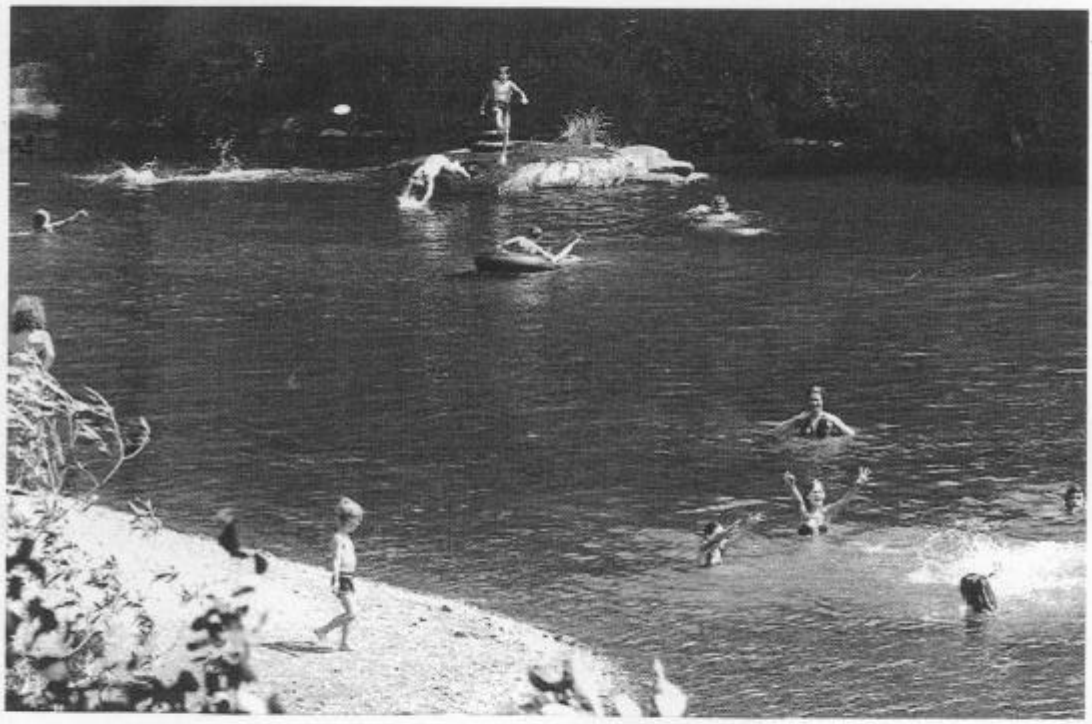
STATE OF VERMONT

2000 WATER QUALITY ASSESSMENT

305(B) REPORT



Bathers take to the waters of the Mad River at Moretown, VT (Photo credit: VT Department of Tourism & Marketing)

Agency of Natural Resources
Department of Environmental Conservation
Water Quality Division
Waterbury, Vermont 05671-0408

June, 2000

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Department of Environmental Conservation
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COMMISSONERS OFFICE
103 South Main Street
Waterbury, VT 05671-0401
802-241-3800
June, 2000

Dear Reader:

It is with a great deal of pleasure that I present to you Vermont's 2000 Water Quality Assessment [305(b)] Report. The report is required by Congress by Section 305(b) of the Clean Water Act. This water quality assessment summarizes Vermont's water quality conditions for 1998 and 1999 and includes updated water resources program information for rivers and streams, lakes and ponds, wetlands and groundwater. The report contains detailed water quality information from round 2 of the rotational assessment, including the Poultney/Mettawee River watersheds, the Ottauquechee/Black River watersheds and the Stevens/Wells/Waits/ Ompompanoosuc River watersheds. The report also includes updated cost/benefit information, monitoring, beach closures, among other information.

The water quality assessment found that 78% of Vermont's total assessed river and stream miles (5,261 miles assessed) fully support all water uses. Of 53,350 lake acres assessed, 22,940 acres (43% of lake acres assessed) fully support all uses. If the EPA guidelines regarding the fish consumption advisory were applied in their strictest sense, none of the state's surface waters would fully support water uses. However, states have been advised to assess their waters without the advisory so other polluting sources would not be "masked" by the mercury advisory.

Common pollutants found in the assessed waterbodies include silt, pathogens and nutrients, which come from eroding stream/lake banks, urban areas and agricultural lands. Additional causes of pollution occurring in certain of the state's watersheds include thermal modifications, organic enrichment/low dissolved oxygen, flow alterations, habitat alterations metals, noxious aquatic plants, and exotic species. Sources of these pollutants include atmospheric deposition, natural sources, flow regulation and habitat alterations, among others.

Many of Vermont's lakes and rivers have been cleaned up by construction of approximately 150 municipal and industrial waste water treatment facilities. However, as you can see from the figures above, much work needs to be done to complete the clean-up job - primarily to reduce pollution from nonpoint, or dispersed sources. We are indeed fortunate to have many volunteer groups around the state to assist us in this important work. As of last count, there were active watershed or lay monitoring groups on approximately 26 rivers, 31 lakes and 36 Lake Champlain stations. Their work is truly needed and greatly appreciated.

Your comments on the report or other comments or suggestions on ways to improve Vermont's water resources are always welcome. Please write to me or call me at the above phone number.

Sincerely,

Canute E. Dalmasse
Commissioner

CED:jm
enclosure

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LIST OF ACRONYMS USED IN THIS DOCUMENT

AAP	Acceptable Agricultural Practices
AMP	Acceptable Management Practices
ANCP	Aquatic Nuisance Control Program
ANR	VT Agency of Natural Resources
AOT	VT Agency of Transportation
BASS	Biomonitoring & Aquatic Studies Section
BMP	Best Management Practice
CSO	Combined Sewer Overflow (Sanitary and Storm Sewer Discharges in the Same Pipe)
DAF&M	VT Department of Agriculture, Food & Markets
DEC	VT Department of Environmental Conservation
Department	VT Department of Environmental Conservation
EPA, USEPA	Federal Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
FRAC	Forest Resources Advisory Committee
FS	Fully Supporting Uses as Defined by the Water Quality Standards
NPDES	National Pollution Discharge Elimination System
NOAV	Notice of Alleged Violation
NPS	Nonpoint Source Pollution
NRCS	National Resource & Conservation Service (Formerly SCS)
NWI	National Wetland Inventory
NS	Not Supporting Uses as Defined by the Water Quality Standards
GIS	Geographic Information System
GPS	Geo Positioning System
HHW	Household Hazardous Waste
IBI	Index of Biotic Integrity
O&M	Operation & Maintenance
ORW	Outstanding Resource Water
TMDL	Total Maximum Daily Load
UST	Underground Storage Tank
WBID	Waterbody Identification Number
WBS	Waterbody System
WMZ	Waste Management Zone
WWTF	Waste Water Treatment Facility

FOREWORD

Section 305(b) of the Federal Water Pollution Control Act (Clean Water Act, or CWA) requires each state to submit a biennial report to the Environmental Protection Agency (EPA), which provides information about the quality of the state's surface and ground waters. This water quality assessment [often called the *305(b) Report, or 305(b) Process*] summarizes Vermont's water quality conditions during the January 1, 1998 through December 31, 1999 reporting period. Also included is updated water resources program information for rivers and streams, lakes and ponds, wetlands and groundwater. The report includes updated cost/benefit information, monitoring, beach closures, among other information.

The 305(b) report also briefly provides the reader with an understanding of the programs designed to assess and reduce or eliminate water quality problems, as well as some special state concerns which have been identified. However, rather than repeating program and other information that was included in previous reports, this report refers the reader to earlier reports from time to time. The 1996 and 1998 305b reports may be found on the internet at: www.anr.state.vt.us/dec/water1.htm.

Vermont is now on a rotating basin schedule for assessing the state's waters, assessing one-fifth of the state each year. This 2000 305b Report contains detailed water quality information for round 2 of the rotating assessments. The basins included in this report are: Basin 2, the Poultney/Mettawee River watersheds; Basin 10, the Ottauquechee/Black River watersheds and Basin 14, the Stevens/Wells Waits/ Ompompanoosuc River watersheds. This report also contains a summary of the entire state's water quality, which has been updated with the most recent rotating basin water quality information.

The Water Quality Assessment reports whether or not the state's surface water uses as defined by EPA and the State Water Quality Standards are *fully supported, threatened/fully supported, partially supported,* or *not supported.* Water uses include, but are not limited to, drinking, aquatic life, recreation, fish consumption and agriculture. Determination of use support may be made either from *monitored*[1] information or from *evaluated*[2] information by water resources personnel, fish and wildlife biologists, aquatic biologists, lake association members and other qualified individuals or groups. The assessment report does not attempt to identify which segments of rivers and streams were either monitored or evaluated. The present software does not permit this type of data entry. When new software is installed, the Department will be able to report the number of miles evaluated or monitored.

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[1] Water quality assessment based on environmental data (biological, chemical or physical) less than 5 years old.

[2] Information obtained from professional opinions and department files. Also, information based on water quality sampling which is five years old or older.

For CWA 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 partially supported or not supported by either monitoring or evaluated information) are considered impaired (*Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates: Supplement, September 1997).* For CWA Section 303(d) listing and reporting purposes, impaired waters are those where one or more criteria of the Water Quality Standards are violated. Violations of Water Quality standards are substantiated by chemical, physical or biological water quality data collected through monitoring.

The 305(b) report is a highly visible mechanism for communicating to Congress, Vermont residents and the Vermont General Assembly the progress made in maintaining and restoring the state's water quality and the extent of the remaining problems. The 305(b) report has become increasingly important to support funding decisions to the state at the federal level under the Clean Water Act Section 106 formula. EPA’s Index of Watershed Indicators relies heavily on 305(b) reports. Also, the 305(b) report is an important tracking tool for the performance of water quality protection initiatives under the Core Performance Measures of the Performance Partnership Agreements and the Government Performance for Results Act. 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.

EPA's vision for State 305(b) reports is that the "...reports will characterize water quality and the attainment of water quality standards at various geographic scales." EPA's more detailed vision states that the 305(b) reports will:

- Comprehensively characterize the waters of the States, Tribes, Territories and the Nation, including surface water, ground water and wetlands. Progress should result in full coverage by 2002.
- Use data of known quality from multiple sources to make assessments
- Indicate progress toward meeting water quality standards and goals.
- Describe causes of polluted waters and where and when waters need special protection.
- Support watershed and environmental policy decision making and resource allocation to address these needs.
- Describe the effects of prevention and restoration programs as well as associated cost and benefits.
- In the long term, describe assessment trends and predict changes.
- Initiate development of a comprehensive inventory of water quality that identifies the location and causes of polluted waters and that helps States, Tribes, Territories direct control programs and implement management decisions.

In order to achieve the vision and long-term goals for the 305(b) process and to coordinate reporting efforts among the States, Territories, Interstate Commissions and Tribes, EPA requested that the following goals be addressed in the 2000 305(b) report:

- *Expand use of biological indicators and reporting*
  The Department has expanded its ambient biological monitoring activities each year since 1985. Since 1985, the DEC has compiled biological monitoring data from over 1000 sites, representing 1850 macroinvertebrate and 630 fish community sampling events." The figure for macroinvertebrate sampling represents some 1280 more sampling events than reported in the 1996 305(b) report.

- *Improve data management, increase the documentation of data quality, and increase the use of electronic databases and geographic information systems.*
  The Department's Analytical laboratory conducts its business under the auspices of EPA's Quality Assurance/Quality Control Plan (QA/QC), and monitoring is carried out under QA/QC Project Plans. The Department now uses an Access© database for improved 305(b) lakes data management, and has increased the documentation of data quality. Biological monitoring data is of the highest quality due to its being managed by professional biologists. Regarding electronic reporting, the Department submits rotating assessment data to EPA as each one-fifth of the state is completed. As to geographic information systems (GIS), Vermont is presently gearing up to spatially locate water quality information for rivers and streams. At this time, lakes and ponds have been spatially located for water quality reporting purposes.

- *Demonstrate a significant expansion in the number of waters assessed across all water body types and uses and improve the quality of monitoring and assessment data and reporting.*
  Vermont has responded to this goal by implementing a rotational assessment process such that the rivers and streams and lakes and ponds of all seventeen major basins in the state are assessed once every five years. This has resulted in much more detailed assessments and many more miles/acres of waterbodies being assessed each year, as well as specific follow-up action to monitor suspected problem sites and correct impairments.

- *Increase assessments of drinking water use support*
  This remains a goal for the Department. Until sufficient resources are available to specifically perform drinking water use source support assessments, they will be performed as part of the Department's yearly rotational basin assessments.

- *Develop a process for reporting by hydrologic unit (georeferencing*)
  The Department uses waterbody identification numbers (WBID) for reporting by hydrologic unit. All waterbodies in the state are assigned waterbody identification numbers and are georeferenced. The WBID consists of the state two-letter abbreviation followed by a two-digit basin number, then a two-digit (river) or five-digit (lake) waterbody number. Waterbodies may consist of several small tributaries, a lake or a portion of the mainstem of a river. For example, WBID #VT08-01 is the mainstem of the Lower Winooski River (Basin 08). WBID #VT05-04L01 is the Northeast Arm of Upper Lake Champlain. There are 556 lake and pond waterbodies and 210 river and stream waterbodies designated in Vermont.

The Department has developed a data base table to link hydrologic unit codes (HUC 14s) to all but three WBIDs. This allows the Department to exchange data between the two systems.

Part 1: Executive Summary/Overview

Background

Vermont has approximately 7,100 miles of rivers and streams, 300,000 acres of fresh water wetlands and 808 lakes and ponds (those over 5 acres in size or those named on USGS maps) totaling 228,920 acres. The state's waters (not including wetlands) are classified as Class A or Class B, with an overlay Waste Management Zone in Class B waters for public protection below sanitary wastewater discharges. 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 that have significant ecological values.

There are approximately 164 miles of Class A rivers and streams and 1,740 acres of Class A lakes and ponds in Vermont (not including waters above 2,500 feet elevation which are also Class A). In addition, there are 6,935 miles of Class B rivers and streams and 227,184 acres of Class B lakes and ponds. Approximately 313 miles of the Class B rivers and streams and 15 acres of lakes and ponds are Waste Management Zones. The Batten Kill, the West Branch of the Batten Kill, Lower Poultney River, a segment of the Ompompanoosuc River and Pikes Falls on the North Branch of Ball Mountain Brook have been designated by the Vermont Water Resources Board as Outstanding Resource Waters.

Overall Description of Vermont's Water Quality

The water quality of all Vermont’s rivers and streams and lakes and ponds is considered good. The federal EPA has requested states to also assess the state’s water quality considering the fish consumption advisory for mercury which was issued in June, 1995 and revised in July, 1997. The advisory was issued as the result of fish tissue sampling which showed mercury in the tissue of all fish, particularly in walleye and lake trout, and also PCBs in lake trout in Lake Champlain (See updated advisory as Appendix A). Taking the advisory into consideration, the overall water quality of all the state's waterbodies would be rated as fair.

Vermont also has identified 122 impaired surface waterbodies and 196 unique water quality impairment problems in part A of the 1998 List of Waters.

With regard to Vermont’s wetlands, their water quality is believed to be generally good, although Vermont does not have a specific program of assessing wetland water quality. 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; however, the quality is considered to be excellent as the result of reports of very few contaminated public water supplies.

Water Pollution Control Program

GENERAL

Watershed Approach - Vermont is in the process of refining the watershed approach to surface water quality planning. The draft document, *Watershed Improvement: A Strategy for the Next Century,* calls for basin surface water plans to be developed on a periodic basis. Appendix E contains the draft Vermont Watershed Approach to Surface Water Planning.

Water Quality Standards - The Water Quality Standards are the foundation of the state's water pollution control and water quality protection efforts. The present Standards were adopted April 2, 1997 and contain a few changes from those that were in use when the 1996 and 1998 305(b) reports were prepared. The revised Vermont Water Quality Standards, which were adopted June 10, 1999, were approved by EPA on December 22, 1999 and will become effective on July 2, 2000.

POINT SOURCE CONTROL PROGRAM

Approximately $44 million dollars were spent during the 1998-1999 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 15 municipalities.

NONPOINT SOURCE CONTROL PROGRAM

Overview - Vermont was one of the first states in the country to have an EPA-approved Nonpoint Source Management Program (March, 1989). Since its inception in 1990, Vermont has received approximately $7.8 million in Clean Water Act Section 319 Nonpoint Source (NPS) funds to implement a variety of activities directed at high priority waterbodies. The goal of the NPS management program is to encourage the successful implementation of best management practices (BMPs) by farmers, developers, municipalities, lakeshore residents and landowners to prevent or reduce the runoff of pollutants. During the reporting period, the regional office of US EPA approved the Upgrade for an Enhanced Vermont Nonpoint Source Management Program.

Some notable activities carried out with Section 319 funding during the last two years included agricultural BMP evaluation and development, youth-based watershed restoration efforts, further water quality characterization for remediation of an abandoned copper mine and cooperative funding assistance from the Partnership Program for the Better Backroads Program to protect surface waters near town roads.

Section 604(b) Program - Work under the 604(b) Program continued with the awarding of pass through funds to the 12 Regional Planning Commissions to determine the

causes of pollution and develop plans to resolve those problems. Other notable 604(b) work included field evaluation of the water quality of rivers and streams as part of the second and third year's rotational basin assessment, and preparation of the 305(b) Water Quality Assessment Report.

Other Federal Sources - FFY98 EQIP funds ($0.94 million) were directed as cost sharing assistance to approximately 120 farms for nonpoint source pollution control. In addition, the Lake Champlain Management Conference receives federal funding for its many NPS programs within the Lake Champlain basin (See below).

Lake Champlain Management Conference - The Lake Champlain Management Conference, in its October 1996 Plan, has recommended three priorities for action to improve the water quality of Lake Champlain. They are: 1) Reduce phosphorus pollution; 2) Prevent pollution from toxic substances; and 3) Manage nuisance nonnative aquatic plants and animals. Steady progress has been reported in the reduction of both point and nonpoint sources of phosphorus, and remediation of sediment-bound contaminants. A comprehensive basin-wide non-native species management plan has been written and was submitted to the Aquatic Nuisance Species Task Force in February 2000.

Agriculture - In 1995, the Legislature created a state financial assistance program to help pay for voluntary construction of farm improvements designed to abate NPS waste discharges. The sum of approximately $350,000 was appropriated by the Vermont Legislature for this purpose in 1995 and 1996, and approximately $500,000 was appropriated in 1997. The annual amount was increased to $750,000 in 1998 and 1999. These funds have resulted in about 310 grants to agricultural landowners who installed some 500 BMPs. During the reporting period, permitting rules were adopted which affect Large Farm Operations (LFO). It has been estimated by the DAF&M there are approximately 30 farms existing in Vermont that qualify as an LFO.

Storm Water - Due to development in certain watersheds of Vermont's higher elevation, or lower ordered streams (hydrologically sensitive streams, or HSW) and the continuing debate over stream gravel mining, a study authorized by the Department quantified the relationship between stream geomorphology and watershed land use activities.

With regard to EPA's Phase I Rules, the state's cities are exempt due to their being less than 100,000 population; however, the Department has been issuing General Stormwater permits for developments larger than 5 acres since 1991. Storm Water Phase II Rules became effective in December, 1999. Certain of Vermont's larger cities will be affected by these new rules.

River Restoration and Protection - This new initiative was started after severe flash floods devastated several streams in northern Vermont. The program focuses on restoring natural channel stability. The Trout River in Montgomery is the first river (a one mile segment) to be restored under the program, with several more awaiting additional resources.

Cost Benefit Assessment

The total expenditure of state, federal and local funds for all municipal wastewater treatment facilities and appurtances to date has been approximately $512 million. Nearly $44 million in wastewater treatment appurtenances and improvements were constructed during the 1998-1999 reporting period, which have further improved the water quality of nine rivers and one lake.

The amount of funding expended on nonpoint source (NPS) control of pollutants is not as easy to calculate due to the various state and federal agencies as well as landowners and volunteer watershed groups which deal with NPS pollution. Aside from several federal and state cost sharing programs to assist with planning and implementation of NPS reduction from agricultural sources, there are two federal programs that deal with NPS pollution control - the 604(b) Pass Through program (planning) and the Section 319 (implementation) program (now a component of the Performance Partnership grant). Expenditures for the two programs amounted to approximately $581,000 from FFY89 through FFY99 [604(b)] and approximately $7.8 million from 1990 through 1999 (Section 319).

Special State Concerns and Recommendations

All but two special state concerns which were identified in the 1996 and 1998 305(b) reports remain as special concerns. These two concerns which have been or are presently being addressed are: revision of the Water Quality Standards and the need for Comprehensive Water Resources Planning and Protection. The report updates seven previously-identified concerns and discusses two additional concerns for this reporting period:

- Groundwater (Previous)
- Polluting discharges from large farms (Previous)
- Road runoff to waterbodies (Previous)
- Lack of statewide vegetated buffer requirements (Previous)
- Atmospheric deposition (Previous)
- Hydrologic modifications in lakes (New)
- Hydrologic modifications in rivers and streams (New)
- Exotic aquatic species as pollutants (Previous)
- Eutrophication of Vermont lakes (Previous)

Current Surface Water Quality Monitoring Program

Overview - The surface water quality monitoring activities conducted by the Department during 1998-1999 are similar in most respects to those conducted during the 1996-1997 reporting period. They are described in the 1996 and 1998 305(b) reports and in the document, “Monitoring of the Aquatic Environment.” The documents are available from the Department. They are also available through the internet at: www.anr.state.vt.us/dec/water1.htm. The following are new monitoring/evaluation assessment initiatives begun during the reporting period.

New Monitoring Projects - The Lake Bioassessment Program and Assessment of Mercury in Hypolimnetic Sediments of Vermont and New Hampshire Lakes Project remain active, high priority lake monitoring projects. In addition, two lakes are the subject of new special studies: Lake Parker in Glover and Ticklenaked Pond in Ryegate. Also, new monitoring activities have been conducted in conjunction with an EPA grant to evaluate the use of biocriteria in certain wetlands, primarily vernal pools and white cedar swamps.

Rotational Watershed Assessment - Vermont's rotational watershed water quality assessment process began in the spring of 1997. Two rounds of assessments have been completed and the third is underway. Six basins have been assessed to date. The first round of assessments included: Otter Creek (Basin #3), Lower Lake Champlain Direct (Basin #4) and the White River (Basin #9). The second round of assessments included: Poultney, Mettawee (Basin #2), Ottauquechee, Black (Basin #10), and the Stevens, Wells, Waits, Ompompanoosuc (Basin #14). A summary of the second round of assessments is included in this report.

Plan for Achieving Comprehensive Assessments

The rotational watershed assessment process described above and elsewhere in this report is helping Vermont to achieve a more comprehensive assessment every five years. Every waterbody in every basin is being either evaluated or monitored at least once every five years. The proposed *Watershed Improvement Strategy*, of which the rotating assessment will be a part, will also become part of Vermont's comprehensive assessment plan.

Assessment Methodology

River and stream and lakes and ponds data was updated and incorporated into the database for this report. Included in the database is information from the first two rounds of rotational watershed water quality assessments. This information consists of monitored and evaluated water quality data, best professional judgement from biologists and information from numerous agencies, offices and volunteer groups.

Most of the water quality information for rivers and streams was based on evaluated assessments. The remainder of the river and stream information was based on data obtained through monitoring, primarily from the Ambient Biomonitoring Network. Water quality information for wetlands was not determined because data was not available. With respect to lakes and ponds water quality information, most of the assessed inland lakes and all of Lake Champlain were monitored. The remainder of the lakes and ponds information was based on evaluated information.

In conjunction with an effort led by New England Interstate Water Pollution Control Commission (NEIWPCC) to create uniform New England 305(b) decision-making methods, Vermont has adopted a set of 305(b) assessment guidelines which are slightly more stringent than those used previously. This has resulted in minor reductions in acreages and miles previously identified as partially or not supporting uses based on data or information of insufficient quality.

Section 303(d) Waters

The Section 303(d) 1998 List of Waters, finalized in December 1998, was approved by the regional office of US EPA in August 1999. The 1998 List of Waters contains two sections. As mentioned earlier, Part A identifies 122 impaired surface waterbodies and 196 unique water quality impairment problems. The waters on Part A are targeted and scheduled for total maximum daily load (TMDL) development. Part B includes 187 waterbodies and 334 previously-reported "problems" which were listed as impaired in 1996 and which have been "de-listed." The Department will be preparing a Year 2000 303d List of Waters in a similar two-part format.

