Vermont Water Resources and Lake Studies Center

Program Evaluation Report

Fiscal Years 1998−2002

Submitted By

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To:

Office of External Research

Water Resources Discipline

U.S. Geological Survey

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Preface

The Vermont Water Resources and Lake Studies Center receives an annual Federal matching grant as authorized by section 104 of the Water Resources Research Act of 1984 (Public Law 98−242) as amended by Public Law 101−397, Public Law 104−147, and Public Law 106−374. Section 104 of the Act requires that the Secretary of the Interior "conduct a careful and detailed evaluation of each institute at least once every 5 years to determine that the quality and relevance of its water resources research and its effectiveness as an institution for planning, conducting, and arranging for research warrants its continued support under this section." The U.S. Geological Survey (USGS), Department of the Interior, administers the provisions of the Act. This evaluation report describes, in the format prescribed by the USGS, the research, training, and information transfer activities supported by the section 104 grants and required matching funds during fiscal years 1998 through 2002.

Program Evaluation Report

Introduction

Water quality and quantity concerns continue to generate controversy in Vermont, with much of the attention focused on water quality. Continued development pressure in parts of the state, combined with on−going concerns about a host of surface water issues, challenge those charged with maintaining and protecting the quality of Vermont's water resources. Significant issues include the following:

The Water Resource Problems of Vermont

A. Surface Water Quality:

1. Storm water runoff: while early attention in Vermont focused on runoff from agricultural lands, much of the current interest centers on the impact of runoff from urban and suburban development on the state's streams and rivers. While a variety of Best Management Practices have been implemented to control storm water runoff in Vermont, many of the state's streams remain degraded, and debate about the best approaches for dealing with storm water has been intense. At the heart of the issue are difficulties encountered in trying to link storm water controls to specific improvements in stream water quality. The Vermont Water Resources Board is currently holding a docket to gather scientific evidence regarding this issue.

2. Lake Champlain: this critically important ecosystem continues to be a most significant issue in much of Vermont. While research and education about the lake have increased over the past 15 years with funding from the federal government, key issues still demand much attention from both the regulatory and research community. Efforts to reduce inputs of the limiting nutrient phosphorus are being redoubled, particularly after a series of disastrous blue−green algae blooms during the summer of 2003. Additional concerns include exotic species like the zebra mussel, bacterial contamination of near−shore waters and toxic substances.

3. Protection of pristine streams: development pressures, particularly from Vermont's ski industries, continue to be a concern for some of Vermont's high elevation streams. Possible threats include expansion of ski area development, water withdrawals, and wastewater disposal. A recent Vermont Water Resources and Lake Studies Center project compared water quality in developed vs undeveloped high elevation watersheds in northern Vermont.

4. Watershed protection: Vermont is currently updating its river basin plans throughout the state. The use of TMDLs to reduce inputs of such pollutants as phosphorus to Vermont's rivers and lakes continues to be a challenge for the state from both a scientific and a regulatory perspective.

5. Mercury contamination: fish advisories based on elevated mercury levels continue in Lake Champlain and other Vermont lakes. While our knowledge about how mercury moves through Vermont's forested watersheds has increased over the past few years, we need to learn much more about how to better manage this continuing contamination problem. Unfortunately, with at least half of the mercury in Vermont lakes coming from sources outside the state, regulatory fixes are not entirely within our control.

B. Ground Water Quality: while Vermont has closed its unlined landfills, incidents of groundwater contamination continue at various sites in the state. Some of these cases represent on−going contamination from industrial sites, while others result from leaking underground storage tanks, inputs of nitrates from fertilizers and contamination by bacteria from leaking septic systems. Additional concerns in recent years have focused on elevated radon levels in some northern Vermont wells.

C. Water Supply Issues: both ground and surface waters play substantial roles in supplying Vermonters with potable water. The state of knowledge concerning Vermont's aquifers is not well developed in terms of aquifer capacity, flow rate or rates of recharge. In the wake of 9/11, providing security at surface water supplies has become an important issue in Vermont. Of particular concern are a number of water supply reservoirs serving Vermonters.

