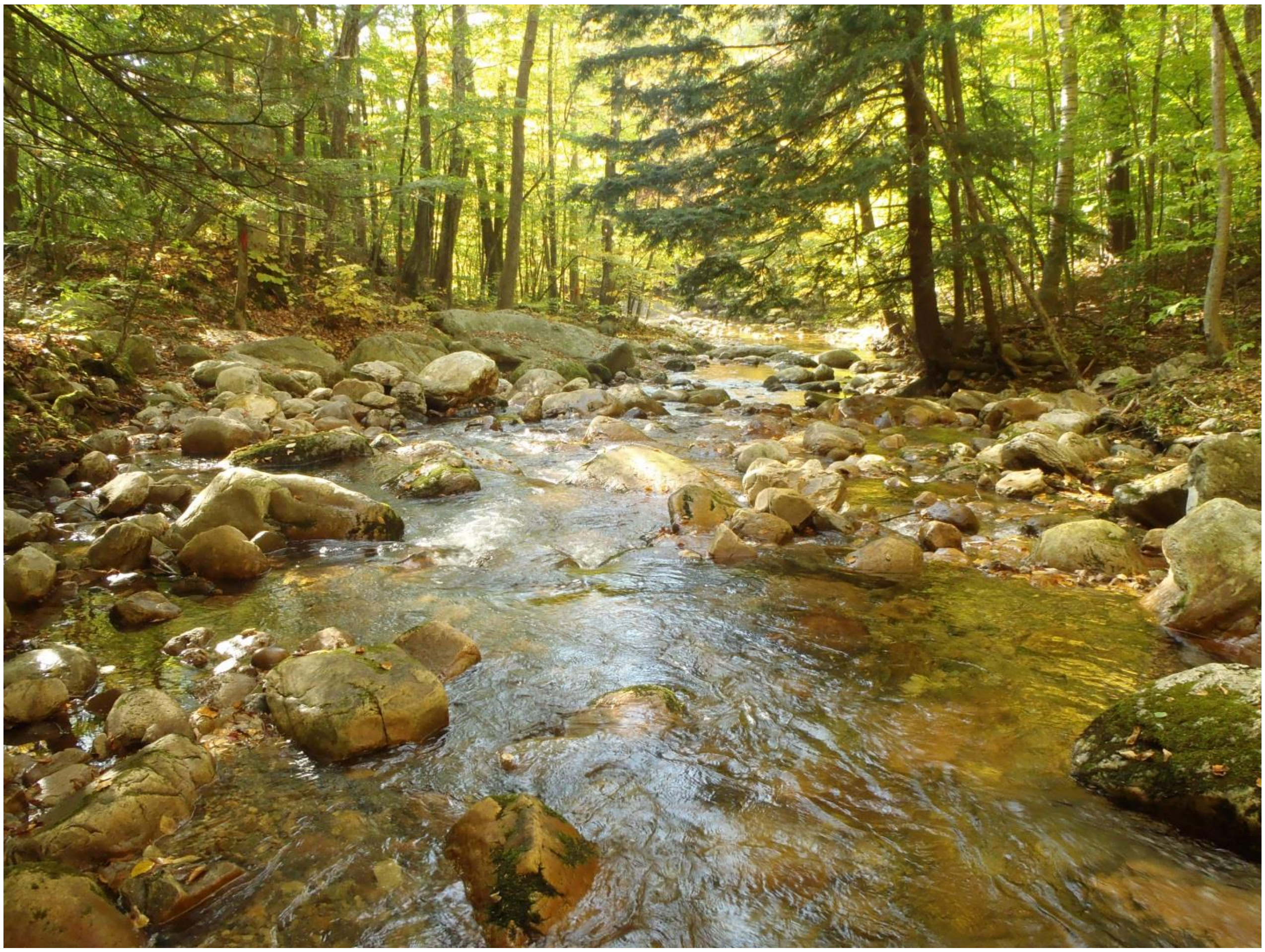
State of Vermont
2014 Water Quality Integrated Assessment Report



Broad Brook – photograph by Steve Fiske

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

August 2014

STATE OF VERMONT

2014 WATER QUALITY INTEGRATED ASSESSMENT REPORT

Clean Water Act Section 305B Report

Vermont Agency of Natural Resources
Department of Environmental Conservation
Watershed Management Division
Montpelier, Vermont 05620
dec.vermont.gov/watershed

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

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Executive Summary

Overall Description

Section 305(b) of the Federal Water Pollution Control Act (also known as the Clean Water Act or CWA) requires each state to submit a report about the quality of the state's surface and ground waters to the US Environmental Protection Agency (EPA) on a biennial basis. This 2014 Water Quality Integrated Assessment Report (*305(b) Report*), prepared by Vermont's Department of Environmental Conservation (DEC) summarizes water quality conditions throughout Vermont with the known conditions as updated with information and data from the 24-month reporting period of January 1, 2012 through December 31, 2013.

Within its borders, Vermont has approximately 7,100 miles of rivers and streams based on 1:100,000 scale maps and approximately 24,500 miles based on 1:5,000 scale mapping. Vermont also has 300,000 acres of fresh water wetlands and 812 lakes and ponds (those at least 5 acres in size or those named on US Geological Survey maps) totaling about 230,900 acres. Surface waters (not including wetlands) are classified as Class A or Class B.

Vermont's water quality policy states that rivers, streams, lakes and ponds should be of high quality, and in most instances, DEC's water quality monitoring programs indicate this to be true. Detailed surface water assessment results are provided in Part C, but aquatic life use support and swimming use support for Vermont's surface waters are summarized in the figure below. Aquatic life and swimming uses are supported on approximately 92% and 97% of assessed rivers and streams respectively and on approximately 59% and 76% of assessed inland lake acres respectively. In Lake Champlain, although phosphorus pollution impairs swimming uses in the majority of lake acres, aquatic life use is in fact supported on 88% of the lake.

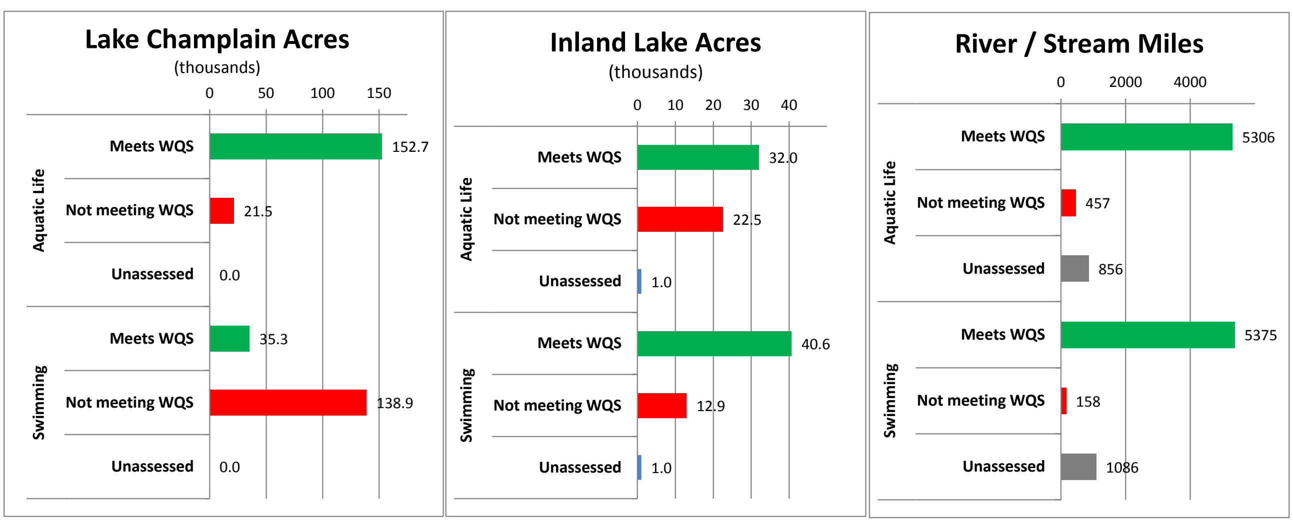


Figure 1. Assessment of Aquatic Life and Swimming Uses in Vermont Lakes and Rivers.

The US Environmental Protection Agency (EPA) has requested that Vermont also assess the attainment of fish consumption use in light of the advisory issued by the Vermont Department of Health in June 1995, and updated most recently in May 2013. The advisory was issued as the result of fish tissue sampling that documented the occurrence of mercury in the tissue of all fish, particularly in walleye and lake trout, and also PCBs in lake trout in Lake Champlain. Taking the fish consumption advisory into consideration, the fish consumption use of all the state's waterbodies ranges from stressed to impaired. Deposition of mercury from the atmosphere is the overwhelming source of mercury in fish. The fish consumption advisory is in Appendix A.

The Wetlands Program of DEC's Watershed Management Division (WSMD) has assessed and monitored wetland condition in the state for over ten years. Since personnel and financial resources are very limited, it has been incumbent upon the state to insure important wetland functions and values are protected from being lost or compromised to development or other destructive practices. The Wetlands Program has recently focused on evaluating and proposing new wetlands for Class 1 wetland status.

In 2008, the legislature declared that groundwater in Vermont is a public trust resource. In mid-2011, the Department of Environmental Conservation completed an interim procedure implementing the public trust doctrine for groundwater quality. DEC continues to incorporate the groundwater public trust doctrine in the Groundwater Protection Rule and Strategy.

Assessment Methodology

As described in DEC's Assessment Methodology, miles of rivers and streams and acres of lakes and ponds are placed into one of four categories by degree of support of designated uses - full support, stressed, altered or impaired. Fully supporting and stressed waters are those that meet the goals of the water quality standards. Impaired waters do not meet goals of the water quality standards because of one or more particular pollutants. Altered waters do not meet water quality standards because of non-pollutant impacts (e.g., alteration of flow to generate electricity).

During the two years since the 2012 305(b) Report, assessment work has now been done in a targeted fashion to assist in providing timely information to the tactical basin planning process. There have been updates to the Poultney, Mettawee, and Passumpsic Rivers watersheds, and the Shelburne, St. Albans, and Malletts Bay watersheds. Updated assessments have begun on the Stevens, Wells, Waits, and Ompompanoosac Rivers watersheds and the West, Williams, Saxtons Rivers watersheds as well. Basin-specific assessment information is always available from DEC upon request and many reports are located on the DEC Watershed Management Division website.

DEC conducts its monitoring, assessment, and listing of waters consistent with the most recent Assessment and Listing Methodology. The 2011 Water Quality Monitoring Strategy contains a thorough description of the Watershed Management Division's monitoring programs and the goals and objectives of the division's monitoring efforts.

Rivers and Streams Assessment

Vermont's river and stream surface water quality and aquatic habitat conditions have been updated from the 2012 305(b) assessment with water quality information and data from waters monitored and assessed during the January 1, 2012 to December 31, 2013 reporting period. Of the 6620 miles identified in the DEC river and stream assessment database, approximately 5763 miles or 87% were assessed for this 2014 305(b) report.

The monitoring data used in stream assessment is primarily biological data and 327 biological monitoring sites were assessed in 2011 and 2012 (the complete assessment for 2013 was not yet available). Vermont DEC does both targeted and probabilistic biological monitoring and in 2012, completed a second probabilistic survey round for wadeable streams. The completion of the 2008 to 2012 round of probability sampling allowed DEC biologists to compare these results to the 2002 – 2006 round as well as to national and regional data from EPA's 2008 – 2009 National Rivers and Streams Assessment. A presentation of the results and comparisons start on page 45.

The major causes of impairment and stress to Vermont rivers and streams include sediments, physical habitat alterations, nutrients, temperature, pathogens, flow alterations, turbidity and metals. The major sources of these pollutants or stream habitat changes are streambank erosion, loss of riparian vegetation, agricultural land use and activities, developed land runoff and hydrology changes, hydro-electric and snowmaking facilities, channel instability, and atmospheric deposition.

Lakes and Ponds Assessment

The assessment of Vermont's lake surface water quality and aquatic habitat conditions have been updated from the 2012 305(b) assessment with respect to invasive exotic species' impacts from waters monitored and assessed during the 1/1/12 to 12/31/13 reporting period. All lakes and ponds within the borders of Vermont are considered as inland lakes or ponds except for the 11 segments of Lake Champlain. Moore Reservoir and Comerford Reservoir on the upper Connecticut River, Lake Memphremagog and Wallace Pond are transboundary waters that are reported as "inland lakes."

In Lake Champlain, none of its 174,175 acres found in Vermont fully support designated uses due to the combined effects of mercury and other contamination, nutrient accumulation, and non-native species. No acres in the Vermont portion of Lake Champlain support fish consumption use due to elevated levels of mercury or polychlorinated biphenyls (PCB) in fish tissue. In the 55,561 inland lake/pond acres that were partially assessed for the 2014 305(b) Report, the causes of impacts to those acres include mercury, phosphorus, pH (acidification), water level fluctuations, and invasive exotic species.

Wetlands Assessment

The Wetlands Section of the Watershed Management Division focused assessment during this past reporting period on identification and evaluation of potential Class 1 wetlands. Twenty-eight of 33 potential Class I wetlands were visited in the field; data and information was gathered; and the wetlands were evaluated using three methods.

Listings of Waters

Development of Vermont's 2014 303(d) List of Impaired Waters runs concurrently with the development of this 2014 Section 305(b) Integrated Report. Consequently, the 2014 303(d) List, which needs approval by EPA, is available in draft form as of this writing. Vermont's complete List of Priority Waters that includes altered or impaired waters in addition to the 303(d) List and Vermont's stressed waters list are also in draft form. This 305(b) report plus the various lists of waters together comprise Vermont's Integrated Water Quality Report.

Vermont's 2012 303(d) List of Impaired Waters was approved by the New England regional office of EPA during the 2014 reporting period (June 2012). The 2012 303(d) listing identified a total of 86 waters as being impaired (71 river/stream segments and 15 lakes/ponds). The 2014 303(d) List potentially adds 3 segments, however, 8 segments are proposed for delisting resulting in a total of 81 segments identified on the 303(d) List for this cycle.

Vermont's 2012 listing of other priority waters outside the scope of 303(d) was also finalized in 2012. This list included: impaired waters that do not need a TMDL (Part B); waters in need of further assessment (Part C); waters with EPA-approved TMDLs (Part D); and waters altered by exotic species (Part E), flow regulation (Part F) and channel alteration (Part G). For the 2014 listing cycle, changes have been made to the Priority Waters List that are detailed in Section C3.3 below.

During the 2014 Section 305(b) reporting period, the New England regional office of EPA approved 2 TMDL determinations that had been completed by DEC. This brings to 119 the total number of TMDLs that have been developed by Vermont DEC and approved by EPA since 2001. These TMDL waters are in various stages of implementation, and while many remain impaired, there have been considerable successes as well. The Department is pleased to point out that in New England, Vermont leads the way in the numbers of so-called §319 Success Stories posted to EPA's website (https://www.epa.gov/polluted-runoff-nonpoint-source-pollution/nonpoint-source-success-stories) and expects more to be added after 303(d) List approval.

Groundwater

Groundwater is currently used for drinking water by approximately 70% of Vermont's population. About 46% of the population is self-supplied while about 24% is served by public water systems using groundwater. The results of a study on groundwater interference caused by Public Community Water Supply (PCWS) sources indicate that, overall, groundwater interference is not a chronic problem in Vermont.

About 87% of the public community water systems in the State have their corresponding Source Protection Areas or aquifer recharge areas mapped on a hydro-geologic basis. The remaining public community water systems are using 3,000 foot radius circles as their Source Protection Areas.

In the 2014 305(b) reporting period, there were: ongoing efforts to incorporate groundwater public trust doctrine in the Groundwater Protection Rule and Strategy; an amendment to a Class IV groundwater petition for the BFI Rockingham Landfill Superfund Site; and 12 Underground Injection Control (UIC) permits issued.

Major State Water Quality Issues

Vermont surface water quality issues of concern are detailed in Section B5 below:
Agricultural runoff
Atmospheric deposition of pollutants
Chlorides and water quality
Climate change and Vermont's waters
Dams and dam removal
Flooding and channel impacts post 2011 floods
Invasive exotic plants and animals in surface waters
Lack of strategic statewide vegetated buffer requirements
Lakeshore development and alteration of littoral habitat
Pharmaceuticals, personal care products, and other contaminants in waters
River corridors and water quality
Stormwater TMDLs Implementation
Water quality standards critieria

Part A: Introduction

Section 305(b) of the Federal Water Pollution Control Act (also known as the Clean Water Act or CWA) requires each state to submit a report about the quality of the state's surface and ground waters to the US Environmental Protection Agency (EPA) on a biennial basis. The 2014 Water Quality Integrated Assessment Report (often called the *305b Report*) summarizes known water quality conditions throughout Vermont updated with information and data from the 24-month reporting period (January 1, 2012 through December 31, 2013). Also included are brief descriptions of water resources monitoring/assessment program information for rivers and streams, lakes and ponds, wetlands and groundwater. The report contains information on certain costs and benefits, monitoring progress, swimming beach closures and special concerns.

Within its borders, Vermont has approximately 7,100 miles of rivers and streams, 300,000 acres of fresh water wetlands and 812 lakes and ponds (those at least 5 acres in size or those named on US Geological Survey maps) totaling about 230,900 acres. Surface waters (not including wetlands) are classified as Class A or Class B. Class A waters are managed for enjoyment of water in its natural condition, as public drinking water supplies (with disinfection when necessary) or as high quality waters which have significant ecological values. Class B waters are managed for aquatic biota and wildlife sustained by high quality habitat; good to excellent aesthetic value; suitable swimming, fishing and boating among other uses. Certain Class B waters have an overlay Waste Management Zone for public protection below sanitary wastewater discharges. In March 1974, Vermont received from EPA the delegation authority to administer discharge permits under the National Pollutant Discharge Elimination System and within Vermont, there are 172 wastewater treatment facilities.

