Basin 8 Water Quality Management Plan
May 2012

APPENDICES

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APPENDIX A - BASIN 8 PLANNING PARTNERS

Watershed Council and Watershed Plan Development
In early 2008, the VANR sent out an open invitation to the communities within the watershed to participate in the development of this plan. The community members that came together as a watershed council represented a diverse mix of stakeholders from within the watershed. They included farmers, foresters, business owners, municipal officials, anglers, local watershed and lakeshore organizations, environmental groups, teachers, and regional planners (Appendix A). The Department of Environmental Conservation (VDEC) watershed coordinator and the watershed council went through the following steps:

- Issue identification
- Issue prioritization
- Strategy and solution development; and
- Identification of resources and funding

Organizations participating in the Winooski Basin planning process included:

Chittenden County Regional Planning Commission
Central Vermont Regional Planning Commission
Essex Town Planning Commission and Conservation Commission
Friends of the Mad River
Friends of the Winooski River
Hunter, Anglers and Trappers Association of Vermont
Lake Champlain International, Inc.
Lamoille County Natural Resources Conservation District
Marshfield, Montpelier, Northfield and Plainfield Conservation Commissions
Trout Unlimited
USDA - Natural Resource Conservation Service
US Fish and Wildlife Service
University of Vermont
UVM Sea Grant
Vermont Agency of Agriculture, Foods and Marketing
Vermont Agency of Transportation
Vermont Back Roads Program
Vermont Federation of Lakes and Ponds
Vermont League of Cities and Towns
Vermont Natural Resource Council
Winooski County Natural Resources Conservation District
Worcester Selectboard

APPENDIX B: PUBLIC PARTICIPATION AND RESPONSIVENESS SUMMARY TO PUBLIC COMMENTS

Non-point source pollution is Vermont's largest water quality problem. Non-point source pollution is generated from numerous land uses and is not easily ascribed to any one polluter. In addition, much of it is a result of an accumulation of environmentally damaging land use practices that are culturally accepted or driven by economics. A plan for controlling non-point source must include a process that helps us as a society understand why we pollute and identifies solutions that we can accept and will implement voluntarily.

Traditional forms of public participation usually depend upon a series of public meetings where people's concerns are heard. This form of one-way communication is used by planners almost solely for data collection. It fails to change people's minds and does not ensure that all of the values of the community are considered. The basin planning process facilitates a two-way discussion between the community and the Agency of Natural Resources through a series of meetings. The meetings also include strategy development through collaborative decision-making. The discussions allow all participants' opinions to be molded by a better understanding of their ecosystem and the social and economic needs of their community.

The following is a list of meetings that were part of the collaborative basin planning process. Participants include partners listed in Appendix A as well as individual citizens.

Public meetings to identify citizens' concerns and goals for the watershed

February and March 2007 - Upper Winooski subwatershed meeting - Stevens/Jail Branch: 3/15 in Barre Town; West Branch/Little River: 2/18 in Stowe; North Branch: 2/22 in Worchester; Winooski Mainstem: 2/13 in Berlin; Kingsbury Branch: 2/21 in Calais; Dog River: 2/27 in Middlesex; and Winooski Headwaters: 2/6 in Marshfield. Over 70 citizens participated.

December 2008 – Upper Winooski basin meetings: 12/9 in Marshfield;12/10 and 16 in Montpelier: 12/15 in Websterville;12/17 in Stowe

March 2009 - Lower Winooski basin meeting to identify citizen's concerns and goals for the watershed. 3/10 in Richmond; 3/11 in Jericho; 3/18 in Williston; 3/19 in Essex. Over 45 citizens participated

March and April, 2010. Three focus groups with agricultural community members were held

Council/Community meetings to develop strategies

2010

Upper Winooski Basin
Montpelier: 2/11, 3/17, 4/21, 7/21, 8/19, 9/15, 10/20
Berlin: 5/19 and 6/16

Lower Winooski Basin (held in Essex Jct.)
3/31, 5/7, 6/7, 9/8; 10/13, 10/14, 12/8,

3 focus group meetings with agricultural community – March and April

2011
Upper Winooski Basin – 3/28 Montpelier
Lower Winooski Basin - 3/30 Essex Junction
Agricultural meeting with Winooski Natural Resources Conservation District Board - January

2012
Public Meeting for draft basin plan
Essex Junction – 2/22
Montpelier – 3/8

Informational Meetings
Central Vermont Planning Commission Board, Berlin – 2/15
Mad River Valley Planning District Board, Waitsfield - 3/15
Chittenden County Regional Planning Commission Board, Winooski – 3/21

Vermont Department of Environmental Conservation
Agency of Natural Resources
Responsiveness Summary to Pubic Comments Regarding:

Winooski River Basin (Basin 8) Water Quality Management Plan

On February 2, 2012 the Vermont Department of Environmental Conservation (DEC) of the Agency of Natural Resources (ANR) released a final draft of the Basin 8 Water Quality Management Plan for a public comment period. The public comment period, which ended on March 23rd, included two public meetings. The meetings were held in Essex Junction on February 22nd and in Montpelier on March 8th 2012.

The DEC prepared this responsiveness summary to address specific comments and questions and to indicate how the plan has been modified. The comments below follow the outline of the final draft. Comments may have been paraphrased or quoted in part. The full text of the comments is available for review or copying at the Essex Junction Regional Office of the Department of Environmental Conservation, 111 West Street, Essex Junction, Vermont 05452.

In General

Comment : In general, the basin plan relies heavily on voluntary and incentive based programs and does not place enough emphasis on regulatory permitting and enforcement

Response: Basin planning process for the Winooski basin followed the Department of Environmental Conservation's 2003 "Guidelines for Watershed Planning," which supported a planning process that focused on encouraging voluntary-based efforts by providing technical and financial assistance. Any plans written today will follow a planning process that may include recommendations to change regulatory or permitting approaches. Further, the reader is referred to the Statewide Surface Water Management Strategy, Appendix A, for the complete roster of regulatory programs that are exercised by the Department and partner agencies. It is important to note that due to legally binding confidentiality issues, a Basin Plan is not a vehicle by which to identify individual landowners that are targeted for regulatory action.

Chapter 2 –Assessment

Comment: The "bug" and "insect" distinction should be clarified. The draft uses the word "bugs" when referring to one of the criteria used in the reclassification of specific water bodies. Vermont Agency of Natural Resources, Draft Winooski River Basin Water Quality Management Plan, page 53, (2012). Although the use of the word does not necessarily detract from the overall meaning of the sentence, it is not scientifically correct. While some "true bugs" (Order Hemiptera) may be prey items for fish in those systems, it is likely that most of the "bugs" that are being referred to, are not "bugs" at all. They are "insects". It would be more proper and scientifically correct to refer to "bugs" as "insects" in the draft.

Response: The Department appreciates this clarification. The word "bug" will be replaced with the work "insect."

Chapter 4 – Implementation Table

Comment: There doesn't seem to be any prioritization of curtailing the agricultural runoff and groundwater contamination created by dairy farming.

Response: The priority action in the executive summary that promotes existing programs, such as CREP, to address surface runoff will be broadened to include additional agricultural BMPs. The new language will include:

Promote existing programs that provide incentives for fencing, buffers, grassed waterways, barnyard treatments, conservation tillage practices, and cover cropping.

With regard to groundwater, Figure 8 in the agricultural section of the basin plan in Appendix G demonstrates that nitrate and herbicide groundwater contamination in Vermont have been on the decline for more than a decade. Further, Figure 21 illustrates that pesticide use in Vermont has declined since the early 1990's. The regulatory and conservation programs that provide these necessary protections for groundwater and surface water are included in Appendix G on page 87 and will continue to be utilized in the Winooski basin and statewide.

Comment: There doesn't seem to be discussion of the Disposal permits that allow untreated septage (far worse than sewage) to be land applied along the river.

Response: Disposal of untreated septage requires a Solid Waste Management Certification through the Residuals Management Section in the Watershed Management Division of the Department of Environmental Conservation (DEC). All Agency programs that protect surface or ground water are included in the Vermont Surface Water Management Strategy, referenced throughout the basin plan, including second page of Chapter 3. There are several regulatory requirements for the land application of sludge (biosolids) and septage that assist in protecting surface waters and groundwater including prohibition of land application in the area of the 100-year floodway and within 100' of surface water as well as maximum allowed slope of site, nutrient management for site, among others.

DEC has no evidence or other data indicating any certified septage disposal site has caused or is causing any surface or ground water problem.

Comment: I understand that the State wants the plan to be action oriented. However, I am concerned that some of the recommendations are so specific that they imply that the issue is smaller than what it actual is. I think some of the recommendation can and should be broadened and center around a process for determining priorities. For example, instead of items that specifically calls out culverts as an issue in the Mad River or lists specific dams for potential removal, consider rephrasing this way:

- Replace or repair culverts where State databases indicate there is a geomorphic and/or fish passage benefit and a cost/benefit analysis warrants it.
- Priority should be given to removing dams that are, based on input from VT FWD and US FWS, degrading otherwise good habitat or present dangers due to the likelihood of failure. Further input and prioritization should be received from the Dam Taskforce.

I am not sure what purpose a Top Ten list serves. If that remains, there should be clearly stated criteria as to why something was selected for that list. Is there some basis for believing that culverts are worse in the Mad than elsewhere in the watershed? To my knowledge, that is not the case. Listing towns that are the remaining few that haven't had BBR studies or stormwater mapping or have a TMDL at least have a basis that is rooted in something clear cut.

In general, I think the specific project approach will:

- Date the plan quickly (there is a specific recommendation in Richmond that discusses using a UVM class in spring 2010!)
- Fail to make adequate use of State tools or staff expertise to guide project development over the long term (see the culvert and dam examples above)
- Limit the flexibility of groups and towns to identify and develop projects that may ultimately be as or more valuable than specific ones listed. This assumes that grant proposals that can cite the Basin Plan will score higher for funding.

Response: The concern is noted and understood. What the commenter observes here is an evolution in the basin planning process from that guided by the Agency's 2003 "Vermont Watershed Initiative Guidelines for Watershed Planning" to the recently issued Statewide Surface Water Management Strategy and its Chapter 4 entitled, "Tactical Basin Planning." The Department has observed over time that the lack of geographic specificity and prioritization for specific projects has in fact been a detriment for partners to plan implementation, in that proposals would be denied funding despite being identified by general strategy in Basin Plans, leading to confusion over the role of Basin Plans.

The intent of the tactical identification of projects and associated prioritization is to provide additional assurance to stakeholders and project partners of the Department's interest in financially supporting identified projects. For the foreseeable future, the Department's Ecosystem Restoration Program (ERP) funding resources will continue to be at levels below those needed for whole-scale Basin Plan implementation; hence the need for prioritization. Further, the Department has renewed its commitment to revisiting Basin Plans on the originally envisioned 5- year cycle. As such, tactical basin plans are intended to include a high priority list of projects and strategies that are reasonably implemented in that time span. The ERP is looking to tactical basin planning for guidance to allocate funding to these projects. That said, the commenter raises a good point about identifying priorities among subwatersheds, and thus the following suggestions will be included in the basin plan.

The fourth listed priority:

> " Identify culvert replacement projects in Mad River watershed that will improve geomorphic stability of the stream as well as improved fish passage"

Will be replaced to read:

> "Identify culvert replacement projects in the basin, including the Mad River watershed, that will improve geomorphic stability of the stream as well as improve fish passage"

The first strategy of section E in Chapter 3:

> "Identify dams that have high restoration potential based on the results of The Nature Conservancy's Northeast Aquatic Connectivity Project."

will be replaced to read:

> "Prioritize dams for removal that degrade habitat, present danger due to likelihood of failure, have high restoration potential. A resource includes results of the Nature conservancy's Northeast Aquatic Connectivity Project."

The following partners will be added, VFWD, USFWS. The Vermont Dam Task Force is already included as a partner.

Comment: The basin plan does not place appropriate emphasis on VTANR or VTAAFM's regulatory authority to protect and improve water quality. The plan does little to indicate that the agency will strengthen its use of its regulatory and permitting authority to address some of the known pollutant sources outlined in this basin plan. For instance, although the long-delayed establishment of a Vermont CAFO permit is mentioned in the summary, none of the nine specific agricultural strategies highlighted in the main body of this plan include regulatory or permitting approaches.

Response: The basin planning process for the Winooski basin largely followed the Agency's 2003 "Vermont Watershed Initiative Guidelines for Watershed Planning," which supported a planning process that focused on encouraging voluntary-based efforts by providing technical and financial assistance. Any plans written today will follow a planning process that may include recommendations to change regulatory or permitting approaches. Further, the reader is referred to the Statewide Surface Water Management Strategy, Appendix A, for the complete roster of regulatory programs that are exercised by the Agency and partner agencies. It is important to note that due to legally-binding confidentiality issues, a Basin Plan is not a vehicle by which to identify individual landowners that are targeted for regulatory action.

Comment: The report is comprehensive touching on many if not all of the important issues confronting Vermont agriculture today among them, since this is a water basin report, pollution due to agriculture, which is responsible for 50-60% of the nutrients entering the lake. The report stipulates this figure and suggests that through nutrient management plans, adherence to Accepted Agricultural Practices rules and the Presumption of Compliance, Vermont farmers are actively engaged in efforts to address this problem. Unfortunately, the report, prepared on the basis of information supplied to Henzel from the VAAF&M, begins on a false premise: that the conventional dairy protocol is itself "accepted."

Conventional farming, chemical intensive farming, was introduced after WWII to increase agricultural yields and to lower costs. Farmers were eager to take it up because of course both these things were very desirable for them. Early adopters soon realized that the protocol, often referred to as the Miracle of American Agriculture, works as advertised. The cost of food for the average American worker in 1940 accounted for 35% of household income while today that cost has shrunk to about 8%. (The lower cost of food is) no miracle: the protocol is predicated upon

externalizing the costs of soil fertility, weed control and labor into the environment, off the farmer's balance sheet and onto society's. Between the 1950s and today, late adopters jumped on the band wagon and the practice has become almost universal. Food is cheaper than ever in real terms than ever before because it is made in surplus and that by itself sounds great. Until you consider that the protocol introduced a massive transfer of wealth out of the rural farm economy into the urban consumer economy, and that it still deposits those externalities in the form of phosphorous and pharmaceutical wastes into the lake. We see the evidence today that this is so.

Now the agriculture community is "hooked" on the conventional protocol and they are naturally eager to keep it in place. Larger farms, larger tractors, bigger herds and huge barns are appealing and if only they cash flowed, everyone would be fine. They do not. The conventional protocol is also predicated upon over production, which drives farm prices down. That causes local and federal governments to approve tremendous subsidies to help "struggling farmers stay viable." When you add to the farm's cash costs the value of these benefits not to mention the costs society shoulders for cleaning up the lake in order to support the production of more "cheap milk" the profits for even the most "efficient" farms disappear altogether.

Ninety-seven percent of respondents to the Survey on the Future of Vermont reported that they support agriculture. The agriculture they had in mind was the small family farm that tourists come here to gaze upon, not the huge factory farms that depend for their survival upon cannibalizing those thousands of small to medium-sized farms. To see that this is so, look around: Vermont's dairy farms have dwindled from 11,500 in 1940 to fewer than 950 today an attrition rate of 93%. The driver for this attrition, for the 50-60% of pollutants in and still entering the lake is the conventional protocol.

It is untenable, or perhaps even disingenuous, for VAAF&M to issue reports that suggest they are working toward the solution to this problem while they lend implicit and explicit support to the factor that created it.

Response: The financial incentives and economic factors that support dairy farming in Vermont are by and large controlled by federal policy. In this Water Quality Management Plan, the Vermont Agency of Agricultural, Food and Markets (AAFM) and the Agency of Natural Resources focus on what is within the agencies' and the community's power to control.

In the recommendations for improving agricultural impacts in the Winooski Basin, there are specific goals that are aimed at improving soil health and focusing on operations other than dairy farms.

Of the land uses in the Winooski Basin, a large portion is managed organically and the most common land use is hay land. These two types of management are very soil health centric, which is exactly what the commenter suggested, were not being supported. The AAFM will continue to ensure the conservation programs are available to promote healthy soils and prudent land management activities.

Also, see previous response regarding the development of basin plans to promote voluntary implementation of BMPs

Comment: Evaluation of existing dams on the Winooski River and consideration of dam removal or the mitigation of environmental effects. This analysis of existing dams and the potential for removal or mitigation of environmental effects is a positive addition to this plan, in particular for a watershed with so many unused dams.

Response: The Department appreciates this comment and the support it confers.

Comment: Consideration of more stringent wastewater permit standards and more aggressive septic enforcement is lacking. The portion of the draft plan dealing with wastewater plants and illicit discharges from septic systems fails to adequately consider use of the agency's regulatory tools. While the included strategies of continued monitoring of bacterial contamination and with the plan to aid municipalities in financing wastewater infrastructure improvements are valuable, the basin plan fails to consider a more stringent septic enforcement program even where illicit discharges and failed systems are suspected or propose more stringent discharge limits for wastewater plants. Both are needed to address water quality problems caused by phosphorus and bacteria pollution to these waters.

Response: As new wasteload allocations are established by the EPA-led Lake Champlain TMDL revisions, these allocations will be reflected in the updates to the Basin Plan and in wastewater permit standards. Appendix E in the Basin Plan includes some of the information that will be considered. Appendix E identifies every WWTF in the Basin and outlines the date permits are set to be re-issued, and highlights facility-specific information where warranted. The Agency understands that WWTFs in Vermont account for 4% of the total phosphorus load to Lake Champlain, and with limited facility-specific exception, have been operating well below wasteload allocations that were in place until 2011.

When the Agency becomes aware of failing septic systems, the agency works with the Enforcement Division. The Agency also supports work that would identify illegal connections of wastewater to a municipality's stormwater infrastructure. The implementation table of the Basin Plan includes infrastructure mapping and illicit discharge detection and elimination (IDDE) in the following municipalities: Marshfield, Plainfield, Cabot, Berlin and Williamstown, and identifies the need to augment the existing IDDE assessments in Barre and Northfield. In addition, see the response to the first comment in this responsiveness summary.

Comment: There is no discussion about the 17 woefully inadequate antique wastewater treatment plants that discharge into the Winooski

Response: Please see the response immediately above. It should be noted that the Department has invested over $36 million statewide in public wastewater infrastructure upgrades through the surface water revolving fund in 2010-2011 alone. The Department's Intended Use Plan outlines priorities for additional investment through the SRF, which is shown online at http://www.anr.state.vt.us/dec/fed/fms.htm.

Comment: A use attainability analysis is not appropriate for Shelburne Pond. The strategy cited for addressing phosphorus loading in Shelburne Pond is unacceptable and potentially unlawful. Under the federal regulations, a state may not remove a designated use from a water body if it is an existing use, unless a use designation requiring more stringent water quality standards is added. 40 C.F.R. § 131.11 (h)(1) (2008).

In the case of Shelburne Pond, performing a use attainability analysis (UAA) to remove a designated use and thereby allowing less stringent water quality protections is improper. Currently, "Swimming And Other Primary Contact Recreation" the most stringent designated use for Shelburne Pond. US Environmental Protection Agency, Water Quality Assessment Report for Shelburne Pond, (2008).

It is likely that swimming or wading is an existing use of this water body. Therefore, it would be improper for the state to perform a UAA which would remove the "swimming and primary contact" from designated uses. The fact that such uses have been considered a designated use by the state indicates that the state believes those activities have occurred, or had the potential to occur, in Shelburne Pond.

Undertaking a UAA on Shelburne Pond could remove a public use from that body of water and that removal is unacceptable from a policy as well as legal basis. Shelburne Pond is something of a rarity in the heavily developed area where it is located. Located a bit more than 10 miles from downtown Burlington, the state's largest city, this water body and its surrounding areas provide visitors the opportunity to escape the city and experience the outdoors. In addition, due to the efforts both of the state and The Nature Conservancy and the state, the shore of Shelburne Pond has remained undeveloped and the pond is the largest undeveloped body of water in Western Vermont.

While the water body is currently impaired, attempting to remove a designated use is counter to the public good in this case. Requiring less stringent water quality protections by eliminating an existing or potential use would not further the common goal of the Vermont Water Quality Standards and Vermont law to "protect and enhance the quality, character and usefulness of its surface waters and to assure the public health." Vermont Water Quality Standards Section 1-02 (A) (1) page 6 (2011) Vermont State Statutes 10 V.S.A. § 1250 (1).
Lower water quality would further affect other designated uses such as aquatic organisms and the ecosystem, as well as aesthetics.

Instead of giving up on a designated use of Shelburne Pond more work should be put into cleaning it up and attracting more visitors to enjoy it. Natural conditions such as depth and long-standing nutrient deposition in the pond's sediments may have contributed to the pond's current hypereutrophic condition, however a 2007 study of the pond makes clear that sediment accumulation rates have dramatically increased since the late 1800's and that human activity is responsible for its decline. Trophic History of Shelburne Pond, Shelburne Vermont, Vermont

Agency of Natural Resources, Andrea Lini et al. (2007). Fixing those mistakes may require additional time and effort, including perhaps drafting and implementing a Total Maximum Daily Load or Water Quality Remediation Plan for Shelburne Pond as part of this effort.

Response: Shelburne Pond is a unique eutrophic waterbody with very high wildlife and scenic value, and so the Department appreciates this concern. Use attainability analysis as a tool to gauge the suitability of a designated use for a specific surface water has not previously been exercised in Vermont. There are many states, however, who have used this approach as a tool to more appropriately designate uses, and a USEPA memorandum prepared by Office of Science and Technology ("King Memo," Ephraim King, 2006[1]) articulates five specific reasons why UAA's are a suitable tool.

The commenter appropriately urges caution that documentation of an existing use in a surface water precludes the ability of State to change that use. The Department agrees. Under Vermont's procedure for the determination of existing uses, all lakes and ponds are presumed to have swimming, boating, and fishing as existing uses. That procedure also allows that this presumption may be rebutted. In the case of Shelburne Pond, the Department's opinion is that the presumption of swimming as an existing use may potentially be rebuttable, due to the long history of eutrophic conditions as described below. The Department is not aware of work that has been undertaken to date that would substantiate swimming as an existing use in Shelburne Pond. In a case like this, the most appropriate time to investigate whether swimming or other uses are existing would be either during the antidegradation evaluation of a specific permit, or specifically in the consideration of a UAA.

The commenter also indicates that the designation of uses for Shelburne Pond indicates that the State believes those activities have occurred. This is incorrect. The water quality standards regulation requires that States specify appropriate water uses to be achieved and protected. In designating uses for a water body, States examine the suitability of a water body for the uses based on the physical, chemical, and biological characteristics of the water body, its geographical setting and scenic qualities, and economic considerations. However, designated uses do not always become existing uses. An UAA can lead to refinements or changes in use that lead to more or less protective criteria. The goal is that the new use is more accurate. This issue is addressed by the King memo, in points one and two.

The commenter contends that the undeveloped nature of the pond and proximity to Burlington suggest that conducting a UAA is unacceptable policy, and is poorly protective of public health. The Department disagrees that evaluating the suitability of UAA in this instance is poor policy for two reasons. First, the trophic history of Shelburne Pond indicates that there has been a significant increase in sediment deposition and trophic enrichment since the late 1800's. While the commenter correctly indicates that these changes are likely anthropogenic, the Department's read of the referenced Lini study is that conditions in the pond were already highly enriched as of 1975,

[1] http://water.epa.gov/scitech/swguidance/standards/uses/uaa/king-memo.cfm

with ever-increasing productivity levels since that time resulting from prior untreated waste (whey) discharge and post-1990's dynamic nutrient cycling and resultant algal production. While Shelburne Pond is clearly not in its pre-settlement condition, the conditions evident in the pond result from a long history of land use in the watershed, with all but a very short list of watershed sources now controlled. The Department questions the reversibility of the trophic enrichment trend in Shelburne Pond, and believes that consideration of a UAA, with associated careful evaluation of all lines of evidence, is an appropriate step.

In light of this comment, the Department has significantly enhanced the discussion about Shelburne Pond in the final basin plan. Yet, the public review draft action item to which the commenter is responding reads "Consider undertaking a use attainability analysis." The comments filed are not sufficiently persuasive to change the Department's intent to at least further consider a UAA for Shelburne Pond. The Department looks forward to discussions with the commenter and other stakeholders about this issue – an important step in a UAA that is also outlined in the King memo.

TEXT TO INSERT INTO THE PLAN

Shelburne Pond is a 452-acre lake located in the Champlain Valley. This shallow, high-alkalinity lake is fringed by large wetlands, and a considerable portion of the lakeshore is in conservation ownership. There is no direct development on the lakeshore, and a mix of agricultural, forest, and low-density residential characterizes the watershed. Over the past 20 years, much of the agricultural lands have gone out of production, and have been replaced by low density, rural single-family homes. Shelburne Pond supports a wide variety of warmwater species, and hosts tremendous waterfowl use. Recreationally, Shelburne Pond supports a large annual contingent of anglers, paddlers, and hunters. The pond is also heavily used in winter for ice activities. It is an ecologically and recreationally significant resource.

Shelburne Pond also has the highest total phosphorus concentration of any lake monitored by WSMD over the long-term. The mean spring total phosphorus concentration is 92 ppb (± 7.2, std. err.), based on 22 years of measurement. During summer, heavy cyanobacteria blooms can develop. WSMD scientists have observed meter-thick accumulations of cyanobacteria along shore, and pervasive bloom conditions across the entire lake surface. Such extreme bloom conditions may preclude recreational uses of the lake, and have prompted the Vt. Department of Health to post warnings against exposure to the blooms. In addition to persistent algal growth, the lake has experienced fish kills in the past due in part to oxygen depletion from excessive productivity. Paradoxically, these prior kills may not have significantly impacted the quality of the present fishery. In summer 2007, a joint EPA-WSMD fish sampling effort on the lake yielded numerous large and even trophy-sized northern pike and largemouth bass, despite a relatively low sampling effort, and poor sampling conditions. Finally, being quite close to the University of Vermont (UVM), Shelburne Pond has been extensively studied by that organization.

In order to address the nutrient impairment on this lake it is necessary to understand the background, or natural phosphorus concentrations that would have been expected absent any major watershed stressors. WSMD's basic hypothesis for this lake has been that it is to some degree naturally eutrophic, augmented by historic land use practices. If this is the case, it would be

inappropriate to manage the lake towards a mesotrophic state; or one lower than the historic condition. To address this question, WSMD commissioned a paleolimnological investigation of the lake, from a multidisciplinary team led by UVM. The purpose of this investigation was to determine the likely historic trophic state of the lake, to provide guidelines for management. The results of the analysis, as described in the following quotation, were unambiguous:

> *"All paleo-productivity proxies indicate that Shelburne Pond was oligo-mesotrophic before European settlement, and has become increasingly productive since the mid 19th century (~1850). Eutrophication rates intensified after ~1900, and reached peak levels during the past two decades (post-1990). Comparison of the sedimentary record with historical data suggests a causal relationship between deteriorating water quality in the pond and human activities in its watershed. Forest clearing since 1810, a switch to mechanized agriculture around ~1850, and intensive dairy farming during most of the 20th century, all resulted in progressive nutrient enrichment.*
> *Despite these significant recent trends, data extending past the post-settlement record suggest that, although generally lower, Shelburne Pond's productivity levels were at times quite significant during the past few thousand years. The causes of these, apparently natural, fluctuations remain to be investigated."*

This conclusion is emphatic that the historical background in the pond is a meso-oligotrophic state. What remains unanswered, however, is whether the lake can at this point be returned to that condition. There are two pathways available: 1) set a target concentration, and develop a TMDL with loading allocations; or, 2) conduct a Use Attainability Analysis to identify the current water-quality limitation of the lake, and manage the watershed towards the most realistically attainable condition.

