# PART TWO: INTRODUCTION & BACKGROUND

## *A. Introduction: Setting the Stage*

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, which are managed for high quality, may have minimal, minor or moderate change to aquatic biota or habitat according to the water's management type B1, B2 or B3. Certain Class B waters have an overlay Waste Management Zone for public protection below sanitary wastewater discharges.

There are approximately 165 miles of Class A rivers and streams and 1,736 acres of Class A lakes and ponds in Vermont (these figures do not include rivers/streams above 2,500 feet elevation which are also Class A). In addition, there are close to 6,935 miles of Class B rivers/streams and 229,053 acres of Class B lakes/ponds. 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, similar in effect to a zoning overlay, is created on a site-specific basis to accommodate the direct discharge of treated sewage effluent to surface waters.

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 by the Vermont Water Resources Board 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.

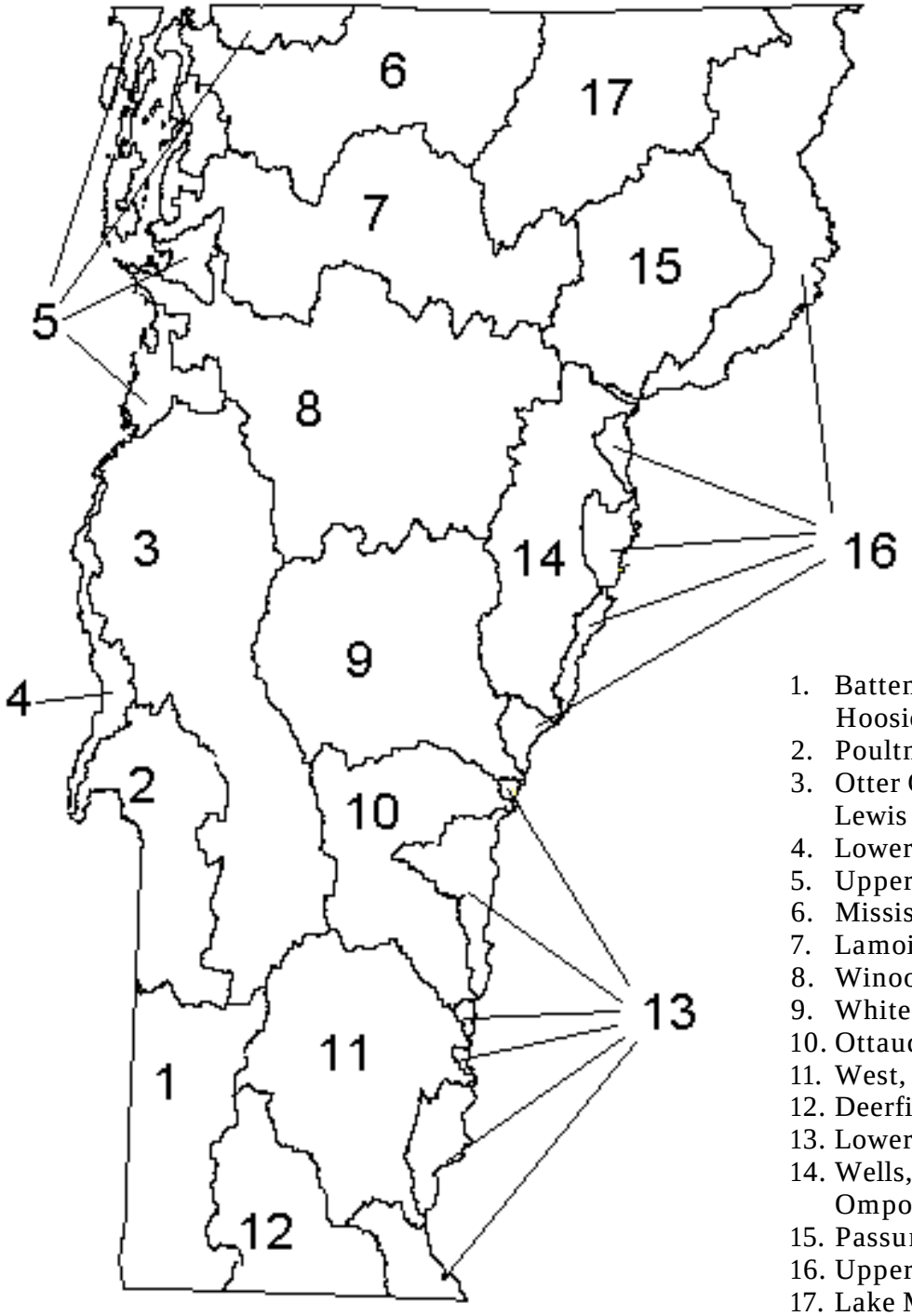
Wetlands within Vermont are classified as Class One, Class Two or Class Three. Class One wetlands are considered exceptional or irreplaceable in their contribution to Vermont's natural heritage and are afforded the highest level of protection. Class Two wetlands are considered significant. Class One and Class Two wetlands are those shown on the National Wetlands Inventory maps. Class Three wetlands are areas that do not appear on the maps. The majority of wetlands within Vermont are Class Two.

Surface water quality monitoring undertaken by the Department during the 2006 305b reporting period (January 1, 2004 through December 31, 2005) continued to support an assortment of water program activities. Long-term monitoring programs are designed to assess trends in water quality, as well as to generate baseline water quality information. DEC also maintains a strong presence on Lake Champlain and conducts a variety of short-term lake and stream-specific monitoring projects. Monitoring data is used to manage and protect Vermont waters in a pro-active manner. The reader is referred to Part Four of the report for a more detailed description of DEC's surface water quality monitoring program and for the results of monitoring and assessment activities. Appendix C and D contain DEC's 2006 Assessment and Listing Methodology and Water Quality Monitoring Program Strategy, respectively.