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

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

The Vermont portion of the Batten Kill along with the West Branch of the Batten Kill (totaling about 33 miles), the Lower Poultney River (about 22 miles), a 3.8 mile segment of the Ompompanoosuc River and a 1.3 mile segment involving Pikes Falls on the North Branch of Ball Mountain Brook have each been designated as an Outstanding Resource Water (ORW). The 3.8 mile segment of the Ompompanoosuc was designated ORW in 1996. All other ORWs noted above were designated in 1991.

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

The 2014 Water Quality Assessment Report describes whether or not the state's surface water uses as defined by EPA and the State Water Quality Standards fall into one of four use support categories. The four use support categories used by the Vermont Department of Environmental Conservation are *full support, stressed, altered,* or *impaired.* The four use support categories are described below on page 24.

Water uses include, but are not limited to, aquatic life, recreation, drinking, fish consumption and agriculture. A determination of use support is made following the Vermont Surface Water Assessment Methodology and using information gathered and provided to the Department of Environmental Conservation by water resources personnel, fish and wildlife biologists, aquatic biologists, lake and river organization members and other qualified individuals or groups. The 2014 Water Quality Assessment Report identifies the distance in miles of rivers and streams and area in acres of lakes and ponds that were assessed.

For Section 305(b) reporting purposes, river or stream segments and lakes and ponds where one or more uses are not fully supported (i.e. either altered or impaired) are considered not to be meeting the Water Quality Standards. However, for Section 303(d)[1] listing and reporting purposes, impaired waters are those where one or more criteria of the Water Quality Standards are violated by a pollutant. Violations of Water Quality Standards are substantiated by chemical, physical or biological water quality data collected through monitoring. The 2014 303(d) list of waters is being developed concurrently to the 2014 305(b) Report. Because the 2014 303(d) list needs EPA approval, that information is presented separately from the 2014 305(b) Report. The 305(b) Report, the 303(d) list, and the other lists of priority waters when taken together however, represent Vermont integrated reporting because this information is inextricably linked.

A rotating basin schedule is used when assessing the state's waters, assessing roughly one-fifth of the state each year, from the 17 major basins found in Vermont. The 2014 305(b) Report contains updated water quality information primarily for the following watersheds: White River, Deerfield River, Passumpsic River, Shelburne Bay, St. Albans Bay, and Malletts Bay. It also contains updates from the last two years of biological monitoring statewide.

For 2014 assessment reporting and listing purposes, DEC used an updated Assessment and Listing Methodology that is dated March 2014. The 2014 Assessment and Listing Methodology can be read on DEC's Watershed Management Division web site (http://dec.vermont.gov/watershed). A map illustrating the 17 Vermont river basins and the year in which they are scheduled for monitoring is provided below.

[1] Section 303d of the Act requires each state to identify those waters for which technology-based pollution controls are not stringent enough to attain or maintain compliance with applicable State water quality standards.

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 305(b) Report has become increasingly important to support funding award decisions to the state made at the federal level under the Clean Water Act Section 106 formula. 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. Finally, the 305(b) water quality assessments are one of several important sources which 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.

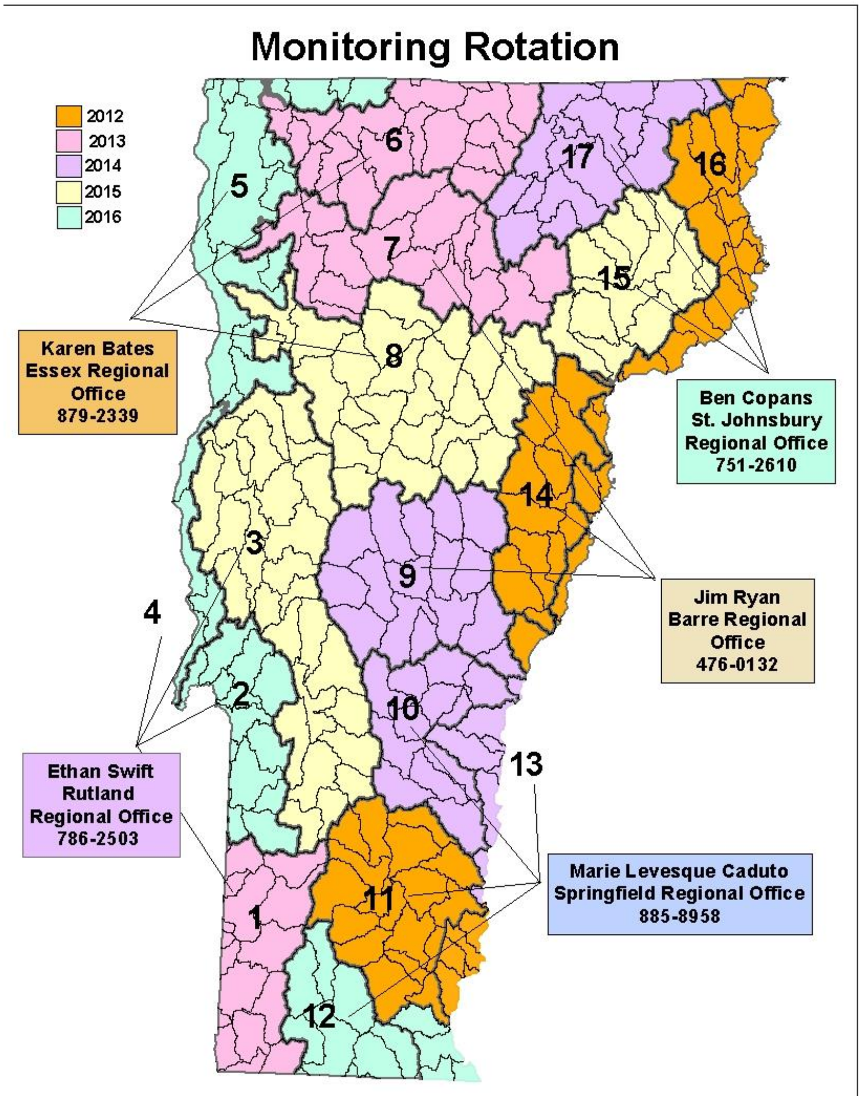


Figure 2. Water Quality and Aquatic Habitat Rotational Monitoring Schedule

Part B: Background Information

B1. Atlas of Total Waters

Vermont has approximately 7,100 miles of rivers and streams based on EPA's Total Waters Database, which uses 1:100,000 scale maps. Vermont DEC currently uses 6620 miles as the total on which to base assessed and unassessed miles. Vermont has 230,900 acres of lakes, reservoirs and ponds and 300,000 acres of freshwater wetlands. The surface area of lakes, ponds and wetlands represent approximately 828 square miles of water or about 8.6% of the state's total 9,609 square mile area.

Vermont's border waters include the Connecticut River on the east (border with New Hampshire), Lake Memphremagog and Lake Champlain on the north (partial border with the Province of Quebec) and the Poultney River and Lake Champlain on the west (partial border with New York). The 17 major river basins of Vermont shown on the earlier map drain to one of four large regional drainages: Lake Champlain, the Connecticut River, Lake Memphremagog, or the Hudson River. Additional surface water resource information is contained in Table 1 below.

Table 1. Atlas

State population (July 1, 2013 estimate)	626,630
State population change (2000-2010)	2.8%
State surface area	9,609 square miles
State population density	65 persons/sq mi
Miles of perennial rivers & streams	7,099 (includes the Conn River)
Border miles of shared rivers/streams (subset)	262 (Conn R. 238, Poultney 24)
Longest river in the state (not including Conn R.)	100 miles (Otter Creek)
Largest river watershed in the state (not including Conn R.)	1080 sq miles (Winooski R watershed)
Number of lakes, reservoirs & ponds over 20 acres	280
Number of lakes, reservoirs & ponds from 10 to 20 acres	190
Number of lakes, reservoirs & ponds (at least 5 acres but less than 10 acres)	148
Number of significant lakes, reservoirs & ponds less than 5 acres(or size unmeasured)	206
Deepest in-land lake (Willoughby)	308 feet
Greatest depth of Lake Champlain (off Thompsons Point)	394 feet
Acres of lakes, reservoirs & ponds[1]	230,927
Acres of freshwater wetlands[2]	300,000

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

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

B2. Water Pollution Control Programs

The Vermont Department of Environmental Conservation (DEC) is designated as the lead water quality management agency for the State of Vermont. In that role, DEC administers a variety of programs that are intended to control, reduce or prevent pollution from point and nonpoint sources to the State's surface and ground water resources. There are also a number of other agencies and organizations that work to control nonpoint source pollution through their programs. Good descriptions of Vermont DEC as well as other programs working to protect water quality and prevent pollution can be found in Appendix D of the Statewide Surface Water Management Strategy and in the 2013 Vermont DEC Ecosystem Restoration Program report to the legislature.

Water Quality Standards

The Water Quality Standards are the foundation of the state's water pollution control and water quality management and protection efforts. The Water Quality Standards used when preparing this report were last amended as of December 30, 2011.

The Standards establish narrative and numeric criteria to support designated and existing uses. Designated uses, as established in Sections 3-02(A), 3-03(A) and 3-04(A) of the Standards, mean any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water. Table 2 lists the designated uses for each class.

Table 2. Designated Uses for Water Classifications.

Designated Uses	Class A(1) – Ecological Waters	Class A(2) – Public Water Supplies	Class B Waters
Aquatic Biota, Wildlife & Aquatic Habitat	✓	✓	✓
Aesthetics	✓	✓	✓
Swimming & Other Contact Recreation	✓		✓
Boating, Fishing & Other Recreation Uses	✓		✓
Water Supplies		✓	✓
Agricultural Uses (Irrigation of Crops ...)			✓

Watershed Planning Process

As of 2011, Vermont has been implementing a revised tactical planning approach to developing water quality/watershed management plans that is considered the core implementation structure for Vermont's new Surface Water Management Strategy. This Strategy sets forth goals and objectives for managing Vermont's surface waters in light of the goals of the federal Clean Water Act and Vermont's state surface water quality policy. The Strategy is continually being updated to reflect changes in statute and water quality policy. A longer description of the Strategy can be found in the 2012 305(b) Integrated Report.

Direct Discharge Program

Vermont administers a comprehensive direct discharge water pollution control program consisting of planning loans and advances, construction grants and loans, permitting and compliance monitoring. In March 1974, Vermont received from EPA the delegation authority to administer discharge permits under the National Pollutant Discharge Elimination System. Within Vermont, there are 172 wastewater treatment facilities.

With the construction of the state's last originally identified municipal wastewater treatment facility (WWTF) and completion of the upgrades from primary to secondary, the program now places emphasis on refurbishment of existing WWTFs, the completion of phosphorus reduction upgrades, advanced waste treatment, correction of combined sewer overflows, control of toxics, pollution prevention activities and facility enlargements. A summary of the projects that have been awarded loans was provided to the Vermont General Assembly by Vermont ANR DEC January 10, 2014 in the report: Annual Report of Loan Awards The Vermont Environmental Protection Agency (EPA) Pollution Control Revolving Fund – Also Known as the CWSRF, State Fiscal years 2013 – 1014. Status reports on the permitting cycle and refurbishment for specific WWTF are found within relevant Tactical Basin Plans.

CAFO Permit

The Vermont statewide CAFO (Concentrated Animal Feeding Operation) general permit was issued in June, 2013. Any farm that discharges pollutants to a surface waterbody can be required to obtain a permit. The CAFO general permit is for medium farms, but an individual permit can be required for a small or large farm.

The CAFO permit requires farms to properly design, construct, operate, and maintain production areas to control waste and to develop and implement a nutrient management plan, which is available to the public. The permit prohibits a discharge of manure, litter, or wastewater, except when direct precipitation equivalent to or greater than a 25-year, 24-hour storm event causes a discharge.

The CAFO permit program is complemented in Vermont by Medium Farm and Large Farm Operating Permits issued by the Vermont Agency of Agriculture, Food, and Markets. These permits feature numerous conditions designed to preclude discharge to surface waters.

B3. Nonpoint Source Program

319 Nonpoint Source Management Program

Vermont has been able to effectively target areas, design work plans, compete for and capture funding and implement NPS projects directed at restoring and protecting water uses and values. In the twenty- three years of Clean Water Act Section 319 NPS implementation funding (1990-2013), Vermont has received a cumulative total of about $28.2 million to implement a variety of activities.

The goal of the NPS management program is to encourage the successful implementation of best management practices (also referred to as "BMPs") by diverse interests such as farmers, developers, municipalities, lakeshore residents, landowners and riparian landowners in order to prevent or reduce the runoff of NPS pollutants. Effective BMPs can be structural, vegetative or management-based as well as regulatory or advisory.

Activities carried out with Section 319 funding during this 305(b) reporting period (1/2012 – 12/2013) were largely those undertaken by personnel with the Vermont Department of Environmental Conservation and the Vermont Agency of Agriculture, Food and Markets (AAF&M). Section 319 funding used by DEC personnel were focused on tactical basin plan development and implementation, river corridor management, storm water management, lakes and ponds management and total maximum daily load determination. Some of the 319 funding received by AAF&M were, in turn, passed through to a few Natural Resource Conservation Districts and then used for activities carried out by Agricultural Resource Specialists.

Because of the diffuse but widespread nature of NPS source pollution, there are several other important programs that are prominent features of Vermont's overall nonpoint program. Some elements are part of DEC while other elements are conducted outside of DEC. Examples of the former include stream stability assessments and floodplain management, construction sediment and erosion control, hazardous and solid waste management, responding to spills and leaks and the control of stormwater from construction sites and developed areas. Grant funding from DEC's Ecosystem Restoration Program (ERP) has assumed a significant and expanded role when combating NPS pollution. Examples of NPS work conducted outside DEC include logging erosion control carried out by the Vermont Department of Forests, Parks and Recreation, controlling runoff and erosion from unpaved back roads by the Vermont Transportation Agency and agricultural runoff control by the Vermont Agency of Agriculture, Food and Markets. The US Department of Agriculture and US Fish and Wildlife Service are important NPS management partners in both forestry and agriculture arenas.

Specific details regarding the NPS program and project activities are available from DEC's Watershed Management Division. DEC has maintained a listing of Section 319 and ERP-assisted project titles by funding year. Vermont will continue to pursue and apply ERP and Section 319 NPS funding in targeted areas that are likely to result in the successful implementation of BMPs and programs and in the improvement of water quality.

A comprehensive summary of nonpoint source practices and programs can be found in the legislative report done recently to describe the measures needed to insure Lake Champlain water quality improvements.

B4. Costs and Benefits of Water Pollution Control Programs

Point Sources

The total commitment and expenditure of state, federal and local funds for all municipal wastewater treatment facilities and appurtenances to date has been over $750 million. These facilities have improved the quality of many river miles and a number of lakes including Lake Champlain. The $750 million figure includes almost $21 million in improvements that were funded in the 2013 and 2014 fiscal years. Refer to the CWSRF report noted on page 11 for the location and estimated cost of recent improvements.

The money spent on stormwater pollution clean-up has included geomorphic assessments, subwatershed mapping, flow and precipitation monitoring, and modeling work in impaired watersheds in order to develop the best management practices needed to understand the impairment and clean up the streams. To date, at least $1.39 million have been spent on the stormwater impaired streams through grants and contracts for the work described above.

In addition, over $17.1 million have been spent in private and/or public projects in about 16 towns retrofitting existing stormwater systems or enhancing stormwater treatment. Some of this work has provided stormwater offsets for new development by allowing the developers to purchase their offset credits rather than find an appropriate project themselves.

Nonpoint Sources

Unlike point sources, quantifying the financial resources spent on nonpoint source control of pollutants is not as easy to determine or link to specific river miles/lake acres of improvement. This is due to several factors: contributions of resources come from various state, federal and local agencies as well as from landowners, volunteer groups, foundations, businesses; NPS controls take many shapes and forms and can be applied as structural or non-structural measures; some NPS controls may be implemented one year and not applied the following year (e.g. cover crops); some NPS efforts are focused on education as a way to encourage adoption of recommended practices.

During state fiscal year 2014, the Ecosystem Restoration Program received and made available about $2 million for ecosystem restoration grants. Close to 60 grants were issued which enabled NPS pollution reduction work.

Funding for the two CWA programs under DEC administration from 1989 through 2013 has amounted to about $1.5 million (604b) and over $28 million (319). The 604b Program's 40% pass-through has helped the 11 Vermont regional planning commissions (RPC) conduct a wide variety of water quality planning related activities that are a priority to the State and to each RPC. In one year (2009), Section 604b funding was increased by $194,000 as a result of money arising out of the American Recovery and Reinvestment Act. Forty percent of that amount was distributed to the RPCs and linked to low impact development planning purposes. Subsequent to those dollars and the LID related effort by the RPCs, DEC has created a Green Stormwater Infrastructure coordinator position who is working with other state agencies and the development community to further expand knowledge and use of such "green" techniques. Prior to FFY2012, a portion of the 319 Program has provided varying levels of grant funding to government and non-profit organizations across Vermont to carry out a wide variety of NPS implementation efforts.

Another notable state funded water quality and aquatic habitat program (aside from the Ecosytem Restoration Program) is the Vermont Conservation License Plate program. In the 16 years of its existence (1998-2014), the license plate program and the associated Vermont Watershed Grants Program have awarded over $1.1 million in state monies to many diverse groups for a wide variety of water quality or aquatic habitat projects. Many of the license plate funded projects provide water quality and/or aquatic habitat benefits that have some connection to NPS management. The program, co-administered by DEC and the Vermont Department of Fish and Wildlife, would not be possible without the assistance and insight of citizens who serve on a committee charged with reviewing the numerous proposals submitted each year.

B5. Issues of Special State Concern

The following issues of state concern are generally updates on the topics in the 2012 and/or 2010 305(b) report. The 2012 305(b) report, however, has a number of flooding impacts issues described that are not carried over necessarily to this report. Those discussions as well as other information on most of the topics below can be found in the 2012 305(b) report on the Vermont ANR DEC Watershed Management Division website.

Agricultural Runoff

Controlling agricultural nonpoint source pollution is a key element in reducing nutrient loading to Vermont's lakes and streams, and to meeting water quality standards. The control of nonpoint source pollution presents a major challenge due to the diffuse nature of nonpoint source contributions, which can originate from farm fields and production areas. Some of these sources, especially from field practices, are difficult to identify, quantify and control.