Given the current condition of the watershed, it is difficult to see how reductions of external loads can be achieved in a manner sufficient to meet a loading capacity in Shelburne Pond aimed at an in-lake phosphorus concentration consistent with all recreational uses. The internal sediment recycling in the lake is very likely a dominant phosphorus source; one that is increasing in magnitude with the continuing increases in growth of nitrogen-fixing cyanobacteria that senesce to the lake sediments annually. Given the shallow, windswept nature of the pond, it is unlikely that chemical controls on internal recycling would successfully control the sediment-phosphorus cycle. Likewise, mechanistic solutions to increase sediment-phosphorus retention by aeration would be cost and energy-prohibitive. Given these considerations, WSMD is considering initiating discussions about drafting a Use Attainability Analysis for Shelburne Pond. Such an approach would articulate the need for achievable controls on watershed loads, while acknowledging the existing water quality limitations in Shelburne Pond that result from historical impacts to the lake.

Comment: There is a lack of a needed approach for controlling Eurasian water milfoil in the Winooski River. Aquatic invasive species are a serious problem for a number of reasons, including damage to water quality, their detrimental effect on ecosystem integrity and causing a reduction in public access and use. The draft seems to largely ignore these dangers posed by invasive species. The agency states that controlling the population of Eurasian watermilfoil in the Winooski River is too difficult, and therefore, the aquatic plant will not be controlled at all. Vermont Agency of Natural Resources, "Draft Winooski River Basin Water Quality Management Plan, page 51,

(2012). While it is true that Eurasian watermilfoil proliferates quickly it can be controlled with enough effort through a variety of methods. In Wisconsin, this invasive species is controlled through mechanical, chemical, biological or public education methods. It is inappropriate to completely give up on the control of this invasive plant in the attempt to restore and protect the Winooski River Basin.

Response: In Part E of the State of Vermont's "2008 List Of Priority Surface Waters Outside The Scope Of Clean Water Act Section 303(d)" the State has identified Eurasian watermilfoil (EW) as altering the Winooski River from the mouth to Alder Brook to the extent that aquatic habitat and other designated uses are no longer supported. Eurasian water milfoil is widely distributed throughout Lake Champlain. EW has also been identified in at least 58 other bodies of water throughout the Lake Champlain Basin; however, 53% of these populations represent scattered areas of growth in limited areas. While new infestations of EW are discovered nearly every year, more and more are found before they become widely established due in part to increased public awareness and spread prevention efforts like volunteer watchers.

The Watershed Management Division has been charged with managing waters in Part E. The extensive effort required to control a population over many years, requires that the Division take an approach that focuses technical and limited financial resources where community groups are participating in control efforts.

The State statute governing the control of Eurasian water milfoil and nuisance native species is 10 V.S.A. Chapter 50, 1455, Aquatic Nuisance Control Permit (ANC). New non-indigenous aquatic species control is governed by 10 V.S.A. Chapter 50, 1456 (Rapid Response General Permit). To date, control of the invasive Eurasian watermilfoil has been requested via ANC Permit Application by shoreline property owners, Lake Associations, lake groups (as Applicant) and a Lake Management Company (as Co-Applicant) certified with the Vermont Agency of Agriculture, Food and Markets in Category Five – Aquatics. The States role has been to provide technical assistance and regulatory oversight (issue or deny ANC Permit Applications, etc.) The State has not initiated or paid for a control project for Eurasian watermilfoil (other than via an externally funded grant program, Grant-in-Aid Program) due to limited resources and the difficulty in managing an invasive that is well established in Vermont.

The lower Winooski's population does not currently have the interest of a community group. In addition, the threat of spread of this invasive aquatic plant from the present population in the lower Winooski to new areas is low as the receiving waterbody, Lake Champlain, is already infested with EW. Priorities for the Agency are spread prevention and that the limited resources to control populations should be directed towards existing efforts by community members.

Chapter 5 – Water management typing and classification

Comment : The draft lacks discussion and analysis of water management typing as required by law. According to the Vermont Water Quality Standards, a basin plan is required to propose water management typing (WMT) for Class B waters that are "…based on both the existing water quality and reasonably attainable and desired water quality management goals." Vermont Water Quality

Standards, Section 1-02(D)(5), (2011). In order to provide for the protection and management of Class B waters, "…all Class B waters shall eventually be designated…" by WMT. Id. at Section 3-06(A). Therefore, all waters are required to be classified and to be classified by specific criteria.

Vermont Watershed Initiative Guidelines for Watershed Planning also provide guidance on this issue. A basin plan is required to include a detailed discussion on classification and typing of waters. These requirements are made clear in the "Plan Structure" section, beginning on page 9 of the Guidelines. Vermont Dept. of Environmental Conservation, Vermont Watershed Initiative Guidelines for Watershed Planning, page 9, (2007).
The draft states that a discussion of WMT was essentially not included because such an analysis is too difficult. The document cited as support for this conclusion concedes that water management typing has become difficult over time. Vermont Agency of Natural Resources, Dept. of Environmental Conservation, Progress Report on River Basin Management Planning During 2010, page 3, (2011). However, the Progress Report does not conclude that the difficulty of WMT precludes that type of analysis. Id. In fact, despite the level of difficultly involved, DEC states that it "remains committed to the concept" of implementing WMT. Id.
Meanwhile, the basin management plan "considerable challenges over the past decade have limited ANR's ability to identify proposed water management types, and the Panel's ability to promulgate these designations … as such, recommendations for water management types are not presented in this basin plan." Draft Winooski River Basin Water Quality Management Plan, page 54 (2012).
Just because WMT is difficult to implement, does not mean that the agency can dismiss it when it remains a requirement under the Vermont Water Quality Standards and under state and federal law. A line of reasoning such as this is particularly insufficient when the agency accepts that WMT will still be used.

Response: The Department has identified the considerable challenges associated with water management typing in VDEC's 2010 Report to the Vermont General Assembly on Basin Planning. As such, recommendations for water management types are not presented in this basin plan.

Comment: We commend the agency's decision to designate two water bodies as Outstanding Water Resources. We agree with the agency that the section of the Huntington River to be designated is a valuable resource for its recreation, aesthetic and cultural components. Designating this area is an important step in preserving the river for the public's use and enjoyment. Similarly, we believe the decision to designate the North Branch section is an important one for preserving Vermont's waters. Conservation Law Foundation appreciates the agency's effort to secure areas for public swimming and wading and protect their water quality.

Response: The Department appreciates this comment and the support it confers; however, we are only proposing a designation and will depend on the assistance of the community in initiating and developing such a proposal.

APPENDIX C - FISHERIES ASSESSMENT OF THE UPPER WINOOSKI WATERSHED HEADWATERS TO BOLTON DAM

Headwaters to confluence with Molly's Brook

Mainstem: Abundant wild brook trout populations from Cabot Village upstream. Temperature and habitat conditions deteriorate downstream. Max temperature of 78 F observed above the GMP powerhouse in 2004. GMP hydro generation results in extreme daily fluctuations in flow as well as rapid temp changes of >5 degrees F.

Ammonia discharge from Cabot Creamery in 2005 resulted in a complete fish kill (all species/lifestages) for 5.5 miles downstream.

Tributaries:

- Jug Brook - wild brook trout
- Molly's Brook –wild brook and brown trout above Marshfield Reservoir. Extreme flow reduction below due to hydro bypass and unregulated minimum flow, max temp of 77 F in 2004, limits wild trout populations downstream of dam.
- Kidder (Hooker) Brook –wild brook and brown trout

Lakes and Ponds:

- Coits Pond – Chain pickerel, yellow perch, brown bullhead, VDFW access
- West Hill Pond – Largemouth bass, chain pickerel, yellow perch, brown bullhead, VDFW access.
- Molly's Falls Pond (Marshfield Reservoir) – Northern Pike, smallmouth bass, yellow perch, rainbow trout (stocked), brown trout (stocked), brown bullhead. VDFW access. Late fall, winter drawdown impacts littoral zone productivity and may effect spawning tributary access.
- Peacham Pond – brown trout (stocked), yellow perch, rainbow smelt, VDFW access. Late fall, winter drawdown impacts littoral zone productivity and may effect spawning tributary access.
- Molly's Pond – chain pickerel, yellow perch

Confluence with Molly's Brook to confluence with Kingsbury Branch

Mainstem: Mix of wild brown trout and rainbow trout with supplemental stockings of both species. Low levels of wild brook trout, likely originating from coldwater tributaries. Populations vary in abundance with local habitat conditions which vary widely in this reach. Unregulated GMP hydro generation substantially alters natural flow and temperature regimes. Aquatic habitat is isolated between mainstem dams: Marshfield 8 and Plainfield Village.

Slow recovery of wild rainbow trout below Marshfield 8 following 2005 fish kill. No recovery of wild rainbow or brown trout observed above Marshfield 8 as of 2007, due to barrier (downstream populations unable to access habitats above Marshfield 8).
VDFW owns 3 parcels of riparian land along mainstem in Plainfield and Marshfield.

Tributaries:

- Creamery Road Brook – wild brook trout
- Marshfield Brook – wild brook trout
- Naismith Brook – wild brook and rainbow trout. Important rainbow trout spawning tributary for mainstem populations.
- King Brook – wild brook and rainbow trout
- Great Brook – wild brook, brown and rainbow trout. Important rainbow and brown trout spawning tributary for mainstem populations.

Kingsbury Branch

Mainstem: Wild brook trout in East Calais and upstream. Access limited and sampling conditions difficult from East Calais to mouth. Surface area of North Montpelier Pond increases water temperatures downstream.

Tributaries:

- Pekin Brook – wild brook trout
- Dugar Brook – wild brook trout

Lakes and Ponds:

- Buck Lake – brook trout (stocked), smallmouth bass, yellow perch, brown bullhead, pumpkinseed, seasonal VDFW access.
- Greenwood Lake – brown trout (stocked), smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed,VDFW access.
- Valley Lake – smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed,VDFW access.
- Cranberry Meadow Pond – smallmouth bass, yellow perch, pumkinseed.
- Nelson Pond – lake trout (wild & stocked), rainbow trout (stocked), brown trout (stocked) rainbow smelt, smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed, VDFW access
- Mirror Lake– lake trout (stocked), rainbow trout (stocked), rainbow smelt, smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed, VDFW access
- Woodbury Lake - rainbow trout (stocked), brown trout (stocked), smallmouth bass, largemouth bass, rainbow smelt, smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed, VDFW access
- Curtis Pond – largemouth bass, chain pickerel, yellow perch, brown bullhead, pumpkinseed, VDFW access.
- Bliss Pond – largemouth bass, yellow perch, chain pickerel, brown bullhead.
- North Montpelier Pond – chain pickerel, yellow perch, brown bullhead, pumpkinseed.

Confluence with Kingsbury Branch to Stevens Branch

Mainstem: Mix of wild brown trout and rainbow trout with supplemental stockings of rainbow trout. Populations vary in abundance with local habitat conditions which vary widely in this reach.

Large size limits direct population sampling, although angler creel surveys have been conducted (1999). Several dams fragment and degrade habitat within this reach.

VDFW owns extensive riparian land along the Winooski River directly above Warsaw's dam in East Montpelier.

Tributaries:

- Sodom Pond Brook – wild brook, brown and rainbow trout. Important rainbow and brown trout spawning tributary for mainstem populations.
- Mallory Brook -
- Bennett Brook – wild brook trout

Stevens Branch

Mainstem: Exclusively wild brook trout above Rt 63. South Barre and downstream supports mix of wild brook, brown and rainbow trout. Despite urbanization and associated impacts, still supports good levels of wild trout populations in areas. Dam in South Barre.

Tributaries:

- Jail Branch – Upper reaches (Washington) supports exclusively wild brook trout. East Barre to mouth supports mix of wild brook, brown and rainbow trout. Very low trout abundance below East Barre dam, unsure why.
- Gunner Brook - wild brook, brown and rainbow trout. Important rainbow and brown trout spawning tributary for Stevens Branch populations.

Lakes and Ponds:

- Thurman Dix Reservoir - Public water supply – no fishing access. No fisheries data.

Stevens Branch to confluence with Dog River

Mainstem: Mix of wild brown trout and rainbow trout with supplemental stockings of brown trout. Populations vary in abundance with local habitat conditions which vary widely in this reach. Large size limits direct population sampling, although angler creel surveys have been conducted (1999). Several dams fragment and degrade habitat within this reach.

Lakes and Ponds:
Berlin Pond – Public water supply – no fishing access. Largemouth bass, smallmouth bass, chain pickerel, yellow perch, pumpkinseed, brown bullhead.

North Branch

Mainstem: Wild brook trout in upper elevations (>1000') only.
Brown trout below Wrightsville (stocked)
Temperature increases quickly moving downstream:

Max Temperatures recorded June 26-27, 2003:
BM 1038' – 72.4
Rt 12 bridge elev 822' - 80.5

Above confl w/ Worchester Brook – 79
Putnamville – 82.5
Below Wrighstville – 80.5

Wrightsville Reservoir has a surface release therefore does not moderate temperatures. High temperatures and flow fluctuations limit coldwater species.

Tributaries

- Martins Brook – wild brook trout and wild brown trout (lower reaches)
- Patterson - wild brook trout and wild brown trout (lower reaches)
- Herrick - wild brook trout and wild brown trout (lower reaches)
- Minister Brook – wild brook trout
- Hancock Brook - wild brook trout
- Worcester Brook - wild brook trout and wild brown trout (lower reaches)
- Catamount Brook – wild brook trout

Lakes and Ponds:
Wrightsville Reservoir – Largemouth and smallmouth bass, yellow perch, chain pickerel, pumpkinseed, brown bullhead. VDEC Access area.

<u>Dog River</u>

Mainstem: Exclusively wild brook trout above Rt 12A in Roxbury, a mix of wild brook, brown and rainbow trout downstream. Wild rainbows and brown trout dominant below Northfield Falls. Entire mainstem and all tributaries managed as wild trout waters. A 4.3 mile section in Berlin is managed with special fishing regulations (reduced harvest) to improve size structure of wild trout. A toxic chlorine discharge from the Northfield sewage treatment plant resulted in a complete fish kill for 0.6 miles downstream to the confluence with Cox Brook in 1999.

Tributaries

- Felchner Brook - wild brook trout above falls, wild brook, brown and rainbow trout below.
- Bull Run – Wild brook and rainbow trout, also wild brown trout in lower reaches
- Stony Brook - Wild brook and rainbow trout
- Sunny Brook – Wild brook, brown and rainbow trout
- Union Brook – Wild brook, brown and rainbow trout
- Cox Brook – Wild brook, brown and rainbow trout; dam in lower reach restricts movement of spawning fish in some years. dam scheduled to be breached in 2008 as cooperative project with TU, USFWS and ANR.
- Chase Brook – Wild brook, brown and rainbow trout. Managed as a spawning water with special fishing regulations (closed to fishing until June 1.)

Lakes and Ponds:
Baker Pond – Largemouth, yellow perch, pumpkinseed, brown bullhead, brook trout (stocked). VDFW owns surrounding land, dam and access area.

Dog River to confluence with Mad River

Mainstem: Mix of wild brown trout and rainbow trout with supplemental stockings of brown trout. Populations vary in abundance with local habitat conditions which vary widely in this reach. Large size limits direct population sampling, although angler creel surveys have been conducted (1999). Dam in Middlesex fragments and degrades habitat within this reach.

Tributaries

- Sunny Brook – wild brook and rainbow trout.
- Jones Brook – Wild brook, brown and rainbow trout

Mad River

Mainstem: Upper reach supports wild brook, brown and rainbow rout and is managed for wild trout. Below Warren Village, increasing temperature and habitat deficiencies limit trout production to "pocket populations" associated with large pools or nearby tributaries. This are stocked with rainbow trout to supplement recreational fishery. VDFW contracted a temperature study of the Mad River watershed (see Rod Wentworth for more info). Dams in Warren and Moretown fragment and degrade habitat.

Tributaries

- Austin, Mills, Stetson, Lincoln, Freeman, Bradley Brook – wild brook trout with possible wild rainbow trout in lower reaches.
- Mill Brook – wild brook, brown and rainbow trout
- Rice, Clay, Chase, Slide, Lockwood Brook - wild brook trout.
- Folsom Brook – wild brook, brown and rainbow trout
- High Bridge Brook – wild brook trout, possible wild rainbow and brown trout in lower reaches.
- Shepard and Dowsville Brook – wild brook brown and rainbow trout.

Mad River to Bolton Dam

Mainstem: Mix of wild brown trout and rainbow trout with supplemental stockings of brown trout. Populations vary in abundance with local habitat conditions which vary widely in this reach. Large size limits direct population sampling, although angler creel surveys have been conducted (1999). Bolton Dam fragments and degrades habitat within this reach. Waterbury Reservoir hydroelectric releases result in dramatic flow and temperature fluctuations.

Tributaries

- Crossett Brook – wild rainbow and brown trout.
- Welder Brook – wild brook trout; possible wild rainbow and brown trout in lower reaches.
- Thatcher Brook – wild brook trout above falls; wild brook, brown and rainbow trout below falls.

Lakes and Ponds:
Waterbury Reservoir – Brook trout, brown trout , rainbow trout (wild and stocked), smallmouth bass, rainbow smelt, yellow perch, pumpkinseed, brown bullhead. FP&R and GMP access.

Annual winter drawdown (~40') precludes littoral zone formation and interferes with rainbow smelt spawning.

Little River

Mainstem: Wild brook trout in higher elevations, wild brown and rainbow trout below confluence with West Branch. Mainstem above reservoir provides spawning habitat for migrating brown trout, rainbow trout, rainbow smelt and other species. Downstream of Waterbury Dam supports wild brown and rainbow trout. Populations limited by regular and extreme flow and temperature fluctuations associated from hydroelectric release.

Tributaries

- West Branch – wild brook trout above confluence with Ranch Brook; wild brook trout and brown trout below.
- Ranch Brook – wild brook trout; wild brown trout in lowest reaches.
- Moss Glen and Sterling Brook – wild brook trout
- Gold Brook - wild brook, brown and rainbow trout
- Miller Brook wild brook trout, brown trout and rainbow trout; serves as spawning habitat for migrating brown trout, rainbow trout, rainbow smelt and other species from Waterbury Reservoir in lower reaches.
- Cotton Brook – wild brook trout, brown trout and rainbow trout; serves as spawning habitat for migrating brown trout, rainbow trout, rainbow smelt and other species from Waterbury Reservoir in lower reaches.
- Stevenson Brook - wild brook trout, brown trout and rainbow trout; serves as spawning habitat for migrating brown trout, rainbow trout, rainbow smelt and other species from Waterbury Reservoir in lower reaches.

prepared by:

Rich Kirn, VDFW 4/21/08

APPENDIX D – PERMITTED DISCHARGES

Discharges in Selected BASIN by receiving water — 08 Winooski

Receiving Water	Discharge Activity	Program	Facility Name	Town	Permit & Discharge ID		Expires
Barre WWTF	Landfill Leachate	Pretreatment Discharge	Moretown Landfill	Moretown	3-1357	004	3/31/2013
Barre WWTF	Landfill Leachate	Pretreatment Discharge	Moretown Landfill	Moretown	3-1357	007	3/31/2013
Barre WWTF	Landfill Leachate	Pretreatment Discharge	Moretown Landfill	Moretown	3-1357	010	3/31/2013
Barre WWTF	Landfill Leachate	Pretreatment Discharge	New England Waste Services - Coventry	Barre City	3-1406	005	12/31/2016
Big Spruce Brook	Snowmaking	Industrial Discharge	Mt Mansfield	Stowe	3-1514	001	3/31/2015
Big Spruce Brook	Snowmaking	Industrial Discharge	Mt Mansfield	Stowe	3-1514	002	3/31/2015
Big Spruce Brook	Snowmaking	Industrial Discharge	Mt Mansfield	Stowe	3-1514	003	3/31/2015
Big Spruce Brook	Snowmaking	Industrial Discharge	Mt Mansfield	Stowe	3-1514	004	3/31/2015
Big Spruce Brook	Snowmaking	Industrial Discharge	Mt Mansfield	Stowe	3-1514	005	3/31/2015
Big Spruce Brook	Snowmaking	Industrial Discharge	Mt Mansfield	Stowe	3-1514	006	3/31/2015
Big Spruce Brook	Snowmaking	Industrial Discharge	Mt Mansfield	Stowe	3-1514	007	3/31/2015
Big Spruce Brook	Snowmaking	Industrial Discharge	Mt Mansfield	Stowe	3-1514	008	3/31/2015
Burlington North & Essex Ju	Landfill Leachate	Pretreatment Discharge	Chittenden Solid Waste District	Williston	3-1363	001	6/30/2012
Burlington North WWTF	Landfill Leachate	Pretreatment Discharge	Casella Waste Mgmt Inc - multiple facilities	Burlington	3-1427	003	3/31/2017
Centennial Brook	Treated Groundwater	Industrial Discharge	Greer Family LLC	South Burlington	3-1531	001	3/31/2015
Dog River	Sanitary Waste Outfall	Municipal Discharge	Northfield	Northfield	3-1158	001	6/30/2010
Dog River	Combined Sewer Overflow (CSO	Municipal Discharge	Northfield	Northfield	3-1158	002	6/30/2010
Essex Junction WWTF	Landfill Leachate	Pretreatment Discharge	Burlington Transfer Station	Williston	3-1441	001	9/30/2012
Essex Junction WWTF	Landfill Leachate	Pretreatment Discharge	Casella Waste Mgmt Inc - multiple facilities	Essex	3-1427	001	3/31/2017
Essex Junction WWTF	Landfill Leachate	Pretreatment Discharge	New England Waste Services - Coventry	Essex	3-1406	004	12/31/2016
Joiner Brook	Treated Groundwater	Industrial Discharge	Catamount Bolton WTP	Bolton	3-1528	001	3/31/2014
LITTLE RIVER	Sanitary Waste Outfall	Municipal Discharge	Stowe	Stowe	3-1232	001	12/31/2013
Montpelier WWTF	Landfill Leachate	Pretreatment Discharge	Casella Waste Mgmt Inc - multiple facilities	Montpelier	3-1427	002	3/31/2017
Montpelier WWTF	Landfill Leachate	Pretreatment Discharge	New England Waste Services - Coventry	Coventry	3-1406	001	12/31/2016
MUDDY BROOK	Quarry/Mine De-Watering	Industrial Discharge	S D Ireland - Green Acres Quarry	South Burlington	3-1381	001	6/30/2014
North Branch River	Combined Sewer Overflow (CSO	Municipal Discharge	Montpelier	Montpelier	3-1207	007	12/31/2012
North Branch River	Combined Sewer Overflow (CSO	Municipal Discharge	Montpelier	Montpelier	3-1207	008	12/31/2012
North Branch River	Combined Sewer Overflow (CSO	Municipal Discharge	Montpelier	Montpelier	3-1207	011	12/31/2012
North Branch River	Drainage	Industrial Discharge	Montpelier Swimming Pool	Montpelier	3-1338	001	3/31/2012
Northfield WWTF	Rinsewater from Process	Pretreatment Discharge	Cabot Hosiery Mills	Northfield	3-1462	001	6/30/2014

Discharges in Selected BASIN by receiving water 08 Winooski

Receiving Water	Discharge Activity	Program	Facility Name	Town	Permit & Discharge ID		Expires
Northfield WWTF	Textile Processing / Dyeing	Pretreatment Discharge	Chouinard Inc Barry T	Northfield	3-1430	001	9/30/2013
POND BROOK	Return/Recycled Water	Industrial Discharge	Montpelier Water Treatment Plant	Berlin	3-1400	001	12/31/2016
Stevens Branch	Sanitary Waste Outfall	Municipal Discharge	Barre City	Barre City	3-1272	001	9/30/2011
Stevens Branch	Quarry/Mine De-Watering	Industrial Discharge	Rock of Ages	Barre Town	3-0347	001	3/31/2016
Stevens Branch	Quarry/Mine De-Watering	Industrial Discharge	Rock of Ages	Barre Town	3-0347	002	3/31/2016
Stevens Branch	Quarry/Mine De-Watering	Industrial Discharge	Rock of Ages	Barre Town	3-0347	003	3/31/2016
Stevens Branch	Sanitary Waste Outfall	Municipal Discharge	Williamstown	Williamstown	3-1176	001	12/31/2011
THATCHER BROOK	Filter Backwash	Industrial Discharge	Waterbury WTP	Waterbury	3-1327	001	6/30/2016
THATCHER BROOK	Drainage	Industrial Discharge	Waterbury WTP	Waterbury	3-1327	002	6/30/2016
UT N BR WINOOSKI	Filter Backwash	Industrial Discharge	Worcester FD 1	Worcester	3-0324	001	3/31/2015
UT of Rouleau Brook	Treated Groundwater	Industrial Discharge	Unifirst	Williamstown	3-1435	001	3/31/2013
UT of Stevens Branch	Quarry/Mine De-Watering	Industrial Discharge	Pike Industries (Williamstown Quarry)	Williamstown	3-1495	001	3/31/2013
UT of Sunderland Brook	Quarry/Mine De-Watering	Industrial Discharge	Whitcomb Construction	Colchester	3-1429	001	3/31/2012
Waterbury WWTF	Dairy Products	Pretreatment Discharge	Ben & Jerry's Waterbury	Waterbury	3-0404	001	3/31/2017
Winooski River	Combined Waste	Industrial Discharge	Burlington Electric McNeil Generating Station	Burlington	3-1219	001	9/30/2012
Winooski River	Combined Waste	Industrial Discharge	Burlington Electric McNeil Generating Station	Burlington	3-1219	002	9/30/2012
WINOOSKI RIVER	Sanitary Waste Outfall	Municipal Discharge	Burlington North	Burlington	3-1245	001	9/30/2009
WINOOSKI RIVER	Combined Sewer Overflow (CSO	Municipal Discharge	Burlington North	Burlington	3-1245	002	9/30/2009
WINOOSKI RIVER	Sanitary Waste Outfall	Municipal Discharge	Burlington River	Burlington	3-1247	001	9/30/2009
Winooski River	Sanitary Waste Outfall	Municipal Discharge	Cabot	Cabot	3-1440	001	12/31/2009
WINOOSKI RIVER	Sanitary Waste Outfall	Municipal Discharge	Essex Junction	Essex	3-1254	001	6/30/2009
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	001	9/30/2008
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	002	9/30/2008
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	004	9/30/2008
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	006	9/30/2008
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	007	9/30/2008
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	008	9/30/2008
Winooski River	Stormwater to Surface Water	Industrial Discharge	I B M Corp	Essex	3-1295	009	9/30/2008
Winooski River	Stormwater to Surface Water	Industrial Discharge	I B M Corp	Essex	3-1295	010	9/30/2008
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	011	9/30/2008

Discharges in Selected BASIN by receiving water — 08 Winooski

Receiving Water	Discharge Activity	Program	Facility Name	Town	Permit & Discharge ID		Expires
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	012	9/30/2008
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	013	9/30/2008
Winooski River	Stormwater to Surface Water	Industrial Discharge	I B M Corp	Essex	3-1295	014	9/30/2008
Winooski River	Stormwater to Surface Water	Industrial Discharge	I B M Corp	Essex	3-1295	015	9/30/2008
Winooski River	Stormwater to Surface Water	Industrial Discharge	I B M Corp	Essex	3-1295	016	9/30/2008
Winooski River	Combined Waste	Industrial Discharge	I B M Corp	Essex	3-1295	017	9/30/2008
Winooski River	Stormwater to Surface Water	Industrial Discharge	I B M Corp	Essex	3-1295	018	9/30/2008
Winooski River	Stormwater to Surface Water	Industrial Discharge	I B M Corp	Essex	3-1295	019	9/30/2008
WINOOSKI RIVER	Sanitary Waste Outfall	Municipal Discharge	Marshfield	Marshfield	3-1195	001	9/30/2010
Winooski River	Sanitary Waste Outfall	Municipal Discharge	Montpelier	Montpelier	3-1207	001	12/31/2012
WINOOSKI RIVER	Combined Sewer Overflow (CSO	Municipal Discharge	Montpelier	Montpelier	3-1207	002	12/31/2012
WINOOSKI RIVER	Combined Sewer Overflow (CSO	Municipal Discharge	Montpelier	Montpelier	3-1207	003	12/31/2012
WINOOSKI RIVER	Combined Sewer Overflow (CSO	Municipal Discharge	Montpelier	Montpelier	3-1207	004	12/31/2012
WINOOSKI RIVER	Combined Sewer Overflow (CSO	Municipal Discharge	Montpelier	Montpelier	3-1207	012	12/31/2012
WINOOSKI RIVER	Combined Sewer Overflow (CSO	Municipal Discharge	Montpelier	Montpelier	3-1207	014	12/31/2012
WINOOSKI RIVER	Combined Sewer Overflow (CSO	Municipal Discharge	Montpelier	Montpelier	3-1207	015	12/31/2012
Winooski River	Sanitary Waste Outfall	Municipal Discharge	Plainfield	Plainfield	3-0381	001	6/30/2011
Winooski River	Sanitary Waste Outfall	Municipal Discharge	Richmond	Richmond	3-1173	001	9/30/2010
Winooski River	Sanitary Waste Outfall	Municipal Discharge	South Burlington - Airport Parkway	South Burlington	3-1278	001	3/31/2013
Winooski River	Quarry/Mine De-Watering	Industrial Discharge	St Michael's College - Colchester Lime Quarry	Colchester	3-1525	001	6/30/2013
Winooski River	Sanitary Waste Outfall	Municipal Discharge	Waterbury	Waterbury	3-1160	001	12/31/2009
Winooski River	Sanitary Waste Outfall	Municipal Discharge	Winooski	Winooski	3-1248	001	12/31/2009

APPENDIX E – WASTEWATER TREATMENT FACILITIES IN THE WINOOSKI BASIN

Discharges from wastewater treatment facilities (WWTF) compose the majority of Vermont's "steady-state" point source pollution[1]. In 1970's nearly half of the total load of phosphorus to Lake Champlain came from wastewater discharges; however, since 1990, significant funding for facility upgrades has yielded dramatic reductions in phosphorus and other pollutant loads. Flows from WWTF in the Winooski basin are still significant: the 15 WWTF are designed to discharge a maximum of 40.67 MGD to the river, which would represent 39.6% of total flow at the lowest river flows (7Q10). This is rarely realized, however, as these facilities operate well below design capacity, and by definition, flows only attain 7Q10 one week in ten years. Further as a result of facility upgrades in the Winooski basin, wastewater discharges now contributed only 4% of the total load from Vermont during the most recent time interval of 2007-2008. The goal of current permitting requirements and ongoing data collection is to ensure that the pollutant loads from discharges continue to be managed such that receiving waters remain high-quality, and meet Vermont water quality standards.