For the wide range of water quality management and planning purposes, there are 17 major river basins found in Vermont. These rivers drain into one of four large regional drainages: Hudson River,

Lake Champlain, Lake Memphremagog and the Connecticut River. A map illustrating the 17 river basins is provided below.

# Vermont's Major Watersheds




1. Battenkill, Walloomsac, Hoosic
2. Poultney-Mettawee
3. Otter Creek, Little Otter, Lewis
4. Lower Lake Champlain
5. Upper Lake Champlain
6. Missisquoi
7. Lamoille
8. Winooski
9. White
10. Ottauquechee, Black
11. West, Williams, Saxtons
12. Deerfield
13. Lower Connecticut
14. Wells, Waits, Ompompanoosuc
15. Passumpsic
16. Upper Connecticut
17. Lake Memphremagog

## *B. Background: An Overall Description of Vermont's Water Quality & Surface Water Resources*

### *Summary Description of Vermont's Water Quality*

The water quality of Vermont's many rivers and streams and lakes and ponds is considered good. This overall water quality rating has not changed from the overall rating level that was reported in the 2004 Section 305b Report. The US Environmental Protection Agency (EPA) has requested states to also assess the state's surface water quality considering the fish consumption advisory for mercury which was issued in June 1995 and most recently revised in June 2000. The advisory was issued as the result of fish tissue sampling that showed mercury in the tissue of all fish, particularly in walleye and lake trout, and also PCBs in lake trout[1] in Lake Champlain (see updated advisory as Appendix B). Taking the fish consumption advisory into consideration, the overall water quality of all the state's waterbodies would be rated as fair. A statewide assessment of mercury in sediments, waters, and biota of Vermont lakes was completed during the 2004 reporting cycle. Results of the project are discussed and can be found in Part Four of the 2004 305b Report.

With regard to Vermont's wetlands, their water quality is believed to be generally good. Since Vermont does not have a specific program of assessing and monitoring wetland water quality, this characterization is somewhat speculative. It has been incumbent upon the state's limited resources to insure important wetland functions and values are protected from being lost to development or other destructive practices.

No comprehensive studies have been completed on the quality of Vermont's groundwater. In most cases it is believed that groundwater quality meets drinking water standards. A thorough evaluation of groundwater is needed, however, to provide a factual characterization of this important resource.

### *Atlas/Total Waters*

Vermont has approximately 7,100[2] miles of rivers and streams, 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 (border with New York).

There are 17 major river basins in Vermont (refer to map in Part Two), which 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 2.1 below.

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[1] Still in effect is the 1989 advisory for PCBs (polychlorinated biphenyls) in Lake Champlain.

[2] Source of 7,100 mile figure is EPA's Total Waters Database. Earlier 305b reports relied upon Don Webster's list of Vermont waters prepared in 1962 that showed a total of 4,936 miles. A number of omissions have been discovered in Webster's listing with many small streams overlooked and the lengths of some rivers and streams significantly underestimated. The total mile figure is likely to change once the Vermont Hydrography Dataset becomes functional.

**Table 2.1. Atlas.**

| | |
|---|---|
| State population | 608,827 (2000 Census) |
| State population change (1990 - 2000) | 8.2 % increase |
| State surface area | 9,609 square miles |
| State population density | 63.36 persons/sq mi |
| Number of water basins | 17 |
| Miles of perennial rivers & streams[3] | 7,099 |
| Border miles of shared rivers/streams (subset)[4] | 262 |
| Number of lakes, reservoirs & ponds (at least 20 acres) | 291 |
| Number of lakes, reservoirs & ponds (at least 5 acres but less than 20 acres) | 318 |
| Number of significant, lakes, reservoirs & ponds (less than 5 acres) | 203 |
| Acres of lakes, reservoirs & ponds[5] | 230,901 |
| Acres of freshwater wetlands[6] | 300,000 |

There are no coastal waters, estuaries or tidal wetlands in Vermont. However, due to the size of Lake Champlain (approximately 120 miles long and 12 miles wide at its widest), the lake is considered an inland sea by many residents of Vermont, New York and Quebec. The Atlantic Ocean and Inland Waterway are accessible to the south from Lake Champlain via the New York Barge Canal. The Richelieu River, St. Lawrence River and the Atlantic Ocean are accessible to the north through Canada.

***Estimated total stream miles and lake acres in Vermont using the Vermont Hydrographic Dataset***

During the reporting period, the Vermont Center for Geographic Information developed a new spatially referenced geographic layer and accounting of surface waters throughout the state. This so-called Vermont Hydrographic Dataset (VHD) was derived by photo-interpretation of 1:5,000 scale aerial orthophotographs and through use of the 1:100,000 scale National Hydrographic Dataset (NHD) as a base layer. VHD has been approved by USGS as the NHD dataset for Vermont and, accordingly, all reach addressing is compliant with NHD standards and specifications.

For many years and concerning several previous Section 305b Reports, DEC has provided a statewide estimate of about 7,100 river and stream miles. This estimate is based upon the older EPA Total Waters dataset which was a precursor to the NHD and sized to capture surface waters at 1:100,000 scale. A map scale of 1:100,000 implies that waters visible on USGS 1:100,000 scale quadrangle maps will be captured by the geographic coverage in question. The 1:5,000 scale VHD shows all waters visible on a base layer of that scale, resulting in significantly more waterbodies being mapped.

[3] Includes the Connecticut River.

[4] Connecticut River - 238 miles; Poultney River - 24 miles.