In working to control nutrient runoff, Vermont has invested heavily in programs to provide technical and financial assistance to farmers to help improve farmstead runoff, and incentivize soil-based conservation practices such as cover cropping, reduced tillage and improved nutrient and manure management that may be new or innovative. In Vermont, a strong agriculture conservation partnership exists between state and federal agencies, as well as the non-profit sector that provides non-regulatory outreach and education about these programs to the farming community.

However, concerns continue to exist regarding the impacts of agricultural runoff, especially from farm fields and small farms that have been less regulated due to unavailable staffing resources at the Vermont Agency of Agriculture (VAAFM). DEC and VAAFM have worked extensively in the agricultural community over the past two years in preparation for policy and programmatic changes resulting from the Lake Champlain TMDL, since any changes will have statewide implications. DEC and VAAFM convened an Agricultural Workgroup in 2013 which helped develop proposed changes to the state Accepted Agricultural Practices and ideas for additional incentives for farmers. The reports from the workgroup include statewide recommendations for improving surface water quality by increasing enforcement and educational outreach on agricultural nonpoint sources.

Atmospheric Deposition of Pollutants

The long-distance transport and deposition of air-borne pollutants (mercury, sulfate, and nitrous oxides) to the Vermont landscape from the atmosphere has been principally responsible for the impairment of fish consumption uses on 8,165 inland lake acres, all of Lake Champlain, and 54 river and stream miles. Acidity due to atmospheric deposition of pollutants impairs aquatic life uses on 4,468 inland lake acres and has resulted in the listing of 38 lakes now listed as impaired because of acidity and placed on the 303(d) list.

Over the past 32 years, various regional US (and Canadian) emission control programs have resulted in substantial reductions in the deposition of sulfate, nitrate and acidity as measured at the Bennington, Vermont National Atmospheric Deposition Program (NADP) site. Reductions in deposition have translated into significant reductions of in-lake concentrations of acidifying pollutants.

Figure 3 shows trends in the annual average precipitation chemistry in Bennington, VT. Since 1981, sulfate ion concentrations in precipitation have declined by 70%. Nitrate concentrations have since declined by more than 50%. Concentrations of ammonium ion and base cations (Ca, Mg, K, Na) have remained relatively constant. Average precipitation pH has increased from 4.3 to nearly 5.0.

Figure 3. Annual Average Precipitation Chemistry at Bennington, VT NADP site, 1981-2012.

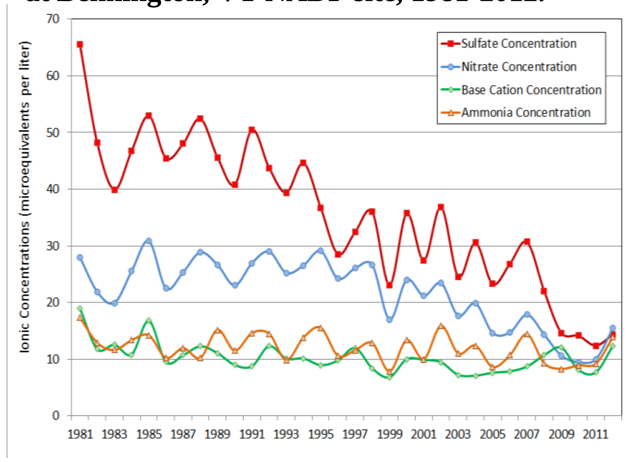
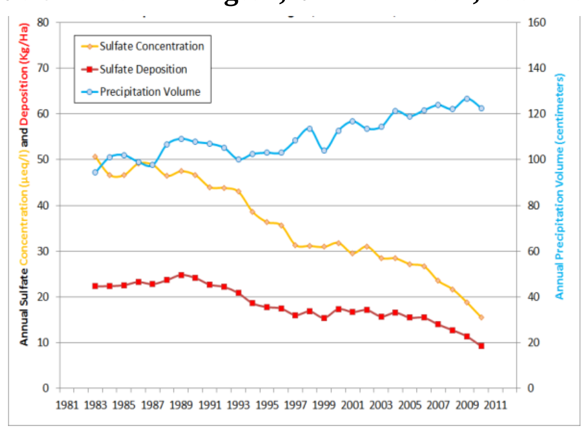


Figure 4 compares changes in sulfate concentration (µeq/l) with wet sulfate deposition (kg/ha), expressed as 5-year running averages. Sulfate deposition has decreased by 50 to 60% from the early 1980s. This improvement, however, is not as great as the 70% reduction in sulfate concentration over this same time period.

Figure 4. Five year Running Average Sulfate Concentration and Deposition and Precipitation Volume at Bennington, VT NADP site, 1981-2012.

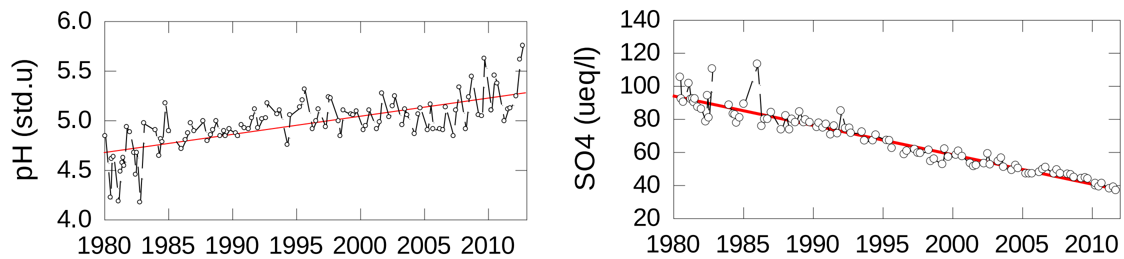


The reductions in concentration appear to have been partially offset by increases in the quantity of precipitation, which has increased by about 20% over the past 30 years. This increase in precipitation amount is consistent with observations from the 2009 report of the US Global Change Research Program (GCRP),* which noted a 50-year trend of increasing precipitation in the Northeast through 2008, along with a large (67%) increase in the amounts of "very heavy" precipitation events over the past 50-year period.

Future projections summarized in the GCRP report include continued increases in northeastern US precipitation volumes and extreme events, especially during winter and spring, with decreases during the summer, increasing soil and surface water temperatures, shorter winters and earlier snowmelt. These changes will have an impact on the water chemistry of all waterbodies in Vermont.

*Global Change Research Program (2009) Global Climate Change Impacts in the United States, http://nca2009.globalchange.gov/

Acid lakes in Vermont have responded to these changes in deposition with reduced in-lake sulfate concentrations and increasing pH levels as shown on Haystack Pond (Wilmington, VT) from 1981-2012 (Figures 5 and 6). However, in-lake calcium concentrations remain too low to support sensitive aquatic organisms, such as fingernail clams. Future reductions in acid deposition and increases in calcium and other base cation concentrations are necessary for healthy waterbodies.



Figures 5 and 6. pH and sulfate concentration on Haystack Pond, Wilmington, VT. 1981-2012.

Recent federal regulations such as the 2014 EPA Tier 3 Motor Vehicle Emission and Fuel Standards are expected to further reduce the acidifying pollutants in the atmosphere and in Vermont lakes. It is anticipated that these reductions will improve the water quality of Vermont's acid lakes. However, changes in precipitation volume and intensity due to climate change will have, as yet, unpredictable effects on Vermont's acid sensitive lakes.

Chlorides and water quality

Chloride concentrations are monitored in streams through the Ambient Biomonitoring Program, in lakes and ponds through the Spring Phosphorus and Acid Rain Programs, and on Lake Champlain by the Lake Champlain Long-term Water Quality and Biological Monitoring Program. Current trends on Lake Champlain can be found on the program website. No substantial updates or analysis have been done since the 2010 305(b) report, however, the Watershed Management Division is moving to add chloride criteria for the protection of aquatic biota to the Vermont Water Quality Standards Appendix C (860 mg/L and 230 mg/L, for acute and chronic criteria respectively).

Climate Change and Vermont's Waters

As a result of climate change, Vermont and the region are expected to experience changes that could have critical consequences for hydrology, water quality, ecological integrity, and human infrastructure from more extreme and less predictable weather patterns.

With more extreme precipitation events, flooding and erosion concerns are likely to become more pressing. Vermont communities have already experienced an increase in the frequency of damaging floods in recent years including the record setting flows and floods of 2011. This trend is likely exacerbated by greater development in flood-prone areas, as well as chronic instability from historic and current channelization of rivers and streams.

In addition to flooding, intensified stormwater runoff will increase water pollution as flows carry pesticides, fertilizers, sediments, oils, heavy metals, animal waste, inundated septic system and combined sewage overflows, and other pollution into rivers and lakes. Wastewater treatment facilities that are not completely disconnected from storm sewers may be overwhelmed by storm water volumes, allowing for the possibility of pathogen contamination of lakes or rivers. Warmer, nutrient-rich waters may encourage more frequent cyanobacterial blooms and elevated populations of the bacterium *E.coli*.

Aquatic life could face severe challenges. One concern is that warmer waters hold less dissolved oxygen and this low-oxygen condition can be detrimental to many aquatic species. Changes in the timing and duration of high and low flows could interfere with the life cycles of migratory fish or aquatic insects. Species interactions may be disrupted, as more tolerant species gain competitive advantages, and aquatic communities become less resistant to invasive species.

Aquatic ecosystems may be especially vulnerable wherever habitats are already compromised. For example, locations with little or no vegetated buffer will experience higher thermal stress. Critical ecosystem processes that have been altered (e.g., where floodplain function is diminished by flow regulation or excessive encroachment or where habitats are fragmented due to barriers to aquatic species movement such as culverts or dams) may already limit habitat diversity and availability.

Particular species vulnerabilities may include species sensitive to warmer temperatures and oxygen-poor waters (e.g., brook trout), rare species or species sensitive to sedimentation (e.g., freshwater mussels), species with pronounced susceptibility to mercury contamination (e.g., loons), or species that may provide benefits to other species (e.g., tree species important for riparian buffers that may themselves be vulnerable to warming temperatures).

Dams and Dam Removal

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

While the 2012 305(b) report noted increased interest in the use of existing dams particularly for hydroelectric power generation and flood control, it is important to note that interest in dam removal has also been increasing recently. This interest is not surprising given the many ecological benefits of dam removal, which include reduced water temperature, increased dissolved oxygen concentrations, increased habitat connectivity, and the restoration of natural flow and sediment dynamics. Removal of unused dams often resolves other issues too, including public safety (dams may exacerbate upstream flooding and many are poorly or not maintained) and economics (the cost of dam ownership to towns, the state and private individuals can be significant).

In response, efforts have been undertaken to build additional capacity in the state to restore free flowing rivers. For instance, the Vermont Dam Task Force, a public-private advisory group formed in 2000, identifies potential removal projects and provides technical assistance to dam owners and watershed groups. The state has also created a modest revolving loan fund to help facilitate the removal of unsafe dams. And currently, there is legislation in the statehouse that would compel owners to register dams and pay registration fees, which could drive further interest in dam removal.

These efforts are bearing fruit and are exemplified by several recent projects that highlight the impacts of these structures, as well as the benefits that can be captured through their removal. Foremost is the removal of the Dufresne Dam in Manchester, which stood as the only dam on the mainstem of the Batten Kill in Vermont. Originally built in 1908 to power a saw mill, the dam's adverse impact on aquatic habitat was substantial. Data from the Dufresne impoundment showed water temperatures reached 75° F, only a few degrees below the upper lethal limit for trout. The removal of this structure in 2013 not only reduced in-stream temperature, but also allowed for the restoration of thousands of feet of riverine habitat and opened five miles of upstream habitat to the Batten Kill's populations of wild brook and brown trout.

The Marshfield-8 Dam was the focus of another recent dam removal project after close to 40 years of non use. Sediment analysis prior to removal demonstrated the extent to which the dam altered the natural sediment regime, revealing 2,375 cubic yards of sediment had accumulated behind the dam, up to a depth of nine feet. Dam removal restored natural sediment dynamics, stabilizing the reach while also improving aquatic habitat. Other recently completed dam removals include the Henry Bridge Dam in Bennington, which had become a safety hazard for swimmers and the Beaver Pond Dam in Mendon that became a haven for Eurasian water-milfoil, an invasive species. In these two instances, dam removal provided recreational benefits, while simultaneously improving connectivity and habitat quality. Other projects, including Kendrick Pond Dam in Pittsford and Franconia Dam in Groton, are progressing along the path to removal.

The degree to which dams disrupt river ecology make them one of the most significant alterations humans have wrought on river systems. The recent removals described above demonstrate the multiple benefits that can be captured through restoration of free flowing rivers. As pressure to dam rivers persists, it is becoming increasingly important to effectively communicate the benefits of free flowing rivers to the public and to ensure that resources are available to resolve the conflict presented by dams that have outlived their utility, but continue to exert an ecological impact on riverine systems.

Flooding and Channel Impacts Post 2011 Flooding

Vermont's rivers, streams, lakes, ponds, and associated wetlands suffered substantial damage in 2011. The flooding of Lake Champlain in May and June of 2011 set new records due to its height and duration and amount of damage. Rivers like the Winooski and Missisquoi each delivered about 400 metric tons of phosphorus to Lake Champlain during 2011, more than twice their average annual amounts. About two-thirds of this phosphorus arrived during the runoff of April and May. Tropical Storm Irene accounted for another 9 to 13 percent.

And then on August 28, 2011, Tropical Storm Irene moved through the state dropping anywhere from 2.25 to 7.80 inches of rain resulting in record flooding in some of Vermont's watersheds. Following the floods themselves, many miles of southern and central Vermont rivers and streams were dredged, channelized, re-channelized and/or bermed. Some of the activity was conducted to obtain material for road rebuilding and to reclaim lands. The repercussions of post-Irene channel manipulation as well as the flooding itself continues today in terms of channel instability and erosion, loss of habitat, and vulnerability in the next flood. Three sections of the 2012 305(b) report discussed the impacts of the 2011 Lake Champlain flooding and of TS Irene in a lot of informative detail.

Invasive exotic plants and animals in surface waters

Non-native aquatic plants and animals are established in Vermont - at least 49 non-native aquatic species are known – and many of the state's waters, especially lakes, have a history of impacts related to these invasions. Although the number of new introductions of species already known from Vermont increases annually, many of these populations are found early in the invasion, when control efforts can be more successful.

During the 2014 305(b) reporting period, there were a number of invasive species expansions or events:

- No new Eurasian watermilfoil (*Myriophyllum spicatum*) lakes or other waters were discovered. The total number of lakes with Eurasian watermilfoil is 67 (with a dam removal at Beaver Pond in Mendon, this lake switches to an "other water") and other waters, 30.

- Water chestnut (*Trapa natans*) was discovered in three more waterbodies bringing the total number of waterbodies with water chestnut to 26.

- Control and search efforts continued on Vermont's first variable-leaved watermilfoil (*Myriophyllum heterohpyllum*) population in Halls Lake in Newbury (confirmed in 2008). Surveys conducted in 2012 and 2013 found no variable-leaved watermilfoil. Variable-leaved watermilfoil has not been found in the lake since June 2011. The only other populations known from a Vermont waterbody is in Lake Champlain confirmed in both Missisquoi and South (NY) bays.
- One new brittle naiad (*Najas minor*) water was confirmed, 839-acre Waterbury Reservoir in Waterbury and Stowe, bringing the total number of known lakes with populations of this species to eight.* This species was first confirmed in Vermont in 1984.
  ** In two of these six water bodies, declines of brittle naiad have been noted.*
- A new exotic crayfish species, big water crayfish (*Cambarus robustus*), was confirmed for the first time in Vermont in the White River. Extensive crayfish surveys done in the White River in 2005 did not find this species suggesting that this is a recent introduction. (Extensive monitoring of crayfish in the state has not been performed.)

- Alewives (*Alosa pseudoharaengus*) were first confirmed in Lake Champlain in 2005. Alewives of all age classes have now been documented in the lake, and schooling alewives were observed for the first time during summer 2007 indicating a significant population increase. These fish have the potential to seriously alter trophic conditions and food chain dynamics as they have in the Great Lakes and Finger Lakes. A fish kill of millions of alewives in the winter of 2008 resulted in fouled beaches and shorelines along the entire length of Lake Champlain.

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

Additional aquatic invasive species information for the 2014reporting period can be found at:
Vermont Aquatic Invasive Species Program 2012 Update, November 2012
Vermont Aquatic Invasive Species Program 2013 Update, November 2013

Lack of strategic statewide vegetated buffer requirements

In 1970, Vermont was one of the first states in the nation to pass a shoreland protection act. In 1975, the law was passively repealed. Maine copied Vermont's law and has refined and strengthened their Mandatory Shoreland Zoning Act ever since. Maine's law applies to all lakes, rivers, streams, and coastline. Meanwhile, Vermont's primary tool to protect riparian vegetation has been the use of outreach and education to municipalities, lakeshore residents and lake associations. As a result of the devastating impacts from Tropical Storm Irene, the 2011-2012 Vermont legislature passed Act 138 asking the Agency of Natural Resources to identify ways to better protect Vermont's waters. In January of 2013, ANR produced a comprehensive report that outlined statewide strategies for better protecting vegetative buffers, a waterway's first line of defense against erosion and flooding. In response to recommendations in the Act 138 report, the 2013 Vermont House of Representatives passed a shoreland protection act for lakes. A shoreland commission, made up of members of the Vermont House, Vermont Senate and ANR was then formed to take public input at a series of public meetings held over the course of the 2013 summer. During the current 2013-2014 legislative session, the Vermont Senate passed a revised version of the House's shoreland protection act. The bill went through a legislative conference committee and the Governor signed the legislation that includes minimum standards for vegetated buffers around lakeshores in Vermont.

Lakeshore development and alteration of littoral habitat

In March, 2013, the WSMD released two reports on the effects that lakeshore development in Vermont was having on lake health and littoral habitat and biota. *Gauging the Health of Vermont Lakes* summarized the findings of the 2007 National Lake Assessment (NLA), and *Determining if Maine's Mandatory Shoreland Zoning Act Standards are Effective at Protecting Aquatic Habitat* summarized the findings of a joint study between VTDEC and Maine Department of Environmental Protection.