Rivers and Streams Water Quality Assessment (Statewide)

Including the round two waters assessed for this report, 78% of Vermont's total assessed miles (5,261 miles assessed) fully support designated water uses. Approximately 38% of the fully supported miles (22% of total assessed) are threatened. Approximately 15% partially support uses, and 7% do not fully support designated uses. Applying the fish advisory to all the state's rivers and streams would result in no rivers and streams fully supporting designated uses, 93% would be partially supporting, and 7% not supporting. This is due to the EPA guidelines, which, under the strictest interpretation, require waters to be designated as partially supporting if there are any fish consumption advisories for the general public. As stated in the 1998 305(b) report, nonpoint sources of pollution, especially sediment, remain the most widespread cause of water quality impairment affecting rivers and streams.

Lakes and Ponds Water Quality Assessment (Statewide - Inland Lakes Only - Not Including Lake Champlain)

Overall statewide use support indicates that 22,940 acres (43% of the total assessed inland lake acres of 53,350 acres) fully support all uses. Approximately 12,488 of the fully supporting acres (23% of total assessed) are threatened. Approximately 23,918 acres (45% of total acres assessed) partially support all uses, and 6,492 acres (12% of total lake acres assessed) do not support uses. If the fish consumption advisory were applied, based on the strictest interpretation of EPA guidelines, no lake acres would be fully supported, 88% of Vermont's inland lake acres would be partially supported, and 12% would be not supported

Rotating Basin Assessment (Specific Watersheds)

Assessment of use support in the Poultney-Mettawee Basin indicates that approximately 86% of the assessed river miles, and approximately 69% of assessed lake acres fully support designated uses. Assessment of use support of the Ottauquechee-Black River Basin indicates that approximately 86% of the assessed river miles and 40% of the assessed lake acres fully support designated uses. Assessment of use support of the Stevens, Wells, Waits and Ompompanoosuc River Basin indicates that approximately 82% of assessed river miles and 78% of assessed lake acres fully support designated uses.

Wetlands

An analysis of wetland loss between 1990 and 1998 shows that there have been a total of 257 acres of documented wetland loss and 446 acres of documented wetland impairment due to developments. During the same period, approximately 537 acres of wetlands were saved by encouraging developers to adjust the footprints of their proposed developments to avoid wetlands.

Public Health Concerns

There were eleven reported public beach closures in Vermont during this reporting period. Included, were four state park beach closures, which were due to unknown sources. It is believed that most of the Burlington area (Lake Champlain) beach closures were due to urban runoff and faulty septic systems. The permanent closing of Blanchard Beach at Oakledge Park in Burlington is believed to be caused by illegal sewer pipe connections to the stormwater system, plus urban runoff.

Fish consumption advisories continue in effect due to mercury contamination. Still in effect is the 1989 fish consumption advisory for lake trout over 25" in length in Lake Champlain due to PCBs and brown trout in the Hoosic River, also due to PCBs.

There were no closures of drinking water supplies during the reporting period; however, there were five boil water notices during the period.

Ground Water

The majority of Vermont's citizens depend upon ground water for drinking and other uses. Generally, the quality of Vermont's ground water is considered to be excellent, although no comprehensive studies have been completed on groundwater quality due to a lack of data and the resources required to gather and assess the needed data. The ground water quality assessment of “excellent”is based on the small number of public water supplies which have detected contamination.

PART II: BACKGROUND

PART II: BACKGROUND

Chapter One: Vermont's Surface Water Resources

Vermont has approximately 7,100[3] miles of rivers and streams, 228,920 acres of lakes, reservoirs and ponds and 300,000 acres of freshwater wetlands. The surface area of lakes, ponds and wetlands represent 826 square miles of water, or 8.5% of the state's total 9,609 square miles. Vermont's border waters include the Connecticut River on the east (border with New Hampshire), Lake Memphremagog 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 seventeen major river basins in Vermont, which drain to one of four regional drainages: Lake Champlain, the Connecticut River, Lake Memphremagog, or the Hudson River.

Table II.1.1 - Atlas

State population	562,758 (1990 Census)
State surface area	9,609 square miles
Number of water basins	17
Miles of perennial rivers and streams[4]	7,099
Border miles of shared rivers/streams (subset)[5]	262
Number of lakes, reservoirs and ponds (at least 20 acres)	285
Number of lakes, reservoirs and ponds (at least 5 acres but less than 20 acres)	317
Number of significant, lakes, reservoirs and ponds (less than 5 acres)	206
Acres of lakes, reservoirs and ponds[6]	228,920
Acres of freshwater wetlands[7]	300,000

[3] Source: EPA's Total Waters Database. Past 305(b) reports have relied upon Don Webster's 1962 list of Vermont waters; however, many errors and omissions have been discovered in this early listing. Specifically, many streams have been left out or lengths of rivers and streams have been underestimated.

[4] Includes the Connecticut River

[5] Connecticut River - 238 miles; Poultney River - 24 miles

[6] Includes some private waters and some waters less than 5 acres in size. This figure also accounts for a 5-acre pond which was previously of undetermined size.

[7] Does not include wetlands on agricultural lands which are actively used for agricultural purposes

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

Total Waters/Mapping

Until Vermont completes its GIS mapping of waterbodies, the 305(b) Report will use EPA's 1995 estimate of total river and stream miles. Using Clean Water Act 604(b) Pass Through funding, the Regional Planning Commissions (RPC) are gradually digitizing all of Vermont's waterbodies on GIS maps by waterbody ID number. Presently, all but one or two of the RPCs have either completed their waterbody mapping or are planning to do so. In addition, the Agency, in coordination with the RPCs and Vermont Center of Geographic Information, is developing a statewide map of waterbodies. When the waterbodies have all been mapped, then Vermont will be able to determine the total mileage of its rivers and streams.

Maps of the three basins which were assessed during the second year of the rotating basin assessment are included in this report.

Chapter Two: Water Pollution Control Program

Watershed Approach

Vermont is refining its basin approach to surface water quality planning (See the draft paper entitled *The Watershed Improvement Project: A Strategy for the Next Century* (Appendix B). This innovative approach, when adopted, will motivate, through watershed managers, state and local interests including towns, local commissions and watershed groups to improve water quality through watershed protection and restoration goals identified at the local level.
Specific outputs include, among others, seventeen basin plans adopted and revised every five years.

The Department has proposed a new initiative, entitled *Proposed Watershed Improvement - A Strategy for the Next Century*. If approved by the VT Legislature, it would place watershed managers in the regional offices to provide individual assistance to lake, river and watershed groups and determine watershed management needs of communities, among other responsibilities .

In addition to basin assessments, (see page III-4 for a discussion of the on-going rotational basin assessment process), the basin plans will summarize current and past (within five years) assessment, planning, and implementation activities at the state and local level in the basin. The plans 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.

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Water Quality Standards

The Water Quality Standards are the foundation for the state's water pollution control and water quality protection efforts. The Standards provide the specific criteria and policies for the management and protection of Vermont's surface waters. The classification of waters as Class A, Class B or Class B with Waste Management Zone (WMZ) are the management goals to be attained, if not already attained, which are necessary to protect the designated water uses for each class. The existing Water Quality Standards were adopted April 2, 1997, and were used as a basis for this report.

The Water Quality Standards call for the protection of existing uses and the maintenance of water quality necessary to protect those existing uses. Existing water uses are those uses which have actually occurred on or after November 28, 1975 in or on a waterbody whether or not the uses are included in the standard for classification of the particular waterbody. Determinations of what constitutes an existing water use on a particular waterbody shall be made on a case-by-case basis by the Secretary.

The Department has revised the Water Quality Standards, which take effect July 2, 2000. Included in the new Standards will be narrative, biological criteria. Associated implementation procedures are being developed for the biological criteria. Another revision to the Standards involves the regulation of stream flows and the inclusion of specific criteria for minimum conservation flows.

Surface Water Classification

All surface waters in Vermont are classified as either Class A or Class B (see Table II.2.1). Class B waters comprise approximately 98% of all waters in the State, and are managed to achieve and maintain a high level of quality that is compatible with values and uses as presented in the table. The July 2, 2000 Water Quality Standards recognize two categories of Class A waters. Class A(1) Waters are ecological waters, which are managed to maintain waters in a natural condition. Class A(2) Waters are public water supplies. The new Standards contain a provision which calls for all Class B waters to be eventually designated as being either Water Management Type 1, Type 2 or Type 3, depending upon the protection and management which recognizes their attainable uses and the level of water quality protection already afforded under the antidegradation policy.

Class A Reclassifications

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 reclassified to Class A. A reclassification 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, 10 V.S.A. § 1253. No streams have been reclassified to Class A since the 1998 305(b) Report.

The Vermont Natural Resources Council filed petitions with the Water Resources Board to reclassify the Nulhegan River and its tributaries to Class A and as Outstanding Resource Waters; however, the petition was withdrawn due to the need for more water quality data. The Department will conduct a water quality assessment for the Nulhegan River during 2000.

Outstanding Resource Waters

An overlay of both Class A and Class B waters is an 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.

Table II.2.1 Summary of Classified Uses and Values (Existing)

Classified Uses & Values	Total Size Classified for Use	
	Rivers (miles)	**Lakes (acres)**
Class A: ! water quality uniformly excellent ! enjoyment of water in its natural condition ! contact recreation when compatible ! public water supply with disinfection ! high quality waters with significant ecological value	164 approx.(not including all waters above 2500' elevation)	1,736
Class B: ! water consistently exhibits good aesthetic value ! swimming & recreation ! public water supply with filtration & disinfection ! high quality habitat for aquatic biota, fish and wildlife ! irrigation and other agricultural uses	6,935	227,184
TOTALS	**7,099**	**228,920**

Point Source Control Program

Vermont administers a well-planned and comprehensive direct discharge water pollution control program, consisting of planning advances, construction grants and loans, permitting and compliance monitoring. 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 shifted emphasis to refurbishment of existing WWTFs, the completion of phosphorus reduction upgrades (Table II.2.2), advanced waste treatment, correction of CSOs (Table II.2.3), control of toxics, pollution prevention activities and facility enlargements.

During the 1998-99 reporting period, construction commenced on CSO corrections, sewer line rehabilitations and extensions, sludge handling and sewer system improvements, wastewater treatment plant upgrades, and phosphorus reductions. These projects are being funded by state, federal and local funds of approximately $44 million (Table II.2.4).

All 3 of the phosphorus reduction projects in Vermont in the Lake Memphremagog basin have now been completed. Of the 33 planned phosphorus reduction projects in the Vermont portion of the Lake Champlain basin, 21 have been completed. It is hoped that the remaining Lake Champlain basin projects will be completed by 2001.

Of the 29 planned CSO correction projects, 20 have been completed, 4 are underway, 3 are pending, one will be initiated in the spring of 2000, and one will be initiated in 2003.

Table II.2.2. **Phosphorus Removal Projects**
Champlain And Memphremagog Drainage Basins
Construction Status

Municipality	Construction Status	Comments
Champlain Drainage Basin		
Barre City	Completed	
Brandon	Construction in 2000	
Burlington (North Plant)	Completed	
Burlington (Main Plant)	Completed	
Burlington (East Plant)	Completed	
Cabot	Construction in 2000	
Castleton	Completed	
Enosburg Falls (Phase I-Chem)	Completed	
Enosburg Falls (Phase II-Bio)	Construction in 2000	May start later
Essex Jct.	Completed	
Fair Haven	Construction in 2000	
Hinesburg	Completed	
Johnson	Completed	
Middlebury	Completion in 2000	
Milton	Construction in 2001	May start later
Montpelier (Phase I)	Completed	
Montpelier (Phase II)	Underway	
Montpelier (Phase III)	Construction in 2001	
Morrisville	Completed	
Northfield	Construction in 2001	May start later
Poultney	Construction in 2000	
Richmond	Construction in 2001	May start later
Rutland City	Completed	
S. Burlington (Bartlett Bay)	Completed	
S. Burlington (Airport Parkway)	Completed	
Shelburne (Plant #1)	Completed	
Shelburne (Plant #2)	Completed	
St. Albans City & NW Corrections	Completed	
Stowe	Completed	
Swanton	Completed	
Vergennes	Completed	
West Rutland	Underway	
Winooski	Completed	
Memphremagog Basin		
Barton Village	Completed	
Newport City	Completed	
Orleans	Completed	

Table II.2.3. **Combined Sewer Overflow Projects Construction Status**

Municipality	Construction Status	Comments
Barton	Completed	
Bennington	No Project	
Bellows Falls	Completed	
Brandon	Completed	
Burlington	Completed	
Enosburg Falls	Completed	
Hardwick	Completed	
Hartford	Completed	
Ludlow	Done without state assistance	
Lunenburg	Done without state assistance	
Lyndon	Completed	
Middlebury	Completed	
Montpelier - Phase 1	Completed	
Montpelier - Phase 2	Started Fall 1999	
Newport City	Completed	To be completed by 2003
Northfield	Completed	
Orleans	Completed	
Poultney	Underway	
Randolph	Completed	I/I project rather than CSO
Richford Village	Underway by Village	
Rutland City - Phase 1	Completed	
Rutland City - Phase 2A	Pending	Monitoring Phase 1
Rutland City - Phase 2B	Pending	Monitoring Phase 1
Springfield - Phase 1	Initiate Spring 2000	Completion by 2003
Springfield - Phase 2	Initiate in 2003	Completion by 2005
St. Albans City	No Project	Work has been ongoing since 1984 and consists of storm sewer separation affecting 7 of the approximately 20 sewer overflow locations.
St. Johnsbury - Phase 1	Underway by Town	Funding limitations are delaying project
St. Johnsbury - Phase 2	Not yet determined	
Swanton	Completed	
Wilmington	Done without state assistance	Done w/WWTF upgrade
Windsor	Completed	
Winooski	No Project	I/I problems w/no CSO
Woodstock	No Project	

Table II.2.4 Municipal Pollution Control Project Starts
January 1, 1998 to December 31, 1999

Community	Description	Est. Project Cost
Town of Bridgewater	WWTF upgrade for odor control, emergency power & septic/sludge handling	$250,000.
Town of Middlebury	New 2.2 mgd treatment plant with phosphorus removal, solids handling and outfall	15,375,000.
Town of Milton	Sewer rehabilitation	875,000.
City of Montpelier	Combined sewer overflow elimination - Phase I - Contract 4	1,500,000.
City of Montpelier	Combined sewer overflow correction - Phase II - Contract 1	750,000.
City of Montpelier	Digester modification & sludge handling improvements at the WWTF	1,400,000.
Village of Morrisville	WWTF Improvements for phosphorus removal & sludge handling	650,000.
Village of Richford	Lagoon aeration improvements at WWTF	360,000.
Town of Shelburne	Upgrade of Plant #1 to 440,000 gpd & #2 to 660,000 gpd including septage hauling	8,700,000.
City of South Burlington	Upgrade of Bartlett Bay WWTF to 1.25 mpg with ultraviolet disinfection, sludge handling & outfall	5,300,000.
Town of Stowe	Mountain Road sewer	1,300,000.
Thetford Town School District	New septic system	300,000.
City of Vergennes	Sewer rehabilitation	750,000.
Town of West Rutland	Upgrade of WWTF to 475,000 gpd with sequential batch reactor treatment system, u/v disinfection, pump st. & sewer system improvements	3,300,000.
Williston Fire District No. 1	Sewer collection & transmission main	1,100.000.
City of Winooski	Upgrade of WWTF with new clarifier & sludge handling	1,300,000.
Town of Woodstock	Upgrade of WWTF for sludge handling including sludge storage tank & transport vehicle	750,000.
	TOTAL	**$43,960,000**.

Chapter Three: Nonpoint Source (NPS) Control Program

Pollution from nonpoint sources continues to be the major source of water use impairment to Vermont surface and ground water resources. It is estimated that 90% of the miles and acres of the state's impaired waterbodies are caused by NPS.

As one of the first states in the nation to have an EPA-approved NPS Management Program (March 1989), 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 ten years of available Section 319 NPS implementation funding (1990-1999), Vermont has received approximately $7.8 million to implement a variety of activities.

In response to the release of the President's Clean Water Action Plan (February 1998), the State of Vermont and the US EPA worked together to review the NPS Management Program document of 1988 as well as revise and implement enhanced State NPS management programs that incorporate the nine essential and key elements of a state program defined by US EPA. Those states which incorporate all nine key elements in their enhanced programs will receive financial incentives - such as being eligible to receive additional Section 319 funds - beginning in federal fiscal year 2000. The Enhanced Vermont NPS Management Program was approved by the regional office of US EPA in October 1999.

Specific details regarding NPS program activities are available from the Department. Readers of this 305b Report should refer to the 1996 305b Report for a discussion of these projects and a listing of project titles by funding year, FFY1990 through FFY1995 (Appendix F of that report). See Appendix J in this Report for a listing of Section 319 projects for FFY96 through FFY99. Vermont will continue to pursue and apply Section 319 NPS funding in targeted areas that are likely to result in the successful implementation of Best Management Practices (BMP) and programs

Section 319 Special Projects

The following are six 319 Special Projects selected as examples of the types of projects taking place under this grant program.

Lake Champlain Basin Agricultural Watersheds Section 319 National Monitoring Program Project

EPA has supported a water quality restoration project in the Missisquoi River watershed in Franklin County since 1994. Aside from visible degradation of the watershed, the receiving waters have suffered from increased fecal coliform and total phosphorus levels.

The project was designed to measure the water quality effectiveness of certain agricultural management practices, including: livestock exclusion fencing, protected livestock stream crossings, establishment of riparian buffers, and bioengineering streambank erosion controls.

Monitoring efforts focus on two small treatment watersheds, which are compared to a control watershed.

Preliminary results from the first year of post-treatment monitoring indicate declines of 46% for E. coli, 52% for fecal coliform, and 42% for total phosphorus export in the treatment watersheds. These encouraging early results suggest that practices, such as fencing out livestock and stabilizing streambanks are making a real difference in water quality. Final project results are expected in 2001.

Preliminary results from a water quality restoration project in the Missisquoi River watershed suggest that practices, such as fencing out livestock and stabilizing streambanks are making a real difference in water quality.

The Vermont Better Backroads Program

This special project continued as a partnership between VTDEC and several outside organizations. A Small Grants Program was initiated during the summer of 1997 and continues to be administered by grant through the Northern Vermont Resource Conservation and Development Council.

The 1999 Vermont Legislature, through the House Transportation Committee, provided additional funding to the Small Grants Program, doubling the funds available through Section 319 funding. The Small Grants Program is currently emphasizing road inventory and capital budgeting projects as a means for towns to more effectively and systematically address road-related erosion.

Demonstration of Alternative Manure Management Technology

The purpose of this special project is to demonstrate, on a farm within the Lake Champlain basin, the performance and adaptability of an electric reactor-type technology for treating dairy manure in northern New England conditions. Specifically, the project will evaluate how the technology may perform in a cold climate and how it may “fit into” current dairy manure management. The project involves a close and working partnership between the cooperating farm operator, the state and federal departments of Agriculture and the University of Vermont.

Connecticut River Sustainable Riverbanks

The purpose of this special project which affects the Connecticut River - a designated American Heritage River - is to establish riverbank stabilization priorities from previous riverbank erosion surveys and to demonstrate assistance with the stabilization of the highest priority sites. This project also seeks to manage and coordinate the inventory of erosion problems, riparian habitat and

This Connecticut River special project establishes riverbank stabilization priorities and demonstrates assistance with the stabilization of the highest priority sites.

different land uses along the lower portions of the river. The 319 project is a cooperative venture between the CT River Joint Commissions and the CT River Watershed Council.

Water Quality Characterization for Remediation of an Abandoned Copper Mine

The purposes of this special project were to further define the variation in pollution levels and to identify potential options for reducing or eliminating severe surface water pollution below an abandoned copper mine site in Strafford, Vermont. A locally-based group of concerned citizens spearheaded the successful completion of the project. Not only did the project result in greater environmental awareness of the site, the project also resulted in attention being directed to the site's historical aspects and potential habitat for an endangered species of bat. In addition, the results of the project have set the stage for remediation of the site.

Youth-based Watershed Restoration

The purpose of this project is two fold: to address NPS problems and also to provide meaningful short-term employment to high school and college-aged youth. Working in a supervised setting under the VT Youth Conservation Corps, participants are provided on-the-job training along with the opportunity to broaden their base of conservation consciousness. Corps members are assigned various in-stream, streambank and riparian restoration projects. Such youth-based efforts and activities, assisted by Section 319 funding, have been underway for several years. "Watershed crews" have been situated in Chittenden County, Franklin County, Caledonia County and Washington County.

Section 604(b)

Use of 604(b) funds by the Department is directed at the inventory, evaluation, strategic planning and management of water resources within the state. Work under the 604(b) program during the reporting period has included the awarding of pass through grants to the 12 regional planning commissions to determine the nature, extent and causes of point and NPS pollution problems and to develop plans to resolve those problems. Appendix C contains an updated inventory of pass through activities by each planning commission. Other 604(b) work included: assessing second and third year rotational basin streams; preparation of the state water quality assessment [305(b) Report]; and data entry of waterbody uses, values and functions.

Section 104(b)(3)

The following project is an example of work being performed under the Partnership Program.

Urban Stormwater Management

This project involves the implementation of watershed management and watershed protection activities in a number of Chittenden County watersheds characterized as impaired by urban stormwater runoff. This project has supported the following activities: creation of a municipal-state-utility partnership to design and construct an extended detention wetland for a significant

nonpoint source discharge to Shelburne Bay, mapping assistance to South Burlington for development of an accurate inventory of their storm sewer infrastructure, research/development of appropriate erosion control ordinances and stormwater maintenance guidelines for area towns, education/outreach on riparian buffer zones for the Malletts Bay watershed, and coordination of regional discussions on stormwater management and watershed management.

Public information, technical assistance and both volunteer and contractual (Vermont Youth Conservation Corps) based watershed restoration activities have been carried out in targeted watersheds. Also, project activities have included: coordination of drinking water source protection activities with the Champlain Water District in the Shelburne Bay watershed (LaPlatte-Potash-Monroe-McCabes-Bartlett subwatersheds); participation in urban long term chemical and biological monitoring; investigation of water quality violations; research on urban stream channel morphology, and development of municipal stormwater guidance.

Other Federal Sources

Agriculture

Agricultural NPS control efforts in the state continued with financial and technical assistance being provided through several programs within the US Department of Agriculture (USDA). FFY98 EQIP funds (about $0.9 million) were directed as cost sharing assistance to approximately 120 farms for best management practices to protect waterbodies from agricultural-related runoff.

Lake Champlain Steering Committee and Lake Champlain Basin Program (LCBP)

The LCBP, in their October, 1996 publication, "Opportunities for Action," set out three priorities for action to improve the water quality of Lake Champlain. These are described briefly below. (The priorities were discussed in detail in the 1998 305(b) Report. The following is updated information since that report was published).

- *1) Reducing Phosphorus Pollution.* In their 1999 publication (Progress '99), the LCBP reports on significant progress made in the arena of phosphorus reduction. As for point sources of phosphorus, treatment plant upgrades are progressing on-schedule in Vermont (as reported earlier in Chapter Two of this Part), and are proceeding at an accelerated schedule in New York, thanks to the New York State Bond Act. As for NPS of phosphorus, LCBP reports significant progress, both by large agricultural projects, and via local small-scale implementation grants.

- *2) Preventing Pollution from Toxic Substances.* Burlington Harbor and Cumberland Bay remain sites of active toxics monitoring and research. In Burlington Harbor, the University of Vermont has received funding through the Pine Street Barge Canal settlement to conduct advanced research into the nature of the contamination there. Tetra Tech, an EPA consultant, also did work in Burlington Harbor, assessing the biological impacts of the sediment contamination. In addition, the State of New York has completed a remediation project to remove the PCB contaminated soil from the Wilcox Dock area.

- *3) Managing Nuisance Nonnative Aquatic Plants and Animals.* The LCBP reports the following progress on nonnative nuisance species:

  A comprehensive management plan was submitted to the Aquatic Nuisance Species Task Force in February 2000.

  There exists evidence that the impact of sea-lamprey on the salmonid fishery has lessened dramatically due to the Federally funded sea-lamprey control program.

  Recent commitments to funding water chestnut management by the Department, the LCBP and the Army Corps of Engineers, plus substantial volunteer assistance appear to have halted the northward expansion of this species in Lake Champlain. For the first time in four years, no new water chestnut infestation sites were found in Lake Champlain in 1999. In fact, no water chestnut plants were found at the three northern- most Lake Champlain sites or in any new inland waterbody in Vermont this past year. Zebra mussels have now been documented virtually throughout Lake Champlain. LCBP in cooperation with VTDEC is actively seeking local sites of zebra mussel-free waters which may serve as refugia for native Unionid mussels.