[5] Figure 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 large CT River impoundments, Moore and Comerford Reservoirs, which are 1,255 and 777 acres in size, respectively. Figure also accounts for three newly inventoried ponds. These were not previously tracked in Vermont's Lake Inventory Database.

[6] Figure does not include wetlands found on agricultural lands that are actively used for agricultural purposes.

The new VHD-based preliminary estimate for total river and stream mileage on a statewide basis is 22,525 miles, an increase of 317% over the older EPA Total Waters estimate. The total number of lake acres captured by VHD does not appreciably change from the current DEC estimates of total statewide lake acreage, as the largest proportion of lake acres in Vermont are already reflected by the current Vermont Lake Inventory.

For the 2006 Section 305b Report, DEC has chosen to continue using the Total Waters estimate. Before the VHD-based estimate is incorporated into its various water quality assessment and reporting efforts, DEC will need to revise the lengths of rivers and streams throughout the state on a systematic basis involving each waterbody. As of this writing, it is not known when that revision process will begin or how long it will take. In order to ensure reporting consistency, the VHD-based mileage values will not be employed until all river and stream waterbodies have been re-evaluated.

### *Effectiveness of Pollution Control Programs*

The Vermont Department of Environmental Conservation (DEC) within the Agency of Natural Resources has been designated as the lead water quality management agency for the State of Vermont. In that role, DEC administers a wide 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. These programs are effective at maintaining, protecting and restoring water quality and aquatic habitat conditions. For the purpose of describing water pollution control program effectiveness, DEC's various water pollution control programs can be summarized into three categories: General, Point Sources and Nonpoint Sources.

Since the 2004 305b Report, a relatively new water quality program has become established in Vermont known as the Clean and Clear Initiative. The Clean and Clear Initiative, which cuts across the three water pollution program categories noted above, is introduced later in this chapter.

#### GENERAL PROGRAM

*Water Quality Standards*

The Water Quality Standards are the foundation of the state's water pollution control and water quality protection efforts. The Water Quality Standards (Standards or WQS) have been promulgated by the Vermont Water Resources Board and provide the specific criteria and policies for the management and protection of Vermont's surface waters. The classification of waters (rivers, streams, lakes and ponds) as Class A, Class B or Class B with Waste Management Zone are the management goals to be attained and maintained. The classification also specifies the designated water uses for each class. Class A waters are either A1 (ecological waters) or A2 (public water supplies). Class B waters fall within one of three water management types (B1, B2 or B3) after consideration by the Water Resources Board.[7] The current Vermont WQS (go to www.state.vt.us/wtrboard, click on "Rules") were adopted June 10, 1999 and became effective July 2, 2000.

The Vermont WQS 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

7 A petition for water management typing of all surface waters in the White River basin was submitted to the Water Resources Board during the 2006 reporting period. Deliberations and rule making regarding the petition – now by the Water Resources Panel - are ongoing.

value or use, whether presently occurring or not, that is specified in the management objectives for each class of water. Table 2.2 serves to indicate applicable designated uses.

**Table 2.2. 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 Primary Contact Recreation | √ | | √ |
| Boating, Fishing & Other Recreation Uses | √ | | √ |
| Public Water Supplies | | √ | √ |
| Irrigation of Crops & Other Agricultural Uses | | | √ |

*Class A Re-classifications*
The 1986 "Pristine Streams Act" created the opportunity for any waterbody supporting habitat that is ecologically significant and has water quality that meets at least Class B standards to be re-classified to Class A. A re-classification is a rule making procedure before the Water Resources Board where a public interest determination must be made pursuant to Vermont's Water Pollution Control Statute, Title 10 VSA Section1253. No streams have been re-classified to Class A since the 1998 305b Report.

*Outstanding Resource Waters*
An overlay of both Class A and Class B waters is the designation of Outstanding Resource Water (ORW). ORWs are waters of the State designated by the Water Resources Board as having exceptional natural, recreational, cultural or scenic values. To gain an ORW designation, the petitioners must, in a contested case hearing before the Board, provide evidence and testimony that the waters in question have exceptional natural, cultural, scenic, or recreational values. The following waters have been designated as ORWs: the Batten Kill and its West Branch, Pikes Falls on the North Branch of Ball Mountain Brook, the lower Poultney River and Great Falls on the Ompompanoosuc River. No additional ORWs were designated during the 2006 305b reporting period.

*Watershed Approach*
Vermont has adopted and is implementing a watershed approach to surface water quality planning. The DEC-prepared document, *Guidelines for Watershed Planning* (refer to the year 2002 305b Report or to www.vtwaterquality.org, click on "planning" then click on "basin planning process") calls for basin surface water plans to be developed on a periodic basis.

The watershed planning process is an inclusive public process that takes into account current and past assessment, planning, and implementation activities at the state and local levels. Assessments are followed by the basin plans that will summarize current and past (within five years) water pollution or water quality management activities. This rotational planning process will also identify topics or areas of special importance in the basin, identify available management tools to address those topics, and make specific recommendations on how to address key topics, including recommendations for continuing community-based planning or implementation action. Each basin plan updates previous basin plans. Each basin is unique in its problems and opportunities. Nevertheless, assessment, planning and implementation are constantly occurring at many different levels from the activities of landowners to municipal, state and federal levels and evolving with public participation. The

*Guidelines for Watershed Planning* looks at all of these activities including the condition of the waters in a given point in time and makes conclusions and recommendations for the future.

During the reporting period, the Poultney-Mettowee River Basin Plan was adopted by the Secretary of the Agency of Natural Resources. The basin plan for the White River was adopted in November 2002. For a summary update on progress of activities in the nine river basins where water quality management plans have been or are being developed, the reader should refer to Appendix A. Table 2.3, appearing on the following page, provides a summary overview of the status of basin planning activities as of December 2005.