Vermont participated in the 2007 National Lake Assessment at the 'overdraw' level. Therefore, Vermont was able to analyze the results from Vermont's lakes in the same manner that EPA had analyzed the results from the regions and nation, thereby affording Vermont the first opportunity to directly compare the condition of Vermont's lakes to the condition of the lakes in the nation and different ecoregions across the country. In addition, it allowed Vermont to compare all the stressors measured in the study and determine which ones are the most widespread stressors to Vermont's lakes. The National Lakes Assessment found that the most widespread stressor to Vermont's lakes is lakeshore disturbance caused by excessive clearing and impervious areas close to the water's edge. It found that 82% of Vermont's lakes greater than 25 acres in size are in fair or poor condition for lakeshore disturbance. That is more than both the NAP ecoregion and the nation. These findings were presented in the 2013 *Gauging the Health of Vermont Lakes* report.

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

Pharmaceuticals, personal care products, and other contaminants in waters

In 2008, EPA's Office of Water launched the National Rivers and Streams Assessment (NRSA), which included a national study of contaminants in the fillet tissue of fish collected from randomly selected sampling locations in the Nation's rivers. Field teams began collecting water and composite fish samples at sites that included several urban sites in Vermont in 2008 and 2009. EPA has analyzed the water and fish fillet samples for an expanded list of PPCP chemicals and has also analyzed the fish fillets for persistent contaminants, including mercury, selenium, PCBs, pesticides, and flame retardants (PBDEs). Originally EPA anticipated having fish tissue results available in 2013 but now it expects to report results during 2014.

River Corridors and Water Quality

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

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

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

Stormwater TMDLs Implementation

On December 5, 2012, DEC issued a General Permit (3-9014) for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s). The 2012 permit includes new requirements for MS4 entities including the development of a Flow Restoration Plan (FRP) for each stormwater impaired watershed to which they discharge by no later than October 1, 2016. The FRPs must include an identification of the suite of necessary stormwater best management practices (BMPs) that will be used to achieve the flow restoration targets. The Department has also issued NPDES General Permit 3-9030 under its residual designation authority (RDA) to discharges in five of the 12 urban stormwater-impaired waters with BMP implementation requirements. The Department plans to issue permits to discharges in the remaining lowland impaired waters in 2014.

Water quality standards criteria

The Department has worked consistently to develop numeric nutrient criteria that are empirically shown to support the designated uses established by Vermont Water Quality Standards. During the reporting period, the Department has completed a third comprehensive technical analysis to produce proposed nutrient criteria. This new criteria proposal, peer-reviewed by EPA-OST scientists and policy staff, presents a framework that is protective, predictable, and transparent. The framework acknowledges the significant likelihood of error associated with reliance solely on numeric criteria for phosphorus, and thus places reliance on the need for bioconfirmation to determine attainment. The entire proposal including the Technical Support Document is available online. As of this writing, DEC has completed pre-rulemaking stakeholder review, and is entering the formal rulemaking process to see the criteria adopted.

In addition to the nutrient criteria, Vermont has completed pre-rulemaking stakeholder outreach for amendments to the Standards for *E. coli* bacteria, and numerous human health and aquatic life support criteria. These long-overdue updates bring Vermont's Water Quality Standards into compliance with current EPA criteria guidance documents.

Part C. Surface Water Monitoring and Assessment

C1. Surface Water Quality Monitoring Program

During 2010 and into 2011, DEC conducted a comprehensive review and redesign of its 2005 Water Quality Monitoring Program Strategy (WQMS). A summary of that re-design can be found here. In addition, other surface water monitoring program accomplishments were thoroughly described in the 2012 305(b) Integrated Report starting on page 49. In brief, during this reporting period, the Department implemented the following:

River Biomonitoring Program:

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) Incorporated upstream-downstream WWTF sampling on identified facilities in the current year basin rotation

III) Completed Year 1 of the National Rivers and Stream Assessment.

Lake Monitoring Program:

I) Continued development of a phosphorus TMDL for Lake Memphremagog by coordinating an international sampling initiative on that lake.

II) Completed a comprehensive assessment report for the 2007 National Lakes Assessment.

III) Implemented the 2012 National Lakes Assessment, including a 50-site statewide assessment based on an overdraw of the Survey.

Wetlands Monitoring Program:

I) Followed the progress of the National Wetlands Condition Assessment

II) Developed criteria for using monitoring data to identify wetlands for Class 1 reclassification (upgrade).

Assessment:

I) Worked with EPA to combine the lakes and rivers ADB into a combined assessment database for all Vermont surface waters reported in the Integrated Report. DEC is now submitting 303(d) lists and other assessment findings to EPA for incorporation into ATTAINS using the newly combined ADB.

Probability Survey Coordinator:
The DEC established a new position of Probability Survey coordinator, which will provide primary coordination for all NARS surveys, beginning with the NRSA.

Data Management:
Used the resources of our data management staff to build online data access tools and internal reporting mechanisms that greatly increase efficiency of data extraction and analysis. As a highlight, the Vermont WQData water quality archive surpassed one-million individual datapoints as the 2013 monitoring data were stored into the system.

Staff Development:
Supported staff participation at annual regional environmental biologists conferences or other national meetings. Several staff participated in the regional NEAEB meetings, staff participated in all NARS trainings.

Establishment of a Monitoring Council:
Working in collaboration with USGS and with participation from EPA region 1, the DEC has established a Vermont Water Monitoring Council.

C2. Surface Water Assessment Methodology

The methods used to derive Vermont's statewide assessment of water quality conditions are found in the *Vermont Surface Water Assessment and Listing Methodology March 2014*. This 2014 305(b) Water Quality Integrated Assessment Report describes whether or not the state's surface water uses as defined by EPA and the State Water Quality Standards fall into one of four use support categories. The four use support categories used by the Vermont Department of Environmental Conservation are *full support, stressed, altered,* or *impaired.* Definitions of these categories are:

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.

Stressed **-** These are waters that support the uses for the classification but the water quality and/or aquatic biota/ habitat have been disturbed to some degree by point or nonpoint sources of pollution of human origin and the water may require some attention to maintain or restore its high quality; the water quality and/or aquatic habitat may be at risk of not supporting uses in the future; or the structure or integrity of the aquatic community has been changed but not to the degree that the standards are not met or uses not supported. Data or other information that is available confirms water quality or habitat disturbance but not to the degree that any designated or existing uses have become altered or impaired (i.e. not supported).

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. The aquatic communities are altered from the expected ecological state. This category includes those waters where there is a documentation of water quality standards violations for flow and aquatic habitat but EPA does not consider the problem(s) caused by a pollutant or where a pollutant results in water quality standards not being met due to historic or previous human-caused channel alterations that are presently no longer occurring.

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.

Water uses include, but are not limited to, aquatic biota/habitat, contact recreation (swimming, wading) and secondary contact recreation (fishing or boating), aesthetics, fish consumption, and agricultural water supply. A 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 qualified individuals or groups who have qualified data and information.

As in prior years, 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." The Vermont Part D list is a list of waters that have approved TMDLs, which is analogous to EPA "Category 4A." In Vermont, so-called 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." This report also provides a tabular assessment of waters by EPA reporting category.

During the 2014 305(b) reporting period, ANR used EPA's Assessment Database (ADB) application for both lake and stream water quality assessment information. For the lakes database, ANR staff updated lakes altered by invasive exotic species. For the river and stream ADB, staff updated the impaired and altered stretches of water.

C3. Assessment Results for Surface Waters

C3.1 Assessment Results for Rivers and Streams

Designated Use Support Status

Vermont has approximately 7,100 miles of perennial rivers and streams based 1:100,000-scale maps, of which 6620 miles are tracked within Vermont's assessment databases. Of the 6620 miles, approximately 87% are assessed and 13% are not assessed. Of the approximately 5,763 river and stream miles assessed for this report, overall about 90% of those miles are in compliance with the state's water quality standards and support designated uses, and 10% do not meet water quality standards or do not fully support the designated uses. Of the 90% meeting standards, approximately 16% are considered stressed by some pollutant or activity. These percentage results are similar to those in the 2012 305(b) Report.

Table 9 is a summary of the number of miles of rivers and streams throughout Vermont that support (full support or stressed) or do not support (altered or impaired) designated uses of the waters. For example, river miles that support aquatic biota have macroinvertebrate and fish communities in good to excellent health in the sampled reaches based on a number of metrics for each community. River uses can be impaired by pollutants or altered by flow reductions or fluctuations and they can be stressed by a pollutant, condition, or direct instream activity.

The number of miles in each support category are provided for the five uses or values shown below and for a use called "overall", which reflects the miles for which one or more of the uses are fully supported, stressed, altered, or impaired. The fish consumption use is not factored into the "overall" category because all miles of river and stream are at least stressed for fish consumption due to a statewide fish consumption advisory. If taken into account in "overall", this status would mask the extent of other stresses.

Table 9. Summary of Use Support for Vermont Rivers & Streams (in miles)

Designated Use	Full support	Stressed	Altered	Impaired	Total Assessed	Total Measured
Overall	4357.2	813.5	281.8	310.7	5763.2	6619.7
Aquatic biota/habitat	4446.5	859.8	283.2	173.7	5763.2	6619.7
Contact recreation	4978.5	396.8	19.1	139.4	5533.8	6619.7
Secondary contact recreation	4877.0	589.7	90.3	37.1	5594.1	6619.7
Aesthetics	4862.7	611.6	165.1	97.2	5736.6	6619.7
Fish consumption	0	6558.3	0	61.4	6619.7	6619.7

Table 10 provides overall use attainment for Vermont rivers and streams using nationally-consistent EPA categories.

Table 10. Size of Rivers or Streams in EPA Assessment Categories (as per ADB).

Category	Description	Total size (miles)	Number of stream segments
1	All uses met	0	0
2	Some uses met, others indeterminate	6046.1	210
3	Insufficient information to assess any use	0	0
4A	Impaired, TMDL approved	128.9	33
4B	Impaired, no TMDL needed	7.5	8
4C	Impaired, but not by pollutant	203.4	44
5	Impaired	189.9	72

Note: Segment is defined as a unique portion of a stream. More than one segment may be present for an individually named stream. Figures are provisional, pending outcome of 2014 303d list approval by EPA and final updating and proofing of the EPA database.

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

A cause is a pollutant or condition that results in a water quality or aquatic habitat impairment, alteration or stress; a source is the origin of the cause and can be a facility, a land use, or an activity. Tables 11 and 12 below summarize the miles of rivers and streams affected by various causes and sources, respectively.

Because a stretch of river or stream may be affected by more than one cause or source, the same mileage may be tallied in several places in the tables. For this reason, the two columns on each table are not additive because the total would overestimate the total number of miles affected by all causes and sources in Vermont. The purpose of these summaries is to give natural resource managers and the public an idea of the relative size of the impact from different pollutants or conditions on Vermont's waters and from which land uses or activities they may originate.

Causes

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

Sources of sediment include runoff from construction sites, roads, and cropland; channel erosion from stormwater runoff; and streambank erosion. Streambank erosion has been associated with the loss of riparian woody vegetation, which does occur a lot, but it is also more complex than that with channels downgrading and widening. A research project with the US Department of Agriculture (USDA) Agriculture Research Service (ARS) National Sedimentation Laboratory, in conjunction with a Lake Champlain Basin Program modeling effort showed that streambank erosion from channel instability contributed approximately 29-42% of the total suspended sediment load, and approximately 50% of total phosphorus at the mouth of the Missisquoi River.

The watersheds with the most documented miles of sediment impacts are the Winooski River, the Lamoille River, and the Otter Creek watersheds.

Table 11. Summary of Causes of Impact to Vermont Rivers & Streams (in miles).

Cause of impairment, alteration or stress	Length impaired or altered by cause	Length stressed due to the cause	Total length on which causes have an impact
Sediments	136.6	809.5	946.1
Physical habitat alterations[1]	135.9	504.2	640.1
Nutrients	62.7	490.5	553.2
Temperature	62.0	467.5	529.5
Pathogens	135.5	248.6	384.1
Flow alterations	203.6	72.5	276.1
Turbidity	45.8	230.0	275.8
Metals	68.4	84.3	152.7
pH	45.8	30.3	76.1
Organic enrichment	26.5	48.0	74.5
Total toxics [2]	0	73.5	73.5
Stormwater	35.9	4.9	40.8

1 These numbers do not necessarily include all the miles of river and stream channelized and dredged post Tropical Storm Irene. The Vermont F&W Department has estimated 77 miles of major impact but also note that they were unable to survey all the streams at the time of their summary and report.

2 Toxic pollution lumped – organic compounds and metals. This information is old at this time and needs re-visiting.

The "cause" that has the second greatest number of miles of impact, impaired and stressed, is one called "physical habitat alterations" ("other habitat alterations" in earlier 305(b) reports). This cause is different from the others that are more obviously pollutants such as pathogens or metals or sediments. However, dredging, instream gravel mining, channelization, berming (captured in the "Sources" section below), all lead to physical alterations in-channel, which is the direct habitat of the aquatic communities that the standards and Vermont DEC among others strive to protect. The

Winooski and Lamoille watersheds have the highest number of miles documented with habitat alterations.

Nutrients are known to impair about 63 miles and stress about 490 miles. Given the agricultural heritage of Vermont and the fact that villages and towns lie along rivers and streams in Vermont valleys, it has always been a challenge keeping nutrients on the land in the soil and out of surface waters and wetlands. The Otter Creek and Missisquoi River watersheds have the most miles of nutrient impacts.

Temperature increases in surface waters are also a challenge to control due to the removal of riparian vegetation and warm impervious surface runoff affecting coldwater streams. Streams with onstream impoundments and high turbidity also suffer from increased temperatures. The watersheds with the most miles of temperature impacts are Basin 11 watersheds (West, Williams, Saxtons rivers), the Missisquoi River, and the White River.

Pathogens get to Vermont rivers and streams in CSOs, from barnyard and pasture runoff, from city and suburban runoff, and from failed waste treatment systems large and small. Elevated *E. coli* also can result from concentrations of wildlife and separating natural from anthropogenic loads is difficult at times.

At the same time that progress is made in dam removal and improving flow through licensed projects, increased development with its impervious surfaces and stormwater runoff especially in areas of steeper slopes causes increased flows that affect aquatic habitat and communities. In addition, an impact not well quantified is the alteration of natural hydrologic patterns when private roads and driveways, ski slopes, and some stormwater infrastructure shifts flows from one stream and its watershed to a different one.

Miles labelled as being at least stressed from metals are slowly increasing as more areas are identified where either old landfills exist or careless development disturbs certain soils or adds fill resulting in iron pollution. However, the success of remediation work at the former Elizabeth Mine did lead this cycle to a substantial reduction in miles impaired from metals.

The other substantial causes identified include turbidity, pH, organic compounds (lumped as total toxics), organic enrichment and stormwater. Stormwater impacts are underestimated because components of stormwater (sediment, flow, turbidity among others) might currently be the proxies for stormwater itself.

Sources

The sources of pollution identified as having the greatest impacts, or causing the greatest stresses, on miles of river and stream are streambank erosion/de-stabilization; removal of riparian vegetation; agricultural land uses and activities; developed land runoff, which includes road runoff; flow alteration from hydroelectric facilities, snowmaking water withdrawals and other sources; channel instability and developed land runoff. Additional significant sources of impacts include atmospheric deposition, flood impacts resulting from poorly sited or designed human structures or activities, land development (active development as opposed to runoff from existing roads and development), and upstream impoundments. See Table 12 below.

Table 12. Summary of Sources of Impact to Vermont Rivers & Streams (in miles).

Source of impairment, alteration or stress	Length impaired or altered due to source	Length stressed due to source	Total length on which sources have an impact
Streambank erosion/ de-stabilization	111.6	669.0	780.6
Riparian vegetation removal	79.8	564.5	644.3
Agriculture	123.3	486.8	610.1
Developed land runoff [1]	85.8	326.1	411.9
Channel instability	53.3	223.2	276.5
Flow modification (hydro, snowmaking withdrawals..)	204.6	66.1	270.7
Channelization	27.0	133.3	160.3
Atmospheric deposition	87.5	71.7	159.2
Flooding (including infrastructure failures)	31.5	112.3	143.8
Impoundment	34.6	71.9	106.5
Land development	33.8	60.8	94.6
Hazardous waste sites	8.9	58.7	67.6
Resource extraction	20.8	37.5	58.3
Municipal point sources	29.3	23.5	52.8

1. Developed land runoff includes road/bridge runoff.

Streambank erosion is described above as a source in and of itself, but this ‘source’ results from other ‘sources’ such as riparian vegetation removal and channel instability processes. In addition, the interrelationship and overlap between several of these sources such as agricultural activities, riparian vegetation loss, streambank erosion, channel instability, channelization makes the attribution of miles stressed, altered, or impaired to each of these sources an imprecise task. The relative contribution of each source should be the focus of the numbers in the table.

Vermont will continue to use stream geomorphic data and other sources to identify stream erosion/sedimentation as a source of alteration or stress emanating from:

1. Channel instability – associated with disequilibrium from watershed hydrology changes, floodplain encroachment, stream loss of access to its floodplain among others;
2. Bank and adjacent land erosion – not associated with disequilibrium, i.e., bank erosion due to sources such as loss of woody vegetation, animal trampling, construction development too close to banks, among others.

Removal of riparian vegetation continues to be a ubiquitous problem in the state. Residential and commercial landowners, developers, ski areas, utility companies, farmers, town road crews and the Agency of Transportation all encroach on the riparian zone with their activities and the result is the loss of the trees and shrubs protecting rivers and riverbanks. Flooding and channel instability also result in loss of riparian vegetation, but the loss of riparian vegetation also increases a stream’s vulnerability to channel changes even in an otherwise stable system.

Agricultural land uses can affect water quality in several different ways including nutrient runoff from barnyards, pasture land, manure storage or spreading, or farm owners can leave too small of a vegetated buffer to protect adjacent streams or wetlands from direct or indirect impacts.