State Sources

Many nonpoint source planning and management activities funded primarily from state sources were discussed in the 1996 305(b) Report, to which the reader is referred. The following are those state-funded activities which had notable changes during the reporting period.

Agriculture

The Legislature has required the Commissioner of the Department of Agriculture, Food and Markets (DAF&M) to develop by rule, implement and enforce two types of agricultural land use practices - accepted agricultural practices (AAPs) and best management practices (BMPs) - in order to reduce pollutants entering waters of the state.

The AAP Rules, which became effective June 29, 1995, are statewide restrictions designed to reduce agricultural nonpoint pollutant discharges through implementation of improved farming techniques. The AAPs are basic practices that all farm operators are expected to follow without financial assistance as a part of normal operations.

The Vermont DAF&M has developed BMP rules. BMPs are voluntary and are more effective than AAPs and will be site specific practices prescribed to correct a problem on a specific farm. BMPs were adopted and became effective as rules January 27, 1996. The Vermont General Assembly authorized in 1995 the creation of a state financial assistance program to help agricultural operators in support of their voluntary construction of on-farm improvements

designed to abate nonpoint source agricultural waste discharges. Approximately $350,000 in State General Funds were appropriated for this purpose in 1995 and1996. Approximately $500,000 were appropriated in 1997. Approximately $750,000 were appropriated in both1998 and 1999. These $2.7 million in state funds have been committed to help in the installation of 737 BMPs. Approximately 62% of these 737 BMPs are located on farms in Addison, Franklin and Orleans counties. Approximately 64% of the BMPs installed are for "waste utilization" (i.e. manure /waste storage) and "barnyard treatment" (i.e. barnyard paving).

During the reporting period, permitting rules affecting Large Farm Operations were adopted. The LFO Rules, to be administered by the VT Department of Agriculture, Food and Markets, will regulate farms that exceed a certain number of animal units. Existing farms, new farms or farms undergoing expansion will be affected by these requirements that are intended to minimize various environmental impacts.

Storm Water

Hydrologically Sensitive Waters (HSW)

Due to rapid development of certain watersheds in Vermont, and the concern over stream gravel mining, the Department formed a Steering Committee to provide direction to the Department for controlling or mitigating these activities that encourage flooding and destruction of a stream's biological community. The Committee commissioned the study of hydrologically sensitive streams to be performed in three phases.

Phase I, completed on January 15, 1998, provided a literature search. The literature search, entitled, *Final Report for Watershed Hydrology Protection and Flood Mitigation: Phase I*, found that, based on studies from locations outside Vermont, human-induced land use changes cause various hydrologic (stream flow) and geomorphic (stream shape, size and alignment) adjustments, including the size and timing of flood peaks. Increased surface runoff from land changes can produce changes in the morphology of a stream with sediment release that have a potential to impact aquatic biota.

Phase II was completed in September, 1999, and consisted of two parts. The first part, *Watershed Hydrology Protection and Flood Mitigation Project, Phase II - Technical Analysis, Stream Geomorphic Assessment*, quantifies the relationship between stream geomorphology (stream ecology, hydrology, and stream channel shape and size) and various watershed land use activities for Vermont. This part of the study will provide a foundation for possible future guidance governing storm water management and other land use strategies for flood hazard mitigation and stream resource protection.

The second part, *Impact Assessment of Instream Management Practices on Channel Morphology*, addresses the impact on channel form associated with gravel extraction practices and instream works for flood hazard mitigation.

Phase III/IV will involve the development of management tools to address the connections outlined in the Phase II documents. The Steering Committee is considering the development of a set of draft activities which would result in recommended changes to the Vermont Stormwater Management Procedures. These draft activities were developed after consideration of watershed approaches, thresholds, the Vermont Water Quality Standards and its classification system, and legislation under consideration by the 2000 Vermont General Assembly:

- Identify vehicles to change watershed development patterns so as to reduce Vermont flood losses and maintain and improve stream stability.
- Develop acceptable development practices for managing stormwater hydrology and quality.
- Develop handbook(s) of acceptable development practices and vehicle to reduce flood losses.
- Evaluate current Vermont stormwater procedures.
- Recommend changes to the Vermont Stormwater Management Procedures based on the results of all of the above.

Storm Water Phase I and Phase II Rules

Phase I of EPA's storm water program was promulgated in 1990 under the Clean Water Act. Phase I addressed storm water runoff from municipalities larger than 100,000 population. As Vermont has no municipalities of this size, the state was exempt from this category of permit requirements. Another category of the Phase I Rules requires the issuance of permits for construction projects larger than 5 acres, as well as certain state and industrial projects. The Department has been issuing Stormwater General Permits for construction projects involving more than 5 acres since 1991, and is in the process of drafting General Permit Rules for state and industrial projects.

EPA has promulgated Storm Water Phase II Rules, which became effective in December, 1999. Storm Water Phase II Rules are intended to further reduce adverse impacts to water quality and aquatic habitat by instituting the use of controls on the unregulated sources of storm water discharges that have the greatest likelihood of causing continued environmental degredation. The new rules apply to "urbanized areas" as delineated by the Bureau of the Census, which have separate storm sewer systems (MS4s). The new rules also apply to small construction activities that disturb 1-5 acres. Any other storm water discharges could also be regulated if it is determined that storm water controls are necessary.

Vermont municipalities to which the new Phase II rules apply include: Burlington, South Burlington, Essex junction and Winooski. Other towns in Chittenden and Rutland counties to come under the new rules will not be determined until the 2000 Census has been completed.

A regulated municipality will be required to apply for NPDES permit coverage, most likely under a general rule rather than an individual permit, and to implement storm water discharge management controls (best management practices). Among other things, a regulated municipality must include the following six minimum storm water control measures:
1) public education and outreach;
2) public participation/involvement;
3) illicit discharge detection and elimination ;

4) construction site runoff control;
5) post-construction runoff control;
6) pollution prevention/good housekeeping.

River Restoration and Protection

Flash floods in many parts of Vermont during the last few years caused much property damage and left many rivers and streams devoid of natural fish and wildlife habitat, and susceptible to repeat flooding. This new initiative coordinates federal, local and state resources to restore damaged streams to their correct dimensions to reduce flooding and provide ecological and recreational values that were lost as a result of the flood event. One segment of the Trout River has been restored (See page II-19), and many other rivers await attention.

Chapter Four: Cost/Benefit Assessment

There have been a few changes to this chapter since the 1996 and 1998 305(b) reports. The following paragraphs detail those changes. Quantifying the costs of construction and operation of facilities, such as wastewater treatment facilities, or river improvement projects, such as the Trout River project, described in this chapter, can be done rather routinely; however, quantifying the environmental and human benefits in dollars as the result of an improved wastewater treatment plant or a stabilized river bank is not an exact science, especially since the benefits of the projects may not be known for many years, if at all.

Point Sources/CSOs

Vermont has constructed 93 municipal wastewater treatment facilities, 50 industrial pretreatment facilities and 53 industrial wastewater treatment facilities. The total expenditure for the public facilities has been approximately $512 million of state, federal, and local funds. This figure includes approximately $44 million of public wastewater treatment facility improvements made during the last two years. There has been no recent estimate of the total amount spent on capital construction of industrial wastewater treatment facilities. The amount of money spent on operation and maintenance of municipal and industrial WWTFs (approximately $69 million in 1994) has not been updated since the 1996 305(b) Report.

In general, improved water quality has meant less weed and algae growth, resulting in improved aesthetics and enhanced swimming, fishing and boating uses. Also, it is assumed that less sickness has occurred due to better removal of pathogens. As a result of these public and private expenditures, approximately 58 rivers and 3 lakes have benefitted from improved water quality and enhanced recreational, fishery and aesthetic uses.

During the period January 1, 1998 through December 31, 1999, $43,960,000 of federal, state and local funds were spent on CSO corrections in one community, WWTF improvements in eight communities, new WWTFs in two communities, sewer line extensions and rehabilitations in four communities, and phosphorus removal at one WWTF. These expenditures have resulted in additional improvements to the water quality of 9 rivers and one lake.

During the reporting period, approximately $44 million of federal, state and local funds were spent on CSO corrections, WWTF improvements, new WWTFs, sewer line extensions/ rehabilitations and phosphorus removal. These expenditures have resulted in additional improvements to the water quality of 9 rivers and one lake.

To give a total picture, one must also consider the costs and benefits of nonpoint source pollution control practices. A discussion of this effort follows.

Nonpoint Sources

Aside from several federal and state cost sharing programs to assist with pollution reduction from agricultural sources, there are two federal Clean Water Act programs to assist with planning and implementation of NPS pollution reduction. The first is the 604(b) Pass Through Program, awarded to regional planning commissions to assess, map or report on areas of NPS pollution. The other federal program is the Section 319 program, which awards grants (on a competitive basis) to water protection groups to be used to repair eroded banks and other areas which cause pollution. Updated total costs of the Section 319 implementation program for ten years, from FFY90 through FFY99 are approximately $7.8 million. Total costs of the Section 604(b) Pass Through NPS planning projects from FFY1989 through FFY1999 were approximately $581,000.

Upper White River Stream Enhancement Project

The project involved work at six different sites from May to October, 1997 by the White River Partnership, and included streambank stabilization, bufferstrip re-establishment and instream fish habitat activities. The result of the work was a total of 4,525 feet of shoreline being stabilized and/or enhanced for fisheries and riparian habitat. In 1999, the Partnership won national recognition for its work, and the Upper White River was named a National Showcase River for its successful and pioneering stream corridor restoration efforts.

Success Story

The Trout River Improvement Project in Montgomery restored one mile of the Trout River to a more natural channel condition at a cost of approximately $125,000. Flood hazards were mitigated and water quality, recreational values and aquatic and riparian habitat functions were restored.

Trout River Improvement Project

The Agency's newly adopted approach to river restoration and flood hazard mitigation is demonstrated for the first time on an approximately one mile reach of the Trout River in the Town of Montgomery. The town and river were devastated by flash floods in 1997. The new approach uses national emerging river restoration techniques to mitigate flood hazards and restore water quality, recreational values and aquatic and riparian habitat functions. Fundamental to the Trout River project was a high level of cooperation and coordination between the town, landowners and many state and federal agencies. During 1999, the river's dimensions, meander, slope and riparian vegetation were restored. Landowners agreed to maintain the riparian vegetation and to allow the river to naturally meander.

Lord's Creek Demonstration Restoration Project

Lord's Creek in Orleans County, is the main tributary to the Black River, which drains to Lake Memphremagog. "The Lake Memphremagog watershed is the most intensely farmed

watershed in the State of Vermont. Orleans County, which is centered in the watershed, is the third most productive dairy county in the northeastern United States."[8] The water quality of Lord's Creek had declined due to siltation, phosphorus and elevated temperatures as the result of the removal of riparian vegetation and also from farm runoff. With the support of the landowners, streambank improvement work on two farms along Lord's Creek was performed by the Lake Memphremagog Watershed Association, together with volunteers from the Lake Region Union High School, Craftsbury Academy, the Albany Community School, the VT Youth Conservation Corps and Ben & Jerry's employees. Work involved placing tree revetments and brush rolls to reduce bank erosion, installation of fencing to exclude animals from the banks and revegetating the streambanks. The cost of the project (direct and indirect expenses) was approximately $50,000. A Section 319 grant provided $17,000. A large section of streambank was restored, thus reducing soil loss, reducing phosphorus contribution, providing shade and improving fish and wildlife habitat. Benefits also were educational, not only for those who worked on the project, but also for the community and landowners.

Urbanizing Watersheds

Chittenden County is Vermont's fastest growing county. As a result, some streams have not been protected from development, and much of their riparian buffer has been removed. Also, development of their watersheds has caused increased runoff with associated pollutants and streambank erosion. An attempt has been made to stabilize streambanks and restore streamside vegetation on certain streams, including Allen Brook (See box) with some good results.

Success Story

Allen Brook, Williston, VT, is a rapidly developing watershed with over two dozen eroded/collapsed banks. With the permission of a major landowner, the Griswold Corporation, the Youth Conservation Corps and volunteers planted thousands of trees along a mile of stream and used bioengineering techniques on several hundred feet of streambank. The Griswold Corp. reshaped over 100 feet of the most heavily eroded areas using heavy machinery. Early biomonitoring results show an improvement in the fishery from "good" to "excellent" as a result of this fine cooperative effort.

Hydroelectric Facilities

Two Clean Water Act Section 401 water quality certifications were issued to hydroelectric facilities during the 1998-1999 reporting period. These were for the Vergennes Project and the Middlebury Lower project. The Vergennes Project has been issued a Federal Energy Regulatory Commission (FERC) license to operate,

[8] *The Lords Creek Demonstration Restoration Project, 1996-1998.* Lake Memphremagog Watershed Association, Irasburg, VT. December, 1999

which will improve flows in approximately 10 miles of Otter Creek. The Middlebury Lower Project license is expected to be issued in 2000, and will improve flows in an additional approximately 2 miles of Otter Creek when the project begins operating under the new license.

During the reporting period, the Agency entered into an agreement with Central Vermont Public Service Corporation for the withdrawal of their appeal for a denial of their Lamoille River project which includes four dams. It was agreed that the utility would complete additional scientific studies before again seeking a water quality certificate. This 401 Water Quality Certificate, when issued, will improve 29 miles of the Lamoille River.

The Department is party to a settlement agreement between the FERC and State of New Hampshire regarding licensing of the Fifteen Mile falls project on the Connecticut River. The 401 Water Quality Certificate, if approved, will improve many miles of the Connecticut River, plus surface areas of the Moore-Comerford and McIndoes Falls impoundments. The certificate would include an agreement on the regulation on flows of the Upper Connecticut River Lakes, including Lake Francis.

Chapter Five: Special State Concerns and Recommendations

All but two of the special state concerns identified in the 1996 and 1998 305(b) reports remain as special concerns. *The Need for Revision of the Vermont Water Quality Standards and Water Classification System* and *Comprehensive Water Resources Planning and Protection* have been, or are being addressed. The following paragraphs update certain of the concerns addressed in the1996 and 1998 reports and also discuss new concerns which were identified subsequent to those reports. The only previously-identified concern that is not updated below is *Need for Wastewater Treatment for Small Communities*. Please refer to the 1998 report for a discussion of this concern.

Groundwater (Updated from previous reports)

Vermont's major needs are for a statewide groundwater quality and quantity monitoring network, geologic maps (i.e., fracture traces, bedrock and surficial geology, and aquifer maps), groundwater education and outreach for schools and planning commissions, and GIS locations of potential and actual sources of groundwater contamination. Many of these activities are being pursued; however, they have an extremely long timeframe for completion or are limited in scope.

Although the state has the necessary statutory and regulatory authority to complete these activities, it is hampered by the lack of adequate funding and in turn the personnel to carry out these tasks. A dedicated source of long-term funding for groundwater projects would allow Vermont to identify and prioritize groundwater projects with state, regional, and local entities.

To protect groundwater, additional monetary and personnel resources are needed to:

< Establish a monitoring and evaluation program of the ambient groundwater quality and quantity
< Assist municipalities and regional planning commissions with plans and programs to protect groundwater and drinking water
< Educate children and the general public on ways to protect and conserve groundwater resources
< Map groundwater and geologic characteristics to provide for protection and planning at the state, regional, and local level
< Improve existing GIS data layers and create new data layers on potential contaminants, geology, etc.
< Provide internet access to all of this information.

Preliminary estimates for completing this work are $250,000 annually.

Polluting Discharges from Large Farms (Updated from previous reports)

There is growing concern regarding potential shifts in agricultural production from a large number of smaller farms to increasing numbers of larger farms. The water pollution potential from

such large farming operations (LFOs) is equivalent to the waste generated by a small to medium sized city. It is recommended and essential that waste management and pollution prevention efforts are well coordinated. The new Large Farm Operation Rules will help ensure animal wastes on these larger facilities are managed effectively.

Road Runoff to Waterbodies (Updated from previous reports)

Threats and some water quality problems as the result of runoff from local roads, as well as from state highways, are widespread. The problems arise from maintenance procedures that are not sensitive to water quality and allow sand and gravel to erode and wash into surface waters.

The Department has developed a small grant program entitled, "Vermont Better Backroads," to assist local road commissioners with better backroad maintenance and planning. The Department is being assisted by many partners, including: the Vermont Local Roads Program at St. Michael's College, Resource Conservation and Development Councils, the Environmental Protection Agency (funding), Regional Planning Commissions, Vermont Lake Associations, Vermont Agency of Transportation and many others. The program offers small grants on a competitive basis for following up on local situations where there are no current water quality violations but where road practices threaten adjacent rivers, streams, lakes or wetlands. It is a good and effective program, but only a few towns are able to be helped each year due to limited resources. The 1999 Legislature, recognizing the value of the program, provided additional funding, effectively doubling the amount of the Section 319 federal funding.

Lack of Statewide Vegetated Buffer Requirements (Updated from previous reports)

Undisturbed vegetation along stream, river and lake shorelines reduces pollutants from reaching surface water. Other than Act 250 development constraints and a few municipal regulations, there are no state-wide requirements that riparian landowners maintain a minimum width of vegetation along bodies of water as there are in other states. As a result, many miles/acres of state waters are impaired by urban runoff, sediment, temperature changes, fertilizers, manure, and other pollutants which can be reduced or eliminated by properly-maintained vegetated buffers.

As the result of the recognized importance of riparian buffers to water quality, a Buffer Procedure Action Team was formed by Secretary John Kassel and met for the first time in October, 1999. The Team is composed of staff from the Agency, whose task is to develop an Agency buffer policy and procedure, including general and site specific standards. The Buffer Procedure will be used by the Agency in the Act 250 process and as guidance to riparian landowners, including public and quasi-public agencies.

The Department has made some strides in the educational effort to inform the public and municipal planning commissions about the environmental benefits of riparian vegetation. The Department and Regional Planning Commissions have been working with municipalities to strengthen their municipal plans and zoning regulations to maintain streamside vegetation and have sponsored some workshops for town officials and the general public regarding strategies to

encourage the maintenance of existing riparian vegetation, as well as promoting the planting of riparian areas lacking vegetative buffers. The Department, YCC, watershed groups and other volunteer groups have worked on many streamside planting projects around the state. However, there is still need for additional public education about the need to maintain riparian buffers for water quality protection and wildlife habitat. It is recommended that the Agency make more use of the print media, TV and radio to draw the public's attention to the benefits of maintaining riparian vegetation.

Atmospheric Deposition of Pollutants (Updated from previous reports)

The deposition of pollutants to the Vermont landscape from the atmosphere is principally responsible for the partial support of fish consumption and aquatic life uses on 22,485 inland lake acres and on all Vermont rivers and streams. Atmospheric deposition is the principal source of two major causes of use loss in Vermont: mercury and pH. The two causes are linked, since in many instances, lakes which are vulnerable to acidification are also those which transfer atmospherically deposited mercury to the aquatic food web in the toxic methyl- form. There may be other lake types which are not at risk of acidification, but have the ability to transfer mercury into the trophic chain via alternate geochemical pathways. This is the subject of ongoing research in Vermont, and a major goal of this inquiry is to make refinements to the existing Vermont Department of Health fish consumption advisory.

Atmospheric deposition of mercury has resulted in the issuance of fish consumption advisories for any Vermont lake or river containing walleye, lake trout, smallmouth bass, and chain pickerel and for all fish except brown bullhead on the five Deerfield chain reservoirs.

The impacts of mercury deposition are not, however, limited to loss of fish consumption uses. Recent research[9] has identified reproductive and behavioral impacts to wildlife that feed on fish which inhabit many northern New England lakes, including those in the Deerfield chain. Potential impacts to upper trophic level biota are presently being measured in several other Vermont lakes in conjunction with the on-going mercury studies (REMAP).

Loss of uses associated with atmospheric deposition also result from the transport, into Vermont, of acid-inducing compounds. The atmospheric deposition of nitrous oxide (NO_x) and sulfate (SO_4) from Midwestern sources has resulted in acidification (low pH) of many Vermont lakes. In Vermont, the potential for acidification is measured by direct measurement of pH, as well as corollary measures such as acid neutralizing capacity, NO_x , SO_4 and others (though deposition of SO_4 and in-lake SO_4 concentrations are presently decreasing).

[9]See http://www.anr.state.vt.us/dec/waterq/hgreview.pdf

Hydrologic Modifications in Lakes (Updated from previous reports)

In Vermont, water level manipulations are a source of use impact to lakes. There are 32 lakes and ponds (8,914 acres) in Vermont for which one or more uses are impaired due to water level manipulations. Flow alteration affects aquatic life uses due to littoral habitat loss. In some instances, flow alteration can also affect aesthetic, swimming, and even boating uses, depending on the severity and/or timing of the drawdown.

The Department's Lake Bioassessment Program needs to obtain more precise and quantitative estimates of aquatic life use impairments in flow-altered lakes and reservoirs. There also exists the need to quantify the effect of water level fluctuation on the bioacccumulation of mercury in reservoirs.

Hydrologic Modifications in Rivers and Streams (New)

As humans develop watersheds more intensely, remove stream gravel and alter the stream channel, increased flooding, impaired water quality, and impacts to aquatic resources are the unwanted results. Land use changes and instream management activities and their relationship to adverse impacts on rivers and streams are the focus of studies either completed or currently being undertaken by the Department. The recommendations of the studies are likely to result in changes to the *Stormwater Management Procedures*.

It is recommended that the Department encourage municipalities to incorporate the future revised management procedures in their plans and ordinances through workshops sponsored by regional planning commissions meeting with selectboards, conservation commissions and local planning commissions. In addition, additional resources are needed to assist with channel restoration of flood-damaged rivers and streams.

Exotic Aquatic Species as Pollutants (Updated from previous reports)

Vermont has a history of impacts related to non-native nuisance plants and animals in its lakes, and unfortunately, the number of non-native introductions to inland Vermont lakes continues to increase. In 1999, zebra mussels (*Dreissena polymorpha*) were found for the first time, either in adult or larval form, in three large and heavily used inland lakes (Dunmore, Bomoseen, and Hortonia) which are near Lake Champlain. This increases greatly the risk of infestation of other inland waterbodies as this species is commonly spread by boating activities. A risk assessment performed by the Department in 1997 identified a large number of recreationally used lakes as being at significant risk of infestation by zebra mussels. In addition, during this 305(b) reporting period, Eurasian watermilfoil was discovered in seven new lakes (Chipman, Coggman, Indian Brook, Seymour, Willoughby, Rescue, and Long Pond in Eden), and water chestnut (*Trapa natans*) was discovered in two lakes (Coggman and Paran).

Heavy infestations of Eurasian watermilfoil and water chestnut have an impact on aesthetic, aquatic life, swimming, and boating uses in those areas where they grow densely. Zebra mussels, in their present densities in inland lakes, only threaten swimming uses (due to the ease with which

one gets cut by the extremely sharp shells). As infestations develop, they may also affect aquatic life uses due to changes in the aquatic food web. The Department has quantified this effect on Lake Champlain, but not for inland lakes, as infestations are not yet sufficiently developed.

Eutrophication of Vermont Lakes (Updated from previous reports)

The Department commits significant resources to the management of human-caused eutrophication on Vermont lakes. Vermont has relatively unproductive lakes as compared to other parts of the country. This is attested to by the fact that only two inland lakes appear on Vermont's 303(d) list due to excessive eutrophic conditions (Shelburne Pond and Lake Carmi). The Department considers that proactive protective actions to reduce human impacts on lake health address the problem in a more efficient manner than waiting until restoration is needed. Several such lake protection projects are described elsewhere in this document.

Eutrophication can simultaneously affect aesthetic, aquatic life, swimming, and in some instances even boating uses. The major causes related to eutrophication for inland Vermont lakes are nutrients, siltation, and organic enrichment. The major sources of these pollutants are construction, urban and suburban runoff, road maintenance and runoff, agriculture, silviculture, and other nonpoint sources. Since Vermont is only part way through the process of reassessing all of its lakes under the rotational watershed assessment process, the reader is urged to exercise caution in interpreting use impacts, causes, and sources related to eutrophication. In many instances to date, upon reassessment, use impacts related to eutrophication have been changed from partial support to fully supported but threatened based on a thorough review of available data in light of the new Water Quality Standards. This is likely to occur for a portion of the remaining Vermont lake acres which are to be assessed over the next two years as well.

PART III: SURFACE WATER ASSESSMENT

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Chapter One: Current Surface Water Monitoring Program

Overview

Surface water quality monitoring undertaken by the Department during the 1998-1999 reporting period 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. The Department 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.