POINT SOURCE CONTROL PROGRAM

Vermont administers a well-planned and 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 33 wastewater treatment facilities considered as “major” and 132 “minor” facilities.

With the construction of the state's last originally identified municipal waste water treatment facility (WWTF) and completion of the upgrades from primary to secondary, the program has continued to place emphasis on refurbishment of existing WWTFs, the completion of phosphorus reduction upgrades (refer to Appendix B, Table B.1), advanced waste treatment, correction of combined sewer overflows (CSO) (see Appendix B, Table B.2), control of toxics, pollution prevention activities and facility enlargements.

During the 2006 305b reporting period, construction commenced on CSO corrections, sewer line rehabilitations and extensions, sewer system improvements, wastewater treatment plant upgrades, and phosphorus reductions. Various new projects, located in all four major drainages within Vermont, commenced construction in 2004 and 2005 using funding from state, federal and local sources, totaling approximately $76 million in ultimate expenditures (refer to Table 2.4 below). Due to the size of some of the projects and limited appropriations, some of the projects received only partial state and federal funding during the reporting period. These projects will receive full funding during succeeding years.

Of the 31 facilities with planned phosphorus reduction projects in the Vermont portion of the Lake Champlain basin, 30 have been or are close to being completed. Of the 33 planned CSO correction projects, 24 have been completed, 5 are underway and 4 are pending.

Vermont’s TMDL planning for Lake Champlain, including a new lower tier of phosphorus limits, anticipates over $5 million in new construction projects at existing municipal wastewater treatment plants in the coming years.

Approximately $76.5 million dollars were spent during the 2004 - 2005 reporting period on waste water treatment facility upgrades, combined sewer overflow corrections, sewer line extensions and rehabilitations and other waste water treatment system improvements in nine communities. This figure is a substantial increase over the $26.5 million figure reported in the 2004 305b Report.

**Table 2.3. Basin Planning Initiative - Status for All Basins (as of December 2005).**

| | River Basin Identification Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Components of the Basin Planning Process** | **2** | **3&4** | **5** | **6** | **7** | **8** | **9** | **11** | **14** |
| Public forums held | C | C | O | I | C | | C | C | C |
| Watershed Council formed | C | C | C | | C | | C | C | C |
| Local water quality concerns identified | C | C | C | O | C | | C | C | C |
| Panel discussions on water quality issues held | C | O | O | O | C | | N/A | C | C |
| Strategies for water quality issues formulated | C | O | O | O | C | | C | C | O |
| Review of town plans & zoning regulations | C | I/O | O | I | C | | C | O | O |
| Develop water management type classification proposal | C | I/O | I | | C | | C | O | O |
| Meetings with towns on classification proposal | C | I/O | | | C | | C | I | |
| Watershed plan draft | C | I | I | | C | | C | I,C | I |
| Public hearings on draft plan | C | | | | | | C | | |
| Final basin plan | C | | | | | | C | | |
| Basin plan adopted by ANR Secretary | C | | | | | | C | | |
| Outreach to schools and local groups | O | O | O | O | O | | C | O | O |
| Basin Assessment Report | C | C | C | C | C | | C | C | C |
| Phase I Stream Geomorphic Assessments | O/C | O/C | O | O | O | O | O | C,O | O/C |
| Phase II Stream Geomorphic Assessments | O/C | I/O/C | O | O | O | O | O | C,O | O/C |
| Bridge and Culvert Inventory | O/C | I/O | | O | O | O | | O | O/C |
| Dam Inventory | I | | | | C | | C | I | |
| Biological Monitoring | O | O | I | C | O | O | C | O | O |
| Restoration Projects | C&O | O | O | O | C&O | C&O | O | C&O | C&O |

Key to Table: I = initiated, O = ongoing, C= completed
Basin 2 = Poultney-Mettowee Rivers; Basin 3 = Otter Creek; Basin 4 = Lower/Southern Lake Champlain; Basin 5 = Northern Lake Champlain; Basin 6 = Missisquoi River; Basin 7 = Lamoille River; Basin 8 = Winooski River; Basin 9 = White River; Basin 11 = West, Williams & Saxtons Rivers; Basin 14 = Waits, Wells, Ompompanoosuc & Stevens Rivers.

**Table 2.4. Municipal Pollution Control Project Starts.**
**(January 1, 2004 to December 31, 2005)**

| Community | Description | Est. Project Cost |
|---|---|---|
| ****** LAKE CHAMPLAIN DRAINAGE ****** | | |
| Burlington | Digester rehabilitation | $3,403,000 |
| Colchester | Individual On-Site Systems | $ 150,000 |
| Milton | Treatment Plant Upgrade | $9,310,000 |
| Richmond | Treatment Plant Upgrade. | $3,907,000 |
| Rutland | Combined Sewer Overflow Reduction | $6,400,000 |
| Shelburne | Sewer Relocation | $1,171,000 |
| ****** HUDSON RIVER DRAINAGE ****** | | |
| Pownal | New sewerage to serve 3 villages including sewers, pump stations & treatment plant | $27,690,000 |
| ****** LAKE MEMPHREMAGOG DRAINAGE ****** | | |
| Barton | Sludge Removal | $ 511,000 |
| Newport City | Treatment Plant Upgrade | $4,394,000 |
| ****** CONNECTICUT RIVER DRAINAGE ****** | | |
| Ludlow | Phosphorus Removal | $1,080,000 |
| Rochester | Treatment Plant Upgrade. | $4,399,000 |
| Saint Johnsbury | New sewerage to serve East St. Johnsbury village | $ 346,000 |
| Saint Johnsbury | Combined Sewer Overflow Reduction | $3,153,000 |
| Springfield | Treatment Plant Replacement and Enlargement | $10,909,000 |
| Springfield | Combined Sewer Overflow Reduction | $2,451,000 |
| **TOTAL COST** | | **$76,500,000** |

NONPOINT SOURCE (NPS) CONTROL 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 sixteen years of Clean Water Act Section 319 NPS implementation funding (1990-2006), Vermont has received about $19 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 pollutants. Effective BMPs can be structural, vegetative or management-based as well as regulatory or advisory.