Regulation

The Agency of Natural Resources administers the National Discharge Pollutant Elimination System (NPDES) permit program for discharges from WWTF to state waters. In addition, the agency implements the Vermont Toxic Discharge Control Strategy (TDCS) to quantify all NPDES discharges in Vermont and to establish water quality criteria and discharge permit limits that can be used to regulate discharges in a manner that will assure that Vermont water quality standards and receiving water classification criteria are maintained.

Data collection

To establish permit criteria that will meet Vermont water quality standards (WQS), the agency conducts monitoring and assessment of all the facilities' discharging to wadeable streams, as well as all major Lake Champlain tributaries. In addition, all permittees are required to monitor regularly several core chemical constituents under their permits. Current data indicates that the

[1] Point-source discharges of stormwater are considered by the Department to be "precipitation-driven," and subject to different management considerations. See the Vermont Surface Water Management Strategy for more information.

facilities achieve a high quality of effluent that complies with WQS. Where data indicates problems exist, the Agency assist towns in identifying WWTF needs and obtaining loans or grants from the Clean Water State Revolving Funds to upgrade municipal wastewater systems to reduce pollutant loads.

The 2002 Lake Champlain Phosphorus TMDL

A Lake Champlain Phosphorus Total Maximum Daily Load (TMDL) for phosphorus was approved in 2002, which established phosphorus wasteload limits for each WWTF in the Basin. Current permit criteria for effluent limitations are based on the TMDL; however, in 2011, EPA remanded the TMDL as a result of legal challenge. New wasteload capacities may be prescribed when EPA issues a new TMDL. At the time the TMDL was remanded, all facilities **except** the Waterbury WWTF were operating well below their wasteload allocations. During the 2011 Legislative Session, capital funding was approved to support necessary upgrades to the Waterbury facility to become fully compliant with the 2002 TMDL.

Table 1. Winooski basin Wastewater Treatment Facilities

WWTF location	Type of Treatment	Design Flow	Current Flow (2010)	Permit expiration date	Remaining CSO outfalls which do not comply with the Vermont CSO Control Policy	Receiving Water
Plainfield	Sequential Batch Reactor (SBR)	0.125 mgd	0.054 mgd	6/30/2011	0	Winooski River
Northfield	SBR with chemical precipitation	1.0 mgd	0.459 mgd	6/30/2010	0	Dog River
Waterbury	Aerated Lagoon	0.51 mgd	0.216 mgd	12/31/2009	0	Winooski River
Richmond	Extended aeration with filtration	0.222 mgd	0.072 mgd	9/30/2010	0	Winooski River
Williamstown	Aerated Lagoon	0.150 mgd	0.064 mgd	12/31/2011	0	***Unnamed Tributary*** of the Stevens Branch
Marshfield	Aerated Lagoon	0.045 mgd	0.018 mgd	9/30/2010	0	Winooski River
Montpelier	Activated sludge with chemical precipitation	3.97 mgd	1.807 mgd	12/31/2012	6	Winooski River

WWTF location	Type of Treatment	Design Flow	Current Flow (2010)	Permit expiration date	Remaining CSO outfalls which do not comply with the Vermont CSO Control Policy	Receiving Water
Stowe	SBR with chemical precipiatin and filtration	1.0 mgd	0.300 mgd	12/31/2013	0	Little River
Burlington North	Activated sludge with chemical precipitation	2.0 mgd	1.091 mgd	9/30/2009	0	Winooski River
Burlington River	Activated sludge with chemical precipitation	1.2 mgd	0.597 mgd	9/30/2009	2	Winooski River
Winooski	Activated sludge with chemical precipitation	1.4 mgd	0.715 mgd	12/31/2009	0	Winooski River
Essex Junction	Activated sludge with chemical precipitation and filtration	3.3 mgd	1.842 mgd	6/30/2009	0	Winooski River
International Business Machine, Inc	SBR, pH adjustment, and clarification	8.0 mgd	2.945 mgd	9/30/2008	0	Winooski River
Barre City	Extended aeration with chemical precipitation	4.0 mgd	2.660 mgd	9/30/2011	0	Stevens Branch
South Burlington - Airport PRKW	Activated sludge with chemical precipitation and filtration	3.3 mgd	1.590 mgd	3/31/2013	0	Winooski River
Cabot	Membrane filtration	0.050 mgd	0.022 mgd	12/31/2009	0	Winooski River

Facility-specific information

Montpelier:
Originally there were approximately 15 combined sewer overflows in the Montpelier WWTF collections system. 9 CSOs have been physically eliminated. Montpelier has been issued a series of 1272 Orders requiring separation work and effectiveness studies. 6 CSOs remain: 3 discharge to the North Branch and 3 discharge to the Winooski River. Based on a recent effectiveness study, additional work is necessary at the remaining CSOs for further elimination or to meet the Policy, however the frequency and magnitude of the overflow events are significantly reduced. Due to the litigation of the Montpelier NPDES Discharge Permit, the Agency has not amended the 1272 Order to require additional abatement. Once the appeal of the NPDES permit has been adjudicated, the 1272 Order will be amended to require additional CSO abatement.
Waterbury
The Waterbury WWTF is on the 2012 State Priority List for upgrades to implement phosphorus removal. In 2011, the General Assembly approved an additional $2.7M capital funding to support this upgrade. The ultimate level of phosphorus treatment required in the facility will depend on the wasteload allocations developed under EPA's new phosphorus TMDL for Lake Champlain.
Burlington North

In 2008, the City of Burlington removed several sources of stormwater to the combined system within the subcatchment of this combined sewer overflow. An additional effectiveness study is necessary to determine if these improvements have achieved compliance with the Agency's CSO Control Policy and based upon the results of this study, further corrective actions may be needed.

APPENDIX F – SUMMARY OF GRANT PROGRAMS AND ABBREVIATIONS

Below is a list of the funding sources listed in the basin 8 water quality management plan. These are listed in detail on the Vermont surface water management strategy web page at: http://www.anr.state.vt.us/dec/waterq/wqd_mgtplan/swms_appD.htm#_Toc279493886

319 – Federal section 319 program to address NPS pollution
604b – Federal Section 604b pass-through funding for RPC's
AIS grant – Vermont Aquatic Invasive Species Control Grant
BBR – Better BackRoads Grants
BMP – Vermont Best Management Practices Cost Share Program
CREP – Conservation Reserve Enhancement Program
Eastern Brook Trout Joint Venture – Funding to restore brook trout. see http://www.easternbrooktrout.org/
ERP – Ecosystem Restoration Program
EQIP – Environmental Quality Incentives Program
Forest Legacy – funding to protect working forests
http://www.fs.fed.us/spf/coop/programs/loa/flp.shtml
LCBP - Lake Champlain Basin Program
LaRosa – LaRosa Laboratory Analytical Partnership Program
Partners for Fish and Wildlife
VACB – Vermont Agronomic Practices Program
Watershed Grant – Vermont Watershed (Conservation License Plate) Grants
WHIP – Wildlife Habitat Incentives Program

APPENDIX G – BASIN 8 WATER QUALITY MANAGEMENT PLAN - AGRICULTURAL ASPECTS

Winooski Watershed

Linda J. Henzel, Lean Green & Seen LLC
VACD Consultant for the Project

Goal

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Trends of Concern
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Recommendations for Agricultural NPS Improvement

Recommendations for Agricultural Structures: Management of Barnyards and High Use Areas

Cooperating Partners

Programs that Address Agricultural Issues

References

Acronyms

Sample Questionnaire for Farmer and Producer Input

Goal

This agricultural report was prepared as part of the Vermont Agency of Natural Resources (ANR) river basin planning process. It is a chapter to be included in the most recent plan for the Winooski watershed, the Basin 8 Water Quality Management Plan, which is being prepared by ANR's Department of Environmental Conservation.

This report or chapter is a resource document that compiles relevant agricultural data, provides information about the current status of agriculture, and outlines the concerns and water quality improvement recommendations of the agricultural community within the watershed. The recommendations include preferred types and methods of agricultural improvements as well as the identification of changes to infrastructure and funding mechanisms that will be necessary if agriculture is to remain economically viable. The continuance and improvement of local agriculture as a viable business must be considered a priority. This is essential so that the agricultural community can afford to continue adopting management practices that will result in improved water quality and also help maintain Vermont's pastoral landscape.

About the Data

The data and status information summarized are from the most recently available agricultural data for Basin 8. Sources for this data include USDA Farm Service Agency, USDA National Agricultural Statistics Service, USDA Natural Resources Conservation Service, US Fish & Wildlife Service, US Geological Survey, Vermont Agency of Natural Resources/Department of Environmental Conservation, Vermont Agency of Agriculture Food & Markets, Northeast Organic Farmers Association of Vermont, Winooski Natural Resources Conservation District, and agricultural texts.

Many data are not calculated for the entire watershed but are reported when available. The geographic area for each data source is noted, as much information available is at the county level. The usefulness of county level data varies considerable. Nearly all of Washington County (93 percent) is in the basin, while 35 percent of Chittenden County, 19 percent of Lamoille County, 10 percent of Orange County, and even smaller portions of Addison (3) and Caledonia (2) counties are in the basin (Vermont Agency of Natural Resources 2010, Analysis of VCGI Data). Where data are reported by county, only data for Washington and Chittenden counties are used.

About the Recommendations

The concerns and recommendations for agricultural water quality improvement in this report were developed from input by farmers in Basin 8. A series of questions prompted their opinions about agricultural and water quality concerns. Many methods were used to circulate the questions including telephone calls, emails, follow-up mailings, list serve distributions, newsletters, and exhibit tables at agricultural events. Most of the comments were generated at three focus groups meetings held at the Winooski Natural Resources

Conservation District offices in Berlin and Williston during the spring of 2010. Additional meetings in January, 2011 offered opportunities for farmers to provide feedback on the Recommendations section.

This report is provided by the Vermont Agency of Agriculture, Food & Markets to the Vermont Department of Environmental Conservation for incorporation into the most recent Basin Plan for this watershed. The VAAFM provides funding to the Vermont Association of Conservation Districts to both develop these reports and organize Agricultural Focus Groups within each basin.

INTRODUCTION

Agriculture contributes to the rural characteristics present in the Winooski watershed landscape in much of Washington and Chittenden counties and in parts of Orange, Lamoille, Caledonia, and Addison counties of Vermont. Agriculture provides a base for trade and tourism, a cultural identity, and an environment that combines field, forest, pasture and village (Wood *et al*. 2000). Vermont legislation has recognized these values of agriculture as a public good. State statute requires a primary goal in town planning and development to "maintain the historic settlement pattern of compact village and urban centers separated by rural countryside" (Vermont Statutes 2003, VSA Title 24). Regional planning efforts recognize these valuable contributions and emphasize the need for protection of local agriculture. The public benefits include "open space, recreational opportunities, aesthetic pleasure, and a sense of place" as well as "providing wildlife habitat, maintaining air quality by capturing carbon dioxide, protecting the integrity and function of floodplains and wetlands, and maintaining water supplies through groundwater recharge" (Central Vermont Regional Planning Commission, 2001).

The Winooski watershed is important to the Lake Champlain basin and is its largest tributary basin. The watershed is approximately 1,080 square miles in size and covers nearly 12 percent of the state. It is referred to as Basin 8 and HUC code 02010003. More than 60 percent of the watershed is in Washington County with 21 percent in Chittenden County. Lands within the watershed also occur, in descending order, in Lamoille, Orange, Addison, and Caledonia counties. In 2000 the Winooski watershed, which contains the cities of Burlington and Montpelier, had the highest population in the basin at about 47 percent (Lake Champlain Basin Program, 2003). The Winooski basin drains into the Vermont portion of the lake referred to as the Main Lake or Broad Lake. The Main Lake, VT--93 percent of which is the Winooski drainage--is the only area of the lake having marginally significant increasing trends in both aggregated phosphorus loading rates and flow-weighted mean inflow phosphorus concentrations for the monitoring period 1991 to2008 (Smelzer *et al*., 2009).

Phosphorus reduction is a high priority for managing Lake Champlain, and some agricultural practices may result in runoff that allows more phosphorus to reach surface waters. In 2009 a broad-based group of 200 stakeholders advised the Vermont Agency of Natural Resources of the five highest ranked threats to the water quality of Lake Champlain. Among these are nonpoint source (NPS) pollutants which are generated by a variety of sources. Two threats

on the list related to agriculture are “discharges from farmsteads and agricultural production areas” and “poorly managed cropland” (Vermont Agency of Natural Resources 2010, Revised Implementation Plan).

Cost share opportunities have provided financial incentives and other support to encourage agricultural producers to change their farming practices and modify their infrastructure to help improve water quality. The federal farming cost share programs that are offered by the USDA Natural Resource Conservation Service (NRCS) and the Farm Service Agency (FSA) include both structural projects in production areas and land-based practices for many different types of farms. The US Fish and Wildlife Service’s Partners for Fish and Wildlife Program offers assistance with land-based projects. The cost share programs offered by the state focus on both structural and land based projects for dairy operations. The Vermont Agency of Agriculture, Food & Markets (VAAFM) estimates that, as of the summer of 2010, the projects completed via the state cost share programs reduced phosphorus by 4,402 pounds. Through the state programs, dairy producers throughout the watershed have invested nearly $1.4 million of their own money in various farming practices and infrastructure changes since 1996 alone.

However, the tough economic times in which this plan is being written challenge agricultural producers to find ways just to survive economically. That makes it particularly difficult to implement additional changes to their operations that will build on their long-term efforts to improve water quality. In the Recommendations section, agricultural producers and representatives of agencies and other organizations present a variety of strategies for improving the water quality in the Winooski watershed. Working together--as has been done for decades--producers and their partners can continue to develop and implement management practices that benefit the watershed both economically and ecologically.

For purposes of this report, information is provided at the watershed scale, where available. However, since few datasets are available at this scale, the primary source of data is at the county level. County data are used for Washington and Chittenden counties as most of Washington County and about one-third of Chittenden County lands are in the basin.

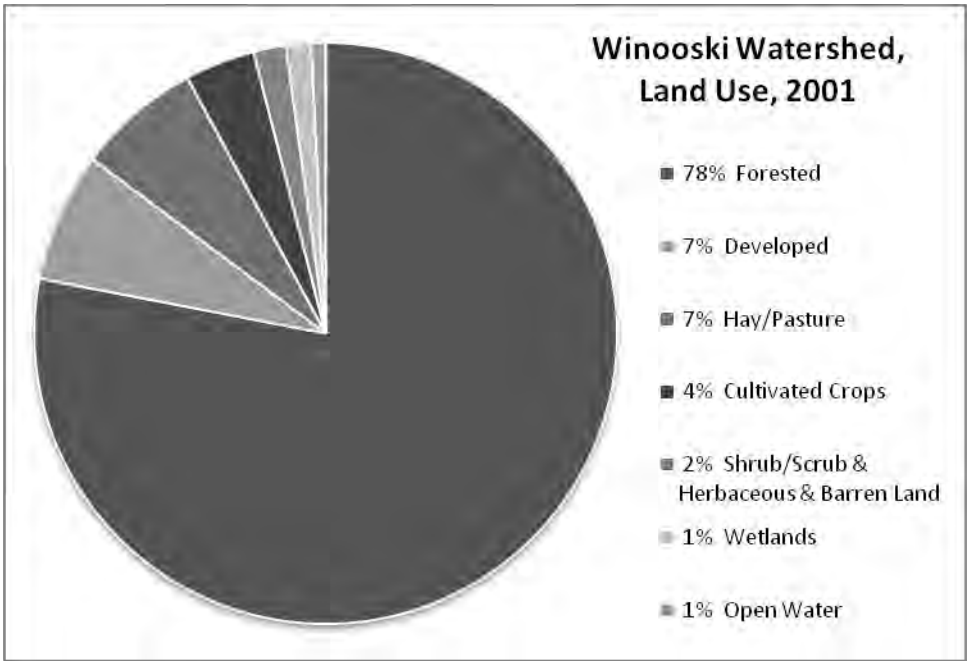
Land Use

As illustrated in Figure 1, agriculture represents the second largest land use type in the basin at about 11 percent when cultivated crops and hay/pasture lands are combined. About 78 percent of the basin is forested (Vermont Agency of Natural Resources, 2010 analysis of 2001 NLCD). About 7 percent of the land is considered to be developed, often referred to as urban lands. Open water accounts for less than 1 percent of the acreage. Figure 2 offers a comparison of the same land use types for Vermont (Homer *et al*., 2004).

About 11 percent of land in the watershed is owned by the State of Vermont and managed by the Agency of Natural Resources. The federal government owns nearly 13,000 acres of land in the watershed (Winooski Natural Resources Conservation District, 2010).

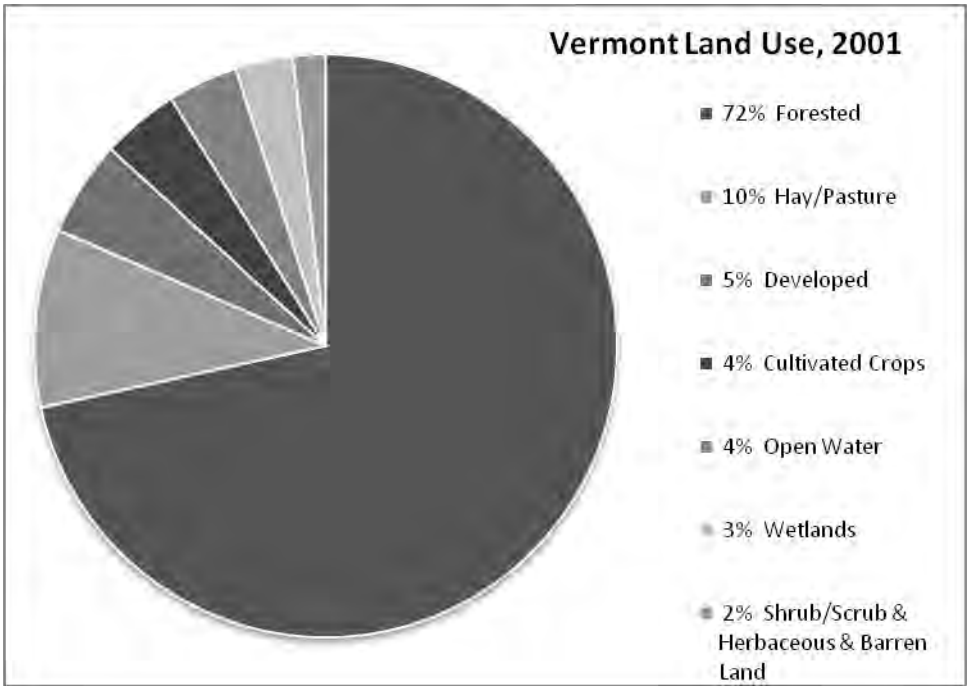
Central Vermont's best agricultural soils are found in the eastern part of the region and in some river valleys in other areas of the region. While only about 5 percent of Central Vermont has prime soils, the towns of East Montpelier, Barre Town, Williamstown, Plainfield, and Cabot have higher percentages ranging from 20 to 50 percent. Higher concentrations also occur along the Mad River in Waitsfield (Central Vermont Regional Planning Commission, 2001). In Chittenden County, prime agricultural soils are found most often in the floodplains of the county's major streams and rivers (Chittenden County Regional Planning Commission, 2006), including the Winooski.

Figure 1. 2001 National Land Cover Dataset Analysis for the Winooski Basin



Source: Vermont Agency of Natural Resources, 2010 analysis of 2001 NLCD

Figure 2. 2001 National Land Cover Dataset Analysis for the State of Vermont



Source: Homer *et al*., 2004.

Local Agriculture

The agricultural history of the Winooski valley near Lake Champlain began about 500 years ago when Native Americans grew corn in the "three sisters guild" with beans and squash. "Leaving the plant material after harvest provided natural ground cover and served as a nutrient sponge and plug" (Ruben, 2010).

In the 1700s, farms in the Champlain Valley were well known for supplying the Northeast with grain (USDA Soil Conservation Service, 1989). Early in the nineteenth century, settlers in much of northern Vermont and the lands along the central spine of the Green Mountains were engaged in land-clearing and burning potash. By the 1840s it is estimated that 80 percent of Vermont families worked a subsistence farm averaging 50 to 100 acres. Those in the hills didn't last more than a few seasons, though, due to the thin and rocky soils (Albers, 2000).

The 1860 census data show that Washington County ranked first in pounds of honey and bushels of oats produced; second in terms of pounds of maple sugar produced; and third in number of milk cows. Chittenden County ranked second in terms of number of milk cows and first in the number of pounds of cheese produced, value of orchard products, and market garden products (Kennedy, 1864).

The all-time highest number of farms in the state at 35,522 was reached in 1880. This coincides with Vermont reaching its highest proportion of "improved" land, estimated at 68 percent and representing the degree of deforestation of the state at that time (Albers, 2000).

As per the 2007 Agricultural Census, the farms of Washington and Chittenden counties provided a variety of farm products including poultry, Christmas trees, vegetables, sweet corn, nurseries, horses and ponies, berries, cattle, sheep, and milk and dairy. The highest ranks for production in two of the watershed counties in 2007 are shown in Table 1. In addition Chittenden was tied with another county in the state for the greatest number of farmer's markets per county in 2010 (Vermont Agency of Agriculture, Food & Markets 2010, Buy Local).

Table 1. State Ranks of Crops and Products of Two Watershed Counties, 2007

County	Inventory	State Rank
Washington	Number of turkeys	2
	Acres of Christmas trees	4
	Number of horses and ponies	4
	Sales value of poultry and eggs	5
	Acres of vegetables harvested for sale	5
Chittenden	Acres of sweet corn	1
	Acres of vegetables harvested for sale	1
	Number of horses and ponies	1
	Number of egg laying chickens	3
	Acres of fruits and berries	3

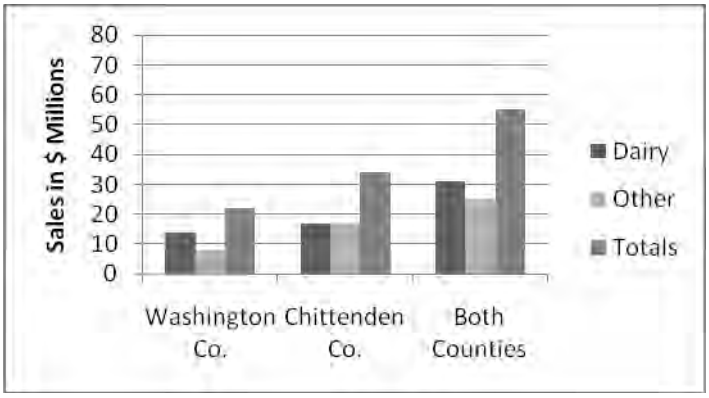
Source: USDA, NASS 2009, County Profiles

More detail about many of these crops and products is presented later Figures 10 through 13 in the Agricultural Data section.

Economic Contributions

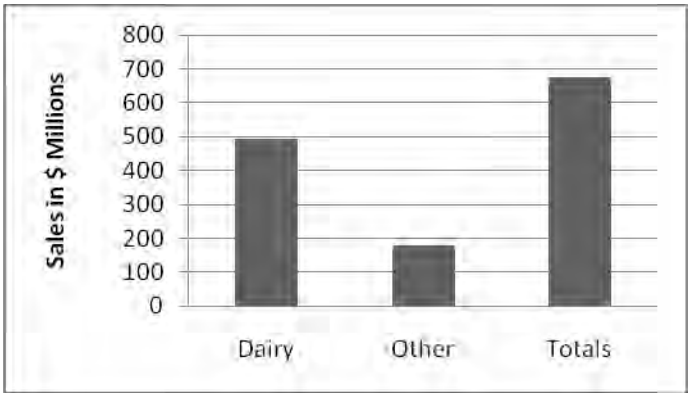
Agriculture makes an important contribution to the economy of the watershed. As shown in Figures 3 and 4, the 2007 Agricultural Census reported that more than $21.5 million of agricultural products were sold by Washington County farms. The value of agricultural products sold by Chittenden County farms was nearly $33.7 million. Statewide data for 2007 indicated a total of nearly $674 million in farm sales (USDA, NASS, 2009).