D. Water Use Demands: competing demands for Vermont's water resources are still a challenge. While past controversies have pitted ski area managers vs trout anglers and canoeists vs motor craft users, more recent examples include the re−licensing of Vermont's hydropower facilities. With the restoration of cold−water fisheries a possibility in several dammed Vermont rivers, discussions between angling interests and water supply purveyors have increased in recent years.

E. Biological Diversity: Vermont's many surface waters, wetlands and marshes are home to a number of rare and endangered species. In addition, a recent state−wide tally identified 91 species of fish in state waters and numerous species of plants, invertebrates, amphibians and other aquatic life. Invasive species like purple loosestrife and zebra mussels threaten the continued existence of many aquatic species, including a number of mussel species on the state's list of rare and endangered species. Evidence of malformations among Vermont's frog population has been well documented. While the exact cause of the problem remains unknown, these abnormalities have raised concerns about the overall condition of Vermont's wetlands.

Vermont Water Resources and Lake Studies Center: An Overview

The goal of the Vermont Water Resources and Lake Studies Center during the review period has been to encourage, fund, and execute objective and competent research to assist in the solution of high priority water resources problems in Vermont. In addition, we have conducted a variety of information transfer activities.

Despite the fact that Vermont is among the smallest and least populated states, there are many issues, as noted in the previous section, relating to both surface and ground water, facing the state. This breadth of concerns is reflected in the research program of the Center over the past five years, with funded projects addressing such diverse topics as remediation of contaminated groundwater, the impact of exotic aquatic plants on native species, and the identification of riparian buffers for reducing bacterial contamination of streams.

Some projects, such as the groundwater remediation work of Dr. George Pinder, have had national implications, as Pinder’s work was designed to reduce the cost of groundwater remediation. Other research, such as that by Dr. Tom Manley on the feasibility of using Lagrangian drifters to study currents in Lake Champlain, is basic in nature but has produced results which may help scientists elsewhere better understand the dynamics of large systems like the Great Lakes.

A reality for the Vermont Water Resources and Lake Studies Center continues to be the comparatively small number of scientists in Vermont available to do water−related research. There are far more issues demanding attention than there are academic scientists available to address them. Because of this limitation, the research program of the Center has typically been largely shaped by the interests of the pool of faculty in the state seeking funding.

While we attempt to reach out broadly across the state, we recognize that there will likely always be some major areas of endeavor that cannot be addressed simply because we do not have the research personnel available to do the work. The 2:1 match requirement has also been detrimental, with several PIs in recent years unable to participate because of this.

In addition to the Section 104 grant, additional efforts that the Vermont Water Resources and Lake Studies Center has undertaken have included:

1. Research and monitoring: throughout the review period, the Vermont Water Resources and Lake Studies Center received support to conduct a variety of research and monitoring activities on the near−shore waters of Lake Champlain. The Burlington Bay Project, funded as part of a local Superfund settlement case, has focused on both the routine monitoring of water quality and biological parameters in the lake and issue−oriented work on the impacts of zebra mussels on plankton communities in the Burlington Bay area and the emerging problem of noxious blue−green algae blooms in portions of the lake. The project web site (www.uvm.edu/envnr/bbay) contains highlights of the program.

2. Outreach and education: the Vermont Water Resources and Lake Studies Center continues to play an active role in educating local officials and the public about storm water runoff, one of the most important and contentious issues facing Vermont today. The Center organized two public meetings on watersheds and storm water during the review period. One meeting, co−sponsored by the Vermont Law School, was a full−day session in January, 2002 devoted to the science, policy and regulatory aspects of storm water, while an earlier meeting in May, 1999 addressed issues relating to watershed−wide impacts on water quality.

Additional storm−water related efforts include on−going monitoring of campus streams and storm water treatment facilities led by the Director of the Water Center. Featuring both routine sampling of water quality of campus streams and storm−related sampling at five campus storm water detention ponds, the storm water monitoring initiative has become an important component of UVM's environmental efforts.

Section 104 Objectives

1. To encourage and support basic and applied research directed at Vermont’s critical water quality and quantity issues.

2. To transmit, through workshops, annual meetings and printed literature, information on water resources statewide.

3. To promote, to the extent possible, education in water resources.

Areas of emphasis: a particular area of emphasis over the past five years has been water quality in the Lake Champlain watershed. We have actively encouraged submission of projects related to this topic.