Some notable activities carried out with Section 319 funding during this 305b reporting period include youth-based watershed restoration efforts, enabling nutrient management services for farm operators and funding assistance targeted at municipalities for reducing sediment runoff from unpaved

backroads. Importantly, the Program was able to assist a variety of locally-led efforts to improve water quality and/or habitat conditions (e.g. Sucker Brook restoration in Williston, the West River planning and management in Windham County and the Missisquoi River assessment and implemtntation in Franklin County).

Because of the diffuse but widespread nature of NPS source pollution, there are several other important programmatic aspects that are prominent features of Vermont's nonpoint program. Some management elements are part of DEC while others elements are conducted outside of DEC. Examples of the former include 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. Examples of the latter include logging erosion control carried out by the Vermont Department of Forests, Parks and Recreation and agricultural runoff control by the Vermont Agency of Agriculture, Food and Markets. The US Department of Agriculture is an important nonpoint source management partner in both forestry and agriculture arenas.

Specific details regarding the NPS program and project activities are available from DEC. DEC has maintained a listing of 319-assisted project titles by funding year. Vermont will continue to pursue and apply 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.

## CLEAN AND CLEAR INITIATIVE

The over abundance of phosphorus in many of Vermont's waterways causes great harm because it nourishes algae blooms, degrades the clarity and overall quality of the water and impacts wildlife. All of these constitute a serious threat to the economic vitality and natural beauty of Vermont. With 2005 being its second year of operation, the Clean and Clear Action Plan is a comprehensive, multi-faceted blue print for reducing phosphorus loading to Vermont's waterways through both point and nonpoint sources. Clean and Clear advances the pollution reduction framework established in the Lake Champlain Phosphorus Total Maximum Daily Load (TMDL) from the year 2016 to 2009, the 400$^{th}$ anniversary of the arrival of the French explorer Samuel de Champlain.

In 2005 Governor Douglas recommended, and the Vermont Legislature appropriated, a nearly twenty percent increase in the Clean and Clear budget for programs in the Vermont Agencies of Agriculture, Natural Resources and Transportation. This increase allowed for: additional stream restoration projects; reduced a greater percentage of the backlog of expired stormwater permits; enabled the development of nutrient management plans on farms and more water quality management financial assistance; broadened the level of public participation in watershed planning; and, provided for more outreach so that the public will become more aware of phosphorus issues. The major components of the Clean and Clear Action Plan Initiative are summarized below.

### *Agency of Agriculture, Food and Markets (AAF&M)*

***Best Management Practices & Alternative Manure Management***

This program provides significant financial assistance through cost share for structures designed to address discharges from farm production areas because the majority of milkhouse waste, silage and manure is stored there. The total estimate to fix all these major production area structural issues on Medium Farm Operations (MFO) is $15.4 million. An additional $0.88 million is needed to assure all MFO farms have nutrient management plans. This totals to $16.3 million for all MFO farm fixes to meet proposed regulatory standards. AAF&M estimates that to fix all of the manure waste storage,

silage leachate, roof runoff and milkhouse waste issues on all farms would cost over $61 million. Five Alternative Manure Management projects have been approved totaling $233,950.

***Conservation Reserve Enhancement Program (CREP)***

CREP encourages farmers to voluntarily install conservation buffers in riparian areas by offering rental payments in exchange for taking strips of land out of production. The goal of CREP is to enroll 7,500 acres by the year 2009. After an initial spike in acreage enrolled in 2002, CREP is showing slow, steady growth through 2005. About 1,175 acres have been enrolled with 200 acres enrolled in FY2005. Although there was a significant expansion of education and outreach efforts with additional staff, rental payments over the last few years had been insufficient to draw more enrollment. During 2005, rental payment rates have been increased which should result in higher enrollment.

***Nutrient Management Program***

Nutrient Management Plans (NMP) are part of the Integrated Crop Management Program (ICMP) and help bring soils to optimum phosphorus levels. Of the 205 MFOs in Vermont, 105 do not have NMPs in place. The cost of implementing NMPs on these farms is about $0.88 million. Some 68 farms have signed up to receive cost share contracts. It is anticipated that as more farmers become aware of water quality issues and regulations, this program will grow rapidly.

***Regulatory Programs***

Rules regarding Accepted Agricultural Practices (AAP), Medium Farm Operations (MFO) and Large Farm Operations (LFO) comprise the regulatory tiers of the Agricultural Water Quality Program and are designed to prevent discharges containing phosphorus and nitrogen. AAPs are a base level of management required of all farms. Proposed changes to AAPs include a mandatory 10 foot buffer on all riparian cropland. Other proposed changes include criteria for nutrient and pesticide storage, soil testing, riparian pasture management. MFOs will soon be subject to an increased level of management because of the potential impact that greater numbers of animals can have being confined in a single area. LFO revisions for nutrient management and waste storage structures will undergo rulemaking procedures in spring of 2006.