Figure 3. Dairy and Other Farm Sales, and Totals, for Two Watershed Counties, in Millions of Dollars, 2007



Source: USDA, NASS, 2009

Figure 4. Vermont Dairy and Other Farm Sales, and Totals, in Millions of Dollars, 2007



Source: USDA, NASS, 2009

Another sizeable contribution to the watershed economy is the more than $4.7 million in property taxes paid by farm operators in the two watershed counties in 2007. This compares with nearly $30.6 million paid statewide (USDA, NASS, 2009).

The 2007 census indicates for each county the farm product producing the most revenue, the highest animal counts, and the most common farm land use. Table 2 summarizes these data from 2007 for the two counties.

Table 2. Highest Income, Highest Animal Counts, and Purpose of Highest Acres for Two Watershed Counties, 2007

	Income Source and Value	Animal Counts	Farm Use, in acres
Washington County	Milk, dairy $13,981,000	Cattle, calves 7161 Layers 4,268	13,257 for forage
Chittenden County	Milk, dairy $17,080,000	Cattle, calves 10,469 Layers 7,376	18,066 for forage

Source: USDA, NASS, 2009

Dairy

Although many of the region's dairy farms have been lost in recent years, milk and other dairy products from cows remain the highest income source for farms in the region. Figure 3 indicates that dairy products account for nearly two-thirds of the $21.5 million of total farm sales in Washington County and about one-half of the estimated $34 million farm sales in Chittenden County. These percentages fall below the 73 percent that dairy sales at $494 million represent for Vermont farms overall, per Figure 4 (USDA, NASS, 2009).

Tourism

Much of Vermont's tourism, a major economic industry of the state, may be attributed to the recognition of the state as a rural countryside of working landscapes which contribute to its scenic beauty and environmental quality (Courtney, 1991). In a 2000 survey at Vermont Welcome Centers, 84 percent of visitors placed a high value on seeing cows and farms. Also from this study, 59 percent of visitors said they would be less likely to visit if farms were not a part of the scenery (Wood *et al*., 2000). A 2007 survey of visitors to Vermont revealed that 37 percent visited a farm or nursery (Portland Research Group, 2007). Informal inquiries in 2009 into vacation plans of visitors by the Vermont Department of Tourism and Marketing resulted in both maple and farm visits being mentioned in the top 20 interests of potential visitors to the state (VDTM, 2010).

Activities that bring visitors to farm operations are being tracked by the U.S. Agricultural Census under the category "Agri-Tourism and Recreational Services." The percentage of total direct sales that agritourism represented for two watershed counties and Vermont in the 2007 census is shown in Table 3.

Table 3. Value of Agricultural Products Sold Directly to Individuals and Agritourism Sales, by Counties and Vermont, 2007

County / Sales Type	Washington	Chittenden	Washington & Chittenden	Vermont
Direct Sales	$1,194,000	$2,915,000	$4,109,000	$22,863000
Agritourism Sales	$151,000	$42,000	$193,000	$1,490,000
Agritourism Sales as Percentage of Direct Sales	12.7%	1.4%	4.7%	6.5%

Source: USDA, NASS, 2009

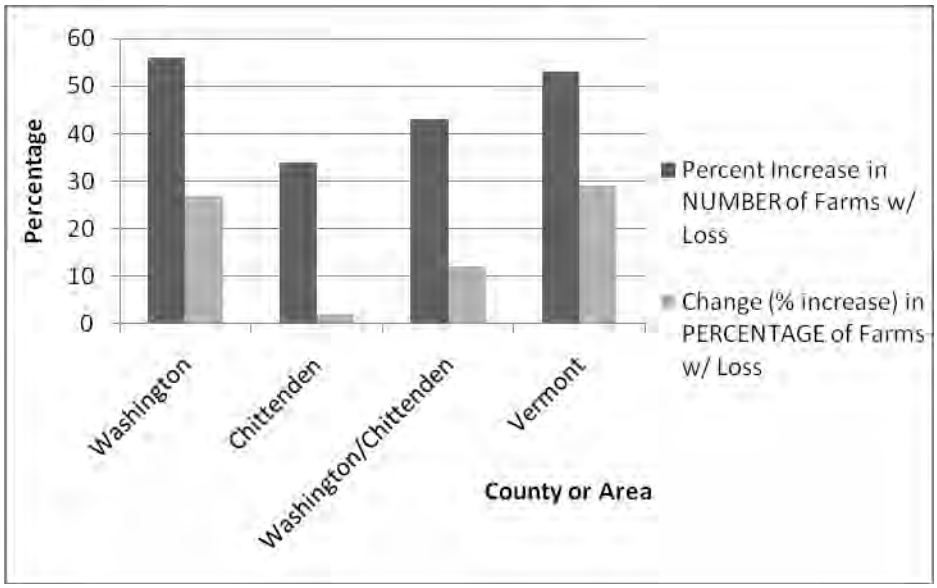
The full economic value of agri-tourism, however, is not reflected in these figures as the census calculations include only direct cash receipts. Initial sales also have indirect or multiplier effects that add to the value of direct cash receipts. For example, "expansion of sales by farms within a local area will mean increased sales for agricultural support firms, increased incomes for farm proprietors and workers, and increased sales for local retail and service businesses that support the agricultural sector and provide goods and services to farm owners and employees" (Mulkey and Hodges, 2000). Types of jobs include milk haulers, equipment dealers, and veterinarians and job locations include food processing plants as well as animal food and fertilizer companies and stores (UVM, 2010).

A more accurate measurement is difficult because there are many complex and overlapping categories to be considered. More precise estimates of these multiplier effects for local areas can be made by using the computer modeling software and database package IMPLAN, which was designed for this purpose. When value-added and indirect economic impacts were calculated for 2007 by using this software, the total economic impact of Vermont's farm industry was estimated at more than $3.7 billion. This compares with the NASS Census calculation of over $673 million as the market value of farm products and $1.5 million for agritourism in 2007 for the state of Vermont (USDA, NASS, 2009). Estimates made by Vermont Association of Conservation Districts staff--estimating from the IMPLAN modeling--suggest that agri-tourism activities likely brought nearly $305.5 million in revenue to the two watershed counties of Washington and Chittenden in 2007.

Net Losses

Farms contribute to the local economy through providing employment, supporting farm-related businesses, production expenses, and property taxes. However, the numbers and percentages of farms with net losses indicate that many farms are struggling financially. Statewide, a steady rise in the percentage of the number of farms with net losses was reported in the censuses between 1987 and 2007. The change between just the 1987 and 2007 figures was a 53 percent increase in number of farms with net losses as shown in Figure 5.

Figure 5. Farms with Net Loss: Percent Increase in Number of Farms with Net Loss, and Change (Increase) in Percentage of Farms with Net Loss, Comparing 1987 and 2007 for Two Watershed Counties and Vermont



Source: USDA, NASS, 1987 and 2007

For the two counties from the Winooski watershed, a steady rise in the percentage of farms with net losses during the 20 year period was not evident. This is most likely due to the rising number of smaller farms.

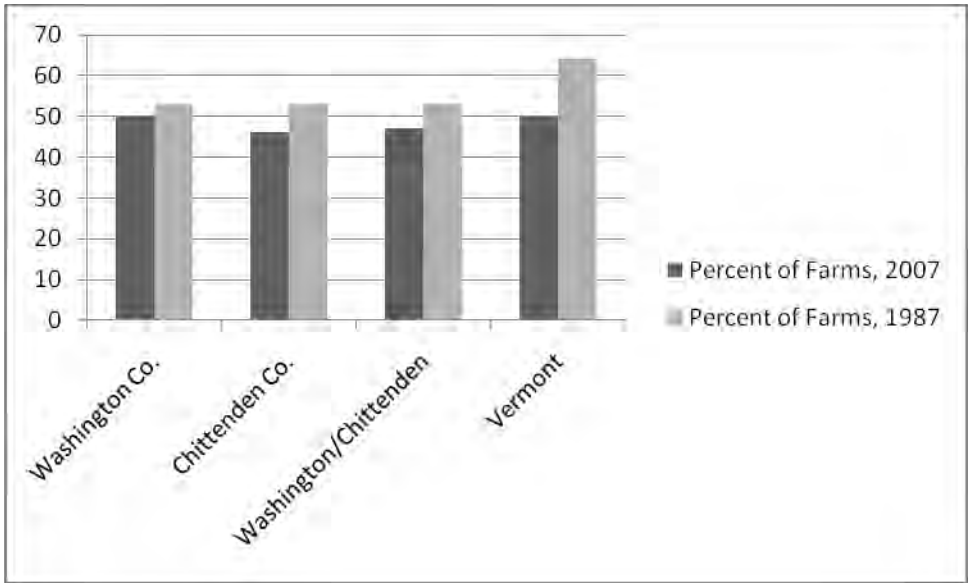
However, the actual number of farms with net losses rose nearly consistently in Washington County (USDA, NASS 1987, 1992, 1997, 2002, 2007), with the change between 1987 and 2007 being an increase of about 56 percent.

When considering percentages of change between just the 1987and 2007 figures, the percentage of Washington County farms with net losses showed an increase of 27 percent. The percent increase in the number of farms with net losses for the county between those two years was 56. In Chittenden County when comparing the 1987 and 2007 census reports, the change in percent of farms with net losses increased about 2 percent, while the percent change in the number of farms with net losses showed an increase of nearly 34 percent. These data are summarized in Figure 5.

Farming as Primary Source of Income

Agricultural census data regarding source of income for farmers indicate that the farm as primary source of income is on the decline in two of the watershed counties as well as statewide. When comparing 1987 and 2007 data, just over half (53 percent) of the operators in Washington and Chittenden counties relied on farming as the primary occupation in 1987, while a lower percentage did the same in 2007, as shown in Figure 6. Statewide in 2007, 56 percent of farms recorded net losses with just less than 50 percent relying on the farm as the primary source of income (USDA, NASS, 1987 and 2007).

Figure 6. Percent of Farm Operators by Primary Occupation in Farming, Comparing 1987 and 2007, by Counties and State



Source: USDA, NASS, 1987 and 2007

Environmental Effects

Benefits

Agricultural operations provide many benefits to the environment. The diversified farming typical of Vermont includes tracts of open space, which include shelterbelts and forage sources for many species of birds and mammals (Jordan, 2002). As field soils absorb rainwater more readily than paved and other impervious surfaces, fewer nutrients are released to surface waters from an acre of agricultural land than from an acre of developed land. Figure 7 shows an example of this from a national perspective, however no Vermont-specific studies exist (U.S. Department of the Interior, 1996). Farms recycle farm-produced wastes, such as manure and spoiled feed, into soil amendments. Farms also work to prevent runoff of soil, nutrients and pathogens through land management practices like cover cropping, filter strips, no-till, and strip farming.

Negative Impacts

Agriculture also has the potential to negatively affect the environment. Groundwater can become contaminated with pollutants such as nitrates when applied in excess of crop needs. However, as seen in Figure 8, Vermont has been sampling groundwater quality for nitrates and herbicides since 1986 and has seen a dramatic decrease in the nitrate detections, and in the last 10 years has not had any herbicide detections exceeding drinking water standards (Personal Communication from Pesticide Program Section Chief. VAAFM). Excess nutrients, pathogens, and sediments can leave the farm as runoff into surface waters when erosion control methods fail or heavy rains and floods inundate fields.

Figure 7. Ammonia and Phosphorous Concentrations in Surface Water: U.S. Statistics by Land Use

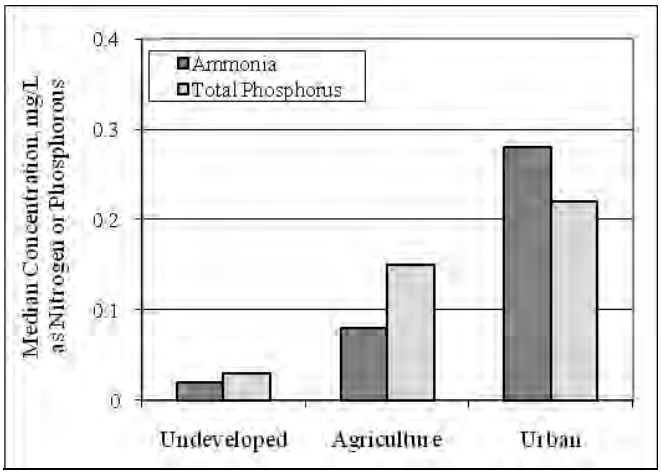
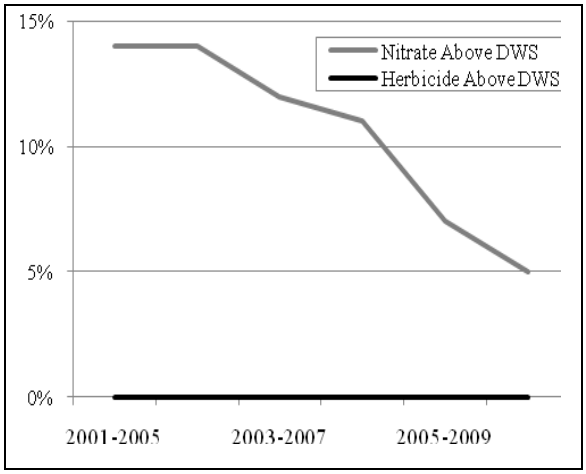


Figure 8. Nitrate & Herbicide Detection Rates for Farm Groundwater Monitoring in Vermont, 2001-2010*



Sources: Figure 7, U.S. Department of the Interior, 1996 and
*VAAFM, Communication from VAAFM Soil Scientist, 2011 for Figure 8

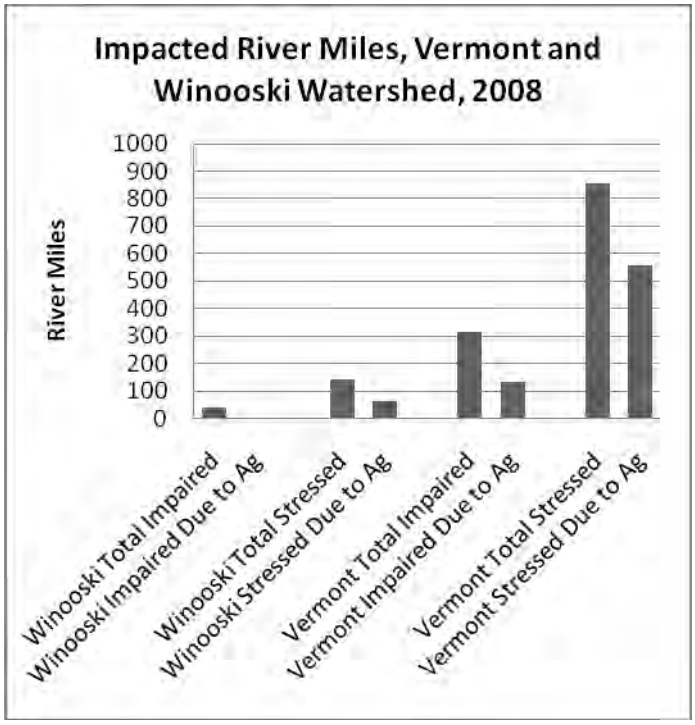
Categories of support of uses for surface waters in Vermont are designated as Full Support, Stressed, Altered, and Impaired. Impaired waters are those where there is an ongoing violation of Water Quality Standards. Altered waters are those that are impaired but not by a pollutant and so they are "altered" by flow alterations or invasive species among others. Stressed waters are those where a water quality disturbance is occurring but not
to the degree that uses have become impaired or altered (State of Vermont, 2010, Water Quality Integrated Assessment Report).

Figure 9 illustrates the number of river miles affected by agriculture throughout the Winooski Basin. These are designated as Impaired (<1.2) and Stressed (<40.4). The Impaired waters are in Muddy Brook, and the Stressed segments are located in unnamed stretches along the main stem from the mouth to the confluence with Mollys Falls Brook (Vermont Agency of Natural Resources, 2008). No miles designated as Altered were described as being affected by agriculture. However, not all river sections in the watershed have been assessed for pollutants and impairments. Consequently these data must be interpreted with this caveat**.**

In addition, the descriptions of many river sections designated as Impaired and Stressed included loss of riparian vegetation, streambank erosion, and bacteria or nutrient loading of unknown origin, for example. None of these was specifically attributed to agricultural use, although agricultural management practices that result in loss of riparian vegetation, streambank erosion,

and bacterial loading could be a contributing factor in particular segments (Personal communication with Vermont Department of Environmental Conservation staff, 2010).

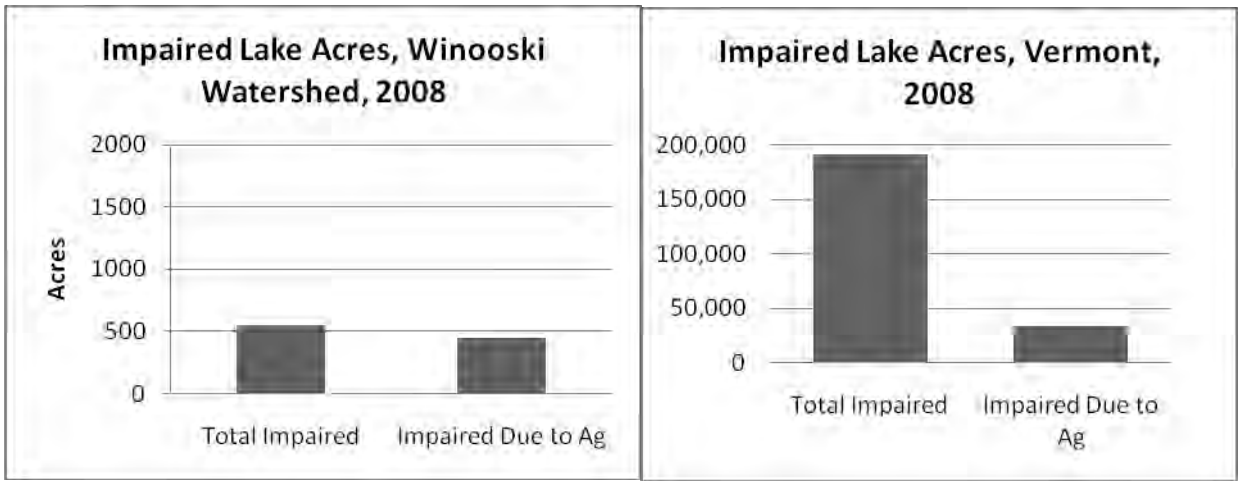
Figure 9. Impacted River Miles in the Winooski Watershed and Vermont, 2008



Source: Basin 8—Winooski River Watershed Water Quality and Aquatic Habitat Assessment Report, 2008

Figure 10 illustrates the number of lake acres in the watershed that are Impaired with reference to agricultural use as the source of impairment. The Stressed category is omitted from this diagram as the Vermont Department of Environmental Conservation (DEC) does not specifically track sources of stress to individual lakes.

Figure 10. Impaired Lake Acres in the Winooski Watershed and Vermont, 2008



Source: Basin 8—Winooski River Watershed Water Quality and Aquatic Habitat Assessment Report, 2008

The 452 Impaired lake acres refer to Shelburne Pond (State of Vermont, 2010) which is eutrophic and also considered to contain excess especially high levels of phosphorus. These result in chronic low dissolved oxygen levels and, in turn, periodic cyano algae blooms, excessive plant growth, and recurring fish kills. Nonetheless, the pond supports outstanding fish and waterfowl populations (Personal communication with Vermont Department of Environmental Conservation staff, 2010).

More than 50 percent of the pond's 4,470-acre watershed is in agricultural use--37 percent in row crops and 18 percent in pasture/hayland based on the 2001 National Land Cover Data (Homer *et al*., 2004). However, agricultural use is not the only contributing factor to excessive phosphorus in the pond. Other stressors include land conversion to residential from lands that had been in agriculture as well as legacy nutrient accumulation. Given the pond's setting in the Champlain Valley, it is predisposed to naturally high nutrient concentrations. These are due the bedrock, which is dolomitic and therefore high in phosphorus, and also the soils, which are primarily clay with an excellent capacity to bind phosphorus. Measuring these various sources of phosphorus inputs is difficult due to extensive wetlands along both sides of the pond (Personal communication with Vermont Department of Environmental Conservation staff, 2010). As a result of these circumstances, designation of the pond as Impaired due to agricultural use should be considered with this qualification.

A number of efforts have and can be undertaken to reverse the trend of the pond toward further eutrophication. The Vermont Chapter of The Nature Conservancy (TNC) has conserved nearly one-quarter (23.4 percent) and transferred most of this land to the University of Vermont (UVM). The university manages this land as the H. Laurence Achilles Natural Area (Personal communication with The Nature Conservancy staff, 2010). Most of the near shore area of the pond will now be allowed to grow in a natural vegetated condition. TNC planted a 50-foot shoreline buffer of woody vegetation at the south end of the pond and another buffer on the north end where cows had been watering as recently as 2007. TNC monitors conservation easements on these and other lands they have conserved in the watershed, and these easements prevent further development.

There is evidence that the pond was not always as enriched as the present condition, and scientific studies using sediment cores suggest an oligo-mesotrophic condition in the early 1800s (Lini, 2008). This suggests that appropriately-placed agricultural and other management efforts to halt or reverse the eutrophication process may limit ongoing nutrient loading. The degree to which Shelburne Pond may return to historical nutrient levels would depend in part on the degree to which legacy nutrient sources that have accumulated since the mid-1850s now dominate the phosphorus cycle in the lake.

Conservation Policy

U.S. agricultural policy, from its roots in the 1930s through the 1970s, encouraged farmers to focus on farm improvement practices that enhanced farm productivity. Examples include increasing agricultural land base by clearing vegetation along rivers and expanding into wetlands.

Despite the fact that soil conservation has been a national effort for over 70 years, it is only within the past 20 years, following the Section 319 amendment to the Clean Water Act, that nonpoint source (NPS) pollution from agricultural lands has begun to be purposefully addressed. Greater awareness of the potential impacts of farming on water quality and a better understanding of the long-term impacts of stream channel and wetland alterations have changed the focus of government farm programs more toward environmental management and improvement. This process began with the 1985 Farm Bill and was strengthened in successive farm bills (Cox, 2006). Farm bills are Acts of Congress that refer to agricultural programs and their funding.

Farm bills have created and provided funding for many state and federal cost share programs. These programs have provided the impetus for farmers to change or modify older management practices as our understanding of environmental systems expands. The implementation of what has become known as "best management practices" has already led to significant improvements to water quality. These practices will be described in more detail in the Conservation Practices section of this chapter. Unfortunately, as shown in Figure 3 above, an average of about 50 percent more farms in watershed counties reported net losses in 2007 as compared to 1987. Given these statistics, it is noteworthy that, since 1996, farmers throughout the watershed have contributed a minimum of nearly $1.4 million toward practices on their farms that are designed to help improve water quality.

Conservation programs will continue to face a number of challenges in the future. The need to make emergency payments for unanticipated flood disasters along with increases in defense and homeland security spending are putting more strain on the government's ability to allocate funds toward cost share programs that benefit water quality (Cain and Lovejoy, 2004). Other factors that could affect conservation funding priorities include the U.S. financial crisis of 2009, the issue of climate change and the potential role of agriculture in reducing greenhouse gases, as well as impacts of ethanol production on natural resources and changes in land use that could impact policies relating to biofuels. Specific environmental issues related to agriculture that may require more funding to implement in the future include concentrated animal feeding operation regulations, greenhouse gas emission reporting for livestock producers, and wetlands mitigation efforts (Stubbs, 2009).

AGRICULTURAL DATA

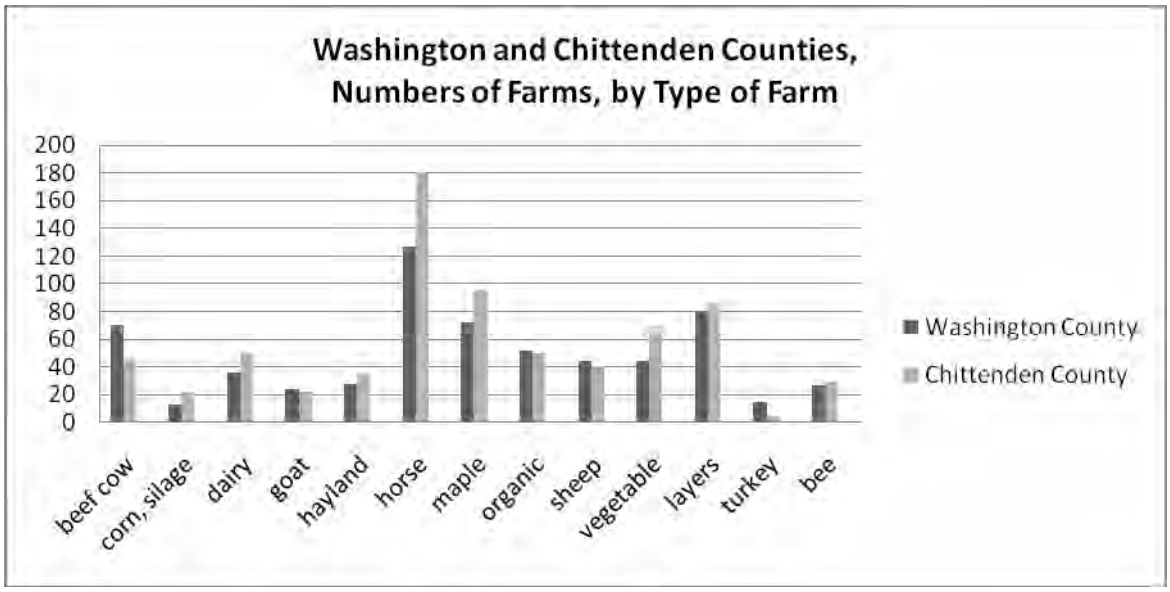
Much of the agricultural information for the Winooski Basin is available only on a county-wide basis. Data from Washington County can be considered fairly representative of the watershed as nearly the entire county is in the watershed. About 35 percent of Chittenden County is in the watershed. Therefore, the data that are presented on a county-wide basis must be viewed with this caveat.

Farm Types

Diversity

Figure 11 presents data from the USDA 2007 Census about the number of farms by farm type in two of the watershed counties. These data indicate that there was great diversity of farm types throughout Washington and Chittenden counties. The Census defines a farm as "any place from which $1000 or more of agricultural products were produced or sold, or normally would have been sold, during the census year." The numbers of farms in the two watershed counties totaled 444 in Washington County and 591 in Chittenden County (USDA, NASS, 2009).