Allocation of Federal Grant and Matching Funds Among Program Activities (Percent): 1998−2002	
Research	88.8
Information Transfer	0.6
Education	4.8
Administration	5.8
Other (please specify)	
Total	

Institutional Support and Effectiveness

None

Discretionary Base Funding

Appropriated or Other Discretionary Funds Available to the Institute: 1998 − 2002

Source of Discretionary Funds	1998	1999	2000	2001	2002

Total Institute Water Resources Research Funding

Water Resources Grants, Contracts, and Cooperative Agreements in Which the Institute Had a Major Role during the Period of the Evaluation: 1998 − 2002

Title/Topic	Source of Funds	Year Initiated	Amount
Burlington Bay Project	Green Mountain Power Corporation	1998	1000000
Campus Stormwater Monitoring	The University of Vermont	1999	60000

Research Program

Research projects funded by Section 104 and required matching funds during the evaluation period are listed in Table R−1. For each project, Attachment A lists relevant information.

Research Projects

Summary of Research Projects

Number of Research Projects and Percentage of Research Funds, by Research Category: 1998−2002

Research Category	Number	Percent of Funds
Biological Sciences	0	0
Climate and Hydrologic Processes	1	10
Engineering	1	21
Ground−water Flow and Transport	0	0
Social Sciences	0	0
Water Quality	6	69

Research Projects Receiving Follow−on Funding

The number of projects receiving follow−on funding from another source after completion as a section 104−funded project was: 0.

Summary of Research Publications

Number of Research Publications, by Category of Publication

Publication Category	Number
Articles in Refereed Journals	2
Book Chapters	0
Theses and Dissertations	3
Water Resources Institute Reports	1

Articles in Conference Proceedings	15
Other Publications	8

Most Significant Research Findings

o. In their project "Water quantity and quality dynamics in high−elevation watersheds: developing a scientific approach to understanding ski area impacts in Vermont," Professor Beverley Wemple et al. showed distinct differences in hydrological responses between the two watersheds, one developed and one undeveloped, including elevated streamflows and delayed peaks during snowmelt in the developed watershed, perhaps attributable to snowmaking.

Water quality data suggest that runoff from parking lots and other disturbed surfaces has resulted in higher suspended sediment concentrations in the developed watershed, particularly during the early part of snowmelt and during intense summer rains.

o. In her project "Identification of candidate parcels for riparian buffers: reducing fecal contamination of Vermont surface waters," Professor Leslie Morrissey of the University of Vermont focused on the problem of bacterial contamination in the watershed of the Mad River. She used state−of−the−art remote sensing and GIS techniques to identify stream−side locations where revegetation may be most effective in reducing inputs of bacteria to the river.

In collaboration with the USDA's Natural Resources Conservation Service, Morrissey applied a Revised Universal Soil Loss Equation model which provided the basis for predicting the non−point source pollution potential for parcels throughout the watershed. This should provide substantial assistance to state regulators managing non−point source pollution.

o. Professor Tom Manley of Middlebury College completed the project "Lagrangian drifters within Lake Champlain feasibility study" in which he collaborated with Dr. Jacques Gascard of France. Manley and Gascard used an innovative technology previously applied only in the open ocean to study complex flow patterns at different depths in Lake Champlain.

Their approach, which was based on free−drifting "SOLO" floats, is helping scientists better understand current patterns in large lakes and how pollutants move through large lakes like Champlain.

Summary of Awards

None

Information Transfer Program

Our Information Transfer program includes distributing a newsletter (cooperatively produced with the UVM Extension Office) and sponsoring/co−sponsoring a variety of water−related meetings.

Information Transfer Projects

Information Transfer Publications

IT Publication Type	IT Publication Citation
Other Publications	Keffer, J.M. 2002. Stormwater Workshop Brief. Vermont Water Resources and Lake Studies Center. University of Vermont, Burlington, Vt. 34p.

Audio−visual Productions

None

Newsletter

Our newsletter is published jointly by the Water Center and the University of Vermont's Extension Office. Ms. Linda Howe, Extension Water Resources Specialist, is editor.