Developed land as a source includes runoff from any urban, suburban, village or other developed areas such as roads, bridges, parking lots, and driveways. Developed land changes the amount and timing of runoff reaching rivers and streams and the runoff contains many pollutants including sediment, metals, nutrients, pathogens, and organic compounds. The impact from ongoing residential sprawl as well as commercial development seems to outpace progress in erosion and runoff control, streamside vegetation re-establishment, and stream stabilization efforts.

Channel instability can be a result of stormwater runoff, flood impacts, flood "repair" work, instream gravel mining, and watershed hydrology changes. Channel instability is a source of both sedimentation and habitat alteration. As discussed above, this source of habitat impact and loss will continue to identified as new physical assessments are done.

Flow modifications come largely from hydro-electric facilities but can also be the result of snowmaking water withdrawals and to a lesser extent, water supply water withdrawals.

Channelization is the dredging and straightening of channels and occurs often adjacent to roads and railroads or other development too close to the rivers and streams. It can be the result of post-flood work and has the same consequences of channel instability resulting in instream habitat impacts.

Atmospheric deposition is primarily responsible for mercury and acidified conditions in Vermont's surface waters. While these conditions are exacerbated in lake systems, stream biological communities do exhibit quantifiable impacts, particularly due to acidification.

The flood impacts are those from poorly sited or designed human structures (road, bridges, culverts), which blow out during a flood resulting in more damage than would be otherwise.

Stream & River Biomonitoring

The DEC Monitoring Assessment and Planning Program Biomonitoring Section has performed both targeted monitoring and a probabilistic site selection design (reported in section C6 starting on page 45 in this report) in its assessments as reported here for 2011 and 2012. As of this writing, the 2013 assessments have not been completed. While the site selection targets sites based on the rotational monitoring schedule (Figure 2), a targeted site is also selected based on the need for biological data requested by an ANR/DEC program or a monitoring requirement incorporated into various permits. These include Act 250, 401 WQ certificate, 1272 order, NPDES, and Indirect Discharge permits.

A total of 327 biological assessments were reported out in the 2011-12 period. A summary of the purpose of all assessments done from 2011 and 2012 fall into 17 general categories listed in table 13 below. In 2011-2012, the greatest number of stream reaches were monitored for the effects of storm water on Vermont's streams in urban, ski area, and wind farm development areas. A significant number of reaches were also selected in support of the probability based assessment project and the push to identify very high quality waters for watershed basin planning and potential reclassification recommendations.

Table 13. Summary of the purpose for a stream biological assessment in the period 2011-12.

# sites	Category of assessment purpose/reason[1]
14	Agricultural
1	Dam operation
1	Dam removal
1	Aquatic nuisance
7	Forest Service partnership agreement
1	Rotational reassessment
10	Hazardous waste management program
29	Probability – statewide 5 yr prg
5	In-stream channel disturbance
67	Ski area development (storm water)
27	Sentinel (reference or climate change)
30	Low gradient stream biocriteria development
3	Solid waste management program (landfills)
51	Urban development (storm water)
21	Very high quality water id (watershed planning)
38	Wind farm development (storm water)
21	Waste water treatment facility

1. These assessments are either performed by the DEC or approved by DEC under a permit condition.

The assessment outcomes for the period 2011 and 2012 are summarized by community type in Table 14 below. This table includes all assessments evaluated by DEC. Over 40% of the streams reaches assessed using the macroinvertebrate community integrity were of very high quality. An equal percentage (25%) were found to be either of high quality or non-support of Class B aquatic life support, and 8% were found to be in need of further assessment or indeterminate between these two categories. A total of 104 fish community assessments were completed in 2011-12. These assessments showed 34% should be considered as very high quality waters, 23% are high quality waters supporting Class B biocriteria, and 34% are non-supporting of Class B biocriteria. An additional 15 sites were sampled but were unable to be assessed using the current IBIs because they were low gradient streams or only supported a brook trout population.

Table 14. Summary of macroinvertebrate and fish community assessment outcomes for 2011-2012.

Assessment rating	Macroinvertebrate Community n= 284	Fish Community n=104
Excellent-Very good (VHQ)	115 or 41%	35 or 34%
Good (Class B)	69 or 24%	24 or 23%
Fair-good - M Indeterminate	22 or 8%	-
Fair-Poor (Non- Support)	48 or 27%	41 or 39%

Toxic Impacts to Rivers and Streams

Sites of Known Sediment Contamination

During the reporting period of 2012- 2013, sediment characterizations were conducted at several locations. Assessments were conducted at former landfills and behind low-head impoundments that are being considered for remediation or removal in order to restore stream connectivity. These are described below. Sediment characterization at these sites includes priority metals and organic compounds. Results are compared to Vermont ANR Sediment Quality Guidelines (SQGs) for protecting aquatic biota.

There are also documented contaminated sediments in Stevens Branch in Barre, Stevens Brook in St. Albans, and in a tributary to Muddy Brook in South Burlington.

Kocher Drive Dump Bennington

Kocher Drive Dump sediment data was reviewed from a 2012 Weston Solutions Removal Program report. Analysis included heavy metals, PCBs, and VOCs for 38 sites. There were two exceedances of the Probable Effect Concentrations (PECs) for lead and cadmium, but due to the magnitude of exceedance, the sediment depth and the low percentage of sites with exceedances, these were considered low risk to aquatic biota. Similarly there were two exceedances of PECs for VOCs Benzo(a)anthracene and Dibenzo (a,h) anthracene. PCB-Aroclor 1248 exceeded the Threshold Effect Concentration (TEC) values for Total PCBs at 11 sites, with no exceedance of the PEC values. Sediment collections on the whole exceeded depths that would be considered a risk for aquatic biota. The plasticizer Bis (2-ethylhexyl) phthalate exceeded the Florida PEL at five sites with a maximum concentration of 760,000 ug/L.

Farwell Street Dump

Farwell Street Dump sediment data was reviewed from a 2012 Stone Environmental report. Sediment samples were analyzed for PAHs and a list of target metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, and Mn). Concentrations of several PAH compounds exceeded the TEC, including anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene and pyrene. Several metals were detected above laboratory reporting limits in sediment samples. However, only arsenic, chromium and nickel were detected above the TEC. Nickel was detected above the PEC at two locations. Because these exceedances occurred at locations upstream of the dump, it is unlikely the former dump is the source of these metals.

Henry Dam – Walloomsac River, Bennington

Sediment chemistry data was reviewed for this dam removal project. Lead and zinc were just below TEC values. This dam was removed in 2013.

Pownal Tannery Dam – Hoosic River, Pownal

Existing sediment data at the Pownal Tannery Dam site was reviewed in preparation for potential redevelopment and Phase II Environmental Assessment. VOCs, PCBs, Dioxin and metals have been documented in the sediment. TECs have been exceeded for several contaminants.

Lampricide Impacts
During the reporting period, 10.5 miles of the Winooski River, 7.8 miles of the Missisquoi River, 3.6 miles of Stonebridge Brook, and 6.0 miles of the Lamoille River were treated with lampricide to kill sea lamprey, which affect the recreational fishery of Lake Champlain.

Stonebridge Brook
There were 3.6 miles of Stonebridge Brook treated with lampricide in fall 2013. An initial survey of post-treatment mortality was done on October 24 and 25, 2013. At that time, six transects were surveyed and the non-lamprey, non-target mortalities seen were: 10 tessellated darters, 3 blacknose dace, 2 white suckers, 2 common shiners, 1 longnose dace, and 1 unknown Cyprinidae.

Missisquoi River
There were 7.8 miles treated with lampricide on the Missisquoi River in 2012. Five stretches in the 7.8 mile treatment length were assessed on two days following the treatment to look for non-target species mortality. Only a small percent of the riverbed was surveyed per section: 10% in M1, 5% in M2, 8% in M3, 5% in M4 and 3% in M5.

The non-target fish species found dead in the immediate post-treatment survey include: 143 silver lamprey, 13 tesselated darters, 6 logperch, 5 brown bullheads, 2 bluegills, 1 unidentified cyprinid, 1 American brook lamprey (threatened), 1 stonecat (endangered). No other species were noted.
Sea lamprey assessments were done prior to and then following the 2012 application of the lampricide. Numbers for pre- and post-treatment lamprey species are summarized in a report by the USFWS Lake Champlain Fish and Wildlife Resources Office that includes maps of the area surveyed. The year before the 2012 Missisquoi treatment, there were 63 sea lamprey, 69 silver lamprey, and 2 American Brook lamprey (threatened) found. Following the treatment in the 2013 season, there were 0 sea lamprey, 1 silver lamprey, and 0 American brook lamprey found.

Winooski River
There were 10.5 miles of the lower Winooski River treated with lampricide in fall 2012, a stretch from the Winooski One Hydroelectric Facility down to Lake Champlain. There were nine stretches on the Winooski and a short section on Sunderland Brook of the 10.5 river miles assessed for non-target mortality following the treatment. The assessment team estimated that between 5 and 15% of the river bed surface was visible due to depth and turbidity.

The non-target fish species found dead in the post-treatment survey included: 3 silver lamprey, 1 banded killifish, 3 logperch, 1 northern pike, 14 spotfin shiners, and 2 unidentified cyprinids. In addition, one mudpuppy was found dead in the sampling areas.

There were pre- and post-treatment surveys of lamprey and before the treatment, 34 sea lamprey, 3 silver lamprey, and no American brook lamprey were collected. Following the treatment, there were actually 106 sea lamprey, 39 silver lamprey, and no American brook lamprey collected – more than before treatment.

Lamoille River
There were 6.0 miles of the Lamoille River treated in fall 2013. There is not yet a report on the non-target impacts at the time of this writing.

C3.2 Assessment Results for Lakes and Ponds

The Lakes and Ponds Management and Protection Section has three major monitoring programs upon which to base this assessment, the Lake Champlain Long Term Monitoring Program, the Lay Monitoring Program and the Lake Assessment Program. The Lake Assessment Program monitors the status and trends in water quality of the inland lakes. To determine trends in nutrient enrichment, it uses data from the almost four decade old spring turnover monitoring effort called spring P (phosphorus). To determine current condition it uses summer lake assessments.

Beginning in 2010, the Lake Assessment Program piloted a more quantitative approach for assessing the condition of Vermont's inland lakes. The approach is a melding of the National Lake Assessment, VTDEC Littoral Habitat Assessment and prior Lake Assessment methodologies. In 2011, staff sampled a suite of reference lakes to be used as long term sentinel lakes for climate change as well as a reference set of lakes upon which to compare the results from the 2012 Vermont NLA statewide assessment lakes. In 2012, the program sampled 52 lakes as part of the NLA in order to compare the condition of Vermont's lakes to the nation and regions, as was done in 2007. However, this time around, it used the Vermont reference set of lakes sampled in 2011 in addition to the reference set of lakes from the region to assess condition.

In 2013, the Lake Assessment Program developed a quantitative approach for identifying the lakes in the state in the highest quality condition, in an effort to make sure our highest quality waters are protected as desired by EPA's Healthy Watershed Initiative. Lakes thought likely to be in this condition, but for which the WSMD lacked the data necessary to rank them, were sampled over the summer of 2013. In 2014, the WSMD will pilot the NLA's stratified random design on the basins in rotation for assessment. Since, the WSMD does not have the staff or resources to monitor the status of all the lakes in target basins each year, the NLA approach presents an opportunity to use a statistically valid approach to make statements about the condition of each basin's lakes. The intent is to be able to compare the condition of the lakes in each basin to the condition of the lakes in the state, ecoregion and nation and set management priorities for each basin accordingly.

The Vermont Lake Assessment Program is also working on an approach to assess the condition of littoral and riparian habitat in a manner to list lakes as stressed or altered for aquatic life uses. With funding from the New England Interstate Water Pollution Control Commission, it is developing a method to characterize the condition of the 2012 NLA sample lakes in the NAP ecoregion using high resolution (1m) aerial imagery and physical habitat assessment data collected by the NLA field teams.

Designated Use Support Status

Since the Lake Assessment Program is in transition from an older way of monitoring and assessing lakes, designated use support determinations from the new approach are not yet ready for dissemination in this year's version of the 305(b) report. Data from the 2012 NLA are still in the quality assurance phase and data from 2013 have yet to be fully analyzed and are not ready to be reported here. Hence, 2014 may represent the last year assessments will be reported using the old approach. The lack of updated information in this assessment cycle reflects a focus on monitoring that is designed to ensure that the data collected are more useful for this report, and for tactical basin planning and implementation efforts in the future.

Table 15. Summary of Use Support for Vermont Lakes & Ponds.

Use Support →		Fully Supporting acres	Stressed acres	Altered acres	Impaired acres	Unassessed acres
Waterbury Type ↓	Use ↓					
Inland Lakes	Aesthetic	31,649	9,112	7,790	6,020	1,002
	Aquatic Biota, Wildlife, and Aquatic Habitat	16,965	15,050	12,046	10,488	1,024
	Boating, Fishing and Other Recreational Uses	29,682	8,765	9,103	6,020	1,018
	Fish Consumption	1,402	46,006	-	8,165	-
	Public Water Supply	1,196	-	-	-	5
	Swimming and Other Primary Contact Recreation	31,333	9,281	6,912	6,020	1029
Lake Champlain	Aesthetic	35,290	-	6,832	132,053	-
	Aquatic Biota, Wildlife, and Aquatic Habitat	152,666	-	21,503	6	-
	Boating, Fishing and Other Recreational Uses	156,974	-	17,195	6	-
	Fish Consumption	-	-	-	174,175	-
	Public Water Supply	148,685	-	15,673	-	-
	Swimming and Other Primary Contact Recreation	35,284	-	6,832	132,059	-

In Table 15 above, use support is presented in relation to designated use and is consistent with the reporting that the Department provided in the 2012 Integrated Report. Changes in use support from the 2012 report result from changes in modifications to altered acres due to Eurasian watermilfoil and other invasive species infestations only. The reader should note that not all uses are assessed at all waters (e.g., swimming and boating uses are sometimes, but not always precluded at drinking water supply reservoirs). Therefore the total sum of acres by use will not necessarily tally to 55,561 acres for inland lakes or 174,175 acres for Lake Champlain.

Size of Lakes & Ponds in EPA Assessment Categories

Table 16 below provides an ADB-based view of overall use attainment for Vermont lakes and ponds. By this view, the majority of lake acres are identified as impaired, falling in EPA Category 5, although this is the result of a relatively small number of large lake segments, where the size of Lake Champlain serves to overstate the severity of impaired waters in Vermont. It is important to note that where an impairment exists that is not yet subject to a TMDL, the acres associated with that impairment will be identified as Category 5, even if a TMDL has been completed for another pollutant on the same waters. For example, the existing impairments associated with PCBs cause all Lake Champlain acres to be assessed as impaired, even though TMDLs for other pollutants have been approved for those same lake segments. According to ADB, there are 54 lake segments that are altered which comprise 7,663 acres. There are 563 lake segments comprising 31,001 acres that support uses. A more detailed display of use support for lakes segregated by use and Champlain/non-Champlain waters is shown in Table 15 above.

Table 16. Size of Lakes & Ponds in EPA Assessment Categories (as per ADB).

Category	Description	Total size (acres)	Number of lake segments
1	All uses met	28,331	438
2	Some uses met, others indeterminate	1,051	113
3	Insufficient information to assess any use	0	0
4A	Impaired, TMDL approved	16,039	52
4B	Impaired, no TMDL needed	0	0
4C	Impaired, but not by pollutant	8,537	64
5	Impaired	175,790	36

Note: Segment is defined as a unique portion of a lake or stream. More than one segment may be present for an individually named lake. Figures are provisional, pending outcome of 2014 303d list approval by EPA.

Summary of Causes & Sources of Impact (Impairment, Alteration, and Stress) - Lakes

Causes of impact to Lake Champlain and Vermont's inland lakes are shown in Table 17, and the related sources of impact are provided in Table 18. For Lake Champlain, the most widespread causes of impairment are mercury and PCB contamination in fish tissue, with atmospheric deposition of toxics and improper waste disposal being the respective sources. The third most widespread cause of impairment for Lake Champlain is phosphorus pollution. The sources of phosphorus vary by lake segment but arise from various categories of nonpoint source pollution, along with minor contributions from municipal wastewater effluents. Toluene and xylenes are the cause of impairment from contaminated sediments at the 6-acre Pine Street Barge Canal site in Burlington Bay. Eurasian watermilfoil, water chestnut, and zebra mussel infestations are the causes of alterations to Lake Champlain, which result from transport of plant fragments and larval zebra mussels through recreational boating and fishing activities.

For the inland lakes of Vermont, mercury in fish tissue impairs the largest number of lake acres, resulting largely from atmospheric deposition. In the case of two reservoirs in the Connecticut River, mercury levels are also attributed to water-level fluctuations. In the case of reservoirs within the Deerfield River drainage, mercury levels are also attributed to natural watershed susceptibility.

The cause of the second largest number of impaired acres for inland lakes is phosphorus pollution. For all nutrient-impaired lakes, the sources of phosphorus are largely nonpoint sources of a variety of types, including agriculture, road maintenance, and sediment losses related to development. Acidity due to atmospheric deposition of acid-forming precursors and natural susceptibility also impairs a significant number of lake acres in Vermont. The principal causes of alterations to inland lakes arise from water-level management and Eurasian watermilfoil infestations that originate from the transport of plant fragments through recreational boating and fishing activities.

The observed effects that stress uses on Lake Champlain include Eurasian watermilfoil and other exotic species, sedimentation, native plants, and *E. coli* bacteria. The observed effects that stress uses on inland lakes are more diverse but principally include algae, Eurasian watermilfoil and other exotic species, acidity, flow alteration, phosphorus, and sedimentation.

Table 17. Summary of Causes of Impact to Vermont Lakes & Ponds (in acres).