A surface water rotational watershed assessment (water quality monitoring/evaluation) procedure was initiated in 1996. The procedure is discussed in Chapter Two, "Assessment Methodology and Summary Data," and Appendix D. Other surface water quality monitoring activities conducted by the Department during 1998-1999 are similar in most respects to those conducted during the 1997-1998 reporting period. They are described in the 1996 and 1998 305(b) reports and in the Department's website. The address for the website is: http://www.anr.state.vt.us/dec/waterq/watermon.htm

The following section describes new monitoring projects or changes to surface water monitoring activities since the 1998 305(b) Report.

Surface Water Quality Monitoring Activities

Volunteer-Collected Surface Water Data

Previous 305(b) reports discussed the fact that citizens groups are involved in stream and lake monitoring, education and restoration projects. Due to greater attention to the state's water quality, it is of utmost importance for citizens to continue to assist in this important work. The Department is most grateful to these dedicated citizens groups, and will continue to provide technical assistance to them as much as possible.

Watershed or lake associations are presently active on approximately 26 rivers and 32 lakes in the state, representing waters in all the State's major river basins. The Department has developed a directory listing the various river watershed associations and their programs and another directory listing lake associations involved in watershed activities. The watershed directory is entitled *Current Programs of Vermont Watershed Associations - July, 1999.* (Appendix E). The lake association directory is entitled, *Lakes With Associations Involved in Watershed Activities* (Appendix F).

Lake Bioassessment Project

With special funding from EPA-Region 1, the preliminary phase of the Lake Bioassessment Project has been developed into an operational biological and paleolimnological assessment program. A major goal of the Lake Bioassessment and Paleolimnology Program is the development of biocriteria for lakes. A regional approach to determining lake biological reference conditions was taken by assessing both Vermont and New Hampshire lakes (the project is managed as a cooperative, bi-state initiative). Application of paleolimnological models to the sediments of selected New Hampshire candidate reference lakes should help ensure that the underlying biological information used to develop criteria is indeed of reference quality. To date, this project has evaluated a total of 41 lakes in both states. Results of biological sampling in Vermont lakes have been used to enhance Aquatic Life Use Support designations for lakes assessed under this project.

Assessment of Mercury in Hypolimnetic Sediments of Vermont and New Hampshire Lakes

The Department received a funding extension during this reporting period from EPA-ORD to enhance the 90-lake evaluation of mercury and methylmercury in lake-bed sediments and lake waters. One major goal of this project is to develop a ranking system which identifies lakes that are likely to have elevated mercury burdens in their fish, in the absence of fish tissue data. Results of this study will be used: 1) to direct future fish tissue monitoring efforts; 2) as an additional dataset with which patterns of mercury deposition in lakes across New England and the Adirondacks of New York can be evaluated; and 3) to suggest, where fish tissue data are unavailable, the type of lake in which fish are likely to have elevated mercury for use in future refinements to existing fish consumption advisories. Water chemistry and sediment mercury results have enhanced the underlying data used to make use impairment designations under the 305(b) reporting process.

Lake Parker Watershed Protection Project

A dedicated group of local volunteers has surveyed the Lake Parker watershed and is in the process of implementing projects in the watershed to reduce nutrient and sediment runoff to the lake. The Department is providing technical assistance to this effort, and is studying the lake to help the group decide on an achievable in-lake water quality goal for this lake protection project.

Ticklenaked Pond Watershed Assessment Project

Thanks to a concerted effort by NRCS, the Ticklenaked Pond Watershed Association (TPWA) was formed to address what shoreline and watershed property owners perceive as declining water quality. Reduced clarity, algal scums, and recurrent beach closures all have been noted by residents. In response to a request for technical assistance by NRCS and the TPWA,

the Department has added the pond to the state's "C" List of waterbodies in need of assessment to determine if violations of the VT Water Quality Standards exist. Current monitoring and research activities include: bi-weekly depth profile monitoring for clarity, phosphorus and physico-chemical parameters; weekly citizen monitoring in the photic zone for transparency, phosphorus, and chlorophyll-a; a comprehensive biological assessment; and a paleolimnological analysis of the lakes' sediments using elemental and stable isotopic carbon and nitrogen ratios as proxies for trophic condition.

Data Interpretation and Communication

The information from the rotational assessments is incorporated into the Water Quality Assessment database. From the database, reports are generated on river basins for 305(b) annual electronic reporting as well as biennial reports, general information, review and feedback purposes. Feedback is requested from the district fisheries biologists, watershed association leaders, U.S. Forest Service fisheries biologists, NRCS and the local USDA working groups.

The lakes portion of Vermont's 305(b) Assessment database (ADB) has been fully modernized during the reporting period, and is fully compliant with the most recent version of the EPA's ADB 305(b) database. The lakes portion of the database contains rigorous error and redundancy checking and has a number of programmed queries to facilitate not only electronic reporting to EPA via its contractor RTI, but also to automate the preparation of required tables. While this modernized database is valuable, the Department is presently considering adopting EPA's ADB as its primary platform for housing and manipulating the lakes 305(b) information. The Department will need to request assistance from EPA or its contractor RTI to perform the data migration from the lakes database to ADB, should that platform be adopted.

Beginning with the 1996 report, Vermont's 305(b) Reports have been placed on the Department's web site, and are available to any member of the public with internet access. This has saved considerable paper resources and duplicating costs.

Plan for Achieving Comprehensive Assessments

Vermont's watershed management and assessment approach to water quality planning as outlined in the draft *Watershed Improvement: A Strategy for the Next Century* (Appendix E), including the state's rotational watershed assessment procedure (see below), constitutes Vermont's plan for achieving comprehensive assessments.

Chapter Two: Assessment Methodology and Summary Data

Vermont has moved to a rotational watershed assessment strategy for the purposes of assessing and reporting water quality information. The state has been divided into seventeen major drainage basins that have from four to twenty-two river subbasins, and mainstem segments within them. The surface waters within these subbasins are referred to as "waterbodies." There are 210 river and 556 lake waterbodies in Vermont. The waters of all seventeen major basins in the state are planned to be assessed at least once every five years. By focusing annual evaluations on selected watersheds each year, more systematic and intensive efforts can be made to collect and evaluate nonpoint and point sources of pollution. For additional information about the rotational watershed assessment, please refer to Appendix F.

The assessment itself involves identifying, compiling, analyzing and evaluating all water quality data and information as well as point and nonpoint source pollution impacts on designated uses specific to the basins being assessed in any given year. The data are maintained in a Paradox database system, (rivers) and in Access (lakes). Sources of information tapped for data or information include:

1) Vermont ANR DEC Water Quality Division (bioassessment data primarily - rivers)
2) Vermont ANR DEC Wastewater Management Division (WWTF facility permit compliance)
3) Vermont ANR DEC Waste Management Division (solid & hazardous waste site monitoring data)
4) Vermont ANR Enforcement Division (violations of water quality standards)
5) Vermont ANR Department of Fish & Wildlife (game fish data, temperature data, studies)
6) Vermont Regional Planning Commissions (known locations of problems)
7) USDA Natural Resource Conservation Service (agricultural nonpoint sources and locations of pollution abatement projects)
8) Citizen associations (lay monitoring data, location of sources)
9) U.S. Geological Survey Water Resources Division (NAQWA studies)
10) U.S. Forest Service (fish habitat and water quality data and information)
11) U.S. Environmental Protection Agency (special studies, WET testing)
12) U.S. Army Corps of Engineers (data in waters above and below ACOE dams)

The aquatic biomonitoring program of the Department provides the most data used in assessment of monitored river miles (see more complete description below). The lakes and ponds program of the Department provides most of the data used in the assessment of monitored lake acres. The other sources listed above provide fewer and less widespread data points.

Evaluated information used for assessments includes desktop modeling, some lay monitoring data, best professional judgement of resource managers, known sources of pollution, and analytical results five years old or older.

River Biological Assessments

Assessment of biological integrity is conducted on the state's rivers and streams for the purposes of trends assessment and site specific impact evaluation. Macroinvertebrate and/or fish populations of rivers and streams are assessed by comparing a series of biometrics measuring community structure and function to a set of biocriteria that represent the biological potential for the ecoregion/habitat being evaluated. The biomonitoring activities can be placed into two categories; 1) long term monitoring of reference level sites and 2) site specific impact evaluations.

The biological potential for various sites is established through long term reference site monitoring. Information from this program element also serves to refine existing biocriteria and indicate any broad trends. The long-term monitoring of reference sites is conducted on a set of 30 sites on a 5-year rotating basis so as to give five years of continuous data for each site. Sites are stratified across stream ecotypes differing in drainage area size, elevation, and alkalinity. Human activity in reference site drainages is judged to be minimal relative to other streams in the ecoregion.

Where site-specific impact assessments are conducted, potential pollution sources are spatially bracketed with sample sites to determine impact/non-impact on the aquatic biota attributable to the pollution source. Either macroinvertebrate or fish populations or both may be sampled. Approximately 50 river sites are assessed each year in the late summer-early fall (Sept-Oct15) on a five year rotational watershed basis. Since 1982 the state has evaluated over 1,000 sites.

Macroinvertebrate community integrity is evaluated by comparing the following set of biometrics with the reference condition. The biometrics of Density, Species Richness, EPT index, EPT/Richness ratio, Bio Index (Hilsenhof), Diversity, # Ephemeroptera species, # Plecoptera species, # Trichoptera species, EPT/EPT & Chiro ratio, Percent Hydropsychidae, Percent Dominant Taxa(Genera), Percent Composition of Major Groups, and Percent Composition of the Functional Groups are all calculated. The Pinkham Pearson Coefficient of Similarity is calculated in assessments used to determine the impact of a specific pollutant source on the aquatic biota when an upstream control is used.

Fish population data are analyzed by applying the species enumerations to an index of biotic integrity modified for Vermont streams. This multimetric index effectively measures the ecological health of the total fish population, with index values directly reflecting narrative biocriteria contained in State Water Quality Standards. Also used in population assessments are a modified Coefficient of Similarity of Pinkham and Pearson and the Coefficient of Concordance.

Use Support Determinations for 305(b) River and Stream Assessments

The following paragraphs provide the reader with specific criteria and other information the Department utilizes to determine use support for individual designated uses and make an assessment of water quality in rivers and streams. Information is presented to show how the water quality monitoring data and information relates directly to the degree of use support for 305(b) reporting purposes.

Aquatic Biota/Habitat (Aquatic Life)

Biological Assessment

- FULL SUPPORT: Reliable data indicate functioning, sustainable biological assemblages (e.g., fish, macroinvertebrates, or algae) none of which has been modified significantly beyond the natural range of the reference condition.* Overall macroinvertebrate or fish community biological integrity is good, very good or excellent as determined by the Ambient Biomonitoring Network program (ABN).

- PARTIAL SUPPORT: At least one assemblage (e.g., fish, macroinvertebrates, or algae) indicates moderate modification of the biological community compared to the reference condition.* Overall macroinvertebrate or fish community biological integrity is rated fair by the ABN program.

- NON SUPPORT: At least one assemblage indicates non-support. Data clearly indicate severe modification of the biological community compared to the reference condition.* Overall macroinvertebrate or fish community biological integrity is rated poor to very poor by the ABN program.

Habitat Assessment*

- FULL SUPPORT: Reliable data indicate natural channel morphology, substrate composition, bank/riparian structure, and flow regime of region. Riparian vegetation of natural types and of relatively full standing crop biomass (i.e., minimal grazing or disruptive pressure).

- PARTIAL SUPPORT: Modification of habitat slight to moderate usually due to road crossings, limited riparian zones because of encroaching land use patterns, and some watershed erosion. Channel modification slight to moderate.

* From Federal Guidance for assessing rivers and streams

- NON SUPPORT: Moderate to severe habitat alteration by channelization and dredging activities, removal of riparian vegetation, bank failure, heavy watershed erosion or alteration of flow regime.

Conventionals (DO, pH, temperature)*

- FULL SUPPORT: For any one pollutant or stressor, criteria (State Water Quality Standard) exceeded in # 10 percent of measurements. [In the case of dissolved oxygen, national ambient water quality criteria specify the recommended acceptable daily average and 7-day average minimums and the acceptable 7-day and 30-day averages.[10]

- PARTIAL SUPPORT: For any one pollutant, criteria exceeded in 11 to 25 percent of measurements. For dissolved oxygen, the above considerations apply.

- NON-SUPPORT: For any one pollutant, criteria exceeded in > 25 percent of measurements. For dissolved oxygen, the above considerations apply.

Toxicants (priority pollutants, metals, chlorine and ammonia)*

- FULL SUPPORT: For any one pollutant, no more than one exceedance of acute criteria (EPA's criteria maximum concentration or applicable State criteria) within a three year period, based on grab or composite samples and no more than one exceedance of chronic criteria (EPA's criteria continuous concentration or applicable State/Tribal criteria) within a three year period based on grab or composite samples.

- PARTIAL SUPPORT: For any one pollutant, acute or chronic criteria exceeded more than once within a three year period, but in <_ 10 percent of samples.

- NON-SUPPORT: For any one pollutant, acute or chronic criteria exceeded in > 10 percent of samples.

Note: The above assumes at least 10 samples over a three year period. If fewer than 10 samples are available, the State should use discretion and consider other factors such as the number of pollutants having a single violation and the magnitude of the exceedance(s).

Fish Consumption

- FULL SUPPORT: No fish consumption restrictions or bans are in effect.

* From Federal Guidance for assessing rivers and streams.

- PARTIAL SUPPORT: Restricted consumption of fish in effect ("restricted consumption" is defined as limits on the number of meals or size of meals consumed per unit time for one or more fish species); or a fish ban in effect for a subpopulation that could be at potentially greater risk for one or more fish/shellfish species.

[10]The State Water Quality Standards for dissolved oxygen are used for use support assessment.

- NON SUPPORT: For a given species, a “no consumption" advisory is in place for the general population, or a commercial fishing ban in effect.

Swimming/Contact Recreation

Bacteria/E. Coli

- FULL SUPPORT: Geometric mean of samples taken not greater than 77 organisms/100 ml.

- FULL SUPPORT BUT THREATENED: If only one or two samples are available so that calculating a geometric mean is not possible but single samples are sometimes greater than 77 organisms/100 ml. and sometimes not.

- PARTIAL SUPPORT: Geometric mean met sometimes and not other times in a given stretch.

- NON-SUPPORT: Geometric mean not met for all sampling sites in a given stretch.

Note: Data for at least two seasons is usually necessary to make non support and partial support determinations. The time at which the sample is taken is also considered. If the numbers are high but the data are limited in scope, and the sampling was done during a high flow event, it is considered less of a problem than if the numbers are high over a number of sample dates and seasons, and the high numbers occur during high and low flows. Also, the following parameters may be used to determine support of contact recreation: turbidity, odor, abundance of algal growth and flow. The Water Quality Standards require ambient samples to contain no more than 77 organisms/100 ml for full support of contact recreation; however numerous samples are usually needed to determine whether contact uses are at risk, and, therefore, a geometric mean is required to properly determine use support.

Secondary (Non-Contact) Recreation

- FULL SUPPORT: Water quantity and quality sufficient for boating, wading and fishing.

- PARTIAL SUPPORT: Boating or fishing limited by flows, odor, color, plant growth, or a diminished fishery.

- NON SUPPORT: Lack of water for boating, or fishing; or water quality of such poor quality that the fishery is almost non-existent; or unnatural plant growth so extreme that boating is not possible.

Note: Partial or non-support due to algal or other plant growth is used only if the Department is reasonably sure that the plant densities are not natural.

*Surface Drinking Water Supply**

- FULL SUPPORT: No drinking water supply closures or advisories in effect during reporting period; no treatment necessary beyond "reasonable levels."

- PARTIAL SUPPORT: One drinking water supply advisory lasting 30 days or less per year; or problems not requiring closures or advisories but adversely affecting treatment costs and the quality of polished water, such as taste and odor problems, color, excessive turbidity, high dissolved solids, pollutants requiring activated charcoal filters, etc.

- NON SUPPORT: One or more drinking water supply advisories lasting more than 30 days per year, or one or more drinking water supply closures per year.

Agricultural Water Supply and Industrial Water Supply

- There are currently no EPA definitions or state standards for agricultural and industrial water supply. These uses are currently unassessed.

Aesthetics

- FULL SUPPORT: No diminishment of the natural aesthetic quality of the water. Water clarity and substrate condition good. No floating solids, oil, grease or scum. Intact, natural riparian zone.

- PARTIAL SUPPORT: Aesthetic quality compromised somewhat. Water unnaturally turbid. Moderate unnatural plant growth. Small or disturbed riparian zone.

- NON-SUPPORT: Aesthetic quality poor. Water is frequently and unnaturally turbid. Excessive unnatural plant growth covers the channel bottom, rocks or water surface. Substrate unnaturally silt-covered or mucky. Presence of floating solids, scum, oil or grease. Stained channel rocks. No riparian vegetation or a highly degraded riparian zone. Unnatural, slumping banks.

Overall

- FULL SUPPORT: all individual designated uses are fully supported and there are no known exceedences of State Water Quality Standards.

- PARTIAL SUPPORT*:* one or more uses are partially supported and the remaining uses are fully supported.

- NON-SUPPORT*:* one or more uses are not supported.

Use Support Determinations for Lakes and Ponds

In concert with NEIWPCC regional consistency efforts, the Department has made minor modifications to its methods for determining degree of use support for lakes. The following is a summary of the decision criteria used by the Department to assess use support for lakes:

First, Partial Support and Non Support use determinations are no longer made based solely on public opinion, town clerk, or Fish and Wildlife warden comments. Lacking any scientifically derived data, comments such as those are only used to indicate a potential threat to a use.

Aquatic Biota/Habitat (*Aquatic Life)*

Biological Assessment

Until recently, very little biological assessment data has been available for lakes. Past assessments often relied on qualitative observations of habitat conditions. It is anticipated that future assessments will be more directly based on biological data for phytoplankton, macroinvertebrate, and macrophyte assemblages. Insofar as sufficient data are available, Aquatic Life Use Support decisions are made consistent with the existing methods detailed in the 1996 305(b) report.

Conventionals (alkalinity, DO)

- PARTIAL SUPPORT: Reliable long-term monitoring data indicates that a lake's acid neutralizing capacity routinely drops below 50 meq/l (2.5 mg/l as CaCO3) during the spring runoff period.

  Reliable long-term monitoring data indicates that a lake's hypolimnetic dissolved oxygen concentration periodically falls to (or near) zero mg/l or zero percent saturation during peak summer stratification and the hypolimnetic sediments are devoid of a macroinvertebrate community. The area designated as partially supporting aquatic life uses is limited to the lake acreage underlain by the hypolimnetic oxygen-deficit area. If, in the best professional judgement of the Department's scientists, the dissolved oxygen deficit is due to natural causes, the lake will be considered fully supported but threatened instead.

- NON SUPPORT: Reliable long-term monitoring data indicates that a lake's acid neutralizing capacity routinely drops below 0 meq/l (0 mg/l as CaCO3) during the spring runoff period.

  Reliable long-term monitoring data indicates that, for the entirety or the majority of a lake's acreage, dissolved oxygen concentrations routinely fall to zero mg/l or zero percent saturation during peak summer stratification and fish kills result.

- THREATENED: Reliable long-term monitoring data indicates that a lake's acid neutralizing capacity routinely drops below 250 meq/l (12.5 mg/l as CaCO3) during the spring runoff period.

Reliable long-term monitoring data indicates that a lake's hypolimnetic dissolved oxygen concentration periodically falls to (or near) zero mg/l or zero percent saturation during peak summer stratification. The area designated as threatening aquatic life uses is limited to the lake acreage underlain by the hypolimnetic oxygen-deficit area.

Fish Consumption

The 1998 federal 305(b) guidelines are now being used to revise Fish Consumption use support on a lake-by-lake basis, as each lake is reassessed. Vermont interprets the USEPA guidance on fish consumption use attainment in the following manner: For any lake on which a species is present which is the subject of a "no-consumption" advisory for a sub-population (women of childbearing age or children), fish consumption use is considered only partially supported. Any lake on which a no-consumption advisory is in place for the general population would be assessed as not supporting fish consumption uses. For lakes on which fish consumption is limited, but not banned, for a sub-population and/or for the general population, the use is considered supported. This is because fish can indeed be consumed from those waters, albeit at a reduced rate. The following summarizes the current assessment guidelines for Fish Consumption Use are as follows:

- PARTIAL SUPPORT: For a given species, a 'no consumption' advisory is in place for a designated sub-population (e.g., children or women of childbearing age).

- NON SUPPORT: For a given species, a 'no consumption' advisory is in place for the general population.

Under these guidelines, fish consumption use is considered Not Supported or Partially Supported only in the event that the fish species subject to the consumption advisory is documented by the VT Dept. of Fish and Wildlife to exist in a lake.

Secondary (Non-Contact) Recreation

As lakes are being reassessed, a closer look is being taken at the reliability of the information used to make this use support assessment and what the correct threshold level should be for considering secondary contact uses as only partially supported or not supported.

Unfiltered Water Supply

The Safe Drinking Water Act criteria for finished water are now being used to assess Unfiltered Water Supply use.

Agricultural Water Supply and Industrial Water Supply

There are currently no EPA definitions or state standards for agricultural and industrial water supply. These uses are currently unassessed.

Aesthetics

A closer look is presently being taken at the reliability of the information used to make this use support assessment and what the correct threshold level should be for considering aesthetic uses as only partially supported or not supported.

Additional Considerations for Lake Champlain

Vermont's Water Quality Standards contain segment-specific total phosphorus criteria for Lake Champlain. These segment-specific standards (that were based in part on user observation/satisfaction survey results) are now being used to evaluate aesthetics and swimming use support for Lake Champlain.

Maps

The Department is finalizing its refinements to the lakes and ponds data layer at 1:24000 or 1:5000; however, mapping the rivers and streams data layer at 1:5000 will take considerably longer. A funding request for mapping the rivers and streams data layer is presently part of the Department's Watershed Improvement initiative, under consideration by the General Assembly. The Department maintains geographic data layers for rivers and streams, lakes and ponds, wetlands and ground water resources.

The Department uses the existing Lakes and Ponds data layer, and other relevant data layers, on a PC-ArcView (v3.0, ESRI) platform. This existing Lakes and Ponds data layer contains fields for both lake name and waterbody ID, enabling linkage to the existing assessment data tables using ArcView's data querying functions. Refinements to the Lakes and Ponds GIS layer will allow users to geographically display use impairment, cause and source information. The VTDEC Lakes Assessment Database is presently housed in an MS-Access© database. Staff now have the ability to link Arcview GIS layers and associated underlying datatables directly to the Lakes Assessment Database using open database connectivity.

Section 303(d) Waters

Section 303(d) of the Clean Water Act requires States to identify waters that do not or are not expected to meet applicable water quality standards with technology-based controls alone. States are required to establish a priority ranking for these waters, taking into account the pollution severity and designated uses of the waters.

Once the identification and priority ranking of water quality-limited waters are completed, states are to develop total maximum daily loads (TMDLs) at a level necessary to achieve applicable state water quality standards. The public must be involved with the development of the priority ranking and targeting of waters needing TMDL determinations. The public must also be consulted to assist the determination of load allocations to particular sources. States must determine pollution controls to be implemented, a schedule for data collection, establishment of the control measures, assessment for water quality standards attainment and, if needed, additional modeling.

The Vermont 1998 Section 303(d) List of Waters was submitted to the regional EPA office for approval in December 1998. Final EPA approval was received in August 1999. In the interim, the Department responded to several requests for listing clarification and supplied documentation supporting listing decisions. There were no changes made to the list between submission and final EPA approval. For Part A of the List of Waters, there are a total of 122 surface waterbodies identified as impaired. Of this total, 66 concern rivers and streams and 56 involve lakes and ponds. There are a total of 196 unique water quality problems identified and scheduled for Total Maximum Daily Load (TMDL) development.

Part B of the List of Waters are waters which appeared on the state's EPA-approved 1996 303(d) list and which have been "de-listed". Reasons for de-listing include: (1) waters now meet standards, (2) waters are expected to meet standards by April 1, 2002, (3) waters were inaccurately placed on the 1998 list (i.e. based on inaccurate or unreliable data or unsubstantiated qualitative information), and (4) current (i.e.) 19980 EPA 303(d) guidance does not require listing.

Several investigations involving impaired waters on Part A of the List of Waters have either been initiated or completed. The one goal of these investigations is to develop TMDL determinations aimed at bringing the waterbody into compliance with the Vermont Water Quality Standards. To date, however, there have been no TMDLs finalized. Upon each individual TMDL completion, there will be a public notice and comment period prior to submission to EPA for final approval. A TMDL project update has been prepared to show the status of TMDLs (Appendix G).