Purpose and audience: the Newsletter serves to inform interested Vermont citizens about water resources. Each issue includes a message from the Director providing an update on Water Center activities and useful information about local or regional water meetings, publications available and the like. The audience, which is statewide, includes academics, practicing professionals in state agencies and consulting firms, state and local elected officials and the interested public.

The Newsletter is distributed via paper copy to a mailing list and via the Vermont Water Resources and Lake Studies Center website.

Over the past five years, one or two issues have been published annually. Newsletters can be accessed at http://www.uvm.edu/envnr/?Page=vtwater/reflect.html

One hundred percent of the costs of producing and mailing the newsletter are borne by the Section 104 budget. Linda Howe donates her time, which, as editor of the newsletter, is covered by the Extension Office.

Conferences

Lead Sponsor

1. Watershed Approaches to Managing Water Quality in Vermont. May 12, 1999.

2. Annual Meeting of the Vermont Water Resources and Lake Studies Center. October 12, 2001.

3. Stormwater Runoff in Vermont: An Educational Workshop. January 19, 2002 (co−sponsored by the Vermont Law School).

Cosponsor or Supporter

Internet Services

Homepage: displays information on research projects, events of interest to Vermont's water community. www.uvm.edu/envnr/vtwater and www.uvm.edu/envnr/stormwater/

Awards

None

Most Significant Achievements

o. The January, 2002 stormwater workshop was our most significant IT accomplishment. By bringing together scientists, regulators, and policy makers (a half dozen state legislators attended), we were able to substantially

increase participants' knowledge about various aspects of stormwater and promote dialogue among key parties.

Education

Number of Students Supported

Number of Students Supported, by Degree and Grant Type: 1998−2002

Degree	Base Grants	Regional and National Competitive Grants
Undergraduate	15	
Masters	10	3
Ph.D.	1	
Post Doc		

Theses and Dissertations

Number of Theses and Dissertations Resulting from Student Support: 1998−2002

Master's Theses	2
Ph.D. Dissertations	1

Student Grants and Fellowships

Administration, Coordination, and Cooperation

Regional and National Competitive Grant Programs

One proposal was submitted and funded in the FY 1998 Regional Competitive Grants Program.

Cooperation

No.

Expenditure of Section 104 and Matching Funds, by University or Other Organization, State, and Year: 1998 − 2002

		Section 104 Federal Grant and Matching Fund Expenditures				
University or Organization	**State**	**1998**	**1999**	**2000**	**2001**	**2002**
The University of Vermont	Vermont	80132	207688	195591	189360	282635
Middlebury College	Vermont		50697	77744	86947	

Institute Directors over Evaluation Period

Name	Academic Discipline	Term
Alan McIntosh	Aquatic Ecotoxicology	1998 − present

Advisory Committees

The Water Center Advisory Committee met to evaluate proposals each spring when there were new proposals to evaluate.

Phil Benedict, VT Dept. Ag., 1998; 1999; 2000; 2001; 2002 Doug Burnham, VT DEC, 1998; 1999; 2000; 2001; 2002 E. Alan Cassell, UVM, Natural Res., 1998; 1999 Craig Heindel, Heindel &Noyes (Consulting firm), 1998; 1999; 2000; 2001; 2002 Linda M. Howe, UVM Extension, 1998; 1999; 2000; 2001; 2002 Chris Killian, VT Nat. Res. Council, 1998; 1999; 2000; 2001; 2002 Winslow Ladue, VT DEC, 1998; 1999; 2000; 2001; 2002 Crea Lintilhac, Lintilhac Foundation, 1998; 1999; 2000; 2001; 2002 Al McIntosh (ex−officio), UVM, Water Resources, 1998; 1999; 2000; 2001; 2002 Mary Watzin, UVM, Natural Resources, 1998; 1999; 2000; 2001; 2002 Jim Hoffmann, UVM, Botany, 1999; 2000; 2001; 2002 William Bartlett, Water Resources Board (Consultant), 2001; 2002

Research Proposal Review and Selection Process

Our review process is as follows: each proposal submitted to the Water Center for consideration is sent out for multiple reviews. The Vermont Department of Environmental Conservation is asked to provide technical review and to evaluate relevance to state needs. Each proposal is also sent out to independent external reviewers for technical evaluation. Finally, internal reviewers may be asked to provide anonymous comment. All reviews are sent to Advisory Committee members prior to our annual meeting so that comments can be considered during the evaluation process.