Use →								
Waterbody Type ↓	Assessment of Waterbody ↓	Cause of Impact →	Aesthetic	Aquatic Biota, Wildlife, and Aquatic Habitat	Boating, Fishing, and Other Recreational Uses	Fish Consumption	Public Water Supply	Swimming and Other Primary Contact Recreation
Inland Lakes	Impaired	Mercury in Fish Tissue				8165		
		Organic Enrichment - DO		700				
		pH		4468				
		Phosphorus	7874	7874	7874			7874
		Sedimentation/Siltation	100	100	100			100
	Altered	Brittle naiad, Najas minor	839	839				839
		Curly Leaf Pondweed, Potamogeton crispus	452	452	452			452
		Eurasian Water Milfoil, Myriophyllum spicatum	4984	4984	4984			4984
		Variable-leaved watermilfoil, Myriophyllum heterophyllum	17	17	17			17
		Water chestnut, Trapa natans	45	45	45			45
		Flow alteration	1490	6485	2803			612
	Fully Supporting but stressed	Alewife, Alosa pseudoharengus	904	2306				
		Common reed, Phragmites australis subsp. Australis		10				
		Curly Leaf Pondweed, Potamogeton crispus	11	11	11			11
		Escherichia coli						25
		Eurasian Water Milfoil, Myriophyllum spicatum	6481	5938	6297			6317
		European frogbit, Hydrocharis morsus-ranae	14	14	14			14
		Excess Algal Growth	27	27	27			
		Flow alteration	193	4385	193			3
		Mercury in Fish Tissue				45853		
		Noxious Aquatic Plants - Algae	9303	9295	9647			9683
		Noxious Aquatic Plants - Native	886	889	1346			1346
		Nutrient/Eutrophication Biological Indicators		7				
		Nutrients	3716	3874	3515			3612
		Oil and Grease	79					
		Organic Enrichment - DO		1419				
		pH		5965				
		Phosphorus	3716	3874	3515			3612
		Salinity		9				
		Sedimentation/Siltation	3353	3612	3166			3203
		Water chestnut, Trapa natans	490	453	453			453
		Zebra mussel, Dreissena polymorph		829				829

Table 17 (cont.). Summary of Causes of Impact to Vermont Lakes & Ponds (in acres).

Use →			Aesthetic	Aquatic Biota, Wildlife, and Aquatic Habitat	Boating, Fishing, and Other Recreational Uses	Fish Consumption	Public Water Supply	Swimming and Other Primary Contact Recreation
Waterbody Type ↓	Assessment of Waterbody ↓	Cause of Impact →						
Lake Champlain	Impaired	Mercury in Fish Tissue				174175		
		PCB in Fish Tissue				166171		
		Phosphorus	132053					132053
		Toluene		6	6			6
		Xylenes (total) (mixed)		6	6			6
	Altered	Eurasian Water Milfoil, Myriophyllum spicatum	6832	17195	17195			6832
		Exotic Species		1101	1101			
		Zebra mussel, Dreissena polymorph		21503			15673	6832
	Fully Supporting but stressed	Escherichia coli						49
		Eurasian Water Milfoil, Myriophyllum spicatum	10363					10363
		Exotic Species	2701	1600	1600			2701
		Noxious Aquatic Plants - Native			500			500
		Sedimentation/Siltation	5388	5388				5388
		Zebra mussel, Dreissena polymorph	5281					6162

Table 18. Summary of Sources of Impact to Vermont Lakes & Ponds (in acres).

Use →			Aesthetic	Aquatic Biota, Wildlife, and Aquatic Habitat	Boating, Fishing, and Other Recreational Uses	Fish Consumption	Swimming and Other Primary Contact Recreation
Waterbody Type ↓	Assessment of Waterbody ↓	Source of Impact →					
Inland Lakes	Impaired	Agriculture	1456	2156	1456		1456
		Animal Feeding Operations (NPS)	1456	2156	1456		1456
		Atmospheric Deposition - Acidity		4468			
		Atmospheric Deposition - Toxics				8165	
		Flow Alterations from Water Diversions				2012	
		Internal Nutrient Recycling	54	506	54		54
		Managed Pasture Grazing	1854	2554	1854		1854
		Natural Sources		4468		3692	
		Non-irrigated Crop Production	1908	2608	1908		1908
		Non-Point Source	7422	7422	7422		7422
		Post-development Erosion and Sedimentation	452	452	452		452
		Streambank Modifications/destabilization	100	100	100		100
	Altered	Flow Alterations from Water Diversions	1280	5985	2803		612
		Impacts from Hydrostructure Flow Regulation/modification	300	2198	235		215
		Other Marina/Boating On-vessel Discharges	6337	6337	5498		6337
Champlain	Impaired	Agriculture	31859				30259
		Atmospheric Deposition - Toxics				174175	
		Combined Sewer Overflows	13725				13725
		Contaminated Sediments		12	12		12
		Highway/Road/Bridge Runoff (Non-construction Related)	13725				13725
		Inappropriate Waste Disposal				166171	
		Industrial Point Source Discharge	4423				4423
		Natural Sources	5388			58184	5388
		Non-Point Source	132053				130453
		Post-development Erosion and Sedimentation	13725				13725
	Altered	Other Marina/Boating On-vessel Discharges	6832	39799	18296	15673	13664
All Waters	Stressed	Sources are not attributed to stressed waters.					

C3.3 Impaired Waters of Vermont – Lakes and Rivers

Total Maximum Daily Load Program & Summary of Impaired Waters

Under Section 303(d) of the Clean Water Act, all states are required to develop lists of impaired surface waters. These impaired waters are lakes, ponds, rivers and streams that do not meet the water quality standards developed by each individual state. In Vermont, these waters are described on the state's Part A 303(d) List of Impaired Waters in Need of a TMDL; Part B List of Impaired Surface Waters - No TMDL Determination Required; and Part D Surface Waters with Completed and Approved TMDLs. These lists can be found on the Assessment page of the Watershed Management Division's website. The Clean Water Act requires that a Total Maximum Daily Load (TMDL) be developed for impaired waters on Part A of the list and the list provides a schedule as to when TMDLs will be completed.

A TMDL is the calculation of the maximum amount of a pollutant that a waterbody can receive and still meet the water quality standards. A TMDL serves as a plan that identifies the pollutant reductions a waterbody needs to meet Vermont's Water Quality Standards and are typically accompanied by an implementation plan that articulates the means to achieve those reductions. TMDL determinations are unique to each individual waterbody but the general process by which they are developed can be summarized in the following manner:

Problem Identification - the pollutant for which the TMDL is developed must first be identified. Examples might include sediment that impacts habitat for aquatic organisms, nutrients that cause excessive algal growth, or bacteria that creates an unsafe environment for swimming.

Identification of Target Values - this establishes water quality goals for the TMDL. These may be given directly in the Water Quality Standards or may need to be interpreted.

Source Assessment - all significant sources of the pollutant in question must be identified in the watershed. This often requires additional water quality monitoring.

Linkage Between Targets and Sources - this process establishes how much pollutant loading can occur while still meeting the water quality standards. This step can vary in complexity from simple calculations to development of complex watershed models.

Allocations - once the maximum pollutant loading is established, the needed reductions must be divided among the various sources. This is done for both point sources and nonpoint sources.

Public Participation - stakeholder involvement is critical for the successful outcome of TMDLs. Draft TMDLs are also released for public comment prior to their completion.

EPA Approval - EPA approval is needed for all TMDLs as required by the Clean Water Act.

Follow-up Monitoring - additional monitoring may be needed to ensure the TMDL is effective in restoring the waters.

Some of the most recent EPA approved TMDLs include two acid pond TMDLs and TMDLs for twenty-two stream and river segments that were included as part of the Vermont Statewide Bacteria TMDL.

Current and upcoming TMDL projects

Lake Champlain Phosphorus TMDL revision

In response to a federal lawsuit filed by the Conservation Law Foundation, the EPA reconsidered its previous approval of the 2002 Lake Champlain TMDL and disapproved the Vermont portion of the TMDL in January 2011. Under federal law, upon such disapproval, the EPA is responsible for establishing a new TMDL to implement the water quality standards. The EPA initiated the process of developing a new TMDL for Lake Champlain in 2011 in cooperation with the State of Vermont. Several key steps involved in this process include:

- Review and revision of the in-lake water quality model to update the lake segment loading capacities
- Complete the study of effects that climate change may play on lake loading capacities
- Estimate phosphorus loads from subwatershed areas within tributary watersheds and estimate potentially achievable phosphorus reductions
- Identify programs and requirements to provide sufficient reasonable assurance that nonpoint phosphorus controls are achievable
- Public outreach and education regarding the TMDL development and proposed implementation process.

During 2013, and while awaiting final loading capacities, and load and wasteload allocations, DEC responded to an EPA requirement for the development of a Phase I implementation plan that would achieve compliance with the TMDL. DEC responded by preparing a draft report on TMDL commitments, followed by a draft Phase I Plan outlining extensive regulatory and implementation priorities to attain compliance in the Lake. TMDL completion is expected in 2014. Additional information regarding the development of the revised TMDL can be found on the EPA website.

Lake Memphremagog Phosphorus TMDL

VTDEC has been working to develop a TMDL for Lake Memphremagog, which is listed as impaired for phosphorus, and is a high priority for TMDL development. Initial work has included intensive lake sampling, tributary sampling to estimate watershed loading, and collaboration with partners in Quebec on a watershed phosphorus export model. Current plans are to develop a full lake model (a simple version of what was done for Lake Champlain) in cooperation with partners in Quebec to more accurately represent phosphorus movement in the lake and watershed as a whole. There are technical challenges associated with this that the project team is currently addressing. It is anticipated that the TMDL will be completed in 2016.

Long Island Sound Nitrogen TMDL revision

The original LIS TMDL was finalized in 2001 and developed among NY, CT and EPA and set forth nitrogen reduction goals for point and nonpoint sources in those states. As part of that TMDL, a non-binding reduction of nitrogen from upstream states' treatment plants (VT, NH, MA) of 25% was set as a goal to help meet standards in the Sound.

For the past several years, the LIS TMDL has been under revision, this time with the participation of the upstream states. Several data gathering and monitoring projects have been undertaken to better understand the role of the upper states in their contribution of nitrogen to the LIS. Current projects include:

- Low cost retrofit project – working with NEIWPCC, a contractor has been hired to investigate low cost opportunities at wastewater treatment facilities in VT, NH and MA. It's hoped that several low cost operational changes at certain WWTFs can have a significant reduction in nitrogen released.
- Tracking Tool Development – working with NEIWPCC, a contractor has been hired to investigate the potential of developing a tool to facilitate the tracking of NPS projects implemented in the Connecticut River basin. Ultimately, the goal would be to calculate the number of BMPs installed and estimate nitrogen reductions.

At present, completion of the revised TMDL appears to be a few years off but a framework has been developed that lays out the tasks needed to be completed before the new TMDL can be developed. In the meantime, an interim plan has been developed to address point source permitting and other nonpoint source actions to be completed by all five states (NY, CT, VT, NH, MA).

Agricultural area TMDLs
There are approximately twenty streams impaired for some combination of excess nutrient and sediment loading that occur in predominantly agricultural areas. VTDEC intends to develop a methodology to enable TMDL development for these areas, beginning in 2014. Since many of these streams occur within the Lake Champlain watershed and tools are currently being developed to quantify loading from similar areas as part of the Lake Champlain TMDL, VTDEC envisions using tools developed as part of that process for these TMDLs.

Impaired Ticklenaked Pond Restoration
During the reporting period, the Department executed a grant agreement with the Town of Ryegate to carry out implementation of an in-lake treatment to address internal nutrient recycling. This project was succesfully carried out during spring of 2014.

Overview of the Vermont 2014 Priority Waters List including Section 303(d) List of Waters
Development of the 2014 Section 303(d) List of Impaired Waters is a process that is ongoing and concurrent to the development of the 2014 Section 305(b) Report. Consequently, the final 2014 303(d) List is not included directly in this report. The 2014 303(d) List will be prepared in a format consistent with the EPA-approved 2012 List and will be developed in accordance with DEC's Assessment and Listing Methodology (2014).

The 2012 303(d) List was approved in June 2012 during the 2014 305(b) reporting period and is available separately on the Watershed Management Division's web site. The 2014 draft and ultimately the EPA-approved 303(d) List will also be available on the web site when finalized.

For the 2014 303d Listing cycle, changes have been made to the composition and content of the Priority Waters List:
- The Priority Waters List now includes only waters that do not meet VTWQS. In other words, waters either impaired or altered;
- Part C, previously titled "Waters in Need of Further Assessment" has been decoupled from the Priority Waters List and its content has been changed to simply identify stressed waters. No distinction is made as to whether further assessment is deemed necessary. This distinction is anticipated to be identified in future Tactical Basin Plans;
- Part D, previously titled "Surface Waters with Completed and Approved TMDLs" has been slightly modified to only list impaired waters with completed TMDLs. Over time, several of

these waters have come back into compliance with the VTWQS and are no longer considered impaired. A list of all completed TMDLs will be maintained on the Watershed Management Division's website.

- Part G, previously titled "Surface Waters Altered by Channel Alteration" has been removed from the Priority Waters List. Since the advent of the Part G List in 2004, there has been considerable development of the Rivers Program which maintains stream geomorphic information in separate databases.

A brief summary of the Vermont Priority Waters List is given in Table 19. It should be noted that the Section 303(d) List of Impaired Waters is only a portion of the overall Vermont Priority Waters List (Part A) and much of the Priority Waters List process occurs outside the scope of Section 303(d). However, it is important to be aware of the overall listing process because it is indirectly involved with the 303(d) listing process.

Table 19. Overview of Vermont Priority Waters List.

Vermont PriorityList Section	Description	Included as Part of 303(d) Listing?
Part A	Impaired Waters in Need of a TMDL	Yes
Interim List	Candidate Waters for Section 303(d) De-listing	Yes, until EPA approval. After approval these waters are removed from 303(d). EPA approved 303(d) list does not include de-listed waters.
Part B	Impaired Waters - No TMDL Required or Needed	No
Part D	Waters with Completed & EPA Approved TMDLs	No
Part E	Surface Waters Altered by Exotic Species	No
Part F	Surface Waters Altered by Flow Regulation	No

A summary of the number of waterbody segments listed as impaired on the 2014 draft Lists is given in Table 20. Numbers in the table are tentative as the list is pending approval by EPA.

Table 20. Number of Impaired Segments (taken from DRAFT 2014 listings).

Impaired Segments	Lakes & Ponds	Streams & Rivers	Total
Listed in Part A – impaired waters needing a TMDL (newly listed waters in 2014 in parentheses)	13	68 (2)	81
Listed in Part B – impaired waters not needing a TMDL (newly listed waters in 2014 in parentheses)	1	9 (1)	10
Total number of impaired segments	14	77	91
Total number of segments restored to full support for a use	0	6	6
Total number of segments moved to Part D due to completion of a TMDL	2	0	2

DEC has developed a new web-reporting format for all lists beginning with the 2014 Draft 303(d) and Priority Waters Lists, at: http://www.vtwaterquality.org/mapp/htm/mp_assessment.htm.

C4. Wetland Program

Class I wetlands are exceptional or irreplaceable in their contribution to Vermont's natural heritage and, therefore, merit the highest level of protection. The designation of Class I Wetland also provides a greater level of protection for the State's most significant and sensitive wetland systems. This protection includes larger protected buffer zones and more rigorous standards for permitting impacts. Currently only three wetlands hold Class I designation in the State; however many thousands of additional wetland acres are likely to meet Class I criteria. Reasons for non-designation include lack of sufficient data.

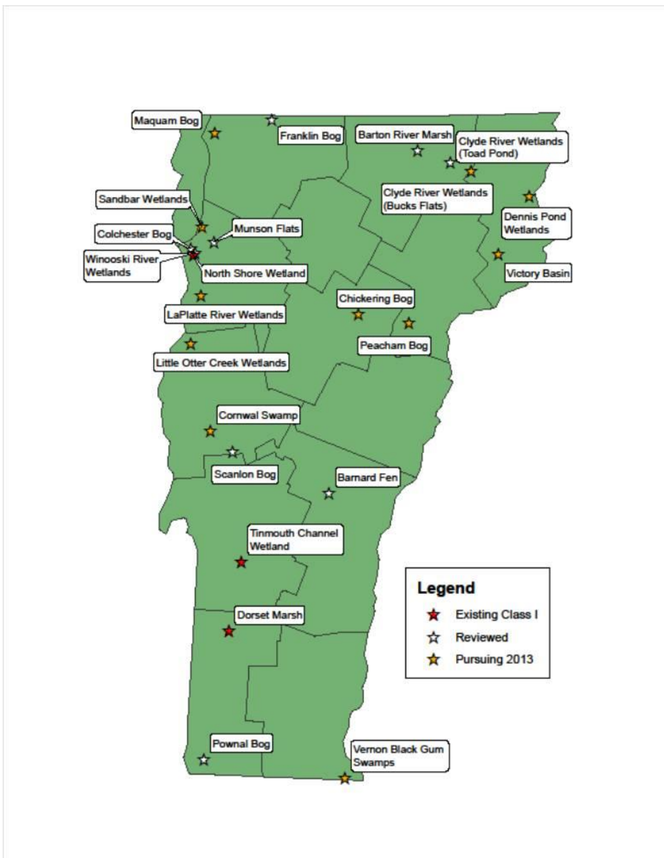


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Figure 7. Class 1 Wetlands and Potential Class 1 Wetlands

The Vermont Wetlands Program embarked in an effort to evaluate and identify potential Class I wetlands in 2013. A list of likely exceptional or irreplaceable wetlands was developed through meetings with Vermont Department of Forest, Parks and Recreation, Vermont Department of Fish and Wildlife, US Fish and Wildlife, and others. This initial list included 12 peatlands, 8 delta-associated wetlands, 6 large wetland complexes and seven unique wetlands for a total of 33 wetlands throughout the State. Of these 33, 28 were evaluated during the growing season of 2013. The Vermont Functions and Values Checklist, draft VRAM (Vermont rapid assessment method) dataform, and draft Class I criteria checklist was used to collect pertinent data on the exceptional or irreplaceable nature of the study wetlands.