***Conservation District Outreach and Technical Assistance Program***

Vermont's 14 Conservation Districts provide direct technical assistance to farmers to help: establish compliance with AAPs; apply for help with conservation practices; apply for exemptions from winter spreading bans; conduct assessments of groundwater contamination and; provide agricultural representation in basin planning being conducted by DEC. The Winooski Conservation District hired two technicians who provide land treatment planning services in watersheds targeted by the Federal Watershed Protection Act.

***Basin Planning***

Agriculture is recognized as a major source of nonpoint pollution in many of Vermont's river basins and watersheds. The Winooski Natural Resource Conservation District has been awarded a grant of $100,000 to write and provide research for agricultural elements of seven basin plans which are required by state law.

*Agencies of Natural Resources and Transportation*

***Wastewater Discharges***

Dramatic progress has been made over the last several years in reducing the level of phosphorus in discharges from municipal wastewater facilities. Under Clean and Clear, the reduction of more than 3.3 metric tons per year of permitted phosphorus discharge was funded in FY2005-2006 for the Richford and Troy/Jay facilities. Funding of similar projects in Hardwick and Waterbury in FY2007 will lead to reductions of another 5 metric tons of permitted phosphorus in discharges.

***River Management***

The Vermont General Assembly provided a major boost to the River Management Program during the 2005 session, appropriating $1.25 million in capital funds for projects. Clean and Clear funds were also used to leverage $1 million in FEMA grants for mapping of erosion hazards which, when addressed, will help prevent transport of phosphorus-laden sediment. More than 3,000 miles of stream have been assessed by River Management staff and our partners since Clean and Clear began in 2004, generating data for more "on the ground" implementation projects in 2005.

***Better Backroads***

The Better Backroads Program helps control phosphorus runoff by assisting towns with improved road maintenance and construction techniques and grants to implement them. Grants pay for bank and ditch stabilization and culvert upgrades, all of which stem erosion and decrease the transport of phosphorus. More than 30 towns participated for the first time in the Better Backroads Program in 2005 due to a significant boost in Clean and Clear grant awards, which totaled $328,486. Five towns and two organizations were awarded grants for road inventory and evaluation projects. Some 41 towns and 3 organizations got grants to correct an erosion problem. The program stabilized 5.8 miles of roadside ditches in 2005, up from 4.0 miles in 2004. Forty-five culverts were stabilized in 2005; nearly double the 23 from 2004. On-site assistance is crucial to getting towns to participate in the program.

***Stormwater Management***

Substantial progress in reducing the backlog of expired stormwater permits combined with an increasing number of sites coming under permit control indicates that overall stormwater treatment is improving in Vermont. The number of individual or general permits for new developments or redevelopment projects has increased from 68 in 2004 to 111 in 2005. All new permits require stormwater treatment systems consistent with state standards in the 2002 Vermont Stormwater Management Manual. The first of 17 hydrology-based TMDLs for stormwater impaired watersheds will be submitted to EPA for approval in early 2006, with more expected later in the year. Two sets of stormwater rules have been established with one set governing stormwater management in watersheds of impaired waters; the other set governing how stormwater is managed in non-impaired waters.

***Erosion Control at Construction Sites***

With additional staff provided by Clean and Clear, there has been considerable improvement in permit processing, education and outreach and permit compliance. The overall rate of compliance is still too low. However, projects in impaired watersheds with Individual Permits have generally shown better compliance records. Despite a significant increase in outreach and education efforts, there were many cases where contractors were not aware of their obligations under Construction General Permits (CGP). After explaining the program, compliance at many of these sites showed improvement. As of November 2005, the number of CGP applications authorized in 2005 was 119, up from a total of 79 in 2004. The number of acres of construction disturbance regulated by the program increased from 998 acres in 2004 to 1,290 acres in 2005. Despite a 50% increase in permit activity, the increase in staff funded by Clean and Clear has allowed for a 92% rate of meeting Permit Expediting Process (PEP) time standards in 2005, up from 66% in 2004.

***Local Municipal Actions***

This program places a Water Quality Specialist at the Vermont League of Cities and Towns to encourage towns to adopt water quality regulations not covered by state law. The program began in early 2005 with the specialist delivering presentations at the Town Officer Education Conference series.

***Wetland Protection and Restoration***

Because wetlands are such a valuable resource in the battle against phosphorus loading, this program seeks to restore wetlands damaged or destroyed by development and agriculture. An $80,000 contract to develop a restoration plan for wetlands in the Lake Champlain Basin was awarded in 2005. Working with the Vermont Land Trust, the Hinesburg Land Trust and the Trust for Public Lands, ANR

has committed $120,000 to restore the natural hydrology to approximately 120 acres of wetland along the LaPlatte River. Clean and Clear also contributed $39,000 to a project in Benson. Partnering with The Nature Conservancy, 50 acres of an agriculturally altered wetland along the Hubbardton River will be restored which will eliminate an active source of phosphorus loading.

***Forest Management***

With forested areas covering over 75 percent of the state and yielding some 900,000 cords of wood per year, there is some concern about sediment discharges from silvicultural practices. Stream crossings are often the most likely to create a discharge, so loggers and landowners are being encouraged to use skidder bridges and other Best Management Practices. A watershed forester has been hired to facilitate these efforts and will begin work in February 2006. In 2004, the last year for which statistics are available, technical advisory teams investigated 34 cases of discharges from silvicultural activities. In all cases, discharges were brought under control and site restoration was achieved quickly in 30 cases.