Peer Review of Institute Publications

The Vermont Water Center encourages its principal investigators to publish their Section 104 research results in technical journals, which receive peer review. We generally do not encourage the publication of results in report form because we believe that data in this format generally do not receive adequate distribution to potential users.

Number of Principal Investigators Supported, by Rank and Year

Principal Investigators on Research Projects Supported by Section 104 Grants and Matching Funds, by Academic Rank and Year: 1998 − 2002

Academic Rank	1998	1999	2000	2001	2002
Assistant Professor and below	2	1	1	1	3
Associate Professor	0	0	1	1	3
Professor	0	1	1	1	0
Total	2	2	3	3	6

Additional Information for the Evaluation Panel

Note: Publication numbers exclude items from earlier projects published during the review period. Please note that an additional seven publications, including four journal articles, resulting from earlier projects were published during the period 1998−2002.

Attachment A: 1999VT101B Research Project Description

Title	Computer−aided analysis for the least−cost solution on groundwater contamination problems.
Project Number	1999VT101B
Start Date	3/1/1999
End Date	2/29/2000
Research Category	Water Quality
Focus Categories	['Groundwater', 'Models', 'Solute Transport']

Principal Investigators

Name	Rank During Project Period	Affiliation
George Pinder	Professor	Civil &Environmental Engineering The University of Vermont

Funding

Funding Period	Federal 104 Funds	Required 104 Matching Funds	Other Funding	
			Source	Funds
3/1/1999 −2/29/2000	25000	50000	–	–

This project received follow−on funding after completion as a section 104−funded project (Yes ___ No _X_).
If yes, please describe the funding period, source and amount in the funding table.

Student Support

Degree Level	Number of Students	Number of Dissertations/Theses
Undergraduate	0	0
Masters	0	0
Ph.D.	1	1
PostDoctoral	0	0

Publications

Publication Type	Publication Citation
Dissertations	Papadopoulou, M.P. 2002. Enhanced methodology for the solution of groundwater management problems. Ph.D. dissertation. The University of Vermont.
Other Publications	Papadopoulou, M.P., G.F. Pinder, and G.P. Karatzas. 2002. A dynamic approach to groundwater remediation design. 8 pp.
Articles in Refereed Scientific Journals	Pinder, G.F., M.P. Papadopoulou and G.P. Karatzas. Optimal management of a coastal aquifer using least−cost design technology. Computational Methods in Water Resources (13):561−566.

Awards and Achievements

None

Attachment A: 2000VT21N Research Project Description

Title	Stable Isotope Analysis of the Contribution of N2 Fixation to Phytoplankton Nutrition, Lake Nitrogen Budgets and Lake Eutrophication
Project Number	2000VT21N
Start Date	8/1/1998
End Date	7/31/2000
Research Category	Water Quality
Focus Categories	['Nutrients', 'Surface Water', 'Water Quality']

Principal Investigators

Name	Rank During Project Period	Affiliation
Suzanne Levine	Assistant Professor	School of Natural Resources The University of Vermont
Andrea Lini	Assistant Professor	Geology Dept The University of Vermont

Funding

Funding Period	Federal 104 Funds	Required 104 Matching Funds	Other Funding	
			Source	Funds
8/1/1998 −7/31/2000	56512	113026	−	−

This project received follow−on funding after completion as a section 104−funded project (Yes ___ No _X_).
If yes, please describe the funding period, source and amount in the funding table.

Student Support

Degree Level	Number of Students	Number of Dissertations/Theses
Undergraduate	0	0
Masters	3	2
Ph.D.	0	0
PostDoctoral	0	0

Publications

Publication Type	Publication Citation
Conference Proceedings	Leech, J.E., A. Lini, M.M. Lescaze, and S.N. Levine. 1998. Stable isotope analysis to determine dietary differences between herbivorous and omnivorous zooplankton. ASLO/ESA Meeting. Abstract Volume.
Conference Proceedings	Lescaze, M.M., S.N. Levine, A. Lini, and J.E. Leech. 1998. An analysis of the relative contribution of atmospheric nitrogen to lake phytoplankton nutrition: Does fixation prevent nitrogen limitation? ASLO/ESA Meeting. Abstract Volume.
Conference Proceedings	Levine, S.N., A. Lini, M.M. Lescaze, and J.E. Leech. 1998. Stable isotope analysis of macrophytes, phytoplankton and periphyton in Vermont lakes. ASLO/ESA Meeting. Abstract Volume.