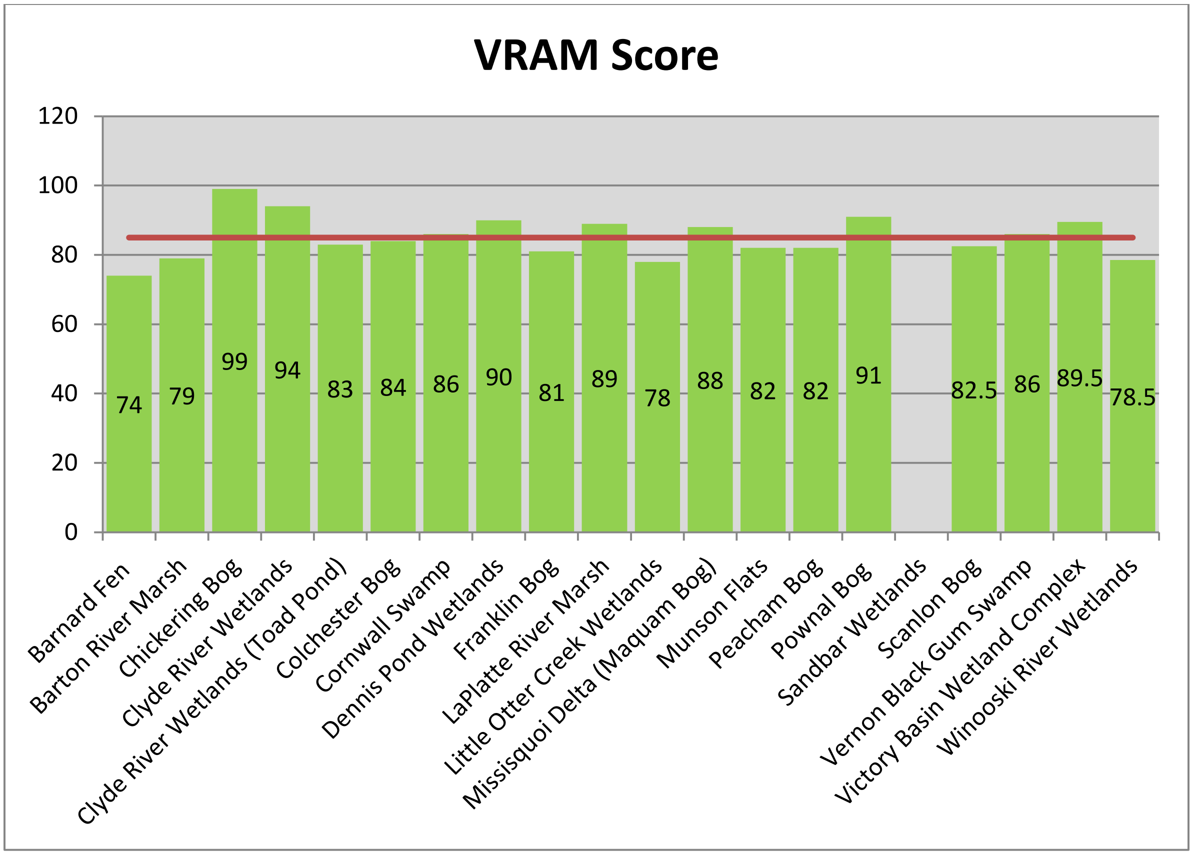


Figure 8. Vermont Rapid Assessment Method Scores for Selected Wetlands

C5. Trends Analysis for Surface Waters

There is no new trends analysis data for this reporting period. See the 2010 305(b) report for the last trends analysis done for Vermont lakes and ponds.

C6. Statewide Probabilistic Survey Results or Progress

Biomonitoring and Streams

For over three decades, the Vermont Department of Environmental Conservation has continuously operated an annual stream biomonitoring program. Between September 1st and October 15th, extensive fish surveys and macroinvertebrate sampling are conducted throughout the state. Fish IBIs and macroinvertebrate metrics are scored, and assessment ratings are given to each community based on those scores. Assessments rated as "Poor" or "Fair" indicated a failure to achieve Vermont's aquatic life use standards, while ratings of "Good", "Very Good" or "Excellent" indicate aquatic life use support, and increasingly healthy communities. DEC also collects an abundance of data relating to stream chemistry, substrate, physical habitat, and riparian characteristics, which are used to help explain patterns in the biological community condition and the potential stressors on the communities.

Biomonitoring resources are divided into two general categories with targeted monitoring directed towards streams of particular management interest. For example, efforts often focus on impaired streams undergoing remediation, compliance monitoring below discharges or development, or sampling at long-term reference sites to observe climate change affects. Targeted monitoring allows DEC to evaluate management efforts within a specific watershed, but doesn't give an unbiased assessment of the overall condition of Vermont's flowing waters.

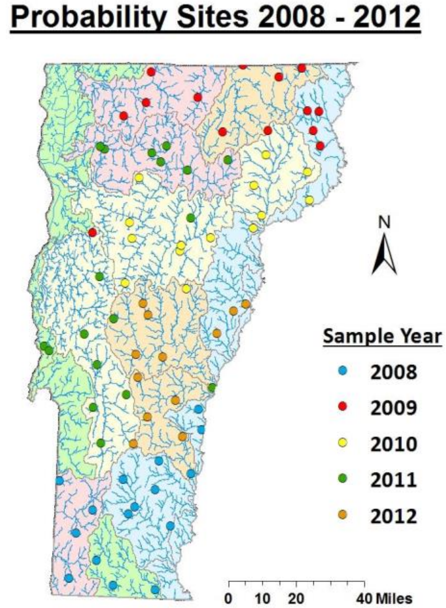
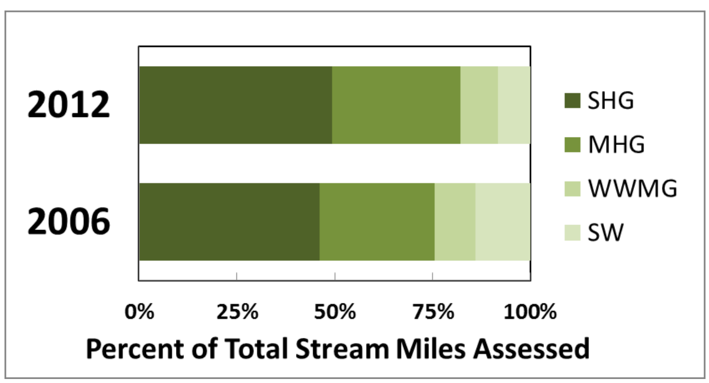


Figure 9: Probability sites sampled in the 2008-2012 rotation. Shaded watersheds indicate the current separation of the annual monitoring rotation

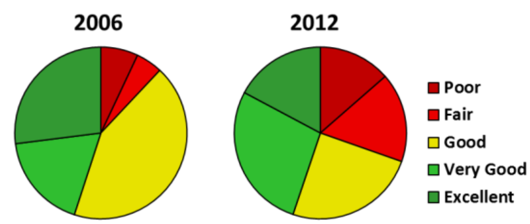
To answer the question "what is the overall biological condition of Vermont's wadeable streams", DEC has implemented probability-based surveys. Vermont's probability-based surveys represent a subset of randomly selected stream reaches (1st-4th order) throughout the state. In 2012, DEC completed a second probability-based survey (2008-2012), which included the sampling of seventy-four sites for macroinvertebrates, with 61 of these sites sampled for fish. The biomonitoring program uses a rotational sampling model, where annual efforts focus on a subset of major watersheds, and all watersheds of the state are monitored over a 5-year period. Probabilistic surveys are designed to coincide with DEC's rotational cycle, as well as to overlap with EPA's National Rivers and Streams Assessments (NRSA). By continuing probabilistic surveys on this cycle, we can investigate long-term trends in Vermont's stream biological condition, re-examine principal environmental stressors, and compare Vermont's biological stream condition to that found at regional and national scales by NRSA. For more information on DEC sampling and assessment methodology please visit: http://dec.vermont.gov/watershed/map/monitor/biomonitoring

Overall Assessments



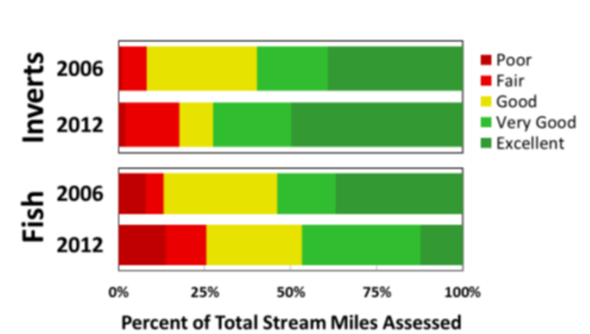
The percentages of stream miles assessed in each category demonstrates that the ratio of stream types were constant between probability surveys completed in 2006 and 2012 (Figure 2).

Overall assessments were determined by using the lesser of the fish or macro-invertebrate ratings, or the macroinvertebrate rating at sites where fish were not surveyed. Results show that in the probability survey ending in 2012, 30% of stream miles assessed failed to meet Vermont's standards for aquatic life use, compared to 12% in 2002-2006 (Figure 3). The increase in failing assessments resulted from a decline in stream miles rated as "Good", which were down from 43% in 2006 to 25% in 2012. The ratio of stream miles receiving the highest ratings of "Very Good" and "Excellent" were identical in the 2006 and 2012 surveys (45%).



The shift in ratings lead to more sites failing to meet aquatic life use standards in 2008-2012, and it is important to understand what might be causing that change. Looking at community assessments separately, it appears that there were indeed fewer "Good" macroinvertebrate assessments in the second survey (Figure 4). However, this decline coincided with a proportionately even increase in both the failing "Fair" ratings, and assessments indicating Very High Quality (VHQ) streams (i.e. "Very Good" and "Excellent"). In contrast, fish assessments showed a more systematic decline across the rating spectrum. Failing assessments increased in the 2008-2012 survey. "Good" fish assessments decreased slightly from 2006 to 2012, as did the total number of VHQ assessments. Also notable was a shift from "Excellent" to "Very Good" within higher quality fish communities. In general, it appears that declining assessments in both communities may be contributing to the trend towards more failing sites in 2008-2012.

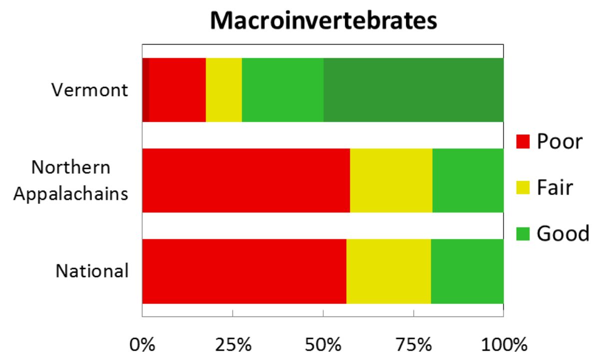
Differences between the two surveys have not been shown to be statistically significant, and the addition of future probability surveys will help shed light as to whether these are genuine trends. However, a closer look at failing sites in the recent survey provides interesting information on the overall biological condition. Of the 19 sites that failed to meet aquatic life use standards, 5 were identified as having experienced flow related stress (scouring and/or low flows), and 5 were identified as being influenced by organic or nutrient enrichment. Other impacts attributed to failing assessments at these sites include thermal stress (profundal release from an upstream reservoir), acidification, and erosion. Interestingly, of 17 failing sites where both communities were assessed, only 6 sites had both failing fish and macroinvertebrate assessments. Three sites had "Fair" invertebrate assessments, but passing fish communities, while 8 sites had failing fish assessments and passing macroinvertebrate communities (mostly VHQ).

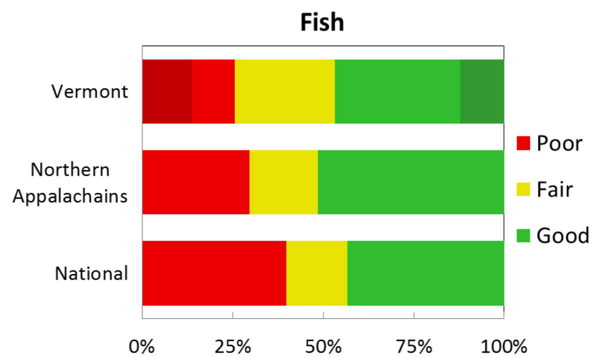


The true utility of these surveys will be a greater understanding of how chemical and physical stressors affect the biology of Vermont streams over time, and may also explain how fish and macroinvertebrates are affected differently by stressors.

Comparisons to National Survey

Vermont's probability surveys are designed to overlap with EPA's National Rivers and Streams Assessments (NRSA). Chemical and biological data from VDEC's 2008-2012 probability survey and EPA's 2008-2009 NRSA survey can be used to draw direct comparisons to wadeable stream conditions at state, regional, and national scales. NRSA scales include the continental U.S. and nine geographically distinct eco-regions. NRSA uses a three tiered assessment scale ("Poor", "Fair", and "Good"). For comparison NRSA "Poor" assessments equate to VDEC's failing assessments ("Poor" and "Fair"). NRSA "Fair" assessments equate to VDEC's "Good" (those sites just above the pass/fail threshold). NRSA "Good" assessments equate to VDEC's very high quality ratings of "Very Good" and "Excellent". Comparisons of macroinvertebrate assessments show that Vermont has a dramatically lower proportion stream miles rated as "Poor", and a much higher percentage rated as "Good" than the national or regional scales. Fish assessments at the State, regional and national scale seem to be remarkably similar throughout the three assessment categories.

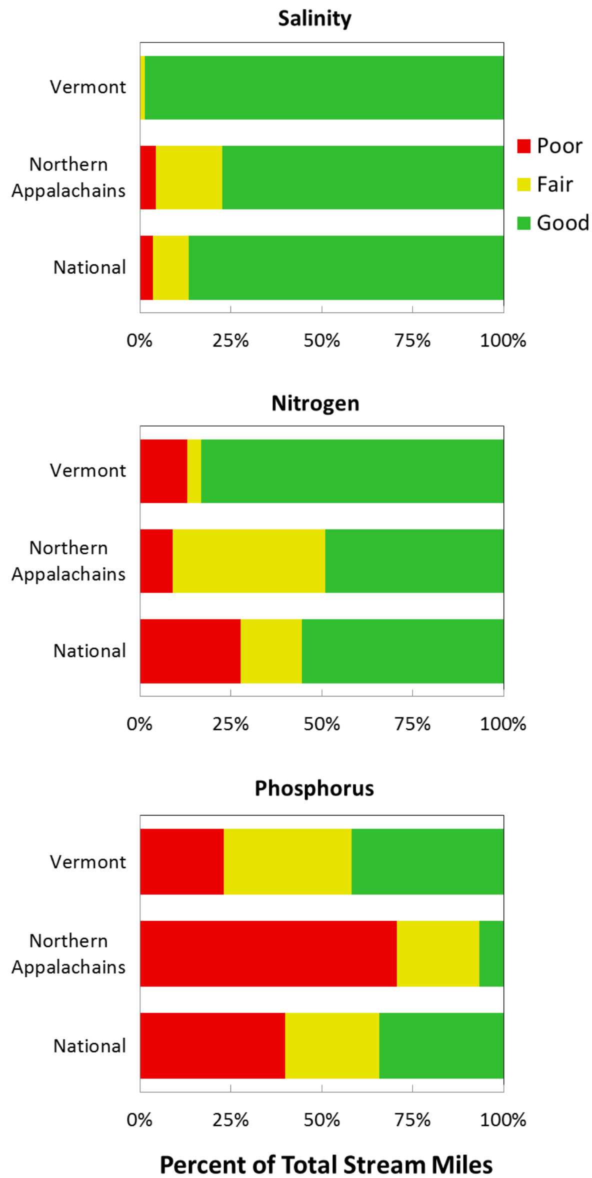




A comparison of stressors (with thresholds scaled by NRSA) shows that salinity in Vermont rates better than national or regional averages. In fact, none of the Vermont sites were rated "Poor", and only one site was above the 500 uS threshold to rate as "Fair". Similar trends were found in the nutrient comparisons. A vast majority of stream miles were rated as "Good" for nitrogen compared to national and regional data, with only 15 of 74 sites falling below this threshold. Phosphorus, which is viewed as a significant water quality problem in Vermont, showed more streams with "Poor" and "Fair" ratings when compared to other stressors, yet a far less percentage than all other scales. In fact the percent of stream miles rated "Poor" for phosphorus was nearly three times less in Vermont than in our eco-region (covering primarily NY and NE).

These comparisons give important information on how our State fits into a larger context. However, it is important to remember that there are caveats to this comparison as well. Our macroinvertebrate ratings follow different methodology and are rated on 5-tier scale, and DEC monitoring is done during the September-October index period, while NRSA data is collected between June and September.

Environmental data shows that nutrient enrichment from agricultural areas may contribute to declining community health, but there is a lot of variability in the results. Understanding the complex connections between environmental variables and trends in the biological data is challenging.



C7. Public Health Issues

Mercury and Fish Consumption

During the reporting period, the Department did not process fish mercury samples directly. The most recent data are from a major reassessment of fish mercury and PCBs in Lake Champlain, sponsored by the Lake Champlain Basin Program in 2011. The data from that project were compared to data collected in 2003 to 2004 and for yellow perch and lake trout, the mean mercury concentrations were significantly lower. Further results are in the report done for the LCBP by Biodiversity Research Institute.

Cyanobacteria

Routine monitoring for cyanobacteria continued on Lake Champlain in 2012 and 2013. Oversight of the program transitioned during this time from the University of Vermont (UVM) to the Watershed Management Division as part of the Lake Champlain Long-term Water Quality and Biological Monitoring Program. Due to personnel changes at UVM, their staff ended participation in the program at the end of the 2012 season. The Department of Health (VDH), the Lake Champlain Committee and their citizen volunteers continue to partner with the VT DEC in this effort. The VDH lab currently runs all microcystin and anatoxin analyses and offers cyanotoxin test kits to the general public for a low fee. Results of the monitoring program and any additional cyanobacteria sightings are reported on the VDH web page (http://healthvermont.gov/enviro/bg_algae/bgalgae.aspx) through a weekly status statement and an interactive lake status map color-coded for alert levels. Historical data can also be viewed through the VDH's Tracking Portal (http://healthvermont.gov/tracking/.) In 2013, a CDC grant to the VDH supported cyanobacteria monitoring at 10 additional Champlain sites and four 'inland' lakes.