The next submittal by the Department to EPA of the 303(d) List of Waters is scheduled for April 1, 2000. The 2000 List of Waters will consist of Part A (impairments) and Part B (de-list candidates). EPA has proposed a controversial set of new regulations for listing development and TMDL determinations that would, once adopted and made effective, influence subsequent 303d lists and the nature of TMDL submittals.

Chapter Three: Rivers and Streams Water Quality Assessment

Statewide Water Quality Assessment/Designated Use Support

Vermont's statewide surface water quality has been determined by updating past years' statewide assessment data with the second round of water quality information (the rotational assessment information begins on page III-14. Tables and narrative are included below which give the overall and individual use support summaries for the state's waters.

According to EPA, Vermont has 7,100 miles of perennial rivers and streams. Of the 5,462 river and stream miles assessed for overall use for this report, approximately 4,294 miles (79%) are in compliance with the state's water quality standards, or fully support designated uses, and 1,168 miles (21%) are not in compliance with the water quality standards, or do not fully support the designated uses.

Individual Use Support Summary

Table III.3.1 is a summary of the number of miles of rivers and streams throughout Vermont which fully support or do not support the water quality standards or designated uses.

Table III.3.1 **Statewide Overall and Individual Use Support Summary**
Rivers and Streams

Designated Use	Miles Fully Supporting	Miles Threatened	Miles Partially Supporting	Miles Not Supporting	Total Miles Assessed
Overall	3105.3	1188.4	786.0	382.5	5462.2
Aquatic biota/habitat	3203.8	1196.4	829.5	232.5	5462.2
Contact Recreation	4114.7	649.7	446.5	99.5	5310.4
Secondary Contact Recreation	4563.0	384.4	309.1	150.2	5406.7
Aesthetics	3831.5	821.1	646.6	153.0	5452.2
Drinking Water Supply	4063.9	271.8	84.5	32.9	4453.1
Agricultural Water Supply	3864.7	147.9	45.9	24.9	4083.4
Industrial Water Supply	0	0	0	0	0

Certain uses were not assessed at all or not assessed on some rivers due to a lack of information. An explanation of individual uses and the methodology by which their support has been determined is included in Part III, Chapter Two.

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 Tables III.3.2 and III.3.3. 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.

Causes and Sources[11] of Pollutants

A cause is a condition of water quality impairment (or pollutant); a source is the origin of the cause of impairment. The sources are subdivided into point and nonpoint, and a nonpoint source is defined as any pollutant not discharged directly from the end of a pipe. Tables III.3.2 and III.3.3 summarize miles of rivers and streams impaired by causes and sources, respectively. Figure 1 illustrates the major causes and sources which result in non support or partial support of rivers and streams**.**

Table III.3.2 **Statewide Total Size of Waters Impaired or Threatened by Various Cause Categories (in Miles)**

Rivers and Streams

Cause of Impairment or Threat	Miles of Waters by Magnitude			
	High	Moderate or Minor	Total	Threat
Siltation/Sedimentation	492.7	406.4	899.1	1054.7
Nutrients	194.2	283.9	478.1	525.4
Thermal Modifications	113.6	347.4	461.0	387.5
Organic Enrichment / Low D.O.	103.9	330.3	434.2	223.1
Pathogens	96.9	301.9	398.8	496.6
Flow Alterations	198.6	162.7	361.3	138.4
Habitat Alterations	219.4	84.2	303.6	197.6
Turbidity	10.6	225.3	235.9	120.5
Metals	179.8	48.2	228.0	169.6

[11]These cause and source categories have been established by the U.S. Environmental Protection Agency.

Assessment of Causes of Impairment

The assessment revealed that the largest causes of impact to river and stream water quality, indicated in descending order by total river miles affected, are: siltation/sedimentation, nutrients, thermal modifications, organic enrichment/low dissolved oxygen, pathogens, flow alterations, habitat alterations,[12] turbidity and metals.

The total river and stream miles impaired by siltation/sedimentation is 899, the largest cause of impairment to Vermont's rivers and streams. The second largest cause of impairment is nutrients, which impair some 478 miles. The third largest, thermal impairments, cause impairments to 461 miles of rivers and streams. Organic enrichment, at 434 miles, is the fourth largest cause of impairments. Pathogens cause impairments to 399 miles of rivers and streams and ranks fifth. The remaining causes of impairment: flow alterations (sixth), habitat alterations (seventh), turbidity (eighth) and metals (ninth) have a combined impact on 1,129 miles of Vermont's rivers and streams.

Siltation and sedimentation has long been the largest cause of river and stream water quality/aquatic habitat impacts. Nutrients, temperature impacts, organic enrichment/low dissolved oxygen, and pathogens were among the top five causes of river and stream water quality problems in 1996 as they are currently. The total miles impaired by several of these pollutants or conditions were are less in 1999 than in 1996. This is largely due to a refinement of the assessment information made possible by the rotational basin assessment process that allows for a more comprehensive analysis of the problems and the river or stream stretches on which they occur. In addition, a stricter standard was applied when using evaluated information (versus using data obtained from monitoring) to make use support decisions. Some reaches of river and stream were given threatened status instead of partial support status depending on the type of assessment and source of information.

Changes in assessment process and comprehensiveness were not the sole reason for fewer miles of impact by sediments, temperature and organic enrichment, however. Agricultural practices that protect streamside vegetation and reduce streambank erosion have been implemented more widely. Improvements were noted in the Poultney- Mettawee Basin especially.

Assessment of Sources of Impairment

"Streambank erosion" ranks first overall among pollution sources with total impact to 593 miles of rivers and streams. Streambank erosion is caused by numerous human activities, including land development along streams and in watersheds, agriculture (livestock access to streams and removal of stream buffer adjacent to fields), clearing for views, road repair, maintenance or construction. In addition, streambank erosion may be the result of flow regulation by hydro

[12] Habitat alteration: Impairments of the suitability of a stream or river for aquatic life due to physical disturbance such as channel alterations and streambed disruption (bulldozers in stream, gravel removal). This category used to include turbidity and other impacts that now have their own codes and because some of the waterbodies have not been updated recently, the numbers included here are an overestimation.

facilities, and poor logging practices. Erosion of stream banks causes sedimentation to the stream which destroys fish and macroinvertebrate habitat and also causes turbidity, resulting in clogged fish gills. In addition, eroding streambanks affect stream channel stability and, thus, aquatic habitat.

Table III.3.3 **Statewide Total Size of Waters Impaired or Threatened by Various Sources (in Miles)**

Rivers and Streams

Source of Impairment or Threat	Miles of Waters by Magnitude			
	High	**Moderate/Minor**	**Total**	**Threatened**
Streambank Erosion	207.7	385.1	592.8	378.7
Agriculture	266.1	297.3	563.4	538.7
Removal of Riparian Vegetation	116.0	237.6	353.6	298.7
Flow Modification - Hydroelectric	125.6	181.2	306.8	43.0
Upstream Impoundment	105.3	191.1	296.4	23.7
Land Development	136.5	95.0	231.5	448.9
Road/Bridge Runoff	2.5	188.0	190.5	277.1
Atmospheric Deposition	158.4	11.0	169.4	70.1
Onsite Septic Systems	3.7	158.5	162.2	132.7
Developed Land Runoff	79.6	51.4	131.0	121.4
Municipal Point Sources	17.5	106.2	123.7	102.5
Flow Modification - Snowmaking	52.2	13.7	65.9	7.9
Channelization	13.8	48.9	62.7	47.1
Resource Extraction/Mining	23.1	12.7	35.8	34.5

“Agriculture” is the second largest source of stream impairment with 563 miles impaired. Agricultural activities can result in nutrient runoff from pasture land, crop production and animal management areas and also can result in loss of riparian vegetation and can cause streambank erosion.

“Removal of riparian (streamside) vegetation” is the third highest source of impairment to Vermont's rivers and streams, with 354 miles affected by this activity. Removal of riparian vegetation continues to be a growing problem in the state, and the miles cited are an
as roadside clearing and some agricultural land clearing. This impact is closely related to streambank erosion because removal of riparian vegetation can lead to streambank destabilization
underestimation. Most of the problem is due to flooding; however, riparian vegetation removal is historically the result of landowners wishing to improve views or "clean up" their properties, as well and erosion, and is linked to the water quality problems (causes) of siltation and thermal modification which are ranked first and third, respectively, in the "Cause" category.

The fourth and fifth highest sources of pollution are “flow regulation-hydroelectric” and “upstream impoundment,” respectively. Flow regulation below hydroelectric power dams causes low and fluctuating flows or dewatering of channels. This impairs the downstream fishery as well as macroinvertebrates and causes low dissolved oxygen and other water quality problems. Upstream impoundments are bodies of water behind hydroelectric dams. Impoundments cause warming of the water, streambank erosion, act as sediment traps, and change fish and wildlife habitats from quick-moving water to still or slow-moving water. Upstream impoundments impair 296 miles of streams and rivers.

The sixth and seventh highest sources of pollution are “land development” and “road/bridge runoff,” respectively. Land development includes clearing, grading, excavation and filling, done usually with no or improperly maintained erosion control devices. Runoff from land development caused 232 miles of impairment, and threatens another 449 miles. Most of the road/bridge water quality impairments come from gravel town roads that drain toward streams or are too close to streams and discharge silt to them. Runoff from bridges over streams goes directly into streams. Road runoff also goes to slopes adjacent to the bridge abutments, which causes the slopes to erode to the streams. In addition, highway maintenance often includes washing pollutants off bridges into adjacent rivers and streams.

“Atmospheric deposition” (eighth highest source) is the primary source of mercury in Vermont. (The reader is referred to page II-24 for a full discussion of this source of pollution to Vermont’s waters).

The ninth highest source, "onsite wastewater systems," as listed in the "Source" table are failed septic systems which may directly or indirectly discharge to nearby streams. The 162 impaired stream miles caused by this category is more serious from a human health viewpoint due
to the fact that the cause of the impairments are pathogens that may be of human origin. The miles of impairment from this source should decrease in the future once new WWTF construction and

expansion is completed in towns where buildings with failed septic systems are connected to the new WWTFs.

The tenth highest source of water quality impairment is “developed land runoff,” which has impaired 131 miles of rivers and streams. This category includes runoff from any urban, suburban, village or other developed areas.

"Municipal point sources," the eleventh largest source of impairment, are wastewater treatment facilities. Recent WWTF enlargements and improvements have improved the state’s water quality.

“Flow modification - snowmaking” is the withdrawal of water from rivers, streams or lakes for the manufacture of snow for ski areas. The 66 miles of streams impaired by this use is the eleventh largest source of stream impairment.

“Channelization,” the twelfth largest source of stream impairment at 63 miles, is a procedure which straightens and/or prevents a stream channel from seeking its own location by the use of large stone pieces (rip-rap) or concrete on its banks. Usually the procedure is performed to keep the human-built environment from being encroached upon by the river or stream. Impairment is caused by the removal of the naturalness of the stream environment (morphology), which sterilizes the stream and renders it incapable (or nearly so) of supporting fish and wildlife. The mileage impaired in this report (63) is approximately the same as in the 1996 report.

The final source category, “resource extraction/mining,” impairs approximately 36 miles, and threatens another 34 miles. It should be noted that this category now takes the place of three source categories in the 1996 report, which were: “surface mining,” “mine tailings,” and “mill tailings.”

The three largest categories of sources are the same top three identified in the 1996 assessment. Improvements due to streamside vegetation protection projects largely on agricultural land and due to streambank stabilization work in a number of locations are counteracted by the riparian vegetation removal in developing areas and by increased streambank erosion due to unstable stream channels. This stream instability is in part a result of increased watershed development. Severe flood events in the last four or five years have taken a toll as well.

Chapter Four: Lakes and Ponds Water Quality Assessment

Assessment of Statewide Use Support, Causes, and Sources, for Inland Vermont Lakes and Ponds

This chapter reports on overall use support, and on the causes and sources of stressors which engender non-support of uses, for inland Vermont lakes. The reader will note reasonably significant changes in the values presented in this 2000 305(b) report relative to the 1996 report, which was the last time these overall statewide measures were presented. The reasons for these changes are largely related to comprehensive reassessments which have been performed on approximately one half of the 556 lake waterbodies in the assessment database.

Vermont's lake assessment database is in a period of flux. As waters are revisited and the assessments re-evaluated and revised, many of the older observations which were previously used to make a determination of "not fully supporting" have been subjected to rigorous comparisons with available modern and historical data. For example, many waters were previously identified as partially or not supporting uses solely on the basis of observations such as "algae in the water column," or "sediment on the bottom." In those instances where the observations were not validated with data indicating a deviation from the Vermont Water Quality Standards, or by a record of public complaints regarding the condition (which would suggest a loss of a designated use), the partial or non support acreage was converted to full support, or fully supported but threatened. Since the Department is only halfway through the comprehensive 5-year rotating reassessment period, the following tables capture simultaneously revised, corrected assessments, and older, to-be-revised assessments.

It is the intent of the Department to perform all revisions to the 11 Lake Champlain waterbody segment entries in the database at the completion of the 5-year rotating assessment cycle. Accordingly, for an assessment of use support, causes, and sources for Lake Champlain, the reader is referred to Vermont's 1996 305(b) Report.

This chapter is formatted such that uses, causes, and sources are presented individually, and are only cursorily related to each other. The major threats and stressors to inland Vermont lakes are then highlighted.

Assessment of Use Support for Inland Vermont Lakes:

Individual use support for inland lakes and ponds is highlighted in Table III.4.1. There are 53,608 assessed inland lake acres in Vermont. Overall, 22,940 lake and pond acres (43% of the total) fully support all uses. Of these acres, 54% are presently considered to have overall uses threatened. Aesthetics are supported on 44,638 acres (83%), and this use is considered threatened on 25% of these acres. Aquatic life uses are supported on 35,099 acres (66%), and this use is considered threatened on 43 % of the supported acres. Fish consumption uses are supported on

only 30,781 acres (57%), which is a direct manifestation of the existing Vermont Department of Health advisory against consumption of freshwater fish due to mercury contamination. Secondary contact and swimming uses are supported on 38,100 (71%), and 44,968 (84%) acres respectively, and 26% and 24% of these acres are threatened. Agricultural, industrial, filtered, and drinking water supply uses are unassessed for the majority of Vermont lake acres.

Table III.4.1 **Statewide Use Support**

545 Inland Vermont Lakes and Ponds

Use	Acres Fully Supporting Uses	Acres with Uses Threatened	Acres Partially Supporting Uses	Acres Not Supporting Uses	Acres Not Assessed
Overall Uses	10,452	12,488	23,918	6,492	258
Aesthetics	33,583	11,055	4,739	3,813	418
Aquatic Life Use Support	19,906	15,193	14,815	3,425	269
Agricultural Water Supply	0	0	0	0	53,608
Drinking Water Supply	1,022	8	123	0	52,455
Fish Consumption	30,781	0	20,958	0	1,869
Filtered Water Supply	767	7	912	0	51,922
Industrial Water Supply	0	180	21	0	53,407
Secondary Contact Uses	28,371	9,729	11,032	3,862	614
Swimming Uses	34,256	10,712	4,120	3,855	665

Assessment of Causes of Use Support Impairment for Inland Vermont Lakes

There are several general causes of use impairments for Vermont lakes. These are listed in Table III.4.2. When referring to Table III.4.2, the reader should be aware that, in many cases, several of these causes simultaneously impact uses on a single lake. Thus, the acreages impacted by these causes cannot be summed to arrive at an estimate of the entire acreage impacted statewide for all causes.

There are ten separate causes which impact uses on at least 1,000 lake acres. The most widespread of these is metals, and most specifically mercury. A related cause is low pH, which is the third largest cause of impact to Vermont lakes. Flow alteration is the second largest cause of impact to Vermont lakes. Causes related to eutrophication (nutrients, algae, siltation, and organic enrichment) constitute the fourth through seventh largest causes, respectively. While the acreage impacted by exotic species is low relative to some of the above mentioned causes (1,372 acres), the importance of exotic species as the cause of serious degradation to Vermont lakes cannot be underestimated (see Synthesis below).

Table III.4.2 **Total Size of Waters Impaired of Threatened by Causes of Impacts (in Acres)**

545 Inland Vermont Lakes and Ponds

Cause of Impact	Magnitude of Impact				Total Acres Not Fully Supporting	Total Acres Threatened
	High	Moderate	Minor	Slight		
0000 Cause Unknown	26			789	815	
0200 Pesticides			5		5	
0500 Metals	5,217	8,618	6,332		20,167	25
0560 Mercury	5,133	8,618	5,357		19,108	
0800 Other Inorganics	6				6	
0900 Nutrients	4,688	56	755	766	6,265	4,872
1000 ph	664		3,608		4,272	6,801
1100 Siltation	1,622		1,878		3,500	4,319
1200 Organic Enrichment - DO	1,957		985		2,942	1,140
1300 Salinity/TDS/ Chlorides					0	9
1400 Thermal Modifications	7				7	160
1500 Flow Alteration	4,341	5	4,568		8,914	1,002
1600 Other Habitat Alterations	7				7	94
1700 Pathogens	54				54	124
2000 Taste and Odor			18		18	
2100 Suspended Solids			215		215	
2200 Noxious Aquatic Plants - Native	400	452	800	37	1,689	1,746
2210 Noxious Aquatic Plants - Algae	2,470		1,600	22	4,092	2,437
2300 Filling and Draining			46		46	29
2500 Turbidity					0	100
2600 Exotic Species	1,153		219		1,372	4,572

With the exception of metals and mercury, the same causes listed above also constitute the major threats to uses on Vermont lakes. Indeed, while pH impacts uses on 4,272 acres, it represents the single greatest threat to uses on 6,801 lake acres. An even more striking example is that of exotic species, which impact 1,372 acres, but threaten 4,572. Other major threats, in order of magnitude, include: nutrients; siltation; algae; and organic enrichment. The relative importance of native aquatic plants as a cause of both impact and threat to uses in Vermont lakes should be treated cautiously. In the process of performing the reassessments completed to date, impacts related to

native aquatic macrophytes were one of the most commonly modified entries, with most of the impacts being changed to threats. Since approximately half of the inland lake waterbodies have yet to be reassessed, Table III.4.2 overestimates the extent of impairments due to native aquatic plants.

Assessment of Sources of Use Support Impairment for Inland Vermont Lakes

There are several general sources of use impairments for Vermont lakes (Table III.4.3). When referring to Table III.4.3, the reader should be aware that the acreages impacted by these sources cannot be summed to arrive at an estimate of the entire acreage impacted statewide. In many cases, several of these sources simultaneously impact uses on a single lake.

Of the 37 separate sources of impacts on uses, ten major sources account for impact to at least 1,000 acres. The single most important source, impacting 22,485 lake acres, is atmospheric deposition. Hydromodification, which includes flow alteration, is the second most important source. General nonpoint sources (3rd), agriculture (5th), habitat modification (6th), construction (7th), land disposal (8th), and highway maintenance (10th) all are related to eutrophication. Natural sources, which are related largely to the cause pH, are the fourth most important source. Finally, in-water releases of exotics are the ninth most important source.

Table III.4.3. **Total Size of Waters Impaired or Threatened by Various Sources** (in Acres)
545 Inland Vermont Lakes and Ponds

Source of Impact	Magnitude of Impact				Total Acres Not Fully Supporting	Total Acres Threatened
	High	Moderate	Minor	Slight		
0100 Industrial Point Sources	6				6	51
0110 Major Industrial Point Sources						160
0200 Municipal Point Sources			623		623	
0400 Combined Sewer Overflow			623		623	
1000 Agriculture	3,380		1,031		4,411	1,590
1100 Nonirrigated Crop Production	2,441		1,485		3,926	467
1200 Irrigated Crop Production						20
1400 Pasture Grazing Riparian and/or Upland	1,803		1,439		3,242	685
1410 Pasture Grazing Riparian	11				11	
1500 Range Grazing Riparian and/or Upland			173		173	

Source of Impact	Magnitude of Impact				Total Acres Not Fully Supporting	Total Acres Threatened
	High	Moderate	Minor	Slight		
1800 VT Animal Holding/Management Area	2,289		1,058		3,347	567
1900 VT Manure Lagoons	21				21	
2000 Silviculture	359		241		600	2,662
2100 Harvesting, Restoration, Residue Management	302		78		380	2,415
2200 Forest Management (pump drainage/fertiliz /pestic)			760		760	
2300 Logging Road Construction/Maintenance						20
3000 Construction	513		1,427	38	1,978	4,329
3100 Highway/Road/Bridge Construction			4		4	12
3200 Land Development	513		1,423	34	1,970	4,329
4000 Urban Runoff/Storm Sewers	35		3		38	1,628
4300 Other Urban Runoff						163
4500 Highway/Road Bridge Runoff	35				35	100
5000 Resource Extraction	7				7	15
5100 Surface Mining	7				7	15
6000 LAND DISPOSAL	496	451	207	265	1,419	825
6300 Landfills						14
6400 Industrial Land Treatment	452				452	446
6500 Onsite Wastewater Systems (Septic Tanks)	44	451	207	265	967	385
6700 Septage Disposal						2
7000 Hydromodification	4,360		4,626		8,986	1,145
7300 Dam Construction	3				3	
7400 Flow Regulation/Modification	4,353		4,626		8,979	1,106

Source of Impact	Magnitude of Impact				Total Acres Not Fully Supporting	Total Acres Threatened
	High	Moderate	Minor	Slight		
7550 Habitat Modification (Other than Hydromodification)	878	1	1,280	3	2,162	129
7600 Removal of Riparian Vegetation		1	306		307	1,495
7700 Streambank Modification/Destabilization	878		1,059	3	1,940	901
7900 Marinas and Recreational Boating	1,195		219		1,414	5,118
7910 In Water Releases	1,195		219		1,414	5,118
8100 Atmospheric Deposition	5,862	11,992	4,631		22,485	5,264
8300 Highway Maintenance and Runoff	567		329	235	1,131	4,806
8500 Contaminated Sediments						25
8530 Internal Nutrient Cycling (Lakes)	79				79	
8600 Natural Sources	244	24	3,966	492	4,726	7,307
8950 Other			105		105	
9000 Source Unknown	27		40	789	856	515
9070 Vt Unspecified Nonpoint Source	4,845	57	160		5,062	25

With respect to sources that result in threats to uses of Vermont lakes, the roster is similar, but not identical. Nine major sources comprise threats to at least 1,000 acres statewide. Natural sources and atmospheric deposition are the first and second most important sources of threats respectively. As reflected by the sources of impairment listed above, while boating and associated in-water releases are the source of **impacts** to 1,414 acres, fully 5,118 acres are **threatened** by this exotic species spread vector. Highway (and other roadway) maintenance (4th), construction (5th), silviculture (6th), urban runoff (7th), and agriculture (8th) are all sources of threats related to eutrophication. Finally, hydromodification (9th) threatens uses on 1,145 acres.

Synthesis: A Summary of Major Impacts and Threats to Uses of Inland Vermont Lakes

Based on the use support, cause, and source information presented above, the following issues surface as the most important ones presently affecting inland Vermont lakes: *Atmospheric Deposition of*

Pollutants, Hydrologic Modifications, Exotic Aquatic Species as Pollutants, and *Eutrophication of Vermont Lakes.* For a discussion of these issues, see pages II-24, II-25 and II-26.

Table III.4.4 summarizes the trophic status for inland Vermont lakes. Specific assessments of individual lake status and trends are included in Appendix H in this document.

Table III.4.4. **Trophic Status of Significant Inland Lakes**

Trophic Status	Number of Lakes	Total Lake Area (ac)
Oligotrophic	33	9820
Mesotrophic	125	25638
Eutrophic	30	6205
Hypertrophic	2	473
Dystrophic	19	445
Unknown	336	11027
Total Assessed	**545**	**53608**

Chapter Five: Round Two Rotating Basin Assessments

This chapter contains summaries of Vermont's second round of rotational watershed assessment information. Water quality assessments were made on nearly every waterbody in the three following basins: Poultney, Mettawee Rivers (Basin 2); Ottauquechee, Black Rivers (Basin 10); and Ompompanoosuc, Waits and Wells Rivers (Basin 14). The assessments for these basins are summarized below. The full assessment reports are available from the Department.[13]

Basin 2. The Poultney-Mettawee Basin

General Description

The Poultney-Mettawee basin encompasses an area of 373 square miles in Addison, Rutland and Bennington counties. The Poultney River originates in the town of Tinmouth and flows northwesterly into New York State. The Mettawee River originates in the town of Dorset and also flows northwesterly into New York state. Both rivers enter the New York Barge Canal near Whitehall, NY.