Conference Proceedings	Lini, A., S.N. Levine, M.M. Lescaze, and J.E. Leech. 1998. Response of lake ecosystems to Holocene climate change: a multiple isotope approach. ASLO/ESA Meeting. Abstract Volume.
Conference Proceedings	Ferber, L., S. Levine, and A. Lini. 2000. Nitrogen dynamics in Shelburne Pond, VT. International Association of Great Lakes Research, 43rd Conference Program and Abstracts, p. A−44.
Conference Proceedings	Ferber, L., S. Levine, A. Lini, and G.P. Livingston. 2000. Nitrogen dynamics in Shelburne Pond. ASLO Meeting, Abstract Volume.
Conference Proceedings	Lini, A., S. Levine, R.C. Howse, and L. Ferber. 2000. Stable isotope composition of lake biota and sediments as proxy for lake trophic state. International Association of Great Lakes Research, 43rd Conference Program and Abstracts, p. A−91.
Conference Proceedings	Lini, A., P. Keane, J.C. Galster, and R.C. Howse. 2000. Integrated analysis of modern and sedimentary stable isotope data in lakes. ASLO Meeting, Abstract Volume.
Dissertations	Lescaze, M.M. 1999. Estimation of the relative contribution of atmospheric nitrogen to lake phytoplankton nutrition: a stable isotope approach. Masters Thesis. The University of Vermont.
Dissertations	Ferber, L.R. 2001. Nitrogen dynamics of blue green algal blooms in a eutrophic Vermont lake. Masters Thesis. The University of Vermont.

Awards and Achievements

None

Attachment A: 2000VT22N Research Project Description

Title	Viability of the seed bank under exotic aquatic weeds
Project Number	2000VT22N
Start Date	3/1/1999
End Date	2/29/2000
Research Category	Water Quality
Focus Categories	['Conservation', 'Surface Water', 'Water Use']

Principal Investigators

Name	Rank During Project Period	Affiliation
Sallie Sheldon	Associate Professor	Biology Dept Middlebury College

Funding

Funding Period	Federal 104 Funds	Required 104 Matching Funds	Other Funding	
			Source	Funds
3/1/1999 −2/29/2000	15486	35211	–	–

This project received follow−on funding after completion as a section 104−funded project (Yes ___ No _X_).
If yes, please describe the funding period, source and amount in the funding table.

Student Support

Degree Level	Number of Students	Number of Dissertations/Theses
Undergraduate	3	0
Masters	0	0
Ph.D.	0	0
PostDoctoral	0	0

Publications

Publication Type	Publication Citation
Water Resources Research Institute Reports	Sheldon, S. 1999. Viability of the seed bank under exotic aquatic weeds. FY1999 Final Report. 15 p.

Awards and Achievements

None

Attachment A: 2001VT661B Research Project Description

Title	Identification of Candidate Parcels for Riparian Buffers: Reducing Fecal Contamination of Vermont Surface Waters
Project Number	2001VT661B
Start Date	3/1/2000
End Date	2/28/2002
Research Category	Water Quality
Focus Categories	['Agriculture', 'Non Point Pollution', 'Water Quality']

Principal Investigators

Name	Rank During Project Period	Affiliation
Leslie Morrissey	Associate Professor	School of Natural Resources The University of Vermont

Funding

Funding Period	Federal 104 Funds	Required 104 Matching Funds	Other Funding	
			Source	Funds
3/1/2000 −2/28/2002	45964	79455	−	−

This project received follow−on funding after completion as a section 104−funded project (Yes ___ No _X_).
If yes, please describe the funding period, source and amount in the funding table.