The visual assessment protocol provided as guidance for Vermont communities by VDH and DEC (http://healthvermont.gov/enviro/bg_algae/bgalgae.aspx#guide), and adapted by the LCC for use by its Champlain monitors (https://www.lakechamplaincommittee.org/get-involved/volunteers/bgamonitors/algaebloomintensity/) enabled a significant increase in the geographic range of cyanobacteria monitoring on Lake Champlain in 2012. The 2013 field season demonstrated its applicability to Vermont's inland lakes as well. The Champlain program, which incorporates both visual and quantitative assessment, has been of interest at the regional and national level as water managers begin to address the issue of harmful algae blooms.

Monitoring began in early June 2012 and continued through September. Over the course of the summer, more than 600 reports were made by partners and volunteers. Bloom conditions developed in several locations around Lake Champlain, including a three week period of widespread *Anabaena*-dominated blooms throughout the main lake early in the summer. No microcystin or anatoxin was detected in samples collected during this event. Microcystins were present in Missisquoi Bay beginning in late July. Concentrations were below levels of concern in most locations, with the exception of the Highgate Spring Shipyard, where one sample reached 54µg/L. St. Albans Bay also experienced blooms but very little microcystin was detected. Anatoxin was detected in St. Albans Bay at very low levels on one date in August, the only time this toxin was detected in Lake Champlain during 2012. There were no reports of human or animal illness connected to algal blooms in 2012.

More than 800 reports were submitted by the partners and citizen volunteers during the 2013 monitoring period, including those from the four inland lakes. Only a few pre-bloom or bloom events were reported in 2013 - 94% of the Champlain assessments reported generally safe conditions as did 100% of the inland lake assessments. Microcystin was detected in 18% of the 166 samples analyzed from Champlain and the inland lakes. The highest concentration observed, 0.43 µg/L, was from Missisquoi Bay. No anatoxin was detected in the 166 samples tested. Bloom conditions were reported from several locations of the main lake and Missisquoi Bay over the summer. None were reported from the four inland lakes.

When compared to other locations across the country, Vermont has few reported cyanobacteria bloom events and rarely has found microcystin and anatoxin concentrations above VDH guidance levels in recent years. Like many states, Vermont relies on the general public to report blooms and may thus be under-reporting the occurrence of cyanobacteria. The DEC continues to work closely with the VDH when responding to bloom events, providing consistent messages to the public regarding safety and water quality concerns. Vermont continues to be involved in the ongoing national discussion of public health risk, suitable sampling methods and appropriate response, including participation in a newly formed regional group organized through the New England Interstate Water Pollution Control Commission (NEIWPCC).

Small Community Untreated Waste Discharges

DEC provides direct funding and technical assistance to small communities without sewers to help them evaluate and plan for their wastewater needs. Funding is provided by either a low interest loan or planning advance, which is a loan that is paid back only when a project is built. It is anticipated that there will be a continuing need from small communities for wastewater evaluations and planning in the coming years. Most of these communities have not been identified in the past as being the sources of surface water pollution, but residents are now realizing that they may have problems with their small lot and older on-site sewage systems. Another factor is the economic viability of small communities, which cannot have commercial or residential growth due to limiting soil conditions for septic system leachfields.

During the 2012 - 2013 reporting period, the Towns of West Windsor (one village), Fairfield (two villages and a recreational camp pond), Huntington (three villages), and Franklin (one village and a large recreational camp lake) completed such studies for their village centers. For the first time, the Department provided funding for combined wastewater and water supply feasibility studies. West Windsor and Huntington took advantage of this integrated and efficient approach.

Restrictions on Bathing Areas During the 2014 Reporting Period

The current Vermont criterion for *E. coli* in Class B swim waters is 77 organisms/100 ml of water for any single sample. This criterion was developed in the 1990s as an interpretation of then-current EPA guidance, which suggested that such a criterion would protect swimmers to somewhat less than 4 expected illnesses per 1000 swimmers. This criterion is significantly more stringent than the current EPA recommended recreational water quality standard for *E. coli* of 235 organisms/100 ml for any single water sample, which corresponds to approximately 8 gastrointestinal illnesses per 1000 swimmers. Other restrictions on bathing areas in Vermont have recently included beach closures due to cyanobacteria blooms and animal fecal waste (e.g. geese and gulls defecating along shoreline), which can be a source of *E. coli* contamination. The reader is cautioned that the occurrence of a beach closure should not be equated with the determination that the beach is impaired due to *E. coli* contamination.

Lake Champlain

The count of beach closures for Lake Champlain public beaches in 2012 and 2013 is shown in Table 25.

Table 25. Number of Beach Closures for Vermont Portion of Lake Champlain.

Segment & Beach	Closures due to *E. coli*		Other Closures
NORTHEAST ARM	**2012**	**2013**	**2012-2013**
North Hero State Park	no data	0	
St. Albans Bay Park Beach	1	0	
Kill Kare State Park	no data	0	
Burton Island State Park	no data	0	
Knight Point State Park	no data	1	
Grand Isle State Park	no data	0	
Sand Bar State Park	no data	3	
MALLETTS BAY	**2012**	**2013**	**2012-2013**
Niquette Bay State Park	no data	0	
Bayside Beach	0	1	
Rossetti Nature Area	1	0	
MAIN LAKE	**2012**	**2013**	**2012-2013**
Leddy Beach	1	1	
North Beach	2	0	
Blanchard Beach	3	1	
Oakledge Beach	0	0	
Red Rocks Park Beach	2	3	June 27 – beach closed due to blue-green algae
Shelburne Town Beach	0	0	
Charlotte Town Beach	0	0	
Ferrisburg Town Beach	0	0	July 3 – closed doe to blue-green algae
Kingsland Bay State Park	no data	2	July 2-3 – closed due to blue-green algae
Alburg Dunes State Park	no data	0	

Restrictions on Surface Drinking Water Supplies During the 2014 Reporting Period

Six surface water systems were on either a "boil water notice" or "do not drink notice" during the reporting period. The Montpelier Water System has a boil water notice for three homes that are not presently connected to the City drinking water distribution system. In addition, the Alburgh Village Water Supply, Camp Skyland, Black Mountain Park, and Wake Robin all had short-term boil water notices during the reporting period. The Alburgh Fire District 1 had a do not drink notice for a short time.

The Missisquoi River, the Winooski River, and the Lamoille River were all treated with lampricide during this reporting period and because of these applications, there were water use advisories for six public water systems, the Burlington water supply intake, and four public water systems respectively.

Chronic or Recurring Fish Kills

The Vermont Department of Fish & Wildlife (DF&W) maintains a fish pathology laboratory which responds to significant fish kills and maintains records of all reported and/or investigated events.

The following fish kills were reported in 2012/2013. These kills are likely due to natural causes and were not intensively investigated by the Vermont Fish & Wildlife Department. All kills were judged to be minor in overall significance to the total fish population.

Fish Kills in 2012 or 2013:

- **January 2012** – Lake Champlain (Mallett's Bay) - alewife die-off due to general immunosuppression caused by low water temperatures.
- **June, 2012** - Lake Parker - small die-off comprised of multiple fish species.
- **June, 2012** - Waterbury Reservoir - small die-off comprised of multiple fish species.
- **August, 2012** – Missisquoi Bay, Lake Champlain - a beach in Phillipsburg, Quebec had hundreds of dead fish including perch, alewives, carp, largemouth bass. Vermont didn't have reports of these large numbers of dead fish.
- **September, 2012** - Lake Memphremagog - small die-off comprised of multiple fish species.
- **April, 2013** - Lake Champlain (Addison County) - alewife die-off due to general immunosuppression caused by low water temperatures.
- **June 2013 -** Martin's Pond - small die-off comprised of a single fish species (brown bullhead).
- **June 2013 -** Fern Lake - small die-off comprised of multiple fish species. The die-off may have been related to pesticide applications for mosquitos near the lake and wetlands.

Part D. Groundwater Monitoring and Assessment

D1. Introduction

The Groundwater Coordinating Committee (GWCC) met infrequently during the 2012 and 2013 biennial. The GWCC was established through legislation (Chapter 48: Groundwater Protection, 1985) with committee representation from the Department of Environmental Conservation, Department of Forests, Parks and Recreation, Agency of Agriculture, Food and Markets, Department of Health, along with representatives of other agencies and the private sector.

The purpose of the GWCC is to advise 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&GWPD) within the Department of Environmental Conservation.
The groundwater program includes:

- Developing a groundwater strategy and integrating the groundwater management strategy with other regulatory programs administered by the Secretary,
- 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. This relationship has been realized through the development of the strategy for the management and protection of groundwater along with the adoption of the Groundwater Protection Rule and Strategy Chapter 12 (adopted February 1988, revised September 2005). The committee's interaction with the Secretary has mostly been involved with the reclassification of ten contaminated groundwater areas to Class IV Groundwater and one groundwater reclassification to Class II Groundwater.

D2. Groundwater Reclassification Issued in this Reporting Period

Groundwater Class IV Area, Disposal Specialist Inc. Landfill

The Vermont Agency of Natural Resources amended the March 2008 reclassification of groundwater from Class III to Class IV at the Disposal Specialist Inc. Landfill (DSI Landfill). The DSI Landfill is located west of Route 5 and the Connecticut River in the northeastern portion of Rockingham. The landfill is bordered on the east by Route 5, on the west by Interstate 89, and on the northwest by Hogan Hill. The Connecticut River flows southward just east of the DSI Landfill.

While the size of the Class IV area and the geographic extent of the reclassified area has not changed, the amendment to the Class IV is required because a survey error in the original Class IV petition incorrectly named certain parcels and included two separate parcels as one parcel. This has been corrected in the amended Class IV petition. The 52.7 acre reclassification area is owned by Browning-Ferris, Inc. The site is also known as the BFI Rockingham Landfill Superfund Site. The findings 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 http://dec.vermont.gov/water 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.

D3. State Regulations

Groundwater Protection Rule & Strategy

Revisions to the above rule have been examined during the biennial period. The rule articulates the State's groundwater policy which is to protect its groundwater resources to maintain high quality drinking water. It shall manage its groundwater resources to minimize the risks of groundwater quality deterioration by limiting human activities that present unreasonable risks to the use classifications of 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. The aim of the public trust doctrine is in part to:

1) Coordinate and strengthen existing data gathering and resource planning programs at the municipal, regional, and state level.
2) Recognize that groundwater and surface water are parts of a single water resource system and to the extent feasible propose changes to regulatory programs to manage groundwater and surface water in a conjunctive manner.
3) Incorporate public trust principles, including revisions to standards and the use of points of compliance, into regulatory programs to ensure the protection of groundwater for present and future generations.
4) Reinforce that a person whose activities result in damage to a public trust resource is responsible to remediate that damage and compensate the public for their losses.

D4. Underground Injection Control Program

Underground Injection Control (UIC) permits are for discharging non-sanitary waste into an opening in the ground. During the period January 1, 2012 through December 31, 2013, there were 12 Underground Injection Control (UIC) Permits issued and 5 permit applications terminated or withdrawn. During calendar year 2013, the UIC Program Coordinator met with numerous business, environmental, and citizen groups and other stakeholders during the formulation of the revised UIC regulations which are currently out for public comment.

D5. Information & Public Education

Each of the Class II and Class IV Groundwater Areas along with source protection areas (SPA) delineations 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 Day at the State House. 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 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 water quality standard, whether naturally occurring or due to nearby land activities, there is technical assistance outlining treatment options so as to 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&GWPD's well driller's database is available on ANR's GIS website providing geographic and geological information to the public.

D6. 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. 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 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 unknown. Characterizing the groundwater resources is overdue relative to the continuing threats of contamination, the pressures and pace of economic development, and the importance of this resource.

Part E. Public Participation

A "Solicitation for Water Quality Data & Information" press release was released on October 9, 2013 by Vermont Department of Environmental Conservation Watershed Management Division. The public was given until November 8, 2013 to provide any data and information for consideration for the 2014 305(b) integrated reporting process and 303(d) listing process. One watershed organization, one environmental organization, and one consulting firm provided some information and comment.

The draft 2014 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 2014 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. A list of all stressed river and stream segments was also produced for review.

Following receipt of public comments, a response summary was developed that described how the comments were addressed. No changes were made to the list and a final version of the Part A 303(d) List of Impaired Waters and the List of Priority Waters were then sent to the New England regional office of EPA for review and approval in June 2014.

Once approved, the Part 303(d) List will be posted on the Vermont ANR DEC Watershed Management Division website along with the other impaired and altered waters lists and along with the stressed waters list.

Appendix A:Vermont Department of Health Fish Consumption Advisory

HEALTH ALERT

The Vermont Department of Health recommends that people limit eating some fish caught in Vermont waters.

These advisories are based on tests of fish caught in Vermont waters and scientific information about the harmful effects of mercury and, in the case of large lake trout in Lake Champlain and all fish in the Hoosic River, PCBs (polychlorinated biphenyls).

You can mix and match fish (you catch or buy) with the same limits, but once you meet the lowest limit eat no more fish that month. Do not eat the monthly limit within a single week.

Store bought fresh and canned fish—including tuna—have mercury levels that are about the same as many Vermont-caught fish. Add in store bought fish when you decide how many fish meals to eat each month.

One fish meal = 8 ounces uncooked fish

For more information call
1-800-439-8550
healthvermont.gov

VERMONT DEPARTMENT OF HEALTH

	Women of childbearing age and children age 6 and under	Everyone else
GENERAL ADVISORY:		
Brown Bullhead Pumpkinseed	No more than 5 meals/month	No Restrictions
Walleye	0 Meals	No more than 1 meal/month
American Eel Chain Pickerel Lake Trout Smallmouth Bass	No more than 1 meal/month	No more than 3 meals/month
Largemouth Bass Northern Pike Yellow Perch (10 inches and larger)	No more than 2 meals/month	No more than 6 meals/month
Brook Trout Brown Trout Rainbow Trout White Perch Yellow Perch (smaller than 10 inches)	No more than 3-4 meals/month	No Restrictions
All Other Fish	No more than 2-3 meals/month	No more than 9 meals/month
SPECIAL ADVISORIES:		
Lake Carmi - Walleye	No more than 4 meals/month	No Restrictions
Lake Champlain Lake Trout (larger than 25 inches)	0 meals (includes all children under 15)	No more than 1 meal/month
Smallmouth Bass (19 inches and larger)	0 meals	No more than 1 meal/month
Yellow Perch (smaller than 10 inches)	No more than 5 meals/month	No Restrictions
Shelburne Pond Yellow Perch (smaller than 10 inches)	No more than 5 meals/month	No Restrictions
Hoosic River - All Fish	0 meals	0 meals
Deerfield Chain (Grout Pond, Somerset Reservoir, Harriman Reservoir, Sherman Reservoir, and Searsburg Reservoir)		
Brook Trout Brown Bullhead	No more than 5 meals/month	No Restrictions
Brown Trout (14 inches and smaller) Rainbow Smelt Rainbow Trout Rock Bass Yellow Perch	No more than 1 meal/month	No more than 3 meals/month
Brown Trout (larger than 14 inches) All Other Fish	0 meals	No more than 1 meal/month
15 Mile Falls Chain (Comerford Reservoir and Moore Reservoir)		
White Sucker	No more than 1 meal/month	No more than 3 meals/month
All Fish	0 meals	No more than 2 meals/month
15 Mile Falls Chain (McIndoes Reservoir)		
Yellow Perch	No more than 2 meals/month	No more than 6 meals/month
All Other Fish	No more than 1 meal/month	No more than 3 meals/month

v.May 2013

Appendix B: WWTFs with Active or Potentially Active CSOs

Communities (WWTFs) with Active or Potentially Active CSOs Remaining

Community	CSOs	Receiving Water	Status
Burlington Main	2	Winooski River Wetlands	City monitoring to determine compliance with CSO Policy.
Burlington North	1	Winooski River	City completed abatement work and is monitoring for compliance with CSO Policy.
Burlington East	1	Winooski River	City completed abatement work and is monitoring for compliance with CSO Policy.
Enosburg	1	Missisquoi River	1272 Order was issued to require abatement work to achieve compliance with the CSO Policy. Work was done. Effectiveness Study was done to determine if the work was adequate. Pending review
Hartford WRJ	2	Connecticut River	**Active CSOs** Emergency Order issued to achieve compliance with CSO Policy. Most recent Effectiveness Study indicates near compliance with Policy. Abatement additional work is planned
Middlebury	2	Otter Creek	1272 Order issued which require an Effectiveness Study to determine if the previous abatement work achieved compliance with the CSO Policy.
Vergennes	1	Otter Creek	**Active CSO.** 1272 Order issued requires ongoing abatement work for compliance with CSO Policy.
Rutland	4	Otter Creek East Creek	**Active CSOs**. Long term project. Current 1272 Order issued requires ongoing abatement work.

Montpelier	6	Winooski River	**Active CSOs.** 1272 Order issued which requires an Effectiveness Study to assess work done to date and a plan for achieving compliance with CSO Policy at the remaining CSOs. Study was submitted 1/17/14 and is pending review
Fairhaven	1	Castleton River	**Active CSO**. Adams Street pump station may still Discharge during large storm events and may not comply with the CSO Policy. Town taken to eliminate sources within the service area of the pump station. When the NPDES permit is reissued conditions to meet the 9 minimum controls and determine compliance with the CSO Policy will be included.
St. Albans	1	Stevens Brook	**Active CSO**. 1272 Order issued which requires ongoing Abatement work to achieve compliance with CSO Policy.
St. Johnsbury	14	Passumpic River Sleepers River	**Active CSOs**. Long term project. To date numerous CSO outfalls have been eliminated. Current 1272 Order requires assessment of abatement work done to date. The further abatement work will be scheduled
Springfield	?	Black River	Status unknown, AOD required monitoring and reports