There are a total of 25 lakes and ponds that are 20 acres and greater within the Vermont portion of the Poultney-Mettawee Basin. They total approximately 5,250 acres. The largest is Lake Bomoseen (2,360 acres) followed by Lake St. Catherine (883 acres), Lake Hortonia (479 acres), Glen Lake (206 acres), Sunset Lake (202 acres), and Little Pond (177 acres).

Designated Use Support, Causes & Sources of Impairments, and Section 303d Waters

Rivers and Streams

Overall, 184.3 miles (86%) of the Poultney-Mettawee Basin river and stream assessed miles (213.9 miles were assessed) meet their overall uses as required by the water quality standards, and are considered fully supported. Approximately 30 miles (14%) partially support or do not support their uses, or are considered impaired. Table III.5.1 summarizes support status for overall and individual designated uses.

The two greatest causes of impairment and threats to the rivers and streams in Basin 2 are nutrients and sediments, which originate from agricultural activities, streambank erosion, removal of streambank vegetation and municipal wastewater treatment facilities. Metals, primarily mercury, transported in the atmosphere, is another impact to water quality.

[13]The first round of assessments were reported on in the 1998 305(b) Report. They were: Basin #3 (Otter Creek Basin), Basin #4 (Lower Lake Champlain Basin), and Basin #9 (White River Basin).

Use Support Status

Table III.5.1 Basin 2 Rivers and Streams

Use	Miles of full support	Miles threatened	Miles of partial support	Miles of non-support	Miles not assessed
Overall	126.5	57.8	26.0	3.6	0.0
Aquatic biota/habitat	127.4	59.3	23.7	3.5	0.0
Contact recreation	166.5	29.0	15.4	3.0	0.0
Secondary contact recreation	175.8	17.1	21.0	0.0	0.0
Fish consumption	203.5	0.0	10.4	0.0	0.0
Aesthetics	151.5	14.9	14.7	3.6	0.0
Drinking water supply	0.0	2.5	0.0	0.0	211.4
Ag water supply	0.0	2.5	0.0	0.0	211.4

Lakes and Ponds

Of 5,410 lake and pond acres assessed for overall uses, 3,740 acres (69%) meet their designated uses, and 1,670 acres (31%) do not meet their designated uses, or are considered impaired. Table III.5.2 summarizes support of overall and individual uses.

The majority of the threats and impairments to lakes in the basin are caused by non-native species aquatic species. These aquatic species include Eurasian watermilfoil, water chestnut and zebra mussels, and impact a total of 1,332 acres in the basin. The most problematic of the species is Eurasian watermilfoil, which infests the largest number of acres of lakes in Basin 2 and the largest number of lakes of any basin in the state. The major sources of the nuisance non-native species include boating and recreational activities, which cause their spread to other non-infested lakes.

Other lake-impacting causes include mercury contamination of fish (1,085 acres) and siltation, which threatens 232 acres. The source of mercury is atmospheric deposition, which has resulted in the need for fish consumption advisories. Siltation is from nonpoint sources, including silviculture, agriculture, land development and other land-disturbing activities.

Table III.5.2. **Use Support Status**

Basin 2 Lake Acres

Use	Acres Fully Supporting	Acres with Uses	Acres Partially	Acres Not Supporting	Acres Not Assessed
Overall Uses	2467	1273	943	727	0
Aesthetics	2749	1910	24	727	0
Aquatic Life Use Support	2643	2016	24	727	0
Agricultural Water Supply	0	0	0	0	5410
Drinking Water Supply	85	0	0	0	0
Fish Consumption	4325	0	1085	0	0
Filtered Water Supply	0	0	0	0	5410
Industrial Water Supply	0	0	0	0	5410
Secondary Contact Uses	3441	1208	34	727	0
Swimming Uses	3441	1208	34	727	0

Section 303(d) Waters

There are seven segments of rivers and streams in Basin 2 which are on the state's 1998 EPA approved Section 303(d) List of Waters and which can be considered impaired: the Poultney River, from Carvers Falls upstream 2.7 miles (nutrient enrichment from agricultural runoff and erosion), the Poultney River, from its mouth upstream 9 miles to Carver Falls (elevated levels of mercury in walleye), the Castleton River, Fair Haven (pathogens from WWTF pump station overflows), the Poultney River, 0.5 mile above to 0.5 mile below its confluence with the Castleton River (nutrient enrichment from agricultural runoff); the Poultney River below the Poultney WWTF (pathogens from periodic/variable overflows); the Mettawee River, upstream of the NY/VT border for 6 miles (high water temperatures due to loss of riparian vegetation); and an unnamed tributary to the Mettawee River (metals from the Pawlet landfill leachate). No Basin #2 lakes and ponds appear on the 1998 List of Waters.

Basin 10. The Ottauquechee and Black River Basin

General Description

Basin 10, comprised of the Ottauquechee and Black River drainages, is located in the southeastern part of Vermont, and drains to the Connecticut River in the Towns of Hartland (Ottauquechee River) and Springfield (Black River). The Ottauquechee River has a length of 38 miles and drains an area of 223 square miles, while the Black River is also 38 miles long and drains an area of 202 square miles. Both rivers course through narrow, hilly and mountainous terrain. Land use is mostly forested, interspersed with villages, lakes and two major ski areas.

There are 49 lakes and ponds in the Black and Ottauquechee Rivers watersheds, comprising 1,807 acres. Of these, 1,755 acres have been assessed, 1,468 acres of which have been monitored and 287 acres evaluated.

Designated Use Support, Causes and Sources of Impairments, and Section 303d Waters

Rivers and Streams

Of approximately 282 river miles assessed in the basin, 244 miles (86%) fully support all designated uses. Of the fully supported miles, approximately 88 miles are threatened by sources, which, if not taken care of, could pollute the streams in the future. Approximately 34 miles of the assessed rivers and streams (12%) partially support designated uses in the basin, and approximately 5 miles do not support designated uses.

The main cause of impairment is flow alteration (20 miles) which is from water withdrawal for snow making at the Killington Resort. (The Resort is expected, however, to bring their water withdrawals into compliance for the 2000-2001 season.) Other causes of impairment (in descending order of magnitude) are sediments, pathogens, thermal modifications, nutrients, organic enrichment and habitat alterations. The sources of these pollutants include (in descending order of magnitude): bank erosion, land development, recreation activities, upstream impoundments, highway/road/bridge runoff, municipal point sources, removal of riparian vegetation, channelization, agriculture and developed land runoff. Table III.5.3 summarizes

Table III.5.3 **Use Support Status**
Basin 10 Rivers and Streams

Use	Degree of Use Support				
	Full Support	**Threat**	**Partial Support**	**Non Support**	**Not Assessed**
Overall	155.5	88.2	33.7	4.6	0
Aquatic biota/habitat	159.1	93.5	27.7	1.7	0
Fish Consumption	282.0	0	0	0	0
Swimming	221.5	46.3	9.9	4.3	0
Secondary Contact Rec.	220.4	44.0	16.1	1.5	0
Aesthetics	216.0	56.2	5.4	4.4	0
Drinking Water	46.0	2.4	0	1.5	232.1
Agricultural Water Supply	0	2.0	0	0	280.0

support of overall and individual uses for rivers and streams.

Lakes and Ponds

The principal cause of impairments of lakes and ponds in the Black and Ottauquechee River Basin is flow alteration, which impairs several uses on two flood control facilities. Mercury in fish is the second largest cause of impairments, resulting in nonattainment of fish consumption uses for 365 lake acres. Critically low pH of several lakes and ponds impairs 171 lake acres, and threatens an additional 145 lake acres. The presence of exotic species causes impacts to 11 lake acres.

The major sources of these impairments are hydromodification, which precludes support of 505 acres, and atmospheric deposition, which impairs 536 acres and threatens 145 acres. Table III.5.4 summarizes support of overall and individual uses for Basin 10 lakes and ponds.

Table III.5.4 **Use Support Status**

Basin 10 Lakes and Ponds

Use	Acres Fully Supporting	Acres with Uses Thrt'nd	Acres Partially Supporting	Acres Not Supporting	Acres Not Assessed
Overall Uses	533	331	376	505	
Aesthetics	1002	228	10	505	10
Aquatic Life Use Support	757	472	11	505	10
Agricultural Water	0	0	0	0	1755
Drinking Water Supply	0	0	0	0	
Fish Consumption	1380		365	0	10
Filtered Water Supply	0	0	0	0	1755
Industrial Water Supply	0	0	0	0	1755
Secondary Contact Uses	1003	227	10	505	10
Swimming Uses	998	232	10	505	

Section 303(d) Waters

There are seven segments of rivers and streams in Basin 10 (no lakes) which are listed on the state's 1998 EPA approved 303(d) List of Waters: an unnamed stream draining a wetland to the Ottauquechee River [metals (Fe, Ni, Zn, Pb) from the Bridgewater landfill]; two segments of the East Branch of Roaring Brook (sediment, iron from land development, erosion, road runoff); two segments of the Black River, one segment below the Springfield WWTF, and one segment below the Ludlow WWTF (pathogens, nutrient enrichment from the WWTFs, urban runoff and CSOs); Soapstone Brook [metals (Fe, As)] from sediment from an active talc mine; and a tributary to Jewell Brook in Ludlow (iron from the Ludlow landfill).

Basin 14. The Stevens, Wells, Waits and Ompompanoosuc River Basin

General Description

Basin 14 is in the eastern, central part of Vermont, and is in the Connecticut River watershed. The four major rivers which make up the basin have a combined drainage area of approximately 428 square miles, and include parts of Orange, Caledonia, Windsor and Washington counties. Land use is primarily forested, at approximately 80%, with agriculture a distant second at approximately 10%, with the remainder in development, highways, wetlands, lakes and ponds.

Designated Use Support, Causes and Sources of Impairments and Section 303d Waters

Rivers and Streams

Overall, approximately 218 miles of the 264 assessed river miles (82%) in the Stevens, Wells, Waits and Ompompanoosuc River Basin fully support all designated uses. Of these fully supported miles, about 16 miles (6%) are threatened by pollutants or activities along their length. Thirty-seven miles (14%) of the assessed river miles partially support one or more uses. Only about 9 miles (3.5 %) of the river miles do not support one or more uses. The non-support miles are below the Elizabeth, Ely and Pike Hill mines and Bradford hydroelectric facility. Table III.5.5 summarizes use support for overall and individual uses for Basin 14 rivers and streams.

Table III.5.5 **Use Support Status**
Basin 14 Rivers and Streams

Use	Full support	Threatened	Partial support	Non-support	Not assessed
Overall	202.3	15.6	37.4	8.7	0
Aquatic biota/habitat	217.3	28.8	9.2	8.7	0
Fish consumption	222.3	0	1.0	5.5	35.5
Contact recreation	235.0	15.5	6.3	7.2	0
Secondary contact recreation	214.1	12.8	29.9	7.2	0
Drinking water supply	241.8	13.5	1.5	7.2	0
Aesthetics	225.3	27.5	2.5	8.7	0
Agricultural water supply	107.9	3.7	1.5	7.2	143.7

Causes and sources of river pollution include: metals and acidity from the mines' runoff, high temperatures, in-channel work, physical habitat limitations plus a cause and source not yet known. These causes and sources are all having an impact on the trout populations and the Waits and Ompompanoosuc fishery. Swimming uses and aesthetics are impaired by the orange color from the copper mine runoff, acid mine drainage and high levels of coliform bacteria.

Lakes and Ponds

Of 2,078 lakes acres assessed in Basin 14 (98% of total), 1,623 acres (78%) fully support their uses, although 1,270 acres (61%) of the total assessed in the basin are threatened. One or more uses are only partially supported in 455 (22%) lake acres. There are no acres in the non-support category.

Fish consumption use has the most lakes acres in the basin in the partial support category, followed by aquatic life use support, then aesthetics, secondary contact, and swimming uses.

Table III.5.6 **Use Support Status**
Basin 14 Lakes and Ponds

Use	Full support (acres)	Threatened (acres)	Partial Support (acres)	Non-support (acres)	Not Assessed (acres)
Overall uses	353	848	877	0	7
Aesthetics	777	1,245	56	0	7
Aquatic Life	786	1,188	104	0	7
Fish Consumption	1,296	0	773	0	16
Secondary Contact Uses	954	1,068	56	0	7
Swimming	872	1,150	56	0	7

Section 303d Waters

Four Basin 14 waterbodies representing seven river segments and one pond are included on the 1998 Vermont Section 303(d) list of waters. The river segments include those waters impaired by metals and pH changes due to the mine runoff: Copperas Brook, West Branch of the Ompompanoosuc River, Ely Brook, Ompompanoosuc River and Pike Hill Brook. The list also includes two reaches of the Ompompanoosuc where bacteria levels were frequently above standard. Levi Pond is on the 303(d) list because of low pH values.

Chapter Six: Wetlands Information

Background

Vermont wetlands are significant resources that contribute to the economic, cultural, and physical well being of its residents. Wetlands provide numerous ecological functions and social values, including habitat for fish and wildlife, recreational and educational opportunities, habitat for threatened and endangered species, temporary storage of flood waters, and they aid in the maintenance of water supply and quality. However, these resources have been significantly affected by human land and water use activities.

The following paragraphs are updated from the 1998 305(b) Report. The remainder of the wetlands information in that report has not changed.

The Department provides comment on Act 250 applications that involve wetland issues. The Department also conducts pre-Act 250 determinations to assist potential developers in meeting the requirements of the Act. Staff provide comment and advice to other state agencies and they are called upon as wetland experts wherever testimony is deemed appropriate. The Department reviews projects that involve wetland filling under Section 401 of the Clean Water Act based on compliance with the Vermont Water Quality Standards and other applicable provisions of State law. On January 23, 1996, the Vermont Water Quality Standards included the statement that the Standards shall apply to "all waters of the United States," as defined in 40 C.F.R. §122.2 (1995). This wording, therefore, includes wetlands as being part of "all water..." with respect to having met the goals of the Water Quality Standards.

Extent of Wetland Resources

Recently, the Agency of Natural Resources digitized all the National Wetland Inventory (NWI) maps for the state. A total of 232,000 acres of palustrine wetlands is depicted in the maps. Until a more accurate figure has been determined, Vermont uses the figure of 300,000 acres of wetlands of all types.

Wetland Loss

A recent analysis of all completed projects reviewed by the Department (full information is available) shows that there has been a total of 257 acres of documented wetland loss and 446 acres of documented wetland impairment over the period 1990 through 1998 (Table III.6.1).

These figures do not represent all wetland impacts as they are based only on summaries of projects that have been completed for each year. It is likely that many of the projects that have not been completed are larger projects and may represent substantial areas of wetland impacts. Also, it is clear that there are many wetland alterations still occurring that are not reported to the Department and are not included in this database.

Table III.6.1. Areas of Wetland Loss and Impairment - 1990 through 1998[14]

	1990	1991	1992	1993	1994	1995	1996	1997	1998
No. of Completed Projects (Percentage of total projects)	474 (%)	478 (76%)	555 (87%)	454 (87%)	375 (%)	331 (%)	301 (%)	336 (%)	312 (%)
Acres of Wetland Loss									
Class One & Two Wetlands	19.4	12.1	11.7	19.1	4.0	5.9	5.3	4.8	2.9
Class Three Wetlands	22.4	10.0	8.0	11.6	6.6	12.2	9.7	7.1	4.6
Acres of Wetland Impair.									
Class One & Two Wetlands	47.8	40.2	111.3	19.0	24.6	30.9	4.3	3.7	3.2
Class Three Wetlands	3.1	7.8	7.2	4.6	10.5	4.0	8.9	1.6	1.4

The database analysis also shows that there were approximately 537 acres of wetlands saved during the 1990-1998 period. This was achieved by encouraging developers to move their projects out of wetlands or to reconfigure them so as to have little or no impact on wetlands.

Wetlands Protection Mechanisms

On October 15, 1997, the State of Vermont and the Army Corps of Engineers issued the State General Permit for projects in waters of the United States that occur in Vermont. Under this program, any fill under 3000 square feet, (except in Class Two wetlands, or special wetlands, or wetlands adjacent to international bodies of water, or in the towns of Athens, Brookline, Grafton, Newfane, Putney, Rockingham, or Townshend), do not have to report their fill activity to either the Corps of Engineers or the State of Vermont. Fills between 3000 square feet and one acre are reviewed by an interdisciplinary team. The Vermont Water Quality Standards are the basis for review of projects under Section 401 Water Quality Certification. The Department works closely with the Corps of Engineer's Vermont Field Office staff on many projects.

Geographically, Rutland County is the area of the state with the highest acreage of wetland alteration, when the 100 acre agricultural conversion is included in the analysis (Table III.6.2). However, Chittenden County remains the area of the state with the largest number of Department site visits and the largest area of wetland loss. Approximately 38 acres of wetland have also been lost or impaired in Washington County over this period.

[14] Figures are based on the projects that have been completed. (Source: Wetlands Office Database).

For projects completed during the 1990-1998 period, the Department's database shows that, of the project types, agricultural projects (126 acres) and commercial/industrial development (127 acres) resulted in the greatest area of wetland loss and impairment, followed by ponds (100 acres) and residential development (78 acres) (Table III.6.3). Commercial/industrial development, residential development and road construction generally result in mostly wetland loss with small areas of wetland impairment. The 109 acres of loss and impairment due to agriculture includes 100 acres of forested swamp conversion from one project in Brandon.

Table III.6.2 Area of Wetland Loss or Impairments by County
1990 through 1998

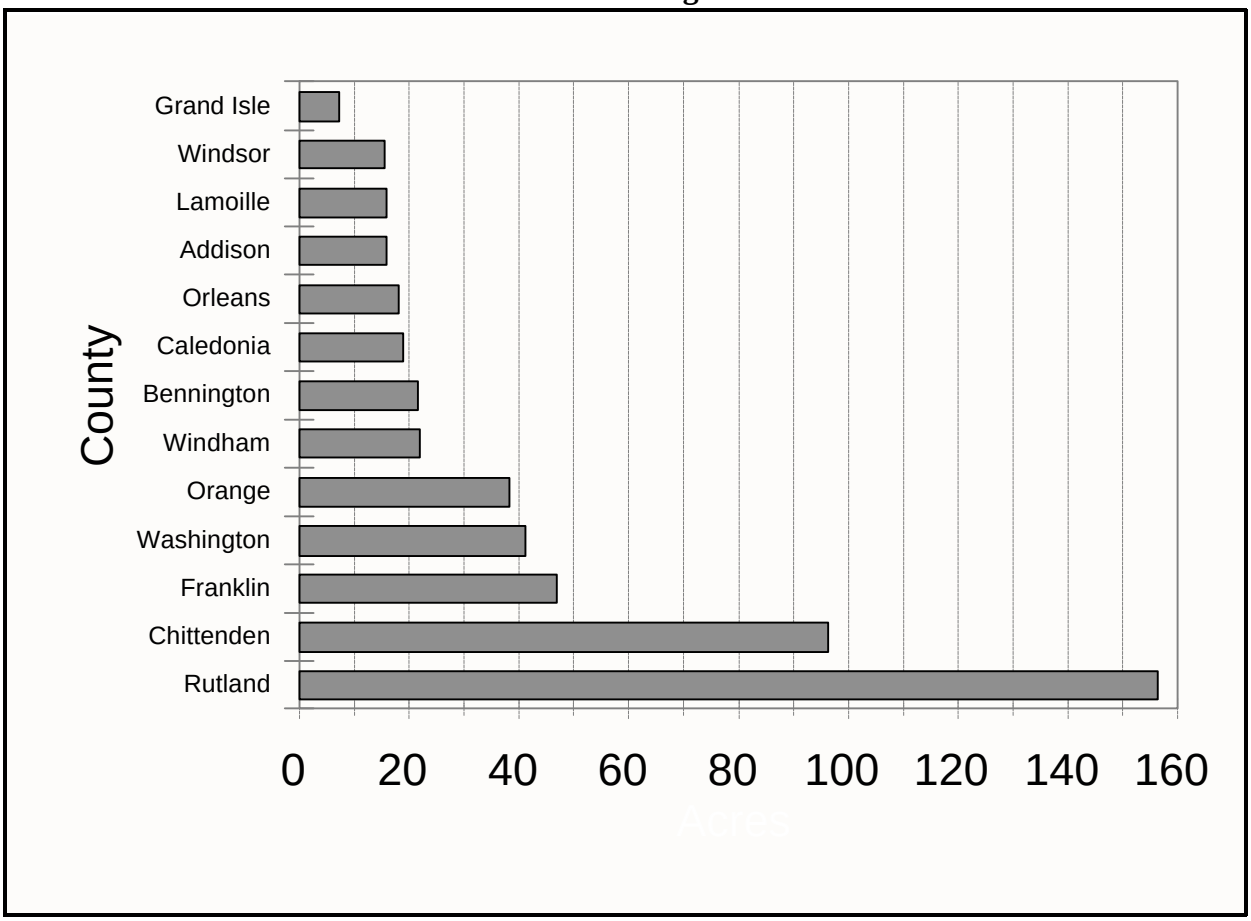
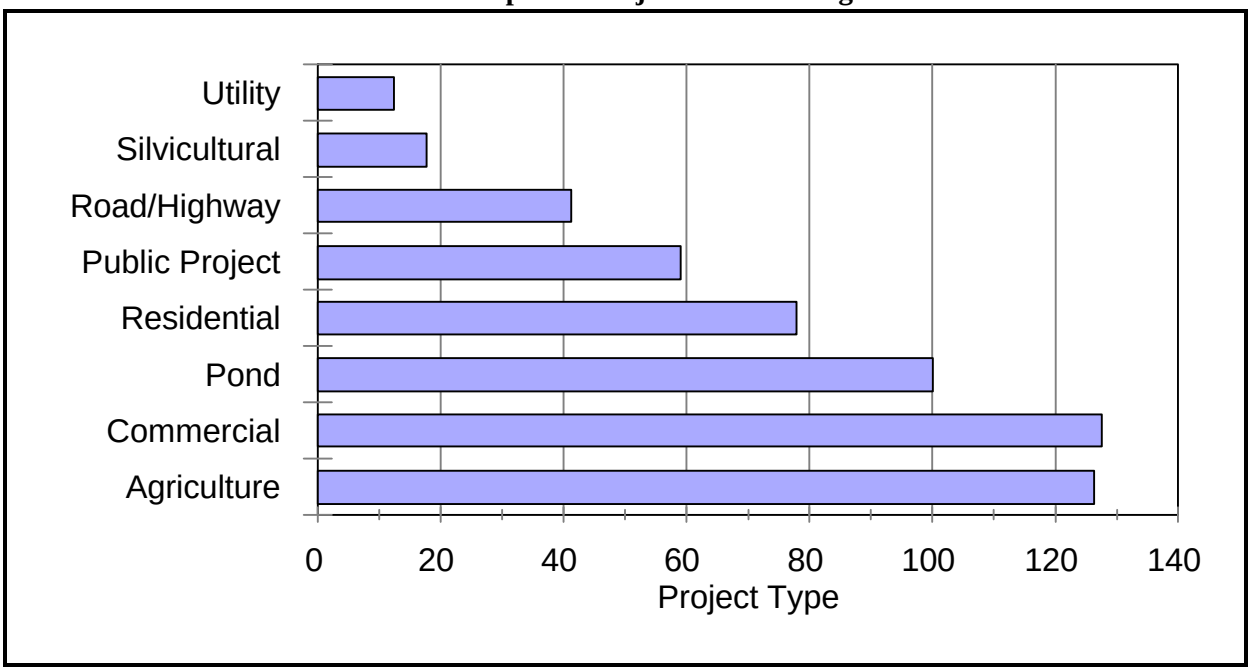


Table III.6.4 shows the area of wetland loss and impairment over the period 1990 to 1998 based on the functions identified to be present in each altered wetland. A particular wetland, where an alteration occurred, may provide one or many of the ten functions and values listed, the documented area of alteration for that wetland is included in the totals for each function and value provided by that wetland. The surface water quality protection and wildlife habitat functions were the most commonly occurring functions in altered wetlands.