***Monitoring***

Monitoring of water quality and land use is necessary to determine whether the goals of the Lake Champlain TMDL implementation plan are being met. Four segments of the Lake are not meeting their in-lake phosphorus standard and six others are borderline. Three segments are seeing increasing phosphorus levels and almost all of the lake's major tributaries exceed allowable limits. Development of land that had been in forested or agricultural use could increase phosphorus runoff which could offset some of the gains from the management activities of Clean and Clear. Citizen volunteers sampled 16 stations in Lake Champlain and 52 other lakes in 2005 as part of the Vermont Lay Monitoring Program, which this year produced a new Vermont Volunteer Surface Water Monitoring Guide. A study of St. Albans Bay has found there is an abundant supply of phosphorus in the sediments of the bay which is likely to nourish algae for many years to come. It is time to consider treatment options to counter this.

***Watershed Action Plans***

Watershed Planning educates citizens about what they can do to reduce pollution, coordinates pollution reduction activities and invites the public to help establish priorities for management projects. Under Clean and Clear, two additional Watershed Coordinator positions were recruited, giving the program five positions in the Lake Champlain Basin and two in the Connecticut River Basin. Watershed Coordinators, working to develop consensus through Watershed Councils, were the catalysts for dozens of water protection activities in 2005 involving more than 3,500 people.

The above serves to summarize the major components of the Clean and Clear Initiative. For those readers interested in a more complete description of the various elements, including program history, program accomplishments and the various indicators being used to document success, the Clear and Clear Action Plan: 2005 Annual Report should be studied. The report can be seen on the Clear and Clear web site: www.anr.state.vt.us/cleanandclear.

***Nature & Extent of Nonpoint Sources of Pollutants***

Pollution from nonpoint sources of pollutants continues to be the major source of water use impairment to Vermont surface and ground water resources. It is estimated that close to 90% of the miles and acres of the state's impaired surface waterbodies are the result of nonpoint source pollution. Water quality impacts and the potential for impact from nonpoint sources are apparent in each of Vermont's 17 drainage basins.

The reader is referred to Part Three (Surface Water Monitoring and Assessment) and Part Six (Groundwater Monitoring and Assessment) for further details regarding the causes and sources of NPS pollution within Vermont.

***Environmental Impact/Economic & Social Costs/Economic and Social Benefits of Effective Water 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 approximately $630 million. These facilities have improved the quality of 59 rivers and 3 lakes for such uses as swimming, fishing, boating and aquatic life. The $630 million figure includes the $76.5 million in improvements which started construction during the 2006 305b reporting period. Refer to Table 3.4 below for the location and estimated cost of these recent improvements.

*Nonpoint Sources*
Quantifying the financial resources expended on nonpoint source control of pollutants is not as easy to determine or link to specific river miles/lake acres of improvement as contributions of resources occur from many and various state, federal and local agencies as well as from landowners, volunteer groups, foundations, businesses and even corporations. There are two Clean Water Act (CWA) programs under DEC administration and a single state-funded program that address nonpoint source pollution control which can be highlighted.

The CWA programs are the Section 604b Pass Though Program and the Section 319 Program and the state-funded program is the Vermont Conservation License Plate Program. Funding for the two CWA programs from 1989 through 2006 has amounted to approximately $860,000 (604b) and over $19 million (319). The 604b Program has assisted the 11 Vermont regional planning commissions conduct a wide variety of water quality planning related activities. A portion of the 319 Program has provided funding assistance to a wide variety of governmental and non-profit organizations to carry out nonpoint source implementation efforts.

The notable state funded program is the Vermont Conservation License Plate Program. In the eight years of its existence (1998-2006), the program has awarded over $400,000 in state monies to many diverse groups for a wide variety of projects. Many of the funded license plate projects provide water quality and/or aquatic habitat benefits. Another extremely important state funded program (which addresses point sources as well) is the Clean and Clear Initiative that has been described previously.

As a way to offset some of these cost-benefit uncertainties, the 2004 Section 305b Report mentioned five fairly recent socio-economic evaluations related to recreational water use or water quality conditions. The reader is referred to the 2004 report for the noteworthy findings of those evaluations. In brief, the five surveys that were mentioned in that report include:

> The Center for Rural Studies at the University of Vermont conducted a survey in the fall 2002 of 1,338 Vermont households regarding their opinions of recreation resources. The survey[8] was done for the Vermont Department of Forests, Parks and Recreation as one component for the 2005 Vermont Outdoor Recreation Plan.

8 Center for Rural Studies. 2003. The 2002 Vermont Outdoor Recreation Survey Report and An Analysis of Change Since 1992. University of Vermont. Burlington, VT.

The Year 2000 Vermont Angler Survey[9].

The Year 2001 National Survey[10].

In the fall 2003 issue of *LakeLine*[11], researchers examine property sale prices and water quality relationships of lakes in 3 New England states (ME, NH, VT) to provide some understanding of the social value of environmental quality and the risk of degraded environmental quality.

A report in 2002 was issued describing a study of visitors to Vermont State Parks.[12] The study was conducted to improve current knowledge of the values and functions of the 47-state park system.

***Strategy to Achieve Comprehensive Monitoring & Assessment Coverage***

In accordance with EPA guidance and during the 2006 Section 305b reporting period, DEC completed a Water Quality Monitoring Program Strategy. The Strategy document consists of ten parts and addresses major elements necessary for monitoring the quality of ambient waters for the purpose of water quality assessment, planning and management. The monitoring strategy is written with a ten-year lifespan and includes annual and mid-term progress evaluations. Implementation of the Strategy began during 2004. The Strategy can be found as Appendix D.

The narrative appearing below is the executive summary that has been excerpted from the EPA-approved Vermont Water Quality Monitoring Program Strategy.