Figure 11. Farm Types and Numbers for Two Watershed Counties, 2007

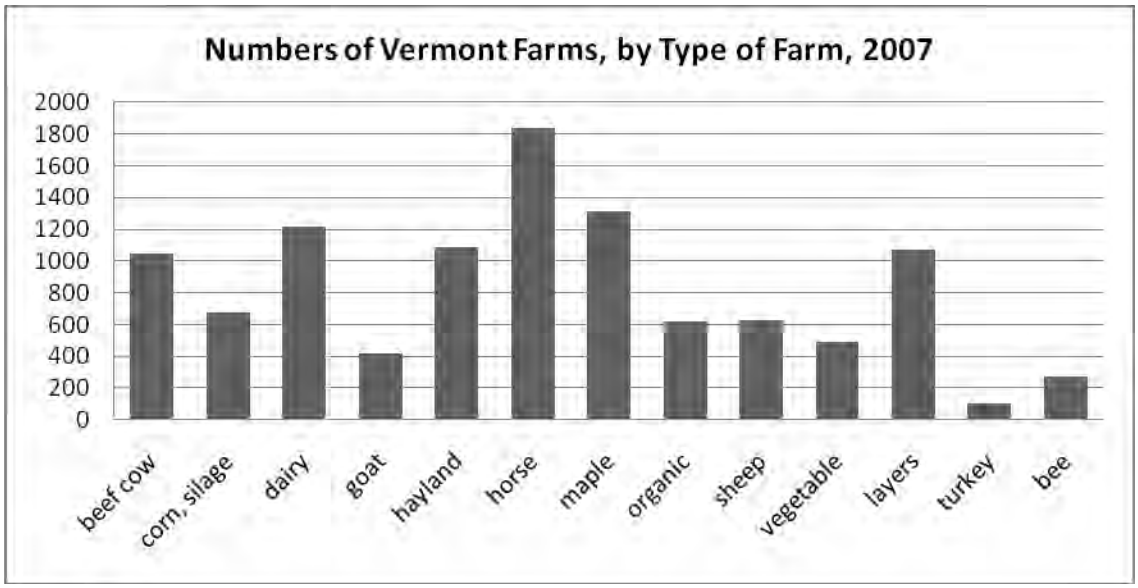


Source: USDA, NASS, 2009

Figure 12 indicates the numbers of various types of farms in Vermont in 2007. Using the data from Figures 11 and 12, the numbers of different farm types in the two watershed counties represented noteworthy percentages of those farm types in the state. The vegetable farms in Washington and Chittenden counties combined represented about 23 percent of vegetable farms in the state, more

than 20 percent of farms with bee hives, 19 percent of turkey farms, and more than 16 percent of farms with horses (USDA, NASS, 2009).

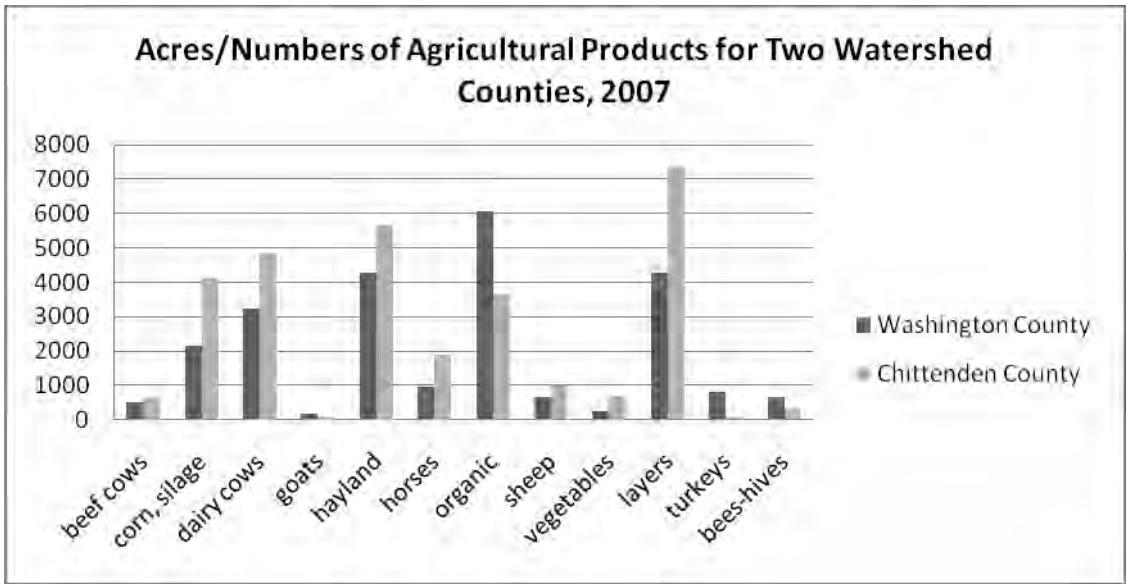
Figure 12. Vermont Farm Types, 2007



Source: USDA, NASS, 2009

Figure 13 presents data about animal inventories, acres, and units for two counties in the watershed—Washington and Chittenden.

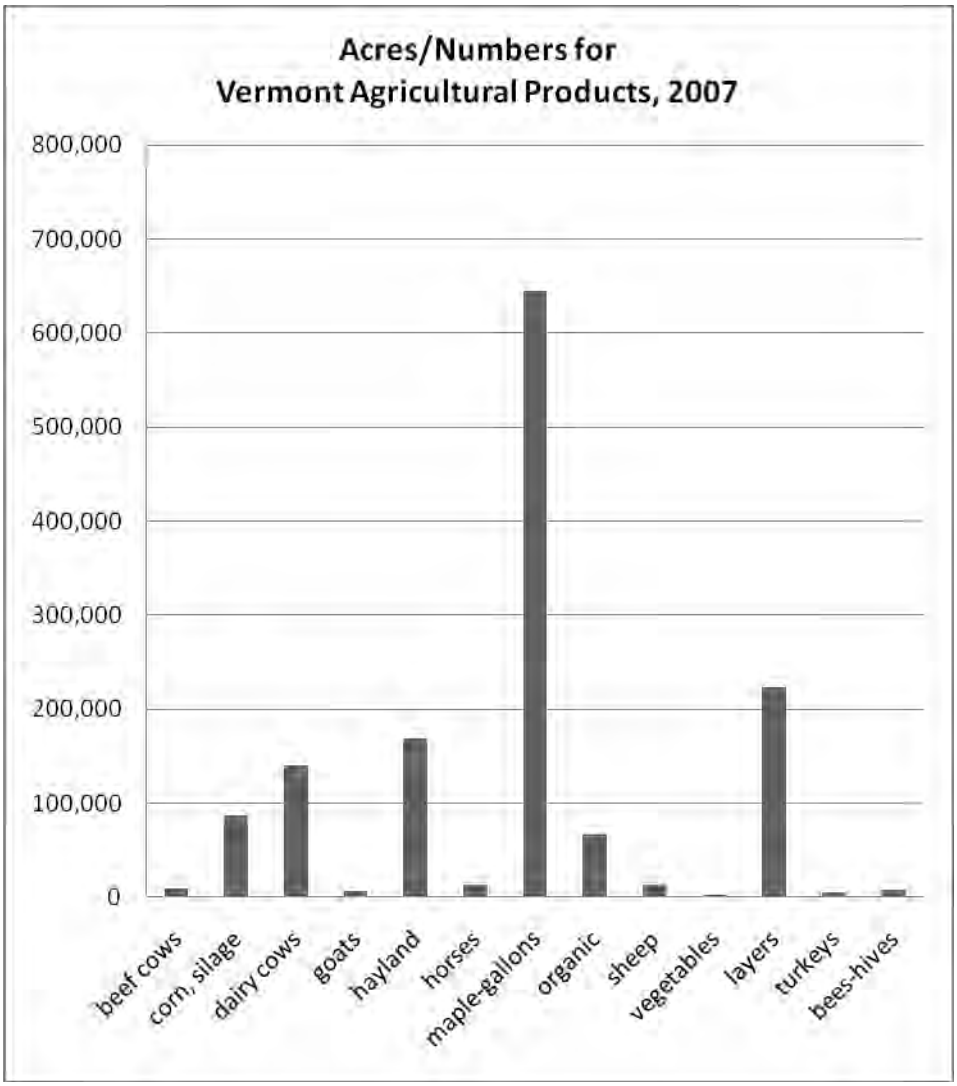
Figure 13. Acres or Numbers of Agricultural Products for Washington and Chittenden Counties, 2007



Source: USDA, NASS, 2009

Figure 14 indicates the number of acres or inventory counts of agricultural products in Vermont in 2007. Based on the numbers in Figures 13 and 14, nearly one-third of the acres in vegetable farms and more than 20 percent of the inventory of horses in the state are located in the counties of Washington and Chittenden combined. With regard to maple production, Washington County produced 23,266 gallons, and Chittenden County produced 49,083 (USDA, NASS, 2009).

Figure 14. Acres or Numbers of Agricultural Products in Vermont, 2007

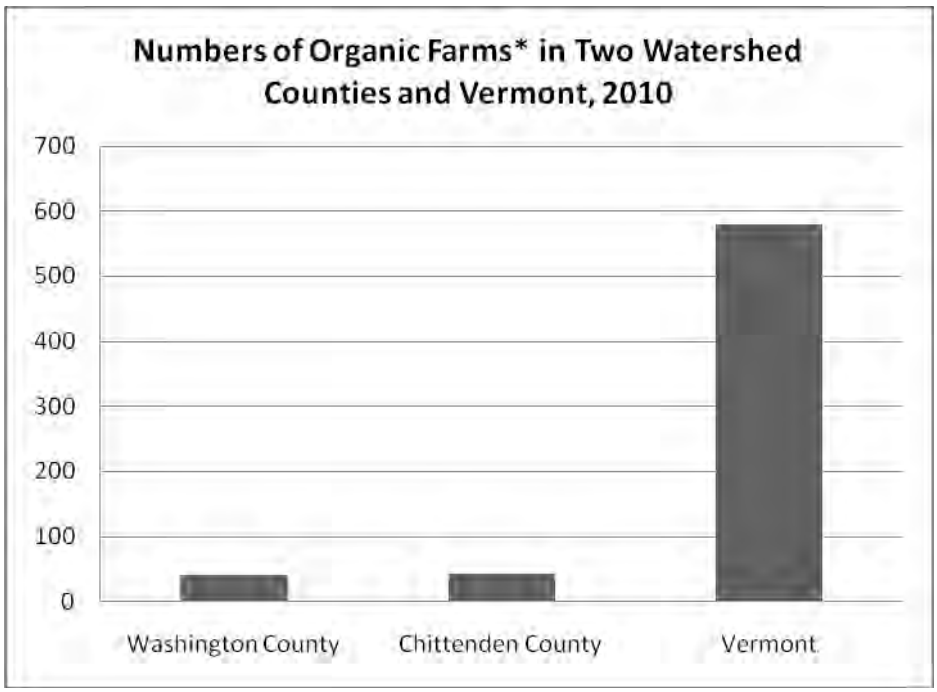


Source: USDA, NASS, 2009

Organic Farms

Figure 15 provides statistics and comparisons of organic operations in two watershed counties and Vermont in 2010. There were 41 organic farms in Washington County, 43 in Chittenden County, and 548 in the state. The 84 farms in the two watershed counties combined represented just over 15 percent of the organic farms in the state (NOFA, 2010).

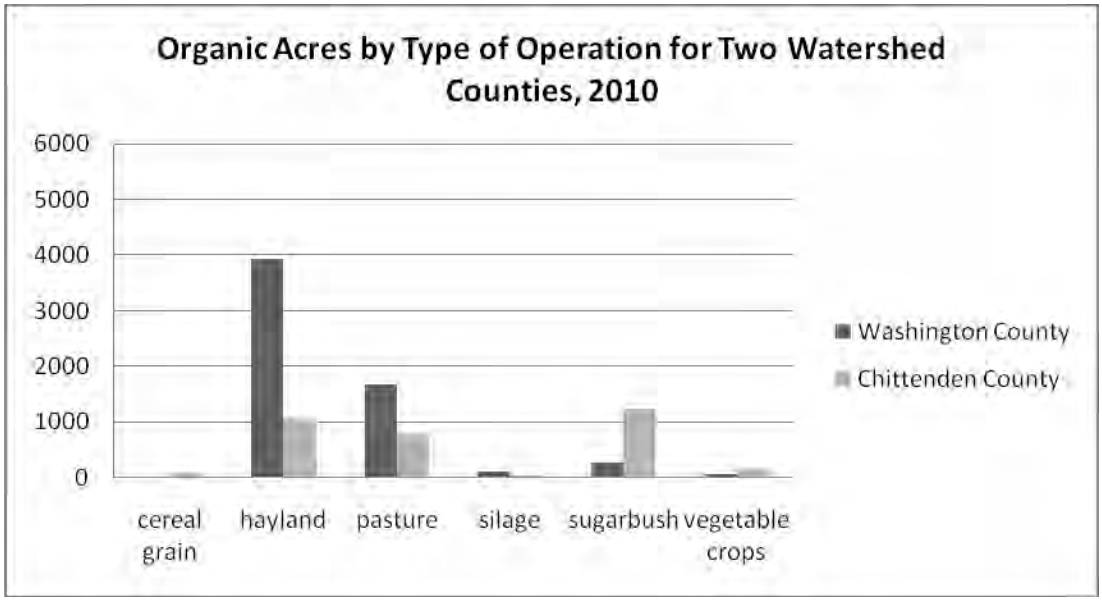
Figure 15. Organic Farms in Vermont and Washington and Chittenden Counties, 2010



Source: NOFA-VT, 2010
*farms certified as organic by Vermont Organic Farmers, LLC

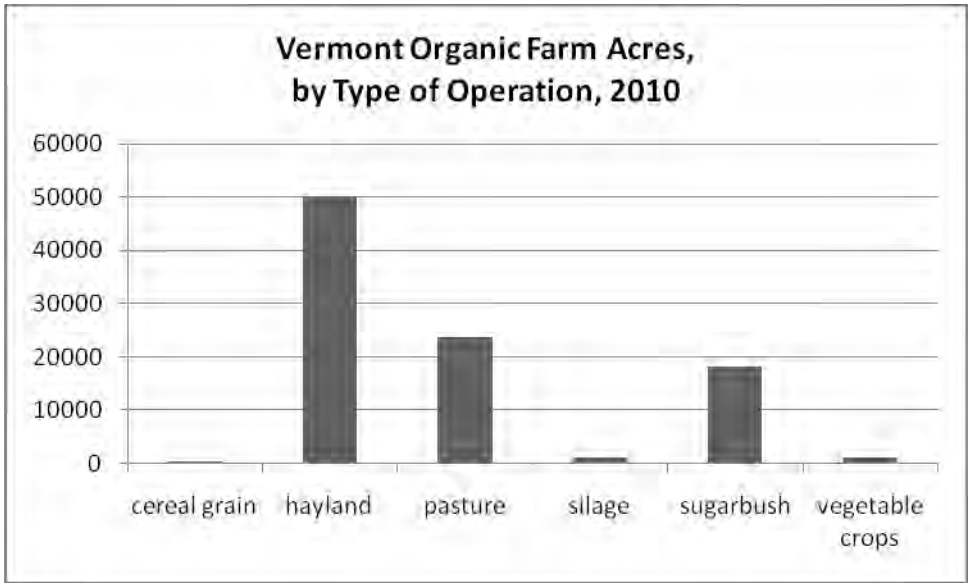
Figures 16 and 17 indicate the acres of various organic farming operations in the watershed counties of Washington and Chittenden and for all of Vermont, respectively. There were six acres of organic cereal grain production, 3,919 acres of organic hayland, 1,673 acres of organic pasture, 98 acres producing organic silage, 274 acres of organic sugarbush, and 60 acres of organic vegetable crops in Washington County in 2010. In Chittenden County, the numbers were 83 acres of cereal grain, 1,062 of hayland, 781 of pasture, 50 of silage, 1,233 of sugarbush, and nearly 161 acres of vegetable crops (NOFA, 2010).

Figure 16. Acres of Organic Operations, by Type, in Two Watershed Counties, 2010



Source: NOFA-VT, 2010

Figure 17. Acres of Organic Operations, by Type, in Vermont, 2010



Source: NOFA-VT, 2010

Size of Operations, Permits, and Regulations

To reduce agricultural nonpoint source pollution, all farms in Vermont are required to follow the state Agency of Agriculture's Accepted Agricultural Practices (AAPs). The AAPs are regulations involving the adoption of improvements in farming techniques that are less costly than infrastructure improvements (VAAFM 2006, AAP Regulations).

Operating permits and requirements for farms in Vermont are based on the number of animals of specific animal types at a farm. For example, a Large Farm Operation (LFO) dairy operation is defined as a farm with 700 or more mature cows and a poultry operation would meet the LFO definition if it has over 82,000 laying hens without a liquid manure system. A Medium Farm Operation (MFO) is defined as any farm with 200 or more mature cows, 300 or more youngstock or heifers, 150 horses, 300 sheep or 25,000 hens. There are thresholds for other animals types, these are just listed as examples.

Large and medium farms must also adopt the state's Best Management Practices (BMP) through additional regulations of their MFO and LFO permits. BMPs are typically the more expensive structural farm improvements, such as manure storage systems or heavy use area protection (Vermont Agency of Agriculture, Food and Markets, 2001). The MFO program requires medium-sized farms to seek coverage under a single Vermont state General Permit. The General Permit prohibits discharges of wastes from a farm's production area to waters of the state and requires manure, compost, and other wastes to be land applied according to a nutrient management plan. The LFO program requires farms to operate under an individual permit specific to that farm. MFO and LFO farms are regularly inspected for permit compliance by the VAAFM.

A number of other regulations from the Agency of Agriculture and other agricultural organizations are required on farms. Dairy farms are inspected annually and must meet strict sanitary standards in order to maintain a shipping license for milk (Vermont Statutes 2003, VSA Title 6, Chapter 151). Organic farms have additional requirements designed to protect farm water quality and are regularly inspected by licensed staff of Vermont Organic Farmers LLC (Vermont Organic Farmers, 2000). Farms must also comply with state and federal wetland and stream alteration regulations.

In 2010 there were eight MFOs and one LFO in the Winooski basin. In 2009 there were 88 dairy farms with milk distribution permits in the two watershed counties of Washington, which had 38, and Chittenden, which had 50 (Communication between the Vermont Agency of Agriculture, Food & Markets and VACD staff, 2010).

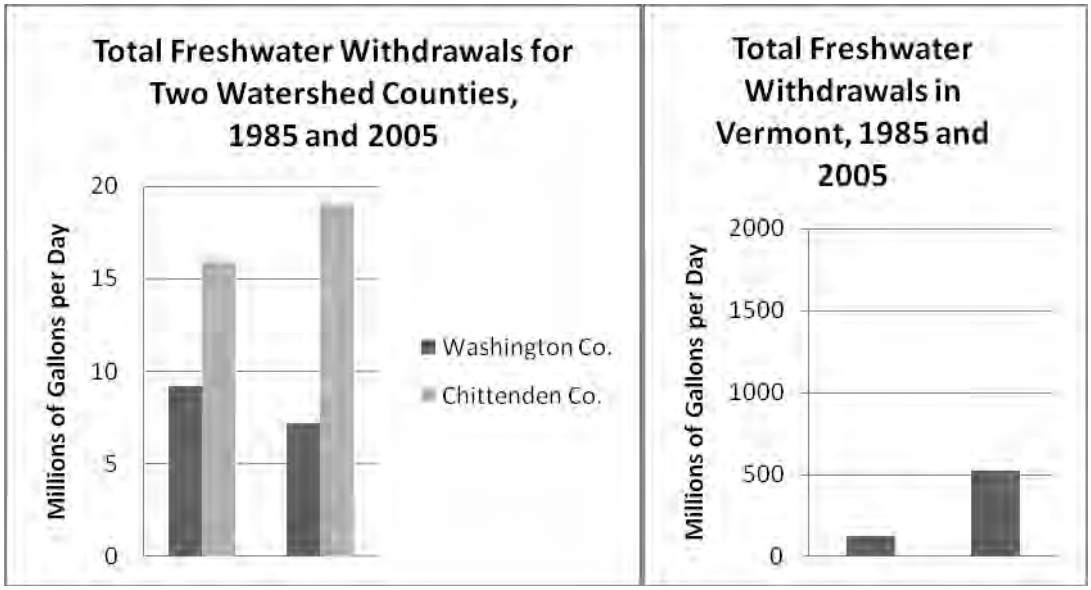
Water Withdrawal

Uses

The majority of water withdrawals in the state in 2005 were for thermoelectric power, public water supplies and community water systems, domestic uses, and fish hatcheries. Snowmaking and commercial/industrial were other uses with estimated withdrawals (Medalie and Horn, 2010).

A comparison of freshwater withdrawal estimates between 1985 and 2005 for counties in the Winooski watershed is shown in Figure 18. The withdrawals in Washington County decreased 22 percent, about 2 million gallons, from 9.23 to 7.22 million gallons. The withdrawals in Chittenden County increased by nearly 12 million gallons from 7.2 to 19, representing about a 19 percent increase. Statewide, withdrawals more than tripled with an increase of nearly 400 million gallons (USDI, USGS, 1985 and 2005).

Figure 18. Total Freshwater Withdrawals for Vermont and Two Counties in the Winooski Watershed, Comparing 1985 to 2005

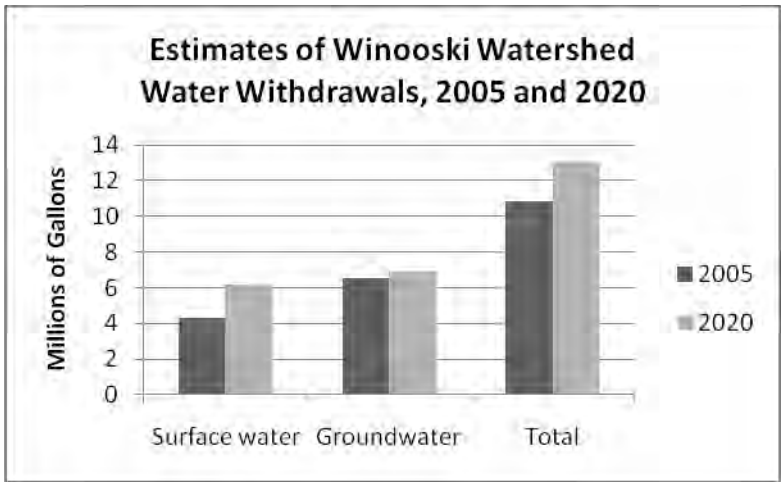


Source: USDI, USGS, 1985 and 2005

Water is an important resource for agriculture not just for watering livestock but also for irrigation of vegetables, orchards, berries, and nursery stock. Statewide in Vermont in 2005, withdrawals of groundwater for livestock and of surface water for irrigation were estimated at less than 1 percent each of the 440 million gallons withdrawn each day, totaling about 2 percent for agricultural uses (Medalie and Horn, 2010).

Although water withdrawals in the Winooski watershed are expected to increase over the next 15 years as shown in Figure 19, these are primarily due to anticipated increases in snowmaking at ski areas and for the cities of Burlington, South Burlington, Barre, and Montpelier. In most other areas of the watershed, little change is expected in return flows through 2020 (Medalie and Horn, 2010). These projected estimates suggest that sufficient water for agricultural use will continue to be available during this period. However, for the longer term by about mid-century, the potential for rising temperatures due to climate change could result in reductions in soil moisture in late summer and early fall. This could, in turn, cause water shortages especially if drought events occur on top of these trends (Union of Concerned Scientists, 2006).

Figure 19. Winooski Watershed Withdrawals, for 2005 and Projections for 2020

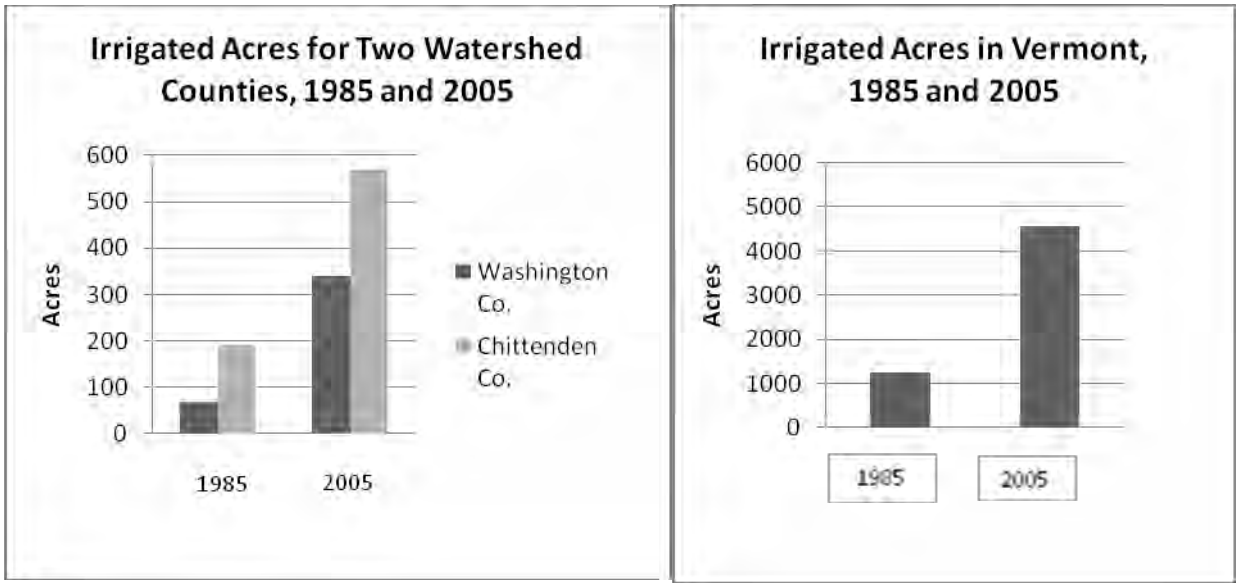


Source: Medalie and Horn, 2010

Irrigated Acres

As illustrated in Figure 20, between 1985 and 2005 the number of acres under irrigation increased nearly five times in Washington County and tripled in Chittenden County (U.S. Department of the Interior, 2008). The overall increase for the state is estimated to have more than tripled in 2005 when compared to 1985. While the irrigation figure is relatively small and covers many uses beside agriculture, such as golf courses and cemeteries, the availability of irrigation is crucial to producers. Irrigation, depending on the system, crop, and climate, can significantly increase crop yield (Natural Resource Conservation Service-USDA, 1997).

Figure 20. Irrigated Acres for Two Counties in the Winooski Watershed and Vermont, 1985 and 2005



Source: USDI, USGS, 1985 and 2005

Regulations

Currently the state has no regulations on quantity of surface water withdrawal other than for snowmaking (Vermont Statutes 2009, VSA Title 10, Chapter 41). However, there are regulations on damming up surface waters which indirectly impacts the ability to make larger withdrawals. The state regulations on quantity of ground water withdrawal require that farming will be exempt from reporting requirements at up to a limit of 57,600 gallons per day per farm, after which a permit will be required (Vermont Statutes 2009, VSA Title 10, Chapter 48).