In 1999 the Department began carrying out a biomonitoring project. The focus of the project is to investigate biological indicators of the health of vernal pools and cedar swamps. The project will be looking for reference conditions of vernal pools. The goal is to describe 20 reference sites. The

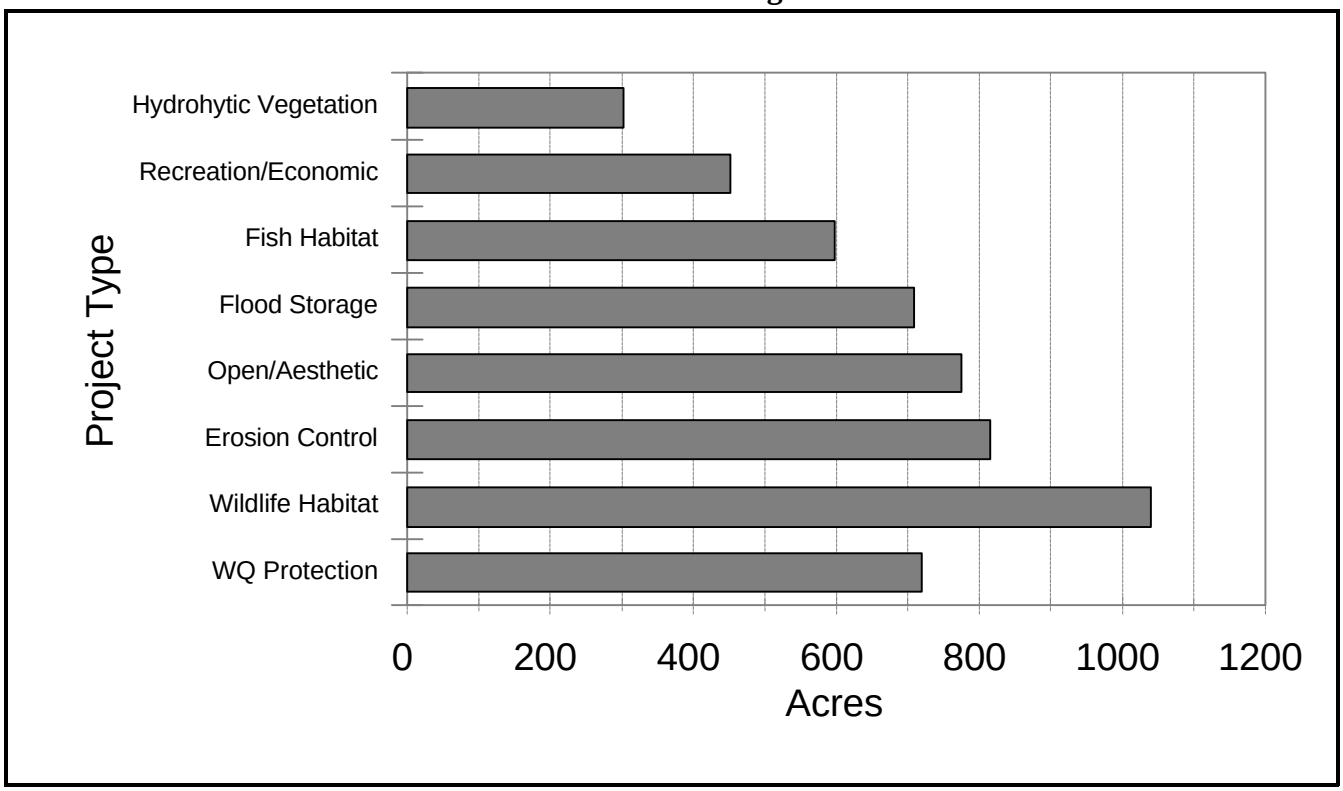
Table III.6.3 Areas of Wetland Loss or Impairment by Project Type for Completed Projects 1990 through 1998



characteristics (metrics) that will be studied include macroinvertebrates, reptiles, algae, and plants. The project will include study of the land 150 meters around vernal pools to characterize the buffers. The study of cedar swamps will be similar but the emphasis will focus on plants and birds as potential indicators. The project is unique because it is a multi-disciplinary study involving programs from Vermont Fish & Wildlife, the Biomonitoring and Aquatic Studies Section (BASS) and the Wetlands Office.

The Wetlands Office has again sponsored work on biocontrol of purple loosestrife. In 1999, twenty seven thousand beetles were released in 21 sites throughout the state, affecting 171 acres of purple loosestrife - infested wetlands. The Department has identified 468 sites of purple loosestrife infestations throughout the state. Each of these sites has been entered in the Department's GIS database and categorized by infestation rate. An ongoing monitoring program was initiated and has enlisted the help of the Agency of Transportation.

Table III.6.4 Area of Wetland Loss or Impairment by Wetland Function 1990 through 1998



The Department assisted in the planning of several wetland restorations and protection projects in cooperation with the NRCS, EPA. the Corps of Engineers and other programs. One project in the West Rutland Marsh complex will eventually restore 145 acres of wetlands through the restoration of natural hydrologic conditions in the area. Another project in the Whiting Swamp area will restore 45 acres of wetland forests along the Otter Creek. A third project along the Lemon Fair River will protect 39 acres of emergent palustrine and riverine wetlands through purchase. Lastly, another site of 35 acres of emergent and riverine wetland was purchased along the Lower Otter Creek with the assistance of the state waterfowl startup funds.

Education is an important approach in dealing with issues related to beaver populations in Vermont. Because beavers change water levels, many conflicts between landowners, local road commissioners and beavers have arisen. The state has been spending an increasing amount of time solving before and after-the-fact problems with beaver dams. The state has organized a task force to study the issue and provide recommendations. The study report has been drafted and it is in the process of review.

Chapter Seven: Public Health Concerns

Size of Water Affected By Toxicants

As stated in past 305(b) reports, and pursuant to Section 304(l) of the Clean Water Act Amendments of 1987, the Department determined that there were no waterbodies in Vermont that were impaired due to the discharge of priority pollutants from point discharges and consequently no point discharges of priority pollutants in Vermont are suspected of causing violations of water quality standards for priority pollutant toxicants. USEPA has reviewed and approved this finding under the provisions of the amended 304(l) regulation of July 24, 1992. Continued point source characterization by the Department and NPDES permittees supports these findings. Cumulative results indicate that, with a few exceptions, toxic substances in point discharges are not likely to be causing significant impairment of surface waters.

Public Health Impacts

Fishing Advisory

Fish consumption advisories due to mercury contamination have been instituted by the Department of Health, as well as most of the other New England states since the 1994 305(b) Report. Vermont's Fish Advisory was last updated in July 1997, and cautions a segment of the population (women of child-bearing age, particularly pregnant women, women planning to get pregnant and beast feeding mothers, and children age 6 and under) against eating any walleye. However, this segment of the population may eat up to four meals per month of walleye from Lake Carmi. It also advises this segment of population to eat no more than one meal of lake trout, smallmouth bass and chain pickerel per month and no more than two to three meals of all other fish per month. Exceptions suggest this segment of the population should eat no lake trout in Lake Champlain larger than 25 inches, and no meals of any other fish except brown bullhead in Grout Pond and Somerset, Harriman, Sherman and Searsburg Reservoirs.

The updated health advisory also alerts all other individuals to eat no more than one meal of walleye per month in all lakes except Lake Carmi, where there is no walleye advisory. This segment of the population is advised to eat no more than three meals of lake trout, smallmouth bass and chain pickerel per month from all lakes except Lake Champlain. From Lake Champlain, no more than one meal per month of lake trout larger than 25 inches should be eaten. No more than nine meals of all other fish per month should be eaten.

Small Community Untreated Waste Discharges

Several small communities throughout the state have been discharging untreated wastes to the state’s waters due to the lack of treatment facilities. The discharges constitute threats to

public health. Included are the villages of East St. Johnsbury, Shoreham, Cabot, Pownal and Warren. The Department is providing technical assistance to these communities to help them plan for the installation of appropriate wastewater treatment facilities. Shoreham and Cabot are significantly advanced in the facilities planning process. Wastewater discharge permits have been applied for and are expected to be issued in early 2000.

Sites of Known Sediment Contamination

The reader is referred to page II-13 for a discussion of a survey of Lake Champlain sediments for toxic contaminants.

Restrictions on Bathing Areas

Table III.7.1 summarizes certain Lake Champlain and state park beach closures for 1998 and 1999 due to nontoxics (high E. coli bacteria counts). The North Beach closings were due to heavy rains resulting in urban runoff containing pollutants. There were no North Beach and Colchester Beach closings in 1998. The completion of corrections to Burlington's combined sewer overflows has resulted in no beach closings from that source.

The Lake Champlain beach closings were due to suspected faulty septic systems and urban runoff. Blanchard Beach (Oakledge), on Lake Champlain, is permanently closed due to urban runoff and illegal sewer connections, which discharge to the beach area. No sources were found for the state park beach closings

Table III.7.1. Closures of Bathing Areas Due to Nontoxics

Waterbody/Swim Area	Dates of Closures
Lake Champlain, North Beach	7/07/99
Lake Champlain, Colchester Bayside Beach	7/06/99, 8/02/99
Lake Champlain, Red Rocks Beach	6/22-6/23/98, 6/25-6/26/98
Lake Champlain, Red Rocks Beach	7/01/98, 7/22/98
Lake Champlain, Red Rocks Beach	8/12/98, 8/25/98
Lake Champlain, Red Rocks Beach	6/14/99, 6/28-6/29/99
Lake Champlain, Red Rocks Beach	7/09/99, 7/14/99, 8/11/99
Brighton State Park - Campers Beach	7/08/99-7/12/99
Lake Carmi State Park	6/19/98-6/23/98
Knight Point State Park	7/01/98-7/16/98
Alburg Dunes State Park	7/01/98-7/08/98

Drinking Water Source Monitoring

The state has not performed ambient water source monitoring for drinking water systems served by surface waters. For further information on this topic, please refer to page III-29 of the 1998 305(b) Report.

Restrictions on Surface Drinking Water Supplies

There were no closures of surface drinking water supplies during the reporting period of 01/01/98 through 12/31/99; however, there were 5 boil water notices issued for the period. The Allen Point Water Supply and Rutland Town Mendon FD 2 systems are under indefinite boil water notices due to system deficiencies, and have been in effect since 09/11/87 and 1/01/71, respectively. Table III.7.2 lists the boil water notices which were issued by the State Health Department to systems with surface water sources.

Table III.7.2. Boil Water Notices, January 1, 1998 through December 31, 1999[15]

Water System Name	Source
Alburg Springs Water Co. Inc.	Lake Champlain
Allen Point Water Supply	Lake Champlain
Coopers MHP	Lake Champlain
Fair Haven Water Dept.	Inman Pond
Rutland Town Mendon FD2	Tenney Brook

[15] Source: Jean Nicolai, VT DEC, Water Supply Division

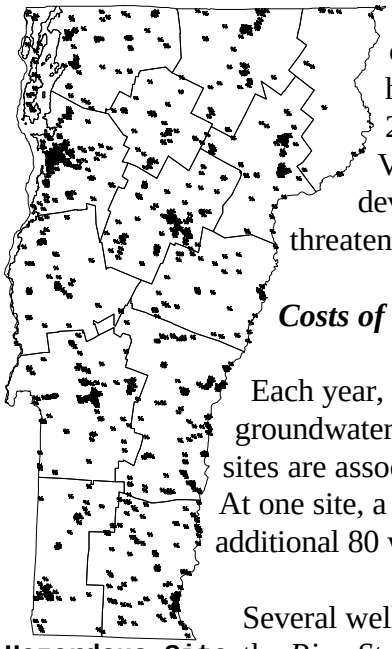
PART IV: GROUNDWATER ASSESSMENT

Groundwater Importance

Groundwater is vital to the livelihood of Vermont's residents. Although Lake Champlain supplies water to approximately 19% of the population, the majority of drinking water is supplied from groundwater sources. Furthermore, groundwater is used to support a variety of commercial, industrial, and agricultural activities, including ski resorts and family farms.

How Good is It?

The quality and quantity of groundwater varies due to both natural and human influences. No comprehensive studies have been completed on the quality of the groundwater. Generally the quality is considered to be excellent and this is supported by the limited number of public water supplies which have detected contamination. Although Vermont's historically rural landscape has precluded large-scale contamination of groundwater, nearly 2,500 contaminated sites have been identified which threaten Vermont's groundwater. As the population and industrial development increase, the groundwater quality and quantity will be threatened further unless the groundwater is properly protected.



Hazardous Site Locations

Costs of Contamination

Each year, an estimated $5-10 million is spent for cleanup of contaminated groundwater at publically and privately funded cleanup sites. Over 75% of the sites are associated with above ground and underground storage tanks (UST). At one site, a leaking UST has contaminated 27 private wells and threatens an additional 80 wells.

Several well known examples of contaminated groundwater exist in the state: the *Pine Street Barge Canal* in Burlington, the *Unifirst site* in Williamstown, and *unlined landfills* across the state. Many of these hazardous sites have not only contaminated groundwater, but also private and public drinking water sources. The cleanup of public drinking water supplies is especially costly due to the difficulties in locating groundwater in adequate quantities to serve the community. As an example, the Unifirst Site in Williamstown required the replacement of a public water supply well, extending water lines to several homes served by private wells which were contaminated, and the installation of a groundwater collection and treatment system. The operation and maintenance costs of the collection and treatment system alone totals $75,000 per year. The cost of developing and installing a new groundwater source for a public water supply is estimated between $500,000 and $1,000,000.

Although historic industrial practices have polluted groundwater, other activities, such as improper disposal of household hazardous waste, leaking home heating oil tanks, inappropriate use of pesticides and fertilizers, excessive road salting, and failing septic systems can also lead to groundwater

pollution. Many of these problems can be prevented through education and improved management practice.

Efforts to Protect Groundwater

Vermont is working at the state, regional, and local level to protect groundwater. Many communities have local zoning ordinances to protect public drinking water supplies. The majority of Public Community Water Systems have plans in place to protect their water sources. Regional planning commissions are working to provide information on groundwater protection to their communities. At the state level, the Department administers permit programs designed to protect groundwater and public health, provides education on groundwater issues, and manages the cleanup of contaminated sites. The Department of Agriculture, Food, and Markets, in cooperation with this Department, has established Acceptable Agricultural Practices to protect groundwater and surface water. The DAF&M also monitors numerous drinking water wells for pesticide and nitrate contamination to protect public health and determine groundwater vulnerability to contamination. Numerous other state agencies, such as the Department of Health, also provide services to protect groundwater and public health. The coordination of many of these activities occurs through the Groundwater Coordinating Committee, an inter-agency organization, which is managed through the Agency of Natural Resources.

APPENDIX C

SECTION 604(b) PASSTHROUGH PROJECTS INVENTORY - FFY89-FFY9

December 10, 1999

Section 604(b)
Pass Through Projects Inventory
FFY89 - FFY99
(all projects completed unless noted with completion date)

Addison County Regional Planning Commission

Develop, for the region, digitally referenced surface waters and augment existing surface water data by adding certain attribute information. (1/14/00)
Phase II of a two-phased project to develop priorities for Little Otter Creek watershed water quality improvement.
Phase I of a two-phased project whose purpose is to develop priorities for Little Otter Creek watershed water quality improvement by reducing phosphorus transport from agricultural and other land uses to Lake Champlain.
Map on-site septic system info for four towns and support On-Site Sewage Committee proposed legislation.
Report on satellite imagery land cover conditions for certain watershed, conduct additional mapping of conditions in Lewis Creek watershed, continue coordination with USDA, sponsor on-site regional meeting.
Assist New Haven River lay monitoring, continue agricultural NPS mapping efforts in certain watersheds, develop capability to utilize LANDSAT TM technology.
Locations of watershed boundaries for seven drainages, of approved (USDA/SCS) agricultural runoff control systems, watershed pollutant loading reductions (incomplete).
Land use/land cover for watersheds of Lake Dunmore and Fern Lake.
Prepare local planning guides for flood plains, wetlands and special/natural areas.
Land use/land cover for Wellhead Protection Areas throughout the region.
Mapped zoning district boundaries within WHPAs of the region.
Evaluation of potential for development within each WHPA of region.
Assist with Lake Champlain Committee's "Planning Manual & Checklist."
Inventory source, number served and the extent of service areas for community and municipal drinking water systems of the region.

Bennington County Regional Commission

Develop digitally-referenced surface waters and augment existing surface water data by adding certain attribute information (10/24/00).
Review municipal health ordinances and related zoning-subdivision regulations and make recommendations for updating such ordinances so they are current and enforceable and protect the state’s waters (6/25/00).
Map ground water source protection areas, overlaid with E911 data for all towns in the region.
Update water resources element of the regional plan, survey conservation commissions to identify conditions which either impact or improve water quality, develop study design and scope of work to prepare comprehensive basin/watershed management plan for region and host a meeting on the proposed on-site sewage rules/regulations.
Locate flood hazard areas (i.e. FEMA lines) for Rupert; integrate flood hazard info with wetlands-related info; enhance town-wide water resources planning efforts.
Characterize existing and projected water consumption and use in region, produce greater awareness of management strategies for source supplies.
Collect data for existing water consumption and use for Bennington County.
Location of flood hazard areas (i.e. FEMA lines) for Dorset.

Location/extent of wetlands in Dorset from NWI maps.
Flood hazard area (ie FEMA lines) for Bennington, overlay with NWI wetlands.
Location of flood hazard areas (ie FEMA lines) for Sunderland & Arlington.
Location of flood hazard areas (ie FEMA lines) for Manchester.
Location/extent of surface water classifications in region. Location/extent of six use restricted waterbodies of the region.
Location/extent watershed boundaries for 14 lakes & ponds in the region greater than 20 acres.
Location/extent of WHPAs in region, attribute information for WHPAs.
Highlight NWI information for region.
Develop a VT Hoosic River Watershed Ground Water Protection Strategy.

Central VT Regional Planning Commission

Review municipal plans and zoning regulations and make recommendations for additional water quality protection in 23 towns in the region (9/13/00).
Map unstable banks on the Mad River to assist with the creation of filter strips (by others) (3/10/00).
Develop a series of planning maps for each town , showing information developed in previous water quality and surface water inventories.
Enter onto the regional GIS the location of all cascades, waterfalls, gorges and whitewater sections in the Region, assist the Dept. with a regional public meeting regarding the status of the on-site sewage reform legislation.
Develop (for remainder of region) digitally referenced surface waters by Waterbody ID and calculate Waterbody sizes; augment existing surface water data by adding certain attribute info.
Develop (for Duxbury, Northfield & Roxbury) digitally referenced surface waters and attributes, sponsor on-site regional public meeting.
Develop (for Fayston & Warren) digitally referenced surface waters and attributes.
Land use/land cover within WHPAs and watersheds of public surface water supplies throughout region.
Land use/land cover for Town of Woodbury at 1:5000 scale.
Land use/land cover for watersheds of at least 5 lakes and ponds in Woodbury, spatial analysis of 5 watersheds.
Sponsored WNRCD to develop soil erosion control handbook for construction equipment operators.
Location/extent of watershed boundaries for lakes/ponds in region greater than 5 acres.
Sponsored DEC to enter NWI Wetland areas by county.
Mapped land use and zoning districts within WHPAs of Calais and Plainfield.
Mapped land use/land cover within WHPAs of region and watersheds of public water supplies.
Mapped extent of existing and planned service areas.
Location and attributes of waterfalls, cascades and gorges and whitewater segments within Calais and Plainfield.

Chittenden County Regional Planning Commission

Review municipal plans and zoning regulations and make recommendations for additional water quality protection in 17 municipalities in the region with adopted municipal plans (11/16/00).
Continue work on automation of municipal drinking water distribution and sewage collection and treatment systems using ARC/INFO GIS for the Town of Milton.
Complete work on automation of municipal sewage collection and treatment systems using ARC/INFO GIS for the towns of Williston and Essex.
Develop digitally-referenced rivers and streams in Chittenden County by Waterbody ID and calculate Waterbody sizes.
Map all drinking water distribution lines greater than 2" for at least one Chittenden County town.

Digitize approximate location and extent of surface water for region, certain attributes, sponsor on-site regional public meeting.
Outfall location associated with each municipal and industrial wastewater treatment facility in region, assist DEC with spatial analysis of urban/suburban conditions in LaPlatte River watershed for Nonpoint source phosphorus TMDL project.
Watershed boundaries for major surface watersheds (50 in number) within region.
Land use/land cover, parcels (where available) and zoning district boundaries within WHPAs in Charlotte, Colchester and Jericho.
Location/extent of land use, parcels and zoning district boundaries within WHPAs of Hinesburg, Richmond and Underhill, well attribute information (incomplete).
Analysis of potential for development within WHPAs of Hinesburg and Richmond.
Assist with Lake Champlain Committee's "Planning Manual & Checklist."

Lamoille County Planning Commission

Provide a septic system suitability and land cover analysis for the remaining five watersheds in the county, and continue to collect water resource policies and priorities for the next update of the regional plan (12/31/99).
Provide a streambank and land use inventory along Wild Branch River in Wolcott and Craftsbury; provide Wolcott with recommendations for areas of building restrictions due to past flood damage; provide Wolcott with a septic system suitability analysis in Wild Branch watershed; continue colleting water resource policies for next update to regional Plan.
Provide a septic system suitability analysis for the West Branch River watershed in Stowe; to continue to collect relevant water resource data for the next update of the regional plan, and assist with public outreach regarding any recent on-site sewage reform rule change.
Spatially locate all boundaries of the Green River watershed and overlay the watershed with septic system suitability information and previously-acquired land use/land cover information; complete the update of the Regional Plan to include water resource policies and priorities, and assist the Dept. with public outreach regarding the status of on-site sewage reform.
Prepare town maps depicting the area and extent of each septic system suitability class for the region.
Map the boundaries of the Gihon watershed and locate the extent of septic system suitability soils information and land use/land cover.
Begin update of Regional Plan to include water resource policies and priorities.
Update regional soils information (septic system suitability), illustrate North Branch watershed land use/cover with septic system suitability, sponsor on-site regional public meeting.
Spatially referenced locations and characteristics of sites where hazardous materials (active/inactive landfills, state/local active salt storage sites, state "registered" non-petroleum haz. waste sites & underground storage tanks, on-site sewage disposal systems greater than 6500 gpd) may be used, stored or generated.
Design, develop and deliver certain portions of an education and information program regarding water source protection planning.
Location and extent of distribution and/or collection lines for municipal drinking water, municipal stormwater and municipal sanitary wastewater throughout the region.
Location and extent of surface water classified as Class C.
Location/extent of land use within WHPAs of region, well attribute information.
Mapped zoning district boundaries and extent of existing and planned service area within WHPAs of the region.
Location/extent and attributes of waterfalls, cascades and gorges of the region, evaluate the potential for loss of these features.

Mapped location and attributes of whitewater segments in region. Inventory (for regional plan development) locations of boating access points, use restricted waters, locations of federal*, state* and municipally* owned property along/adjacent to surface water, locations of hydroelectric* and hydro-related facilities*, locations of targeted waters, trophic status and watershed area for lakes/ponds over 20 acres and locations of nutrient sensitive lakes/ponds* and extent of watershed area; (*) denotes to be GIS compatible

Northeastern VT Development Association

Develop (for certain NVDA towns in the Barton, Memphremagog, Coaticook and Clyde River basins, digitally-referenced surface waters and augment existing surface water data by adding certain attribute information (12/28/98).

Develop for certain NVDA towns in the Missisquoi, Black and Barton River basins, digitally-referenced surface waters by Waterbody ID and calculate Waterbody sizes; augment existing surface water data by adding certain attribute info; assist with public information re the on-site sewage reform.

Spatially reference location/extent of large clear-cutting operations in four towns, review certain programmatic aspects of VT AMPs, sponsor 2 on-site regional public meetings.

For the Passumpsic River basin, inventory locations of unique natural areas, locations of existing and potential public access points to surface waters and evaluate the adequacy of existing municipally-based mechanisms for protecting these resources.

Location/extent of distribution and/or collection lines for municipal drinking water, municipal stormwater and municipal sanitary wastewater for Newport City, Canaan, Danville and St. Johnsbury.

Develop model shoreland ordinance for use in N.E.Kingdom. Prepare/distribute undeveloped shorelines report.

Location/extent and characteristics (zoning, size and use of undeveloped sections, parcels) of undeveloped shoreline areas of lakes/ponds of the region larger than 10 acres, assess adequacy of present municipal shoreline ordinances, develop criteria and prioritize lakes in region in need of protection.

Assist with digitization of features associated with CT River Inventory Project.

Assist with mapping and characterization of features associated with CT River Inventory Project.

Mapped land use, zoning districts and extent of service area within the Wellhead Protection Areas of Brighton, Concord, Greensboro and Sutton.

Watershed boundaries for 88 lakes/ponds in region greater than 20 acres, land uses and zoning districts within watersheds of lakes/ponds in at least 4 municipalities.

Highlight NWI maps information for 12 municipalities.

Northwest Regional Planning Commission

Mapping of surface waters and waterbodies in Grand Isle County, Lake Champlain direct drainage and Franklin County, and attribute the waterbodies with DEC-designated WBIDs, and generate a tabular summary of water course lengths by VT WBID and stream names. (3/22/99)

Conduct a GIS-based land use inventory and analysis of the Missisquoi River watershed and its major sub-basins, and assist the Dept. in sponsoring a regional public form regarding the status of the on-site sewage reform.