Student Support

Degree Level	Number of Students	Number of Dissertations/Theses
Undergraduate	0	0
Masters	1	0
Ph.D.	0	0
PostDoctoral	0	0

Publications

Publication Type	Publication Citation
Conference Proceedings	O'Neil−Dunne, J. and L.A. Morrissey. 2002. Identification of candidate parcels for riparian buffers: reducing fecal contamination of Vermont surface waters. Presented at American Ecological Engineering Society, Burlington, VT.
Other Publications	Morrissey, L.A. 2000. Website created that incorporates data from VT River Watch volunteer groups throughout the state, public state beaches, and on−going research efforts on E. coli and recreational water quality in Vermont. http://www.uvm.edu/snr/sal/ecoli/index.htm
Other Publications	O'Neil−Dunne, J. and B. Wemple. 2001. Hydrologic modeling, Vermont Spatial Data Partnership Roundtable Workshop. Waterbury, VT.
Other Publications	O'Neil−Dunne and L.A. Morrissey. 2002. Satellite remote sensing update, Vermont Spatial Data Partnership Roundtable Workshop.

	Waterbury, VT.

Awards and Achievements

None

Attachment A: 2001VT641B Research Project Description

Title	Lagrangian Drifters Within Lake Champlain: A pilot study
Project Number	2001VT641B
Start Date	3/1/2000
End Date	2/28/2002
Research Category	Engineering
Focus Categories	['Methods', 'Water Quality']

Principal Investigators

Name	Rank During Project Period	Affiliation
Thomas Manley	Assistant Professor	Dept of Geology Middlebury College
Jean Claude Gascard	Professor	Oceanographie Universite Pierre et Marie Curie

Funding

Funding Period	Federal 104 Funds	Required 104 Matching Funds	Other Funding	
			Source	**Funds**
3/1/2000 −2/28/2002	50000	114691	–	–

This project received follow−on funding after completion as a section 104−funded project (Yes ___ No _X_).
If yes, please describe the funding period, source and amount in the funding table.

Student Support

Degree Level	Number of Students	Number of Dissertations/Theses
Undergraduate	1	0
Masters	0	0
Ph.D.	0	0
PostDoctoral	0	0

Publications

Publication Type	Publication Citation
Conference Proceedings	Manley, T.O., J.C. Gascard, and P. Tillier. 2001. Acoustically tracked Lagrangian drifters in Lake Champlain. Presented at IAGLR Annual Meeting, Green Bay, WI, June 12−15.
Conference Proceedings	Manley, T.O., P. Tillier and J.C. Gascard. 2002. Acoustically−tracked neutrally−buoyant Lagrangian drifter in Lake Champlain – a feasibility study. Ocean Sciences Meeting, Hawaii, Feb. 11−15.
Other Publications	Manley, T.O. 2001. Summary of Lake Champlain hydrodynamics. Invited presentation at Great Lakes Environmental Research Lab, Ann Arbor, MI, January 17−20.

Awards and Achievements

None

Attachment A: 2002VT5B Research Project Description

Title	Detection of cyanobacterial blooms using remote sensing
Project Number	2002VT5B
Start Date	3/1/2002
End Date	2/28/2003
Research Category	Water Quality
Focus Categories	['Methods', 'Toxic Substances', 'Water Quality']

Principal Investigators

Name	Rank During Project Period	Affiliation
Suzanne Levine	Associate Professor	School of Natural Resources The University of Vermont
Gerald Livingston	Research Associate Professor	School of Natural Resources The University of Vermont
Leslie Morrissey	Associate Professor	School of Natural Resources The University of Vermont

Funding

Funding Period	Federal 104 Funds	Required 104 Matching Funds	Other Funding	
			Source	Funds
3/1/2002 −2/28/2003	6000	12118	–	–

This project received follow−on funding after completion as a section 104−funded project (Yes ___ No _X_).
If yes, please describe the funding period, source and amount in the funding table.