Pesticides

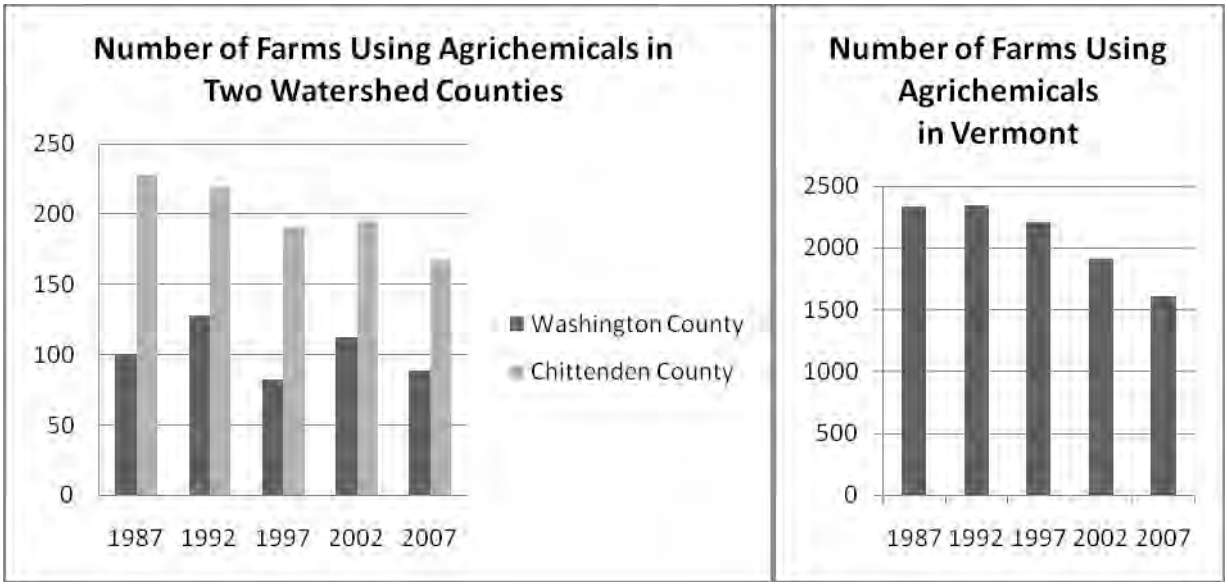
Use of Pesticides

Each farm operation uses a unique and specific combination of tools to combat insect, disease, and weed problems. Agricultural chemicals or agrichemicals have been used in Vermont for decades, and Figures 21 and 22 illustrate their use and trends over the 20-year period 1987 to 2007.

In 2007, when compared to 1987, agrichemicals were used on 31 percent fewer farms statewide but use was increased on 14 percent more acres, as shown in Figures 21 and 22. For the watershed counties of Washington and Chittenden, however, census data for this period reveal that both the number of farms using the chemicals and the numbers of acres treated declined, although not steadily (NASS, 1987-2007).

As shown in Figure 21, the number of farms using chemical controls in Washington County in 1987 was 103, and the number in 2007 was 93 farms. For Chittenden County the numbers were 249 and 177, respectively.

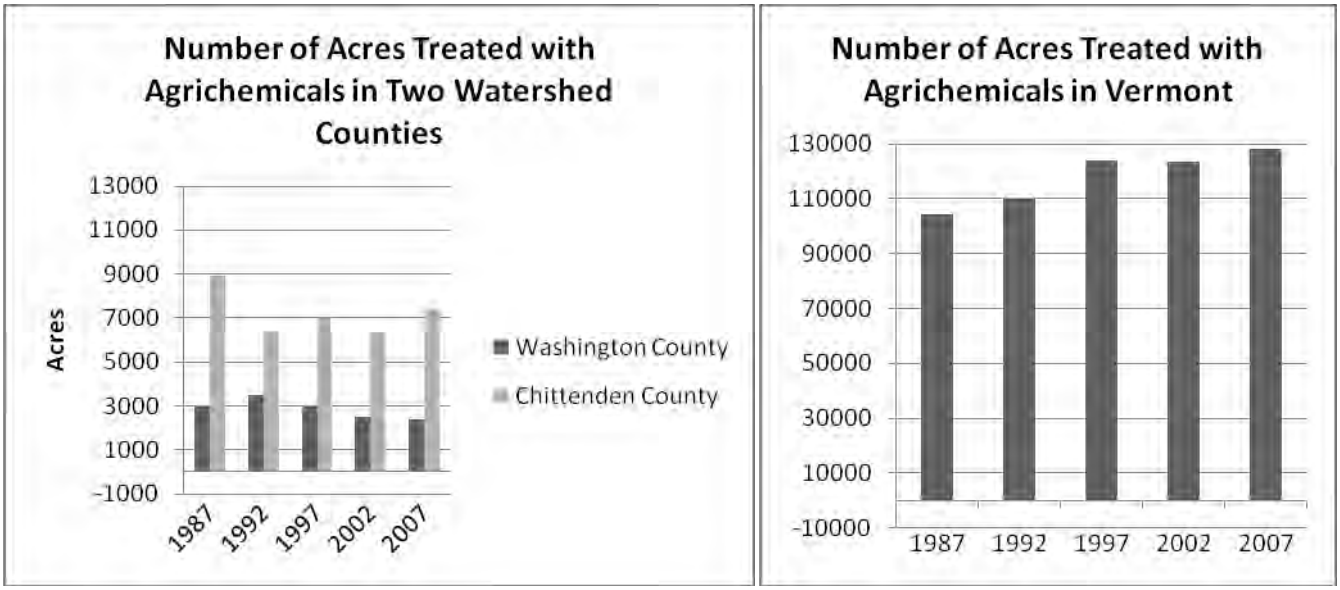
Figure 21. Number of Farms Using Chemical Controls (Agrichemicals), by Watershed Counties and State, 1987-2007*



Source: USDA, NASS, 1987-200 *2002 data pertain to a sampling of farms

For agricultural acres on which chemical controls were applied, as shown in Figure 22, Washington County acres in 1987 were 2,870 and in 2007 were 2,417 acres. For Chittenden County the numbers were 10,199 and 7,420, respectively.

Figure 22. Number of Acres of Farmland Using Chemical Controls (Agrichemicals), by Watershed Counties and State, 1987-2007*

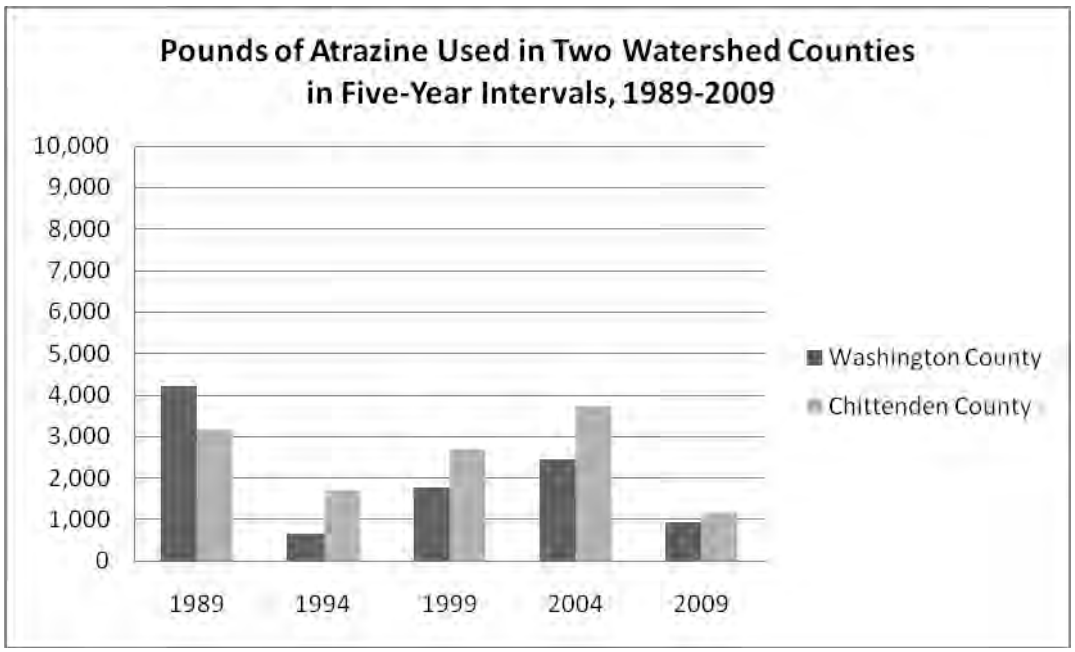


Source: USDA, NASS, 1987-2007
*2002 data pertain to a sampling of farms

Data on pesticide use by certified applicators is maintained by the VAAFM. Atrazine is one of the most commonly used pesticides in farm fields in Vermont. Figures 23 and 24 show the use of atrazine in two counties in the watershed and in the state, respectively. A slight decrease in the use of atrazine occurred in farm fields of both Washington and Chittenden counties, as well as statewide during the period 1989 to 2009 (VAAFM, Communication from Pesticide Program Section Chief, 2011).

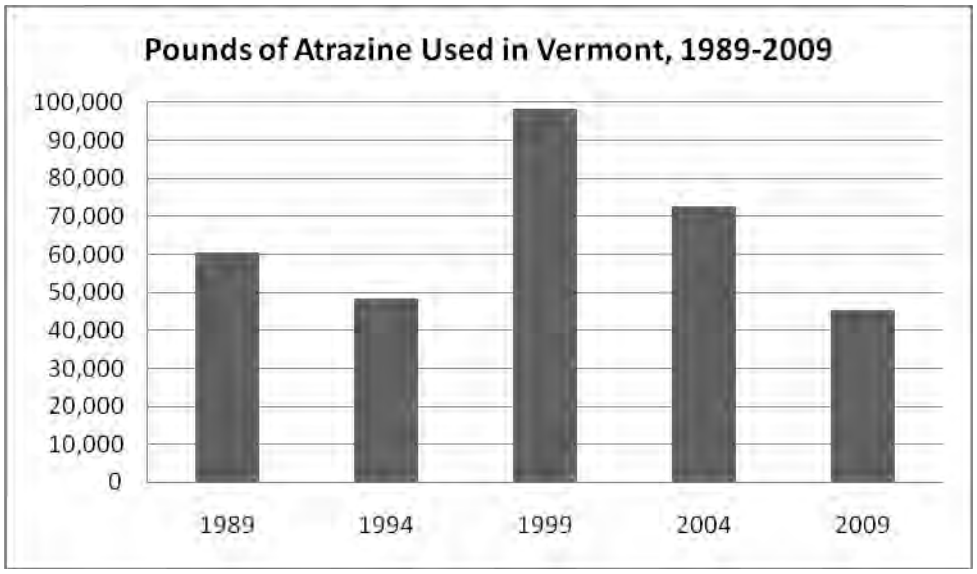
Pesticides are not used consistently each year. Reasons for this include the Integrated Pest Management (IPM) strategies that can change from year to year on each farm. There also may be differences in natural pest cycles and the amount of crops planted, such as when "Round-Up Ready" corn is used. Therefore the data must be interpreted with these qualifications.

Figure 23. Atrazine Use in Agricultural Operations in Two Watershed Counties, 1989-2009



Source: VAAFM, 2011

Figure 24. Atrazine Use in Vermont Agricultural Operations in Five-Year Intervals, 1989-2009



Source: VAAFM, 2011

Monitoring Water Quality

Since 1986 the VAAFM's Pesticide and Groundwater Monitoring Program has evaluated the quality of groundwater and drinking water for many Vermont farms and their neighbors. Tests for agricultural chemicals reaching groundwater are conducted by collecting water samples from drinking water sources near Vermont farms. Participation is voluntary, and a total of 1,972 wells statewide had been tested as of 2010 (Communication from VAAFM Soil Scientist, 2011).

With regard to herbicides, the program focuses primarily on testing groundwater for corn herbicides as, on average, 76 percent of all pesticides used outdoors in Vermont are herbicides applied when growing silage or sweet corn. This Corn Herbicide Project also tests for nitrate which is associated with fertilizers, manure, and septic systems (VAAFM website, 2010). Although wells are monitored for both pesticides and nitrates, nitrate is considered the primary groundwater concern for agricultural water quality in Vermont. Nitrate detections will be presented later in this section.

Drinking water samples are collected and analyzed for a suite of herbicides including the most commonly used chemicals such as atrazine and metolachlor. During the period 2006 to 2010 in Washington and Chittenden counties, there were 16 detections of herbicide in 102 wells analyzed, as shown in Table 4. However, all of these were below the drinking water standard. When considering both counties as shown in the two figures within Figure 25, 86 wells (84 percent) had no detections. Statewide during the same period, herbicides were detected in 39 (6 percent) of the wells sampled, with none above the drinking water standard as shown in Figure 26. Wells that test positive continue to be monitored. VACD's Agriculture Resources Specialists (ARS) program

provides follow up farm assessments and assistance in developing and sourcing funds for water quality improvement projects (VAAFM, 2007 and 2008).

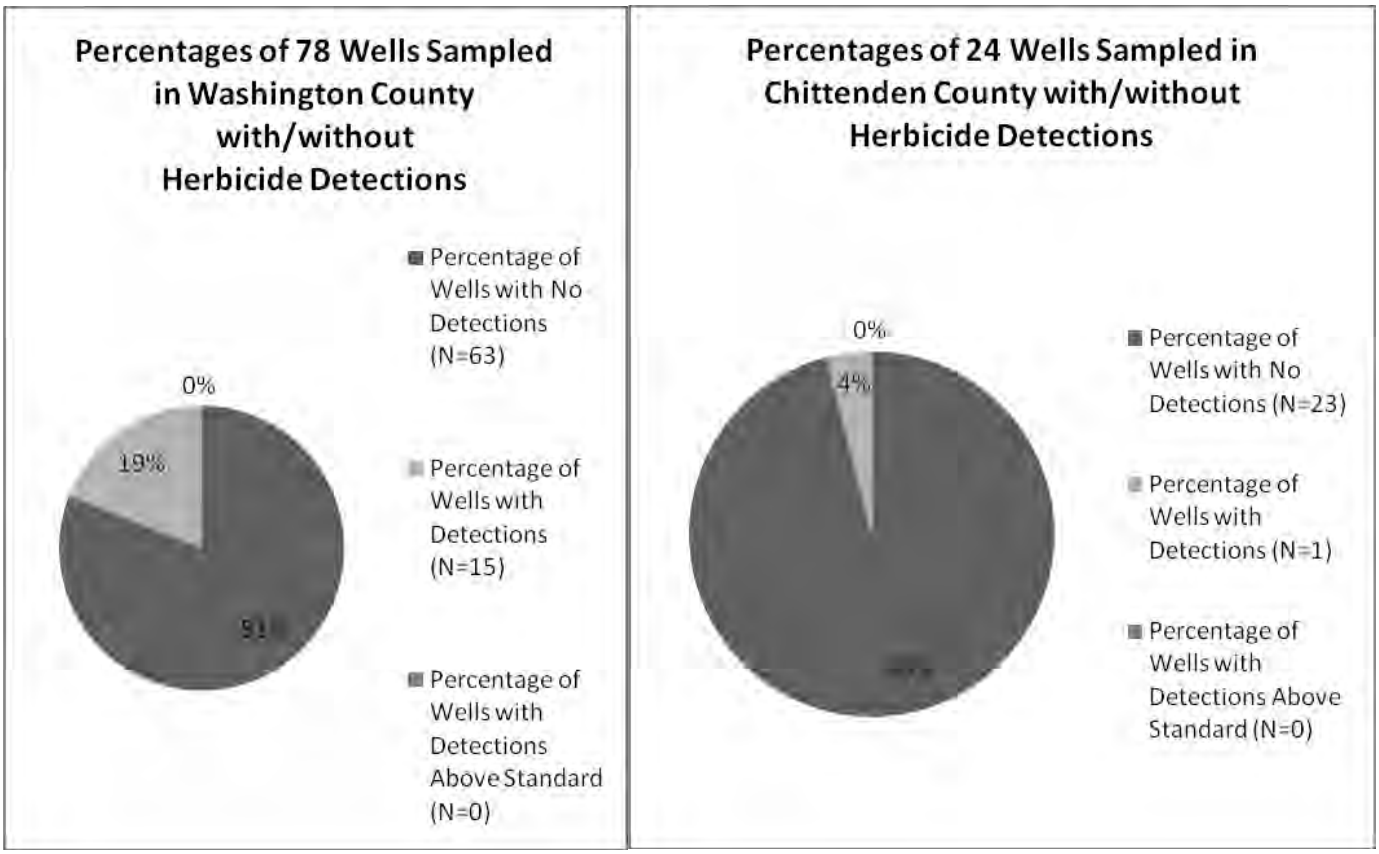
The complexity of agrichemical use is further compounded by a number of factors including the weather, cost of chemical control from year to year, the insect and disease resistance of some crops, and the natural life cycles of pests and diseases. Nitrates and herbicides are good indicators of groundwater quality based on hydrogeologic factors. However, each agrichemical has unique formulations that dictate its fate and transport in the environment (Hancock *et al.*, 2008). It is, therefore, difficult to screen for each possible compound in groundwater.

Table 4. Herbicide Detections in Wells near Farms for Two Watershed Counties and Vermont, 2006 to 2010

	Number of Wells Sampled	Number with 0 Detections	Number with Detections Below Standard	Number of Wells Above Standard
Washington County	78	63	15	0
Chittenden County	24	23	1	0
Vermont	675	636	39	0

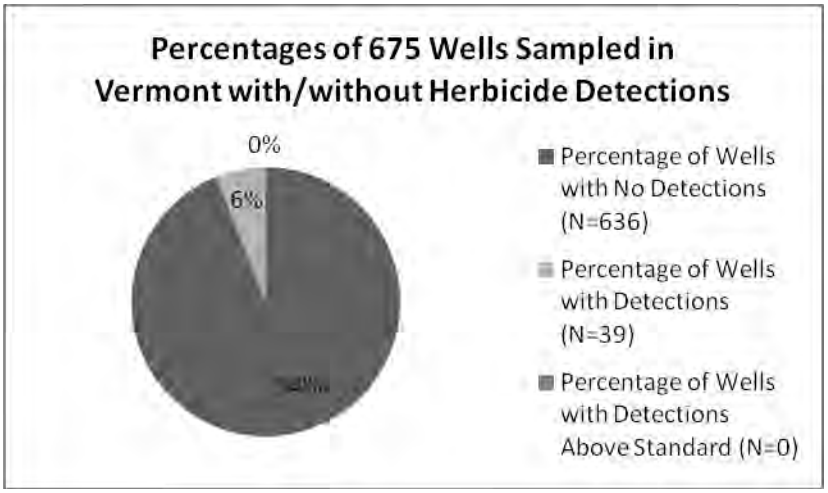
Source: VAAFM, Communication from VAAFM Soil Scientist, 2011

Figure 25. Percentages of Herbicide Detections in Wells in Farm Areas for Two Watershed Counties, 2006 to 2010



Source: VAAFM, Communication from VAAFM Soil Scientist, 2011

Figure 26. Percentages of Herbicide Detections in Wells in Farm Areas in Vermont, 2006 to 2010



Source: VAAFM, Communication from VAAFM Soil Scientist, 2011

Regulations

Vermont requires all applicators and dealers to be licensed and to report products used/sold (Vermont Statutes 2003, VSA Title 6, Chapter 87). Additionally, pesticide applicators licensed in Vermont are required to learn the IPM standards and to use pesticides in accordance with the law, as per the AAP standards (VAAFM 2006, AAP Regulations). UVM Extension also employs an IPM Coordinator who regularly conducts IPM training workshops (UVM 2008, personal communication with VACD staff).

Fertilizers

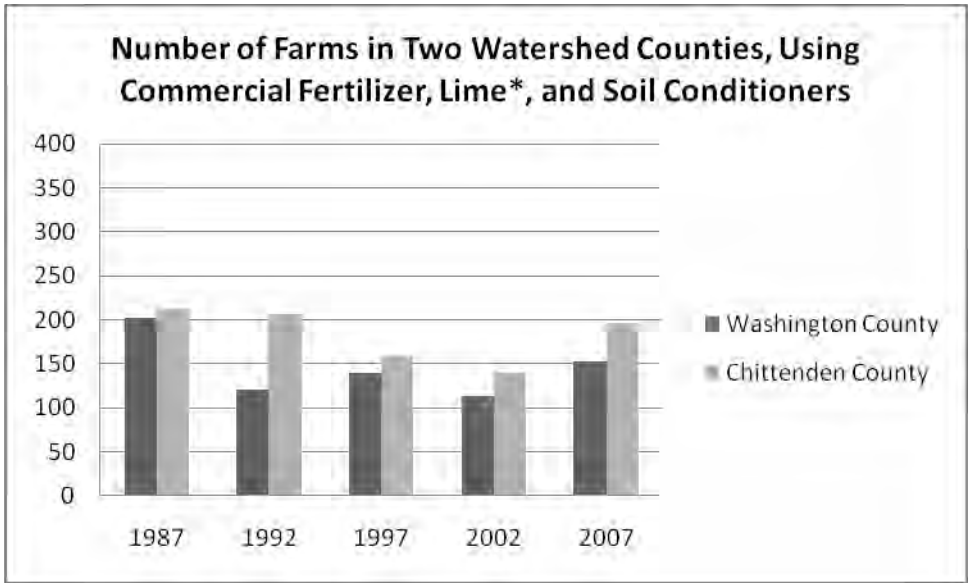
Use of Fertilizers

Soils may be fertilized so that fields have sufficient nitrogen for plants to use. Methods of fertilization include manure and chemical fertilizer, with manure being considered the more natural form of nitrogen.

In 2007, when compared to 1987, commercial fertilizers were used on approximately 31 percent fewer farms statewide and on 20 percent fewer acres, as illustrated in Figures 27 through 30. Both Washington and Chittenden counties also showed percentage declines in both numbers of farms and acres treated. Washington County showed the larger percentage decrease in number of farms

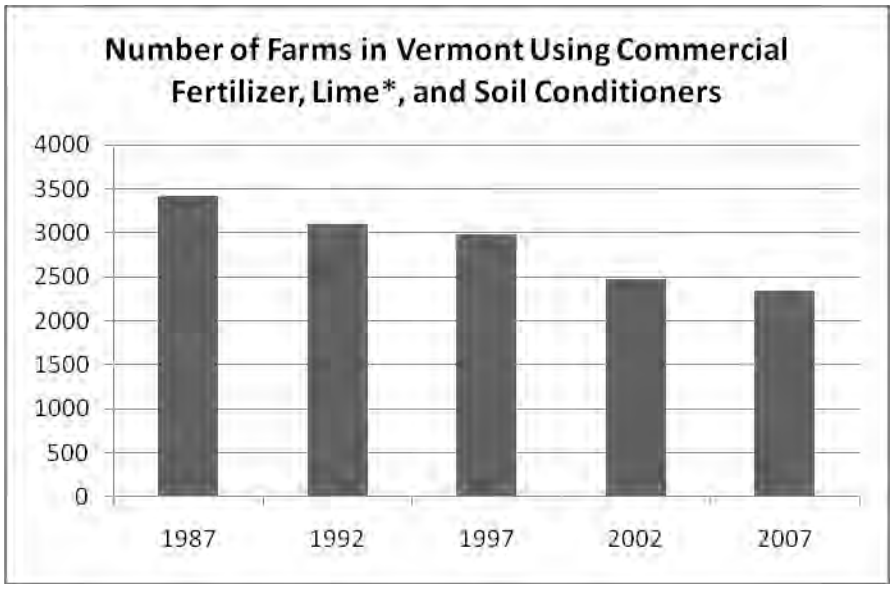
treated at 24 percent, while Chittenden County's percent decrease was 7.5. With regard to numbers of acres treated, Washington County again showed the larger percentage decrease at 30 percent, with Chittenden County at 16.4 percent (NASS, 1987 and 2007). Soil amendments are not used consistently each year due to differences in soil tests done and changes in prices, so these data must be interpreted with these qualifications.

Figure 27. Number of Farms Using Fertilizer, Lime and Soil Conditioners, in Washington and Chittenden Counties, 1987-2007



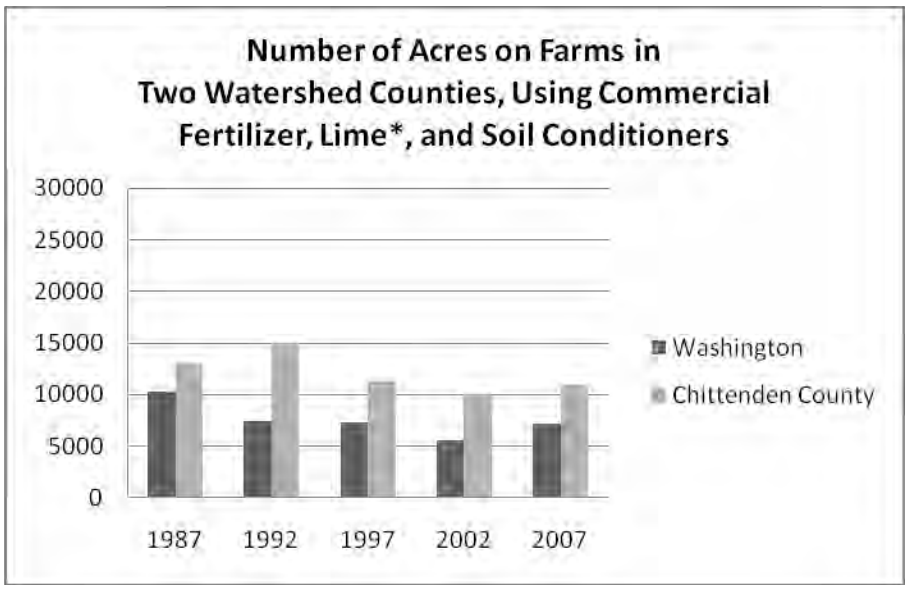
Source: USDA, NASS, 1987-2007
*1997 figures exclude lime

Figure 28. Number of Farms in Vermont Using Fertilizer, Lime and Soil Conditioners, 1987-2007



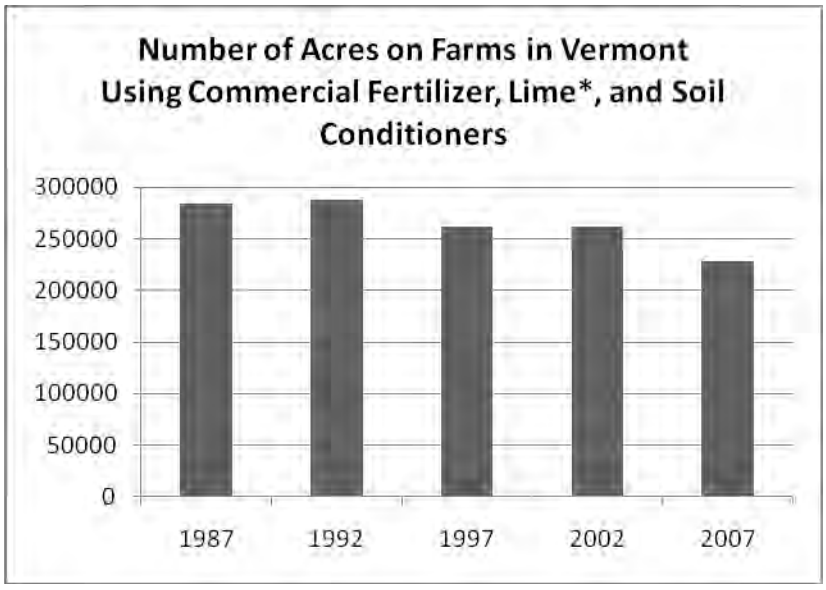
Source: USDA, NASS, 1987-2007
*1997 figures exclude lime

Figure 29. Number of Acres on Farms in Washington and Chittenden Counties Using Fertilizer, Lime and Soil Conditioners, 1987-2007



Source: USDA, NASS, 1987-2007
*1997 figures exclude lime

Figure 30. Number of Acres on Vermont Farms Using Fertilizer, Lime, and Soil Conditioners, 1987-2007



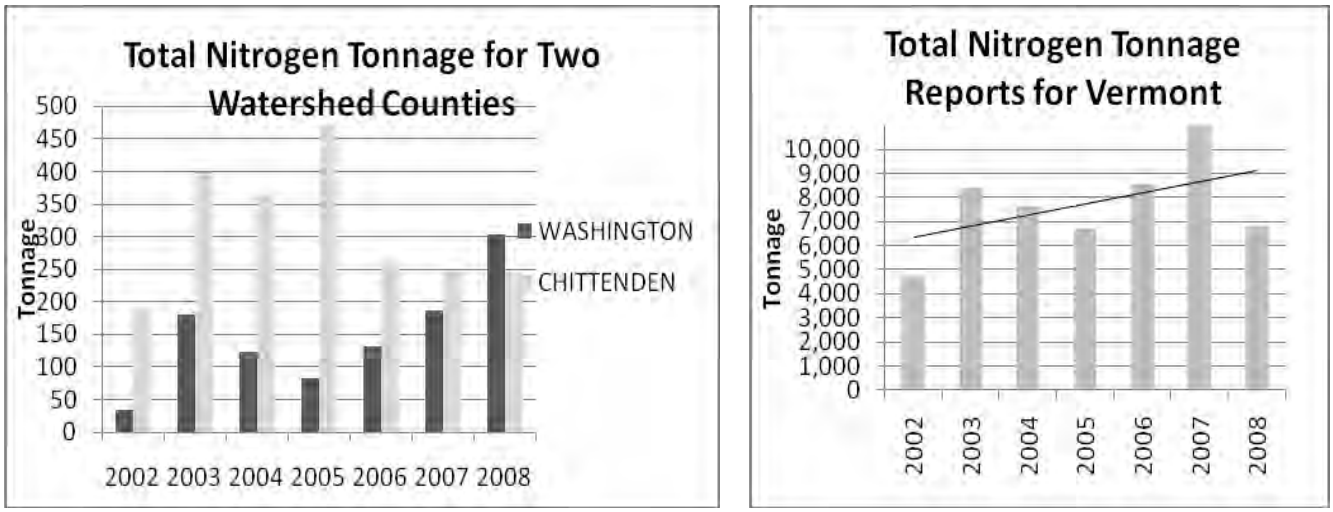
Source: USDA, NASS, 1987-2007
*1997 figures exclude lime

Data regarding farms and farmland acreage where manure was spread are available only for NASS Census years 2002 and 2007. Statewide, there were decreases in both the numbers of farms and acres treated between Census years 2002 and 2007. However, Washington and Chittenden counties saw a rise in both numbers of farms and acres treated between these Census years. Not enough data are available to determine a trend here. Determining the rate of application in tons per acre could be useful data to calculate in the future.