Inventory and digitize on GIS maps, streambank erosion along the Missisquoi River within the Region.

Develop, review & present to public basic regional water resource policies for regional plan, spatially reference certain DEC-WQ information, sponsor on-site regional public meeting.

Map and characterize Lake Carmi watershed land use.

Map and characterize undeveloped shoreline areas of St. Albans Bay & Missisquoi Bay.

Prepare/distribute local strategies for ground water protection handbook.

Location/extent of land use and zoning districts within WHPAs of the region.

Develop/expand regionally based matrix which identifies regionally significant water resources and specific abatement measures for land use scenarios.
Assist with Lake Champlain Committee's "Planning Manual & Checklist."
Mapped extent of existing and planned service area within WHPAs of the region.

Rutland Regional Commission

Using cdroms, transfer water resources information to 26 towns in the region and host informational forums to explain how the towns can use the information to protect water quality (12/31/99).
Update existing water resources information in the Rutland region, develop a waterbody map of the region, attributed with DEC-designated WBIDs, and supply the town of Brandon with a cdrom containing the waterbody information for the town of Brandon.
Study the bedrock influence on water quality and yield for certain public community water systems in the Region and share this information with owners of the systems; assist the Dept. with a public forum regarding the status of the on-site sewage reform.
Map current and proposed land uses (and their areas) within groundwater source protection areas and share info with towns and DEC.
Investigate use of GPS technology in locating private wells and surface water sources in part of region, sponsor on-site regional public meeting.
Develop regional water resource policies for regional plan, present spatially based water resource information using the GIS.
Attribute information associated with 67 community water systems of the region.
Identify and display, for each waterbody in region greater than 20 acres in size (35 waterbodies) the configuration and extent of surface water located within 100' and 200' of shore, identify waterbodies in region under use restrictions enacted by VT Water Resources Board.
Location and attributes of privately owned domestic wells in Brandon and Wallingford.
Location/extent of land use and zoning district boundaries within the WHPAs of Brandon and Wallingford.
Assist with Lake Champlain Committee's "Planning Manual & Checklist."
Location/extent of watershed boundaries for lakes/ponds in region greater than 5 acres.

Southern Windsor County Regional Commission

Complete the first phase of work for the development of a regional water quality plan by preparing regional GIS maps depicting updated surface water uses and values and certain land uses and practices; making recommendations for segments in need of further assessment, and holding a regional public meeting to obtain feedback on surface water uses and threats (12/06/99).
Assist with hosting a Project “WET” workshop and spatially analyze potential impacts of land use activities in the Mill Brook watershed on water quality and water uses.
Assess the potential impact of agricultural activities on nonpoint source pollution in the Mill Brook watershed, and assist the Dept. with public outreach regarding the status of the on-site sewage reform.
Continue developing the Regional Watershed Protection Program and assist local groups involved with water quality protection in the SWC region.
Assist Ascutney Local River Subcommittee in the review of health & sewage ordinances and town plans in 3 towns, increase town involvement associated with Regional Watershed Protection Program, sponsor on-site regional public meeting.
Location and extent of potential pollution sites and current uses of waterbodies in region using GIS.
Land use/land cover and parcel conditions along the CT River, evaluate river protection criteria against land use and parcels, characterize location, type and owner of domestic point sources to CT River.
Initiate phase I of III regarding a Regional Watershed Protection Program.

Forums for local officials regarding the implementation of tools/techniques for surface water quality protection.
Assist with digitization of features associated with CT River Inventory Project.
Assist with mapping and characterization of features associated with CT River Inventory Project.
Location/extent of surface waters and WHPAs in region.
Location/extent of waterfalls, cascades and gorges and whitewater segments in the region, attribute information.
Mapped surface water classifications in region.
Surface water monitoring project on several rivers in region with River Watch & CT River Watershed Council.

Two Rivers-Ottauquechee Regional Commission

Review municipal plans and zoning regulations and prepare recommendations for additional water quality protection for 23 municipalities in the region (7/25/00).
Assist with the rotational basin assessment, conduct a GIS-based land use inventory and analysis of the Barnard Brook watershed, and involve the public in the process through a public meeting. (2/23/00)
Update the water resources element of the Regional Plan, survey town planning and conservation commissions to identify conditions which either impact or improve water quality, and develop a study design and scope of work to prepare a comprehensive basin/watershed management plan for the Ottauquechee River watershed.
Update the Windsor County surface water GIS data sets and assist the Dept with public outreach regarding the status of the on-site sewage reform.
Edit and code surface waters in 16 towns to current VCGI attribute standards, label surface waters with their appropriate VT Waterbody ID number and calculate the length of riverine surface waters by WBID number.
Spatially reference land use/cover conditions in 3 towns, document potential NPSs pollution, sponsor on-site regional public meeting.
Coding of surface waters (VCGI protocol) in towns of region located in Windsor County.
Location of major surface waters and tributaries in Windsor County portion of region (includes 10 towns), location and extent of potential Nonpoint pollution sources (defined as an inventory of land use) immediately adjacent (within 150 feet of shore) to major surface waters and tributaries entered above.
Location, extent and characteristics of land use, zoning district boundaries and parcels found in upper White River towns (Granville & Hancock), identify riparian conservation strategies, complete phase III report.
Assist with digitization of features associated with CT River Inventory Project.
Assist with mapping and characterization of features associated with CT River Inventory Project.
Land use/land cover within WHPAs for the region.
Annotate each surface water segment in region.
Verify and enter all point source locations in region.
Location & attributes of waterfalls, cascades, gorges & whitewater segments of the region.
Location and attributes of hydroelectric and hydro-related facilities of the region.
Highlight information on NWI maps for 3 municipalities.

Upper Valley - Lake Sunapee Council

Assist with the rotational water quality assessment by developing a set of GIS maps of the Bloody Brook watershed in the town of Norwich, and by co-hosting a public meeting with the Norwich Conservation Commission. (2/10/00)

Collect and evaluate information re the status of water supply protection in certain towns and identify each community's needs relative to water supply protection.
Draft an updated and expanded water resources component for the Hartland Town Plan.
Identify, map and enter onto GIS land use/land cover of parcels adjacent to Ottauquechee, White, Ompompanoosuc and West Branch of the Ompompanoosuc Rivers in the region.
Summarize/compare water quality protection features contained in zoning ordinances and subdivision regulations of 10 towns, sponsor on-site regional public meeting.
Identify, map and enter onto GIS land use/land cover of parcels adjacent to CT River in region.
Update/revise maps and data files associated with inventory of formal and informal public access points found on the Ottauquechee, White and Ompompanoosuc Rivers.
Coordinate the CT River Inventory Project - a project which will map and enter many natural resource items found in the 29 VT towns adjacent to the CT River.
Assist with administration of CT River Inventory Project.
Location/extent and characterize public access points to major waterways of region (other than CT River).
Promote bi-state (NH & VT) conference on CT River.

Windham Regional Commission
Assist with rotational watershed assessment by building a regional watershed planning process and by continuing the work of assessing nonpoint source pollution areas on tributaries of the West River.
Initiate a water quality improvement project for the West River Basin, in cooperation with the Bonnyvale Environmental Education Center, and assist the Dept with public outreach regarding the status of the on-site sewage reform.
Continue working with On-Site Sewage Committee to develop plan of action and assist with dissemination of info from Committee to towns in Windham region.
Develop a protected lands map for six Connecticut River towns in the Region, identifying gaps of important resource land protection, including riparian lands.
Summarize/compare water quality protection features contained in bylaws and ordinances of 6 towns, assist with Deerfield River hydro relicensing public participation, sponsor on-site regional public meeting.
Determine condition of individual sewage disposal systems in Dummerston, Newfane and Putney, enhance administration and enforcement of sewage ordinances in region.
Inventory and evaluate local and state septic system control programs, conduct septic system workshops, continue attending Deerfield River Compact meetings.
Assist DEC-WQ with Deerfield River comprehensive river planning, design local implementation strategies, regional plan review.
Assist with digitization of features associated with CT River Inventory Project.
Assist with mapping and characterization of features associated with CT River Inventory Project.
Draft and present to the public policies and action program recommendations regarding recreational greenways adjacent to major rivers/streams in region.
Evaluate Jamaica Town Plan & Regulations with respect to NPS pollution, draft suggested amendments.
Conduct Upper West River Basin "water forums."

In 1989 a cooperative pass through effort involved the **Otter Creek Natural Resources Conservation District** and the VT ANR/GIS. The order in which data were entered onto a geographic information system [for Addison County]....was as follows:
1. surface water classifications

2. public water supply wells
3. aquifer protection areas
4. important water related features - waterfalls, gorges, cascades, whitewater segments
5. wetlands
6. warm and cold water fishery waters
7. important regional swimming areas
8. public surface water supplies
9. electric generating sites

VT Pass Through Program - funding levels by federal fiscal year
Section 604(b) of the Clean Water Act

Year	Amount
89	100,000.
90	80,000.
91	80,707.
92	40,000.
93	40,000.
94	40,000.
95	40,000.
96	40,000.
97	40,000.
98	40,000.
99	40,000.
total	$580,707.

APPENDIX G

TMDL PROJECT UPDATE

TMDL Project Update - January, 2000

303(d) Listed Waterbodies

Segment	Waterbody ID # & Pollutant	Status	TMDL Submittal
• No. Branch Ball Mtn. Brook (Stratton)	11-15 Sediment	Rework of Stratton Remediation Plan. Initial draft complete and sent to EPA Region 1 on 1/24/00.	Draft Submitted Jan 2000
• Styles Brook (Stratton)	11-15 Sediment	Rework of Stratton Remediation Plan. When EPA OK's format of Ball Mtn Brook TMDL, will complete and submit both together as final.	Yes Spring 2000
• Cedar Swamp (Shoreham)	03-10 Pathogens	New WWTF will alleviate e. coli impairment from untreated discharges. Permit near completion, construction expected Summer 2000.	Yes - as equivalent Summer 2000
• Hoosic River (Pownal)	01-02 Enrichment	Working with EPA (EPA lead) to develop P TMDL with Pownal allocation. Expected this winter. 30% design complete. Facilities Engineering Division working with town's engineering firm.	Yes Summer 2000
• East Branch Roaring Brook (Killington)	10-06 Sediment/Iron	Currently reviewing Killington's WQRP. When finalized, TMDL will be prepared similar to # 1&2.	Yes Fall 2000
• Trib to Joiner Brook	08-04 Sediment	Remediation actions complete, needs further monitoring. Initial draft TMDL complete. If EPA accepts Stratton TMDL format, will submit.	Yes Summer 2000
• Sucker Brook	03-04 Dissolved Oxygen	401 WQ Cert. of dam underway. Requirements of 401 will be applied w/in year to alleviate dissolved oxygen problem.	Yes - as equivalent Fall 2000
• Castleton River (Fairhaven)	02-03 Pathogens	Pump station upgrade design complete. Construction planned for Summer 2000. No changes to permit.	Yes - as equivalent Fall 2000
• Winooski River (Cabot Village)	08-09 Pathogens	New facility to alleviate pathogen problem. 90% design complete, draft permit pending, construction expected Summer 2000.	Yes - as equivalent Fall 2000
• Lower Otter Creek (Vergennes)	03-01 Pathogens	Vergennes WWTF upgrades to alleviate e. coli source of impairment. 60% design complete, construction expected Fall 2000.	Yes - as equivalent Fall 2000

Segment	Waterbody ID # & Pollutant	Status	TMDL Submittal
• Black River (Ludlow)	10-14 Enrichment	Will develop permit conditions as TMDL. Town is developing NPDES application to expand discharge and may include phosphorus removal.	Yes 2001
• Lower Black River (Springfield)	10-11 Enrichment	Impairment identified after 1998 list developed. Town developing NPDES application. WWTF to be required to remove P. TMDL will be developed as permit conditions.	Yes 2001
• Allen Brook	08-02 Undefined	Developing RFP to investigate urban SW runoff. Working w/ EPA to ensure results of project will be TMDL.	Yes 2001
• Mettawee River	02-05 Temperature	Planning to conduct NPS TMDL for temperature impairment, data collection and modeling summer 2000.	Yes Winter 2000
• Lake Champlain	9 segments Phosphorus	Anticipate 9 lake segment TMDLs with individual point source allocations w/in each lake segment. Planning ongoing.	Yes 2001
• Tribs to Dowsville Bk.	08-19 Sediment	Remediation actions complete, needs further assessment.	Yes - as equivalent 2001
• Otter Creek Region	Basin 3 Ag runoff	§319 grant in progress to Otter Creek NRCD. Work plan includes proposing remedial strategy with public participation. Waterbody not yet selected. Whether or not formal TMDL submittal will be the outcome is still unanswered.	Yes - as equivalent Mid 2001

APPENDIX H

SPECIFIC ASSESSMENTS OF INDIVIDUAL LAKE STATUS

Basin 2 Lakes and Ponds Individual Use Support

Lake Name	Lake Area (Acres)	Last Assessed (YYMM)	Assessment Type	Basin	Support (Acres)	Threat (Acres)	Partial (Acres)	Not Support (Acres)
AUSTIN	28	199812	Monitored	2	28	28	0	0
BEEBE (HUBDTN)	111	199812	Monitored	2	111	27	0	0
BILLINGS MARSH	56	199903	Evaluated	2	56	56	0	0
BLACK (HUBDTN)	20	199812	Monitored	2	19	4	1	0
BOMOSEEN	2360	199908	Monitored	2	2060	571	0	300
BREESE	12	199903	Evaluated	2	12	12	0	0
BURR (SUDBRY)	85	199908	Monitored	2	45	0	15	25
BUTLER	3	199903	Evaluated	2	3	0	0	0
CHOATE	11	199903	Evaluated	2	11	0	0	0
COGGMAN	20	199908	Monitored	2	19	19	0	1
DOUGHTY	17	199908	Monitored	2	17	17	0	0
ECHO (HUBDTN)	54	199908	Monitored	2	46	6	8	0
FAN;	12	199903	Evaluated	2	12	0	0	0
GLEN	206	199812	Monitored	2	196	0	10	0
HALF MOON	23	199908	Monitored	2	23	23	0	0
HIGH (HUBDTN)	3	199903	Evaluated	2	3	0	0	0
HINKUM	60	199908	Monitored	2	60	12	0	0
HORTONIA	479	199908	Monitored	2	319	0	0	160
HOUGH	16	199810	Monitored	2	16	0	0	0
INMAN	85	199903	Monitored	2	85	17	0	0
LILY (CASLTN)	9	199903	Evaluated	2	9	0	0	0
LILY (POULTY)	21	199908	Monitored	2	0	0	0	21
LITTLE (WELLS)	177	199812	Monitored	2	136	136	0	41
LOVES MARSH	62	199910	Monitored	2	62	62	0	0
MILL (BENSON)	39	199903	Monitored	2	39	39	0	0
MUD (ORWELL)	10	199903	Evaluated	2	10	0	0	0
N.E. DEVELOPERS	27	199908	Evaluated	2	27	27	0	0
OLD MARSH	131	199903	Monitored	2	131	131	0	0
PINE	40	199903	Monitored	2	40	40	0	0
PINNACLE;	6	199903	Evaluated	2	6	0	0	0
PRENTISS	5	199903	Evaluated	2	5	2	0	0
QUARRY;	17	199903	Evaluated	2	17	0	0	0
ROACH	20	199812	Monitored	2	20	20	0	0
ROOT	18	199810	Monitored	2	18	0	0	0
SPRUCE (ORWELL)	25	199903	Monitored	2	25	1	0	0
ST. CATHERINE	883	199908	Monitored	2	0	0	707	176
SUNRISE	57	200002	Monitored	2	54	23	0	3
SUNSET (BENSON)	202	199812	Monitored	2	0	0	202	0

Basin 7 Lakes and Ponds Individual Use Support

Lake Name	Lake Area (Acres)	Last Assessed (YYMM)	Assessment Type	Basin	Support (Acres)	Threat (Acres)	Partial Support (Acres)	Not Support (Acres)
A R R O W R O W H E A D MOUNTAIN	760	199903	Monitored	7	0	0	0	760
BEAR	1	199903	Evaluated	7	1	1	0	0
BEAVER (HYDEPK);	16	199903	Evaluated	7	16	16	0	0
BELDING	4	199903	Evaluated	7	0	0	4	0
BELVIDERE-NE;	9	199903	Evaluated	7	0	0	0	0
BIG MUDDY	17	199903	Monitored	7	17	17	0	0
CAP HILL;	9	199903	Evaluated	7	9	0	0	0
CASPIAN	789	199903	Monitored	7	0	0	789	0
CLEAR	8	199903	Evaluated	7	8	0	0	0
COLLINS	16	199903	Evaluated	7	16	0	0	0
EAST LONG	188	199709	Monitored	7	0	0	188	0
EDEN	194	199812	Monitored	7	194	194	0	0
ELMORE	219	199903	Monitored	7	0	0	219	0
FLAGG	111	199903	Monitored	7	111	0	0	0
GREEN RIVER	554	199812	Monitored	7	554	554	0	0
GUT	13	199903	Evaluated	7	13	13	0	0
HALFMOON	21	199812	Monitored	7	0	0	21	0
HARDWICK	145	199810	Monitored	7	0	0	145	0
HORSE	32	199903	Monitored	7	32	32	0	0
KEELER	5	199903	Evaluated	7	5	5	0	0
LAKE-OF-THE-CLOUDS	1	199709	Evaluated	7	0	0	0	1
LAMOILLE	148	199712	Monitored	7	148	148	0	0
LANDFILL;	7	199903	Evaluated	7	7	0	0	0
LITTLE ELIGO	15	199903	Evaluated	7	15	15	0	0
LITTLE ELMORE	24	199903	Monitored	7	24	24	0	0
LONG (EDEN)	97	199812	Monitored	7	97	97	0	0
LONG (GRNSBO)	100	199709	Monitored	7	100	0	0	0
LOST (BELVDR)	3	199903	Evaluated	7	3	0	0	0
MACKVILLE	11	199903	Evaluated	7	11	0	0	0
MILTON	24	199810	Monitored	7	24	0	0	0
MORRISVILLE;	8	199903	Evaluated	7	0	0	0	0
MUD (HYDEPK)	14	199903	Evaluated	7	14	0	0	0
NICHOLS	171	199812	Monitored	7	0	0	171	0
NORTH UNDERHILL;	12	199903	Evaluated	7	0	0	0	0
PERCH (WOLCTT)	7	199903	Evaluated	7	7	1	0	0
RITTERBUSH	14	199903	Evaluated	7	14	0	0	0
RITTERBUSH MEADOW;	10	199903	Evaluated	7	10	10	0	0
ROUND (MILTON)	22	199903	Monitored	7	22	22	0	0
RUSH	14	199903	Evaluated	7	14	0	0	0
SCHOFIELD	29	199812	Monitored	7	29	29	0	0
SILVER (GEORGA)	27	199903	Evaluated	7	27	27	0	0
SLAYTON (WOODBY)	8	199903	Evaluated	7	8	8	0	0
SOUTH (EDEN)	103	199712	Monitored	7	0	0	103	0
STANNARD	25	199712	Monitored	7	25	0	0	0
TUTTLE (HARDWK)	21	199903	Monitored	7	21	21	0	0
WAPANACKI	21	199903	Evaluated	7	21	21	0	0

WOLCOTT	74	199812	Monitored	7	74	74	0	0
ZACK WOODS	23	199712	Monitored	7	23	0	0	0

Basin 10 Lakes and Ponds Individual Use Support

Lake Name	Lake Area (Acres)	Last Assessed (YYMM)	Assessment Type	Basin	Supporting (Acres)	Threat (Acres)	Partial (Acres)	Not Support (Acres)
AMHERST	81	199904	Monitored	10	0	0	81	0
BLACK (PLYMTH)	20	199904	Monitored	10	20	0	0	0
CARLTON	4	199904	Evaluated	10	4	0	0	0
COLBY	20	199904	Evaluated	10	20	20	0	0
COOK	3	199904	Monitored	10	3	0	0	0
COX	2	199904	Evaluated	10	2	0	0	0
CRYSTAL (HARTLD)	2	199904	Evaluated	10	2	0	0	0
DEWEYS MILL	56	199910	Evaluated	10	56	0	0	0
ECHO (PLYMTH)	104	199912	Monitored	10	0	0	104	0
GRAHAMVILLE;	8	199909	Evaluated	10	8	0	0	0
JEWELL BK #1;	14	199904	Evaluated	10	14	0	0	0
JEWELL BK #2;	17	199904	Evaluated	10	17	0	0	0
JEWELL BK #3;	18	199909	Evaluated	10	18	0	0	0
KENT	99	199912	Monitored	10	89	4	10	0
KNAPP BROOK #1	25	199909	Monitored	10	25	25	0	0
KNAPP BROOK #2	35	199904	Monitored	10	35	35	0	0
LAKOTA	20	199904	Monitored	10	20	20	0	0
LOWER MOORE	5	199904	Evaluated	10	5	0	0	0
MECAWEE	11	199909	Evaluated	10	11	11	0	0
NINEVAH	171	199904	Monitored	10	171	171	0	0
NORTH HARTLAND	215	199910	Monitored	10	0	0	0	215
NORTH SPRINGFIELD	290	199912	Monitored	10	0	0	0	290
PICO	12	199904	Evaluated	10	12	12	0	0
PINNEO	50	199909	Monitored	10	50	0	0	0
READING	22	199904	Evaluated	10	22	22	0	0
RESCUE	180	199912	Monitored	10	0	0	180	0
RESERVOIR	32	199904	Evaluated	10	32	0	0	0
SOUTH MECAWEE;	2	199909	Evaluated	10	2	0	0	0
SPOONERVILLE;	8	199904	Evaluated	10	8	0	0	0
SPRINGFIELD	10	199904	Evaluated	10	0	0	0	0
STOUGHTON	56	199912	Monitored	10	56	11	0	0
THE POGUE	11	199904	Monitored	10	11	0	0	0
TINY	29	199904	Evaluated	10	29	0	0	0
UPPER MOORE	3	199904	Evaluated	10	3	0	0	0
VIEW	4	199904	Evaluated	10	4	0	0	0
VONDELL	10	199904	Evaluated	10	10	0	0	0
WOODWARD	106	199912	Monitored	10	105	0	1	0

Basin 14 Lakes and Ponds Individual Use Support

Lake Name	Lake Area (Acres)	Last Assessed (YYMM)	Assessment Type	Basin	Supporting (Acres)	Threat (Acres)	Partial (Acres)	Not Support (Acres)
ABENAKI	44	199812	Monitored	14	44	5	0	0
BROCKLEBANK;	7	199812	Evaluated	14	0	0	0	0
BURNHAM MTN;	8	199812	Evaluated	14	8	0	0	0
C.C.C.	9	199812	Monitored	14	9	0	0	0
ELY;	5	199812	Evaluated	14	5	0	0	0
EWELL	51	199904	Monitored	14	25	25	26	0
FAIRLEE	457	199812	Monitored	14	457	457	0	0
FOSTERS	61	199812	Monitored	14	61	0	0	0
GALUSHA;	5	199812	Evaluated	14	5	0	0	0
GROTON	422	199812	Monitored	14	422	422	0	0
HARVEYS	351	199903	Monitored	14	0	0	351	0
KETTLE	109	199812	Monitored	14	109	109	0	0
LEVI	22	199812	Monitored	14	0	0	22	0
LILY (THETFD);	19	199812	Evaluated	14	19	0	0	0
MANCHESTERS;	6	199812	Evaluated	14	6	0	0	0
MARTINS	82	199812	Monitored	14	82	82	0	0
MILLER	64	199812	Monitored	14	64	12	0	0
MUD (PEACHM)	34	199812	Monitored	14	34	0	0	0
MUD (THETFD)	20	199904	Monitored	14	20	0	0	0
NORFORD	21	199812	Monitored	14	21	0	0	0
NOYES	39	199711	Monitored	14	37	8	2	0
OSMORE	48	199712	Monitored	14	48	48	0	0
RICKER	95	199812	Monitored	14	95	95	0	0
RIDDEL	15	199904	Evaluated	14	15	0	0	0
RYEGATE CENTER;	7	199812	Evaluated	14	7	7	0	0
TICKLENAKED	54	199810	Monitored	14	0	0	54	0
VERSHIRE-E;	10	199812	Evaluated	14	10	0	0	0
WEST FAIRLEE;	15	199812	Evaluated	14	15	0	0	0
WHITEHOUSE	5	199812	Evaluated	14	5	0	0	0