Student Support

Degree Level	Number of Students	Number of Dissertations/Theses
Undergraduate	0	0
Masters	0	0
Ph.D.	0	0
PostDoctoral	0	0

Publications

Publication Type	Publication Citation

Awards and Achievements

None

Attachment A: 2002VT6B Research Project Description

Title	Substrate− and size−dependent measurement of particle−phase mercury in the atmosphere by aerosol mass spectrometry
Project Number	2002VT6B
Start Date	3/1/2002
End Date	2/28/2003
Research Category	Climate and Hydrologic Processes
Focus Categories	['Methods', 'Solute Transport', 'Toxic Substances']

Principal Investigators

Name	Rank During Project Period	Affiliation
Giuseppe Petrucci	Assistant Professor	Dept of Chemistry The University of Vermont

Funding

Funding Period	Federal 104 Funds	Required 104 Matching Funds	Other Funding	
			Source	Funds
3/1/2002 −2/28/2003	24004	49783	–	–

This project received follow−on funding after completion as a section 104−funded project (Yes ___ No _X_).
If yes, please describe the funding period, source and amount in the funding table.

Student Support

Degree Level	Number of Students	Number of Dissertations/Theses
Undergraduate	1	0
Masters	2	0
Ph.D.	0	0
PostDoctoral	0	0

Publications

Publication Type	Publication Citation
Conference Proceedings	Holmes, B. and G.A. Petrucci, 2002. Measurement of atmospheric particle−phase mercury by laser aerosol mass spectrometry. Federation of Analytical Chemistry and Spectroscopy Societies, FACSS, Providence, RI, USA, October 13−17.

Awards and Achievements

None

Attachment A: 2002VT1B Research Project Description

Title	Water quantity and quality dynamics in high−elevation watersheds: Developing a scientific approach to understanding ski area impacts in Vermont
Project Number	2002VT1B
Start Date	3/1/2002
End Date	2/28/2004
Research Category	Water Quality
Focus Categories	['Hydrology', 'Models', 'Water Quality']

Principal Investigators

Name	Rank During Project Period	Affiliation
Beverley Wemple	Assistant Professor	Geography Dept The Univiversity of Vermont
Donald Ross	Research Assistant Professor	Plant and Soil Science The University of Vermont
James Shanley	unknown	USGS

Funding

Funding Period	Federal 104 Funds	Required 104 Matching Funds	Other Funding	
			Source	Funds
3/1/2002 −2/28/2004	29794	59964	–	–

This project received follow−on funding after completion as a section 104−funded project (Yes ___ No _X_).
If yes, please describe the funding period, source and amount in the funding table.

Student Support

Degree Level	Number of Students	Number of Dissertations/Theses
Undergraduate	1	0
Masters	1	0
Ph.D.	0	0
PostDoctoral	0	0

Publications

Publication Type	Publication Citation
Conference Proceedings	Wemple, B., J. Shanley, and J. Denner. "Effects of an Alpine Ski Resort on Hydrology and Water Quality in the Northeastern U.S.: Preliminary Findings from a Field Study," American Geophysical Union Fall Meeting, San Francisco, CA. December 2002.
Conference Proceedings	Mussleman, K. Analysis of Spatial Variability of Precipitation on Mt. Mansfield, Stowe, VT. Vermont Geological Society Spring Meeting, Middlebury, VT. April 2002.
Conference Proceedings	Denner, J., J. Shanley, and B. Wemple, 2001. Comparison of Runoff from a Ski Resort and Adjacent Undeveloped Watershed in Northern Vermont. Eastern Snow Conference, Stowe, VT. June 2001.
Other Publications	Mussleman, K. 2002. Analysis of Spatial Variability of Precipitation and Snow

	Accumulation on Mount Mansfield, Stowe, Vermont. Unpublished senior research project, Dept. of Geology, University of Vermont.
Other Publications	Muth, M. and L. Pascale. 2001. Runoff from paved and unpaved parking lots at the Spruce Peak parking area, Stowe Mountain Resort, Stowe, Vermont. Unpublished student research paper, prepared for Geol 151, available at http://geology.uvm.edu/morphwww/classes/morph/2001/projects/PROJ2001.html, accessed June 17, 2003.
Other Publications	White, M. 2002. Total Suspended Solids and Runoff Analysis for the Big Spruce and Mansfield Tributaries in the West Branch Watershed, Stowe, Vermont. Unpublished student research paper.
Articles in Refereed Scientific Journals	Shanley, J.B. and B. Wemple, 2002. Water Quality and Quantity in the Mountain Environment. Vermont Law Review (Special issue − Mountain Resorts: Ecology and the Law), 26(3):717−751.

Awards and Achievements

None