Data on fertilizer sales, self-reported by manufacturers and based on collection of a tonnage tax, are maintained by county of sale in Vermont. Figure 31 shows total nitrogen tonnage reports for all fertilizer sold for the period 2002 to 2008. These reports indicate an upward trend for Washington and Chittenden counties as well as statewide (VAAFM, personal communication from Pesticide Program Section Chief, 2011).

These figures represent more than just agricultural use. The data include applications on grassy areas including lawns, cemeteries, and golf courses and use of urea (de-icer, 46 percent nitrogen) at airports. Therefore these data must be interpreted with these caveats.

Figure 31. Total Nitrogen Tonnage Reports for Two Watershed Counties and Vermont, 2002-2008



Source: VAAFM, personal communication, 2011.

Monitoring Water Quality

Since 1986 the VAAFM's Pesticide and Groundwater Monitoring Program has evaluated the quality of groundwater and drinking water for Vermont farms and their neighbors. Tests for agricultural chemicals reaching groundwater are conducted by collecting water samples from drinking water sources near Vermont farms. Participation is voluntary, and a total of 1,972 wells statewide had been tested as of 2010 (Communication from VAAFM Soil Scientist, 2011).

Between 2006 and 2010, nitrate levels above the drinking water standard of 10 ppm were detected in a small percentage of samples from Washington County (5 percent), Chittenden County (8 percent) and statewide (5 percent) as derived from Table 5 and shown in Figures 32 and 33, respectively (Communication from VAAFM Soil Scientist, 2011).

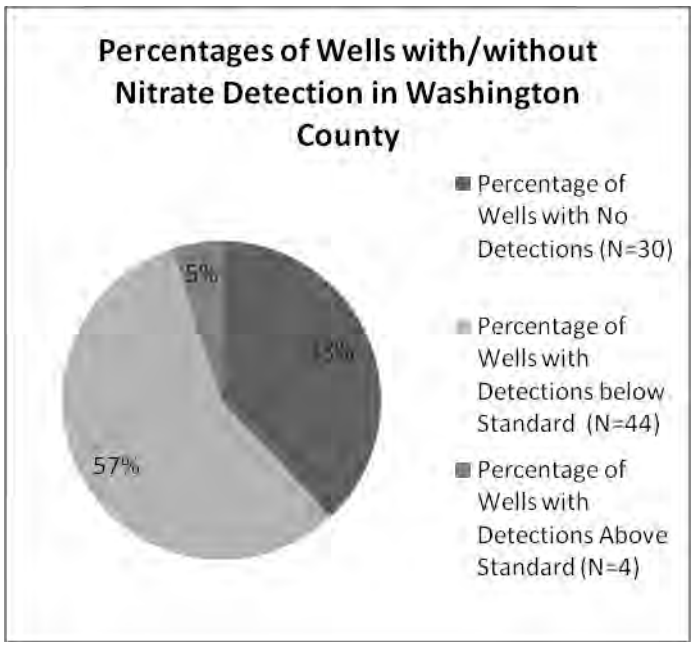
Wells that test positive continue to be monitored. In addition, VACD's Agriculture Resources Specialist (ARS) program provides follow up farm assessments and assistance in developing and sourcing funds for water quality improvement projects.

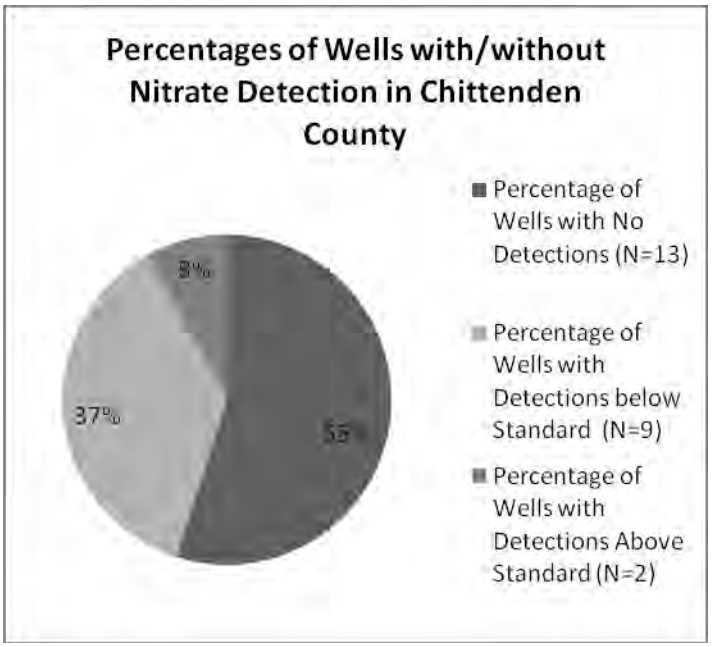
Table 5. Nitrate Detections in Wells in Farm Areas for Two Watershed Counties and Vermont, 2006 to 2010

	Number of Wells Sampled	Number with 0 Detections	Number with Detections Below Standard	Number of Wells Above Standard
Washington County	78	30	44	4
Chittenden County	24	13	9	2
Vermont	675	326	319	30

Source: VAAFM, Communication from VAAFM Soil Scientist, 2011

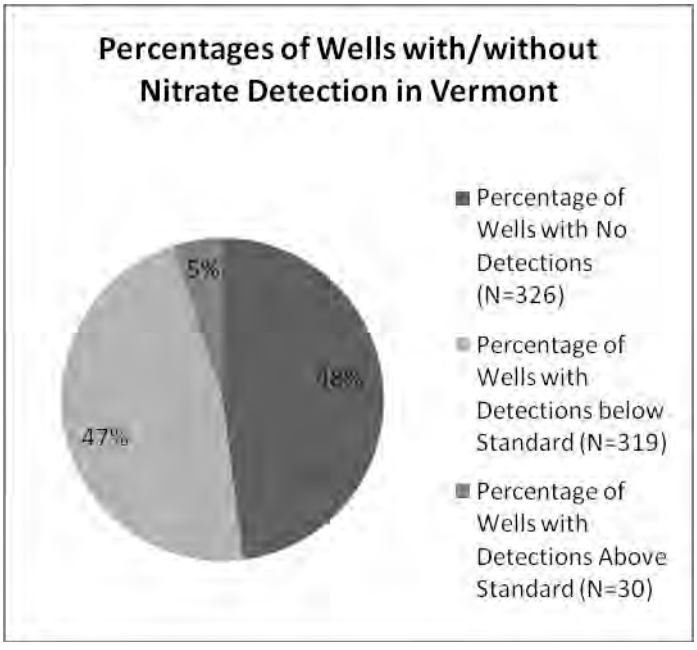
Figure 32. Percentages of Nitrate Detections in Wells in Farm Areas for Two Watershed Counties, 2006 to 2010





Source: VAAFM, Communication from VAAFM Soil Scientist, 2011

Figure 33. Percentages of Nitrate Detections in Wells in Farm Areas for Vermont, 2006 to 2010



Source: VAAFM, Communication from VAAFM Soil Scientist, 2011

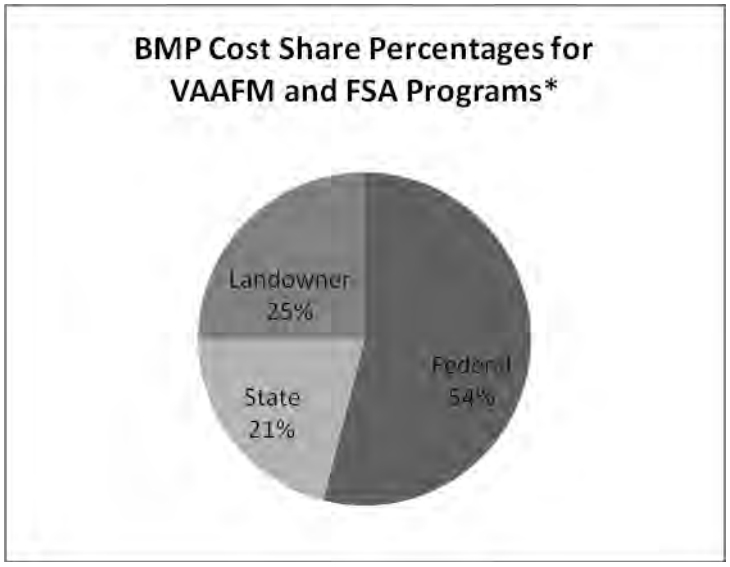
Regulations

Vermont AAPs require soil testing and agronomic rates of nutrient applications for all farm fields on which manure is spread. Large Farm (VAAFM, Large Farm Operations Rules, 2007) and Medium Farm (VAAFM, General Permit, 2007) operations in Vermont are also required to develop Nutrient Management Plans (VAAFM, 2008). NMPs specify the amount of manure and fertilizers that can be utilized on specific farm fields. Additional rules regarding soil testing and the timing and type of manure application are also stipulated in the state's Accepted Agricultural Practices to protect farm water quality (VAAFM 2006, AAP Regulations).

CONSERVATION PRACTICES

Many programs and agencies encourage a wide variety of methods for improving water quality. These include funding assistance for construction of structures as well as changes in farming practices and are referred to as Best Management Practices (BMPs). Landowners can receive assistance from agencies for a certain percentage of the cost of implementing the practices--referred to as cost share. The federal cost share programs for farming that are offered by the USDA Natural Resource Conservation Service (NRCS) and the Farm Service Agency (FSA) include both structural projects in production areas and land-based practices for many different types of farms. The US Fish and Wildlife Service's Partners for Fish and Wildlife Program offers assistance with land-based projects. The cost share programs offered by the state, through the Vermont Agency of Agriculture, Food and Markets (VAAFM), focus on both structural and land-based projects for dairy operations. Refer to Figure 34 for relative cost share percentages for projects completed in the watershed between 1996 and 2009 for the state programs (BMP & CREP), two FSA programs (CRP & GRP), and landowner contributions. These percentages should be reviewed with the caveat that NRCS programs were not included in the calculation.

Figure 34. Estimated Percentages of Cost-Share for BMP Projects Completed through Vermont's VAAFM and the USDA FSA Programs, 1996-2010



Source: VAAFM, 2010 and FSA per VACD staff review, 2011

* Data for NRCS Programs (ACP, AMA, CRP, EC, EQIP and WHIP) were not available.

Costs and Benefits of Implementing Best Management Practices

BMPs are designed to reduce nonpoint source pollution of waterways due to sediment, pathogen, and nutrient loading and to assist farmers in better managing farm nutrients (Yates *et al.*, 2007). Structural BMPs include waste storage facilities and improved barnyard and roof-runoff systems. Land-based BMPs include Land Treatment Planning, Nutrient Management Planning for applying nutrients and pesticides, fencing, streambank stabilization, alternative watering systems, and taking some lands out of production, especially adjacent to streams, through conservation easements and planting vegetation other than crops. Between 1996 and 2010, a total of 226 completed BMPs supported by the state's VAAFM cost share funds were estimated to have reduced phosphorus by 4,402 pounds. For six years between 2002 and 2008, the FSA and 30 landowners accomplished 43 BMPs which improved 252 acres of farmland. Refer to Table 6 for a summary of some of the costs and benefits of different aspects of the cost share programs. The incomplete datasets reflect some of the difficulties in obtaining data for the entire watershed as well as differences between agencies in measuring and tracking progress. Environmental Working Group (EWG) data for NRCS projects in Washington County enabled a minimum estimate to be included. All of these qualifications should be kept in mind when reviewing the data.

Table 6. Relative Costs and Benefits of BMP Cost Share Programs Completed in the Winooski Watershed*, 1995**-2010

Attribute / Agency	Federal Cost †	No. of Farms	Federal Cost Per Farm	Total Project Cost	No. of Projects	Average of Cost per Project	Number of Years Projects Awarded	Average of Total Spent Per Year	Type and Number of Units Treated	Cost per Unit
VAAFM	$2,513,570	n/a ‡	n/a	$4,997,759	226	$22,114	15	$333,183	4,402 pounds of phosphorus	$1,135/ pound
USDA-FSA ^	$528,759	30	$17,625	$597,261	43	$13,889	6	$99,543	252 acres	$2,370/ acre
USFWS-PFW	$67,400	n/a	n/a	n/a	n/a	n/a	n/a	n/a	37 acres and 15.7 miles stream frontage	n/a
USDA-NRCS* for Washington Co. per EWG	$640,010	122	$5,246	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Sources: Vermont Agency of Agriculture, Food & Markets, 2010, Communication between CREP Coordinator and VACD staff; Farm Service Agency-USDA 2010, Communication between FSA-Vermont and VACD staff; U.S. Fish & Wildlife Service, Personal communication with Partners for Fish and Wildlife Vermont State Coordinator, 2010; Environmental Working Group, 2010.

*Data for seven NRCS cost share programs were not able to be obtained from the agency. Data shown are estimates by the Environmental Working Group (EWG), 2010, but only for Washington County, 93 percent of which is in the watershed and representing about 60 percent of the watershed.

**NRCS cost share funds were available in Washington County in 1995, per EWG.

† The VAAFM federal cost included a $368,550 EPA appropriation in 2003.

‡ n/a references indicate data not obtained at time of report and/or not able to be calculated.

^Data for FSA represent only those contracts that have been recorded in the agency's funding database.

Prior to state and federal conservation programs that were fully underway by 1996, many farmers, on their own, implemented water quality improvements and many continue to do so. The amount of money spent by landowners on most of these practices before 1996 is unknown. Between 1996 and 2010, data from the state's VAAFM cost-share records indicate that dairy producers throughout the watershed invested more than $1.3 million of their own money in various farming practices and infrastructure changes. Despite the contributions of federal and state cost share dollars that can be combined to decrease the cost for a farmer/landowner to 15 percent for a typical $200,000 manure pit project, this amount is still a high price and difficult for a landowner to afford.

Based on data that were obtained from agency programs, it can be estimated that at least $3.3 million federal dollars and more than $1.1 million state dollars were distributed to farmers in the Winooski basin during the years 1995 to 2010 to assist with implementing BMPs. A minimum of more than $1.39 million, along with in-kind services, was invested by landowners throughout the watershed during the same period (watershed data per VAAFM, 2010 and FSA per VACD staff review, 2011; and Washington County NRCS data per the Environmental Working Group, 2010). This estimate can be roughly compared to the $42.7million federal and more than $5 million landowners spent on BMPs through cost share programs statewide during the period 1995 to 2009 (Environmental Working Group, 2010).

Additional Programs to Help Improve Water Quality

Land Treatment Plans (LTPs) are developed at no charge to the farmer to assess farm resources and management practices. The plans make recommendations for continued resource stewardship and compliance with regulations. The requirement for LFOs and MFOs is that acreage be managed to soil loss tolerance specific to each field. For all other agricultural operations, soil loss must be managed up to twice the tolerance for soil loss for each field (Vermont Association of Conservation Districts, 2010).

Nutrient Management Plans (NMPs) identify nutrient budgeting, waste management, and other practices with the goal of minimizing water quality impacts from agricultural activities. The number of acres covered by approved plans in 2010 in the two watershed counties of Washington and Chittenden totaled nearly 8,000 acres. Approximately $62,000 of state dollars was spent on developing and implementing the plans.

Table 7 shows estimates of various BMPs, including LTPs and NMPs, which were done within the watershed between 1996 and 2010. Many projects are done through the cooperation of multiple agencies. Therefore, totaling the acreages is not likely to be accurate, as it is difficult to determine if or which of the acreages were supported by more than one program.

Table 7. Estimated Units of Various Best Management Practices (BMPs)* Completed in the Winooski Basin, 1996-2010

Program	Number of Acres, Feet or Miles	Type of Practice	Area
FSA-GRP	196 ac.	Grasslands protection	Watershed
FSA-CREP/CRP	56 ac.	Buffers and fencing along waterways	Watershed
USFWS-PFW	156 acres; 15.7 miles	Fencing to keep livestock from streams and streambanks	Watershed
VAAFM-FAP	1,348 ac.	Cover crops planted and rotation practices	Watershed
VAAFM-NMP	6,293 ac.	Identify nutrient budgets, waste mgmt., etc.	Washington and Chittenden Counties
NRCS-NMP	1,704 ac.	Identify nutrient budgets, waste mgmt., etc.	Watershed

Sources: Vermont Agency of Agriculture, Food & Markets, 2010, Communication between CREP Coordinator and VACD staff; Farm Service Agency-USDA 2010, Communication between FSA-Vermont and VACD staff; U.S. Fish & Wildlife Service, Personal communication with Partners for Wildlife, Vermont State Coordinator, 2010; Personal Communication with Winooski Natural Resources Conservation District Soil Scientists, 2010.

*NRCS cost-share program data were not available.

Structural Practices

VAAFM tracks cost-share funds for BMP structural improvements as shown in Table 8. Between 1996 and 2010, 102 production area improvement BMPs, such as manure handling and barnyard areas, were implemented in the watershed through VAAFM programs. As of 2010, VAAFM estimated that the impacts of 19,779 animals in production areas were managed through its cost-share programs being made available to farmers in the watershed. At the time of this report, 10 VAAFM cost-share projects were in progress with estimated costs shown in Table 8 (Vermont Agency of Agriculture, Food & Markets 2010, Summary Table of Best Management Practice Program Commitments).

Table 8. Cost-Share Funding Estimates for VAAFM BMP Structural Improvement Projects--Completed and in Progress--for Dairy Farms in the Winooski Watershed, 1996-2010.

Completed Projects		Projects in Progress	
Number completed	102	Number in Progress	10
Total Project Cost	$3,165,684	Estimated Total Cost	$482,141
Total Landowner Cost	$879,096	Estimated Landowner Cost	$101,153

Source: VAAFM, 2010

Table 9 provides a list of USDA-NRCS structural improvement BMPs that are planned to be done in the Washington and Chittenden counties area of the Winooski watershed. Data for completed projects were not provided for this report.

Table 9. Area or Number of USDA-NRCS Structural Improvement BMPs that are Planned for Barnyards in Washington and Chittenden County Areas of the Winooski Watershed, 2011

Practice	Number or Area
Animal mortality facility	3 (number)
Composting facility	1 (number)
Roof runoff structure	7 (number)
Seasonal high tunnel system	31,025 square feet
Waste storage facility	10 (number)
Waste Transfer/Treatment System	6 (number)

Source: Communication from USDA-NRCS, 2011

Land-Based Practices

As mentioned above, land-based BMPs for purposes of this report include Land Treatment Planning, Nutrient Management Planning for applying nutrients and pesticides, fencing, streambank stabilization, alternative watering systems, and taking some lands out of production, especially adjacent to streams, through conservation easements and planting vegetation other than crops.

The database of conserved lands maintained by the Vermont Land Trust (VLT) includes land conserved by VLT, public entities, and other nonprofit organizations. Many of the lands are conserved through easements that specify which activities can and cannot occur on the land. In the case of many lands conserved with VLT's assistance, the easement ensures that the land will remain open and as farmland. Lands in held by federal, state, and municipal entities do not generally support farmland activities. For purposes of deriving an estimate of conserved farmlands for the Winooski basin, the acres conserved by VLT and other nonprofit organizations in towns that have lands in the watershed totaled 32,267 acres. Further analysis using overlays of VLT lands with agricultural land cover types could be done to get a more accurate accounting of conserved farmland acreage (Personal communication with VLT GIS Specialist, 2010). Therefore, the estimated acreage reported should be considered with this caveat.

Cost-share funds for BMP field practice (land-based) improvements that were completed and those in progress were made available for VAAFM programs. As shown in Table 10, between 1996 and 2010, 121 field-based improvement BMPs were implemented through the VAAFM programs. As of 2010, VAAFM estimated that the impacts of 16,662 animals in field areas were managed through its cost-share programs being made available to farmers in the watershed. At the time of this report, 49 projects were in progress with estimated costs as noted in Table 10 (Vermont

Agency of Agriculture, Food & Markets 2010, Summary Table of Best Management Practice Program Commitments).

Table 10. Cost-Share Funding for VAAFM BMP Land-Based Projects--Completed and in Progress--for the Winooski Watershed

Completed Projects		Projects in Progress	
Number completed	121	Number in Progress	39
Total Project Cost	$1,128,557	Estimated Total Cost	$171,882
Total Landowner Cost	$308,010	Estimated Landowner Cost	$35,593

Source: VAAFM, 2010

At the time of this report, the USDA-NRCS had many land-based cost-share BMPs planned, as shown in Table 11. Data for complete projects were not provided for this report.

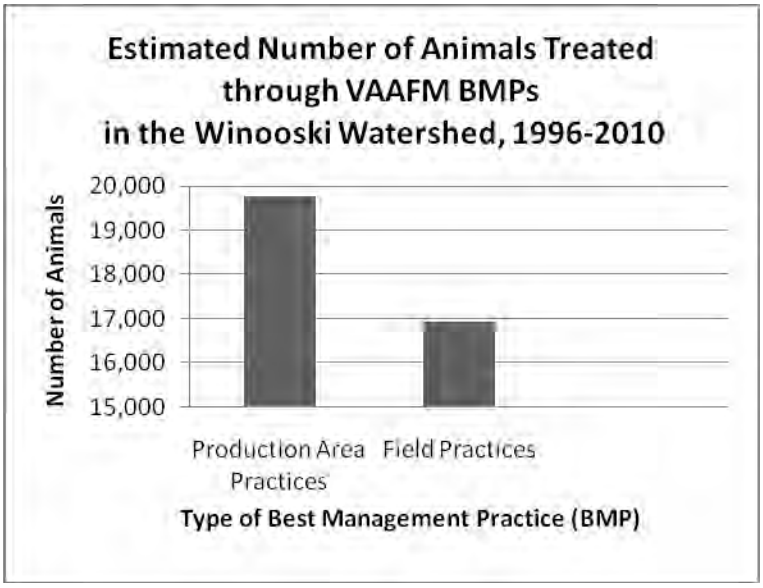
Table 11. Area, Linear Feet, or Number of USDA-NRCS Land-Based BMPs that are Planned in Washington and Chittenden County Areas of the Winooski Watershed, 2011

Practice	Area, Linear Feet, or Number
Animal trails and walkways	4,284 feet
Cover cropping	1,698 acres
Diversion	3,182 feet
Early successional/upland habitat management	1,419 acres
Fencing	90,662 feet
Field border	4 acres
Filter strip/grassed waterway	14 acres
Grade stabilization structure	1 (number)
Grazing management plan	3 (number)
Irrigation system	13 acres
Lined waterway or outlet	1,559 feet
Nutrient management	4,089 acres
Pasture and hay planting	103 acres
Pest management	1,844 acres
Pipeline	25,638 feet
Prescribed grazing	1,376 acres
Residue management, mulching	2,981 acres
Spring development/water well	2 (number)
Stream crossing	5 (number)
Streambank and shoreline protection	326 feet
Underground outlet/Subsurface drain	3,103 feet
Waste field storage area	1 (number)
Waste utilization	554 acres
Watering facility	33 (number)
Windbreak, shelterbelt establishment	3,255 feet

Source: USDA-NRCS, 2011

The VAAFM has estimated the number of animals treated by BMPs on dairy operations for both its structural (production area) practices and its land-based (field practices) per Figure 35.

Figure 35. Estimates of Animals Treated Through VAAFM BMPs, in Dairy Operations in the Winooski Basin, 1997-2008



Source: VAAFM, 2010

TRENDS, CONCERNS, AND FUTURE OPPORTUNITIES

Agriculture has helped to sustain society in the northeastern United States for over 200 years (Ebeling, 2006) and continues to provide important ecological and economic functions for the Winooski watershed. The broad range of complex factors related to food production and environmental quality should not be oversimplified. However, a general awareness of many of them, as presented here, could provide readers with a better understanding of how the agricultural industry can be supported now and in the future.

If local farms are to succeed, strategies must be developed to help them become both financially and environmentally sustainable and be seen as necessary to the community. Most local towns within the basin are committed to maintaining the rural, agricultural qualities that currently exist. However, the economics of agriculture, including conservation program funding, taxation policy, market influences, development pressures, and the local food movement will ultimately determine the character, extent, and sustainability of the basin's working agricultural landscape.