The ambient water quality monitoring program strategy provides a framework describing existing monitoring and assessment efforts in Vermont and elaborates on elements of an ideal monitoring program to meet several objectives. The Strategy has multiple uses and purposes and is organized into EPA's guidance "Elements of a State Water Monitoring and Assessment Program" (March, 2003). The Strategy presents a roster of specific monitoring goals and objectives and a listing of existing and potential monitoring designs for Vermont waters. Recommendations for core and supplemental water quality indicators are provided. Detail is provided on quality control and assurance, data management approaches, a description of data analysis and assessment procedures, and the use of these procedures to support federally required reporting. The final sections of the Strategy address suggestions for periodic review of the monitoring program and provide estimates of necessary resources for full program implementation. Throughout the Strategy, the term "waters" is intended to comprise rivers and streams, lakes, ponds and reservoirs, and wetlands. Groundwater has not yet addressed by this strategy.

Section One serves as an introduction while Section Two provides the goals and objectives to be met. The goals and objectives are as follows:

<u>Goal One: Predict and monitor the condition of Vermont's aquatic and wetland resources to:</u>

- identify emerging problems before they become widespread or irreversible;

9 Vermont Department of Fish & Wildlife. 2000. The 2000 Vermont Angler Survey. Prepared by the University of Vermont, School of Natural Resources. Waterbury, VT.
10 US Fish & Wildlife Service. 2003. 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation in Vermont. Washington, DC.
11 K.Boyle & Bouchard.R. 2003. Water Quality Effects on Property Prices in Northern New England. LakeLine. Journal of North American Lake Management Society. Pages 24-27.
12 A.Gilbert & Manning.R. 2002. Economic and Social Values of Vermont State Parks.

- provide information essential to protecting, maintaining and/or restoring the integrity and use of these resources;
- achieve comprehensive monitoring coverage of all Vermont waters;
- identify water quality conditions, impairments, causes, and sources; and,
- evaluate the success of current policies and programs.

Objectives for Goal One:

A. Identify the status of Vermont's aquatic and wetland resources
B. Identify trends in the condition of Vermont's aquatic and wetland resources, including high-quality waters in need of protection
C. Identify existing and emerging threats to Vermont's aquatic and wetland resources
D. Identify where watershed level activities impact aquatic and wetland resources
E. Provide information to support and evaluate Agency and Department planning, management and regulatory programs, including the development of environmental indicators
F. Respond to citizen complaints and emergency situations regarding Vermont's aquatic and wetland resources (as appropriate)
G. Determine compliance with Vermont Water Quality Standards, and identify where standards may need to be modified to account for natural conditions
H. Provide technical data and information to public water supply operators
I. Obtain monitoring data coverage for all waters such that each significant public water will be monitored directly, or will have its condition estimated based on a statistically unbiased random probability determination

Goal Two: Communicate, collaborate and coordinate with organizations, agencies, and the general public to:

- increase public knowledge of and involvement in aquatic and wetland resource monitoring and assessment (and hence water resource management);
- promote efficient and effective monitoring and assessment programs; and
- collect useful data to supplement state monitoring and assessment programs.

Objectives for Goal Two:

A. Develop a mechanism for identifying and coordinating monitoring and assessment programs in Vermont
B. Identify aquatic and wetland resource data needs and develop mechanisms to enable volunteer monitoring and assessment programs to collect data that are of high quality and relevant to those needs
C. Communicate with other state and federal agencies to assure complementary monitoring programs
D. Encourage volunteer monitoring programs

Section Three addresses monitoring designs. Detail is provided on existing monitoring approaches used in Vermont, including the rotational watershed assessment approach and existing core and supplemental projects, broken into physical, chemical, biological, and volunteer-based categories. A comprehensive listing of potential threats to Vermont waters is provided.

Section Four lists core and supplemental indicators of water quality that are measured by the individual monitoring projects. These indicators spring from the Vermont Water Quality Standards, but also include parameters that relate to ecological and habitat quality. Section Five describes approaches to quality assurance, provides a listing of active quality assurance project plans, and discusses briefly how quality assurance planning relates to quality management planning.

Section Six provides a listing of existing databases that house water quality information generated by the monitoring program. The section also discusses the current status of Vermont's water quality assessment databases, and relates information housed in those data archives to the Vermont Hydrographic Dataset. Section Seven describes how DEC assesses water quality data to arrive at determinations of water quality standards attainment, and further elaborates on approaches to listing waters where uses are not met. The Strategy references Vermont's Water Quality Assessment and Listing Methodology as a standalone document that guides the listing process. Section Eight describes required Federal reporting that is supported in large part by the monitoring program and associated assessment and listing processes. Finally, Sections Nine and Ten of the Strategy describe monitoring program review and institutional needs.

Specific recommendations are provided within each section. The highest priority items requiring funding include securing long-term technician and summer staff support for the biomonitoring and lakes programs, and developing a coordinator position to support volunteer organizations participating in the successful LaRosa Laboratory Services Partnership Program offered by DEC. Other priority items regard increasing consistency in the archiving of water quality assessment findings and expansion of the use of STORET (a national water quality data archive developed by EPA) to hold biomonitoring data.

The Strategy recommends using a hybrid of fixed station and probability-based surveys to assess the conditions of waters statewide. Projects that are developing biological indices of aquatic life use support for large rivers, lakes and reservoirs, and wetlands have identified needs. The Strategy also highlights approaches to developing nutrient criteria and modifying pathogen criteria. With respect to federal assessment methods and reporting requirements, the Strategy specifically recommends that assessment methods be fixed for a period of three assessment and listing cycles and that reporting during those periods be consistent. This will enable DEC to track changes in use attainment with time. From the roster of recommendations and strategies, several higher priority, unmet needs are evident and these are listed in the executive summary section of the strategy which can be seen on the web at: http://www.vtwaterquality.org/lakes/docs/lp_monitoringstrat.pdf.