Trends of Concern

Changes in Farm Size and Land in Production

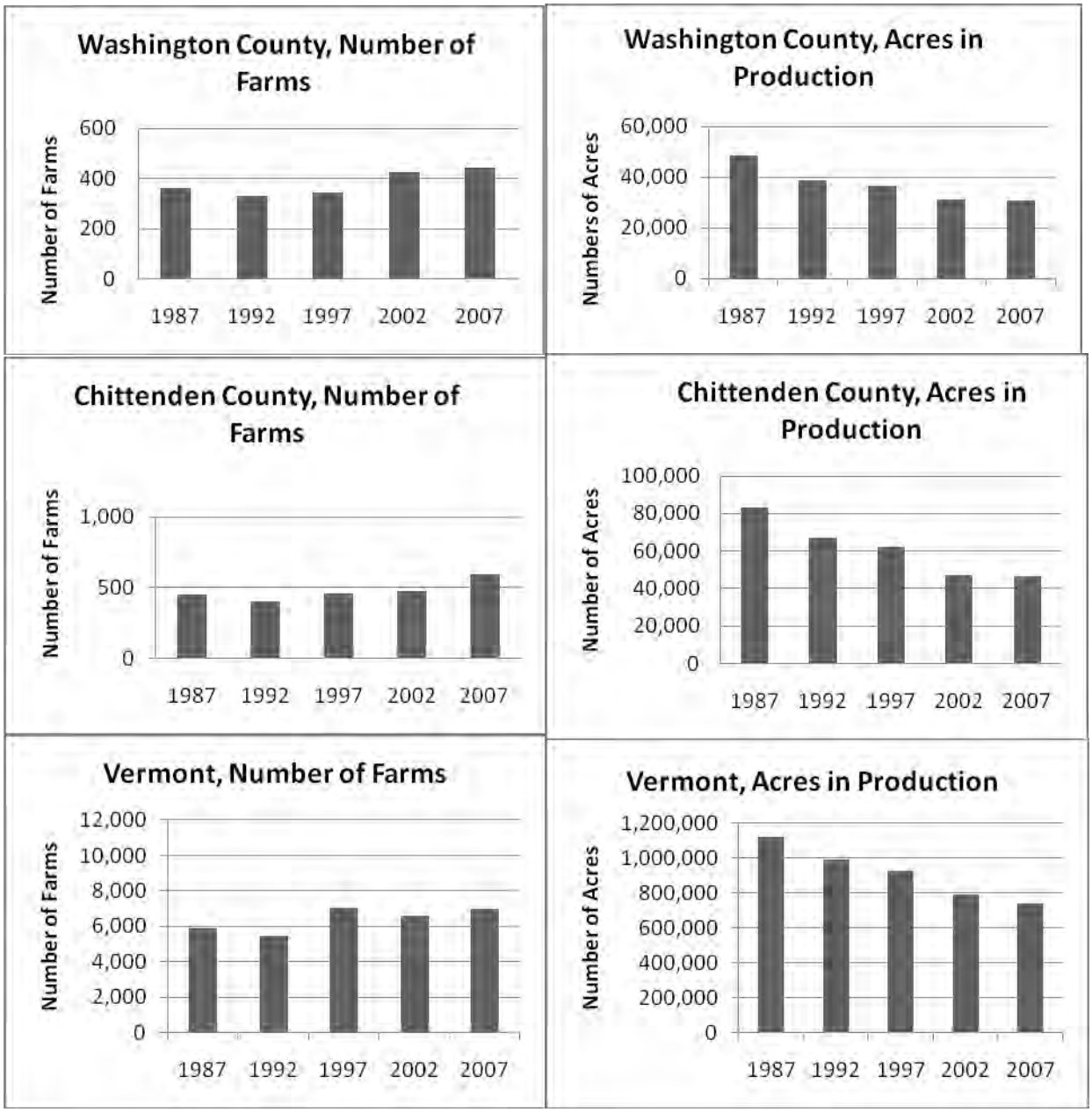
Besides the increase in farms with net losses as described in Figure 5 and decline in farming as the primary occupation of farm operators from Figure 6, there are other trends that raise concerns about the future of farming and land use generally in the Winooski watershed and throughout Vermont. Historically and recently, especially over the past 20 years, there have been dramatic changes in the number of farms and acreage in farm production. Changes in the relationship between farm sales and production costs are another area for concern. There are potentially negative consequences of these trends, if they continue, not only for the farming industry but also for water quality and environmental health.

The Census of 1860 reveals that the average size of farms in Vermont at that time was about 110 acres (Kennedy, 1864). By 1920 the average farm size in Vermont was 120-160 acres. The average size of farms in Vermont increased to 177 acres by the 2007 census. However, farms in two watershed counties in 2007 were typically in the same size range as the 1920s, as the Washington County average was 137 acres and Chittenden was 141 acres (USDA, NASS, 2009). This size is considered small by industry standards and therefore generally less likely to be profitable than larger commercial farms (Dhuyvetter and Kastens, 2011).

Over the past 20 years throughout Vermont and two of the watershed counties, two trends have been occurring: increase in the number of farms and decrease in acreage in production. As shown in Figure 36, the number of farms increased in Vermont by 19 percent while acres in production decreased by 34 percent. The figures for Washington County revealed more change, with a 23 percent increase in number of farms and a 36.5 decrease in acres in production. Chittenden

County had an even greater change with a 31 percent increase in the number of farms along with a 44 percent decrease in acres in production. (USDA, NASS, 2009).

Figure 36. Number of Farms and Land in Production, for Two Winooski Watershed Counties and Vermont, 1987-2007



Source: USDA, NASS, 2009

If the current rate of loss of farm acres in production were to be projected out another 20 years to 2027, the percentage of land in agricultural production in Washington County would drop from about 11 to 2.5 percent and in Chittenden County would drop from about 21 to 5 percent. This forecast does not account for the compounding factors of economics, climate, and the future regulatory environment.

More than tripling the loss of productive farmland in these counties would dramatically change the cultural and environmental qualities of the area. The pastoral character of the landscape would be very different with fewer patches of agricultural lands. There would likely be negative consequences for species dependent on grassland habitat for nesting, feeding, and migratory resting areas. The loss of agricultural land also has negative implications for water quality, especially if it were converted to development. Per acre, urban land has been shown to have a greater adverse impact on surface water quality than agricultural land (Hanmer, 2006). The increase in pavement and other impervious areas from development causes more water to flow across the land (runoff) and toxic pollutants to be carried into waterways. Increased development also results in more disturbance to soils and related impacts on natural resources as well as putting stress on existing farmland to produce more on less land.

Finally, the tourism industry accounts for about 15 percent of the state's economy and depends largely on the renown of Vermont's pastoral landscape. Alterations in the landscape could affect tourism revenues (Wood *et al*., 2000) which were estimated to contribute $193,000 to the economy of the watershed counties of Washington and Chittenden in 2007 (Vermont Sustainable Agriculture Council, 2005). In polls conducted by the Vermont Center for Rural Development, more than 97 percent of Vermonters valued the "working landscape and its heritage" (Vermont Council on Rural Development, 2009).

Decline of Dairy Farms

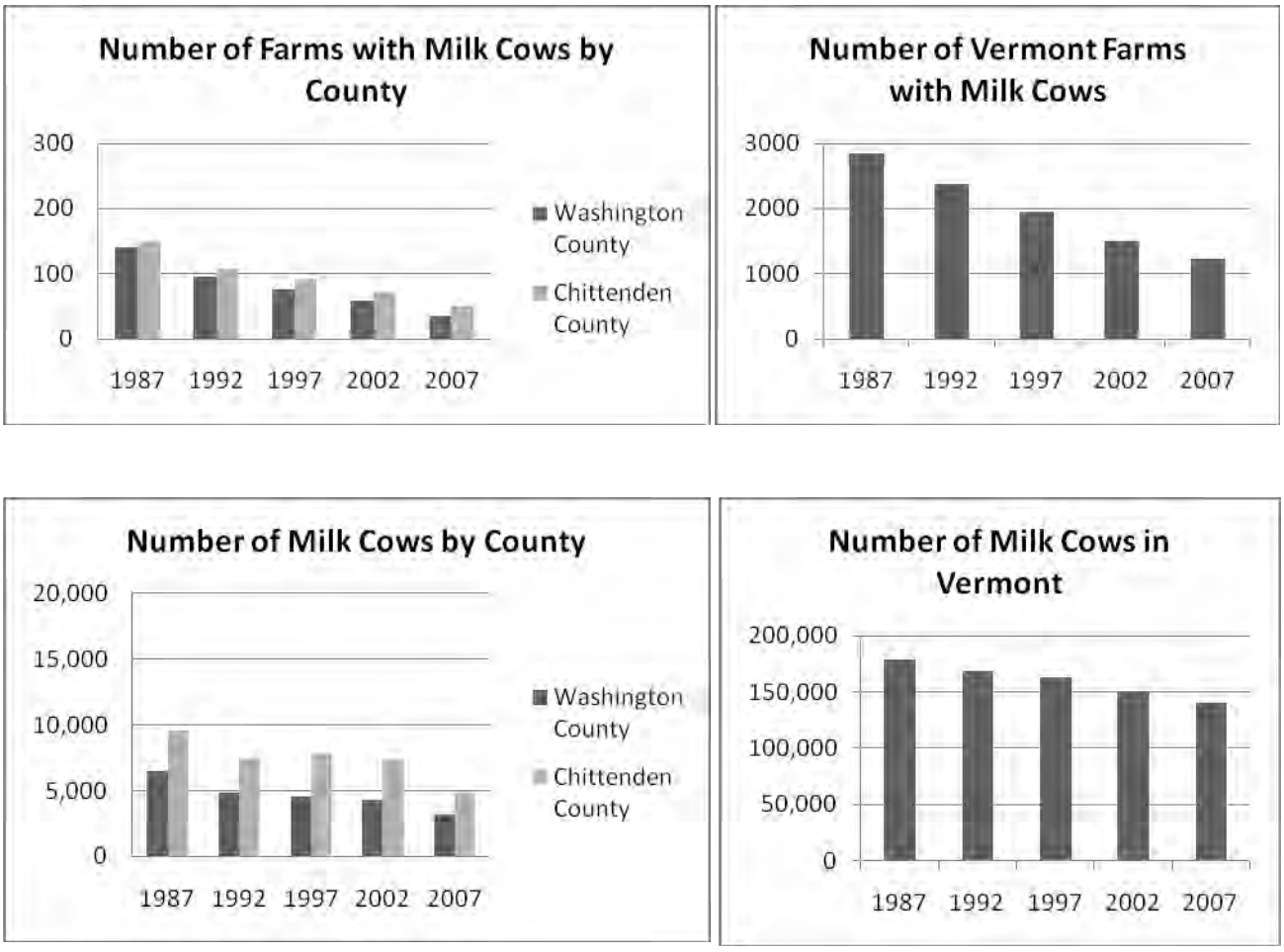
The nearly steady decline in the number of dairy farms in Vermont has been well documented and has been happening for at least 60 years. In 1947 the state had more than 11,000 dairy farms, and by 2010 there were just over 1,000. Figure 37 illustrates the decline in numbers of farms with milk cows and numbers of animals for the 20-year period 1987 to 2007 with figures from agricultural censuses for Vermont and two of the Winooski watershed counties, Washington and Chittenden.

The rates of decline for both counties during this period for both number of farms and milk cows was greater than that for the state. The number of farms with milk cows in Washington County declined almost 75 percent, while the number in Chittenden County declined by 66.7 percent. The decline statewide was about 57 percent. With regard to the number of cows, the decline statewide was about 22 percent, while numbers in each of the two watershed counties declined by about 50 percent.

The dairy industry accounts for more than 75 percent of all agricultural sales in the state (USDA, ERS, 2008). Milk and dairy products from cows represent the highest income source for farms in two of the watershed's counties—nearly two-thirds of farm sales in Washington County and about

one-half of farm sales in Chittenden County (Figure 3). With this single commodity representing such a high percentage of total agricultural sales—in fact the highest in the nation--the decline in dairy farms becomes an even greater concern. Furthermore, consumption of all dairy products has increased less than the productivity of dairy cows. This situation leads to falling prices and lower incomes if the government does not intervene (Bolduc and Kessel, 2008).

Figure 37. Number of Farms and Milk Cows, for Two Winooski Watershed Counties and Vermont, 1987-2007



Source: USDA, NASS, 1987-2007

Other Economic Challenges

As presented in various sections above, there are many economic difficulties facing the future of the local agricultural industry. Farms in the Winooski basin struggle to remain economically viable in the face of development pressures, market competition, labor issues, and increasing regulations.

The relationship between farm sales and production expenses influences the economic viability of farms and the entire agricultural industry. Table 12 shows the percentage changes between sales

and production costs for two of the watershed counties and Vermont from 1987 to 2007. In all cases, production costs increased at a higher rate than market value for agricultural products. The increase in the rate of market value of products for both

Washington and Chittenden counties was lower than the state percentage increase of 79 percent. However, the increase in the rate of production costs for each county was lower than the change in rate for the state, which increased by 90 percent between 1987 and 2007.

Table 12. Rate of Change in Farm Product Value and Production Costs, for Two Winooski Watershed Counties and Vermont, between 1987 and 2007

	Change in Rate of Product Value	Change in Rate of Production Costs
Washington County	46%	51%
Chittenden County	53%	68%
Vermont	79%	90%

Source: USDA, NASS, 2009

It has become increasingly more difficult to recruit new farmers and farm laborers. This situation raises the concern of whether there will be a sufficient number of new farmers who will be able to establish and maintain farms in the state (Bolduc and Kessel, 2008). Additionally, regulations concerning husbandry, genetics, foods safety, and the environment continue to become more and more stringent. These all add to the basic costs of maintaining an agricultural business.

Many farmlands that remain are also suitable for other uses including development for housing. As a result, local land costs are rising, making it more difficult for new farmers to afford land. Although there is significant public support for local foods generally, there is less support for the existence of local farms, especially in growing communities. Residents of these communities, frequently relying on limited or inaccurate information about modern farming practices, often express concern over the environmental effects of farming (Smith *et al*., 2008).

While Vermont has become known for farm products grown in "one of the healthiest environments in the country," Vermont is currently a net importer of food (Bolduc and Kessel, 2008). However, foreseeable changes may require increasing local food production into the future as transportation costs rise, the costs of farm supplies increase, and primary agricultural regions experience other crises. Recently, Vermont state laws have defined local food as that grown within Vermont or within 30 miles (Vermont Statutes, 2008).

Additional factors that could affect conservation funding priorities include the U.S. financial crisis of 2009, the issue of climate change and the potential role of agriculture in reducing greenhouse gases, as well as impacts of ethanol production on natural resources and changes in land use that could impact policies relating to biofuels (Stubbs, 2009).

Yet another factor could be the resolution of the debate over the definition of a farm and whether the USDA's definition should be expanded so that a broader range of operations could compete successfully for state and federal aid, such as small equine operations. Traditionally horse breeding operations fall within the definition of farm production. Small stables that board horse and offer riding lessons are regarded as recreational service facilities, even though they could be considered part of the rural landscape. Reports from farmers within the Winooski basin indicate that some equine operations could be problematic for water quality there as concentrated equine operations may be delivering animal waste to receiving water bodies. Because equine operations, such as riding stables, typically provide services rather than sell products, many aren't counted in the USDA Census of Agriculture. In 1999 the USDA conducted a special equine survey which reported numbers but had no information on how much land is involved. The USDA Natural Resources Inventory (NRI) looks at land cover/use regardless of whether or not the operation meets the USDA definition of a farm. A state level comparison done by New York suggests that equine operations may account for a significant portion of the difference in acreage counted by the Agricultural Census and the NRI (http://www.elcr.org/resources/R16.html printed originally by LandWorks www.farmland.org/landwords.htm).

Regulations and the Need for Continued Conservation Funding

Now, more than ever, farmers are under considerable pressure to maintain environmentally sound farming operations. All Vermont agricultural operations are required to comply with the water quality protection regulations of the AAPs (VAAFM, AAP Regulations, 2006). While Vermont's Large and Medium Farm operations must meet regulations above and beyond AAPs, farms that receive federal conservation program funding must meet further environmental regulations. In complying with the minimum standard AAPs, farmers must address nine key water quality protection concepts, as listed here.

No Direct Discharge of wastes to surface waters
Nutrient and Pesticide Storage and setback requirements
Nutrient and Pesticide Application, setback and soil testing requirements
Soil Cultivation designed to minimize erosion
Waste Management to minimize impacts to water quality
Buffer Zones maintained on cropland
Farm Structure design and setbacks
Streambank Stabilization to federal standards
Groundwater Quality impacts minimized

Federal, state, and private agencies have taken steps to protect farmland and farm water quality through land and conservation programs that involve federal, state, and private funds. Many of these are described in more detail in the Programs that Address Issues section that appears later in this document.

Land protection helps to ensure availability of agricultural land for future food and fiber production and provides those presently working the farm with some financial assistance to help

them succeed. Conservation programs may include assistance for installing conservation practices that reduce non-point source pollution. These include fencing animals out of streams to prevent damage to streambanks, providing alternative watering systems, and installing waste treatment facilities. Unfortunately, federal and state cost-share dollars for these programs are limited, competitive, and decreasing.

Other environmental issues related to agriculture that may require more funding to implement in the future include further regulation of concentrated animal feeding operations, greenhouse gas emission reporting for livestock producers, and wetlands mitigation efforts (Stubbs, 2009).

Efforts to Meet Economic and Water Quality Challenges

There are trends and changes underway that may have positive effects on the economic, water quality, and other environmental challenges of farming. Many organizations have been analyzing the problems facing the agricultural industry and are planning for and solving these problems. The Winooski watershed is home to some of these organizations that are leading the way and/or coordinating new initiatives in support of agriculture within the basin and beyond.

Environmental Benefits

The federal cost-share programs that have become available over the past 20 years have made it possible for many farmers to change their management practices. These changes have helped reduce amounts of phosphorus and other pollutants that may travel beyond the barnyard, grazing, and crop production lands to receiving waters. One recent cover cropping project in the Mad River Valley of the Winooski basin provides an example of how these efforts can be enhanced. The project offered the farmers the opportunity to improve soil health across all their farms in the valley and served as a model for other basins.

Due to the complexities of natural systems and the many decades during which pollutants have been produced, the positive effects of implementing conservation practices may not be readily apparent. However, water quality should gradually improve over time. Levels of phosphorus and nitrogen in surface waters should decrease even though they will not be eliminated in the foreseeable future.

Nutrient management planning requirements will also bring improvements to water quality over time. The movement toward adjusting soil phosphorus levels to as low a level as possible while maintaining the productive agricultural use should be beneficial to both the environment and farmers' budgets. It is encouraging that the amounts of commercial fertilizer, lime, and soil conditioners (Figures 26-29), as well as the herbicide atrazine, being applied to farm fields in the watershed counties of Washington and Chittenden (Figure 22) appear to be on a downward trend.

Another sign that nutrient management planning, farm permitting, and site remediation practices are working is the significant downward trend in the number of farm and non-farm wells with elevated nitrate concentrations. The Agricultural Water Quality Program instituted the practice of tracking water quality results based on the most recent five-year sampling period in 2005 as

shown in Table 13. The five-year time frame represents the most recent sampling activities for newly sampled or repeat sampled wells in Vermont (VAAFM, Communication from Soil Scientist, 2011).

Table 13. History of Nitrate Violation Percentage Rate above the 10 ppm Standard in Vermont Wells

Five-Year Period	Percent of Wells above 10 ppm Standard
2001-2005	14
2002-2006	14
2003-2007	12
2004-2008	11
2005-2009	7
2006-2010	5

Source: VAAFM Soil Scientist, 2011

Conserving wetlands and lands along waterways are important methods for improving water quality. More than 32,000 acres have been conserved through various efforts in the Winooski basin, and many of these are helping buffer the water from production and grazing lands.

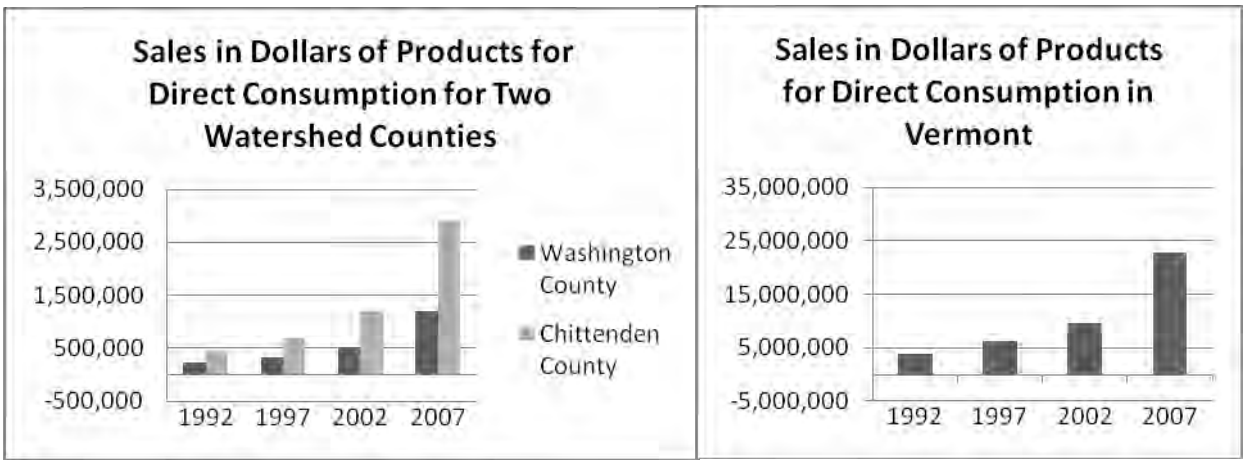
Efforts to Improve Economic Conditions

Many people and organizations have become increasingly aware of the importance of agriculture for the economy and future of the Winooski basin and Vermont. A wide range of initiatives has been undertaken to improve the success of agriculture in a small state. Meeting the challenges will not be easy, but a common vision has been emerging that embraces the many facets of the industry.

Overall, the public of the country recognizes that Vermont products come from one of the healthiest environments in the nation. A program to promote the state's agricultural products as a brand—the Agency of Agriculture's "Seal of Quality"--encouraged that recognition.

It is difficult for relatively small producers like the majority of agricultural operations in Vermont to compete on a volume basis with larger farms in the West and Midwest. Therefore the ability of farmers in the basin and state to differentiate their products and find niche markets is very important (Bolduc and Kessel, 2008). In 2007, the direct agricultural sales income per capita in Vermont, at over $35, exceeded all other states by at least 200 percent (USDA, NASS, 2009). As evidence of the success of farmers in Washington and Chittenden counties, their direct sales to Vermont consumers increased substantially in the 15-year period between 1992 and 2007 as shown in Figure 38.

Figure 38. Sales in Dollars of Products for Direct Consumption for Two Winooski Watershed Counties and Vermont, 1992-2007



Source: USDA, NASS, 1992-2007

While agriculture is identified as a critical economic sector throughout the Winooski watershed, the economic benefits of agriculture are not limited to direct sales. Regional plans developed for Chittenden County and Central Vermont recognize these benefits to include preservation of regional heritage, protection of natural resources from development, a draw for tourism, and instrumental in supporting a highly valued quality of life.

Many operations are making significant contributions to the tourism industry through farm-based recreation, referred to as agri-tourism. This includes activities such as hunting, fishing, horseback riding, roadside stands, farmer's markets, and pick-your-own enterprises (Brown and Reeder, 2007).

The rural working landscape has provided the foundation for a local, regional, and statewide food system. The Vermont Sustainable Agriculture Council acknowledged the need to support infrastructure for a statewide food system with multi-farm distribution, processing, and storage centers. For example, the Local Agricultural Community Exchange (LACE) in the City of Barre in the watershed developed an incubator kitchen facility where farmers can package and process foods on site.

The Council also advocated identifying ways of making local food available to all Vermonters while insuring a fair price to farmers (Vermont Sustainable Agriculture Council, 2009). The Vermont Foodbank Gleaning Program served as a model for harvesting unmarketable produce from local farms. Its Kingsbury Farm provides fresh produce to meal sites in the watershed's Mad River Valley. In partnership with Food Works at Two Rivers Center in Montpelier in the watershed, the Foodbank Farming Network purchased produce from a collection of growers and distributed it to partners who had purchased shares. Food Works also established Farm-to-Table, which is a year-round, pre-order program to deliver local produce to meal sites such as facilities for seniors, hospitals, and schools. The benefits of local agriculture are not limited to the supply of local food. The legislature established a Farm-to-Plate investment program in support of agricultural

economic development (Vermont Statutes 2009, VSA Title 10, Chapter 15a, and Vermont Sustainable Jobs Fund, 2010).

Initiatives have been started in the watershed to encourage those who would like to become farmers. In the watershed, the Intervale in Burlington started the New Entry Incubator Program and New Farms for New Americans. The Vermont New Farmer Network was started early in 2000 by the University of Vermont's Center for Sustainable Agriculture in the watershed in Burlington to get new farmers in touch with other producers. The Resource Guide for Vermont's New and Aspiring Farmers was written to provide guidance in addressing potential obstacles to farming such as access to land, capital, markets, and technical assistance (UVM Center for Sustainable Agriculture, 2004).

Education about the importance of food and farming to communities is an important goal of Food Works at the Two Rivers Center. Their Vermont Food Education Every Day (FEED) program produced Vermont Farm to School: A Guide for Connecting Farms to Schools and Communities in 2007. It is designed to help school-aged children make informed food choices, improve their diets, and recognize the role of local farms in communities (Vermont Food Education Every Day, 2010).

The Winooski basin is rich with organizations involved in creating a strong foundation for supporting local farms in Vermont. If these efforts are successful, the next generation will appreciate the importance of local farms and water quality and will continue supporting them. These actions will help ensure a brighter future for farmers and environmentally-friendly farming practices throughout the basin and the state.

WATERS OF CONCERN DUE TO AGRICULTURAL IMPACTS

Winooski Basin Waters Impaired Due to Agricultural Impacts

The 2008 State of Vermont 303(d) Part A identified one surface water body in need of a TMDL due in part to agricultural impacts.

VT08-02L01 Shelburne Pond

Note: Although Folsom Brook (VT08-20) is also listed, Vermont Department of Environmental Conservation (DEC) has since determined that there is no impairment due to agricultural use (Personal Communication with VT DEC staff, 2011).

Winooski Basin Waters in Need of Further Assessment to Determine if They are Being Impacted by Agriculture

The ***Draft*** 2010 State of Vermont 303(d) Part C identified the following two segments of surface waters in the Winooski watershed in need of further assessment--possibly in part due to agricultural impacts.

VT08-06 Graves Brook (mouth upstream to RM 0.3)
Possible Pollutant--Sediment

VT08-12 East Branch, Little River
Possible pollutants: Sediment, Nutrients, *E. Coli*

General Needs for Farm Practice Improvements

The Winooski agricultural community could benefit from additional practices including:

waste storage & treatment facilities
fencing along streams to exclude animals
alternative watering systems
stream crossings, walkways and access lanes
roof runoff management
silage leachate management
improved barnyards and heavy use area protection
milkhouse waste management
surface and subsurface water diversions
buffers for riparian areas and crop fields
streambank stabilization
stream channel stabilization
grade stabilization structures along the river channel
control of invasive species

RECOMMENDATIONS FOR IMPROVING AGRICULTURAL IMPACTS ON WATER QUALITY IN THE WINOOSKI BASIN

Many recommendations for gaining nonpoint source pollution improvements through the use of agricultural conservation practices in the Winooski watershed were developed from input by farmers, state and federal and non-profit conservation staff representatives working in the Winooski District (Basin 8). These recommendations are presented in this section and have been grouped into three general categories: Recommendations for Agricultural Structures; Land-Based Recommendations; and Recommendations in Support of Agricultural Infrastructure generally.

Producers and organizations throughout the basin were invited to attend four focus groups in March and April, 2010. Three focus groups were held and invitees included basin farmers, Vermont Vegetable & Berry Growers Association, Vermont Grass Farmers' Association, NOFA-VT, Vermont Farm Bureau, Northern Grain Growers Association, Vermont Horse Council, The Intervale Center, Foodworks at Two Rivers, and the Winooski Natural Resources Conservation District Supervisors for both Washington and Chittenden counties. Methods of contact included: invitations by telephone, email, and follow-up mailings; questionnaires tailored to different types of producers; newsletters and on-line publications such as Agriview and Under the Golden Dome; list serves and calendar listings; and presence at events to make personal invitations and hand out questionnaires, including the Vermont Farm Show; farmers markets in Montpelier, Waterbury, and Williston; town meetings of many watershed towns; National Agriculture Day at the State House; and the NOFA conference.

Some of the recommendations repeated comments received from farmers at a listening forum in 2005 to hear concerns about agriculture in Chittenden County (Chittenden County Regional Planning Commission, 2005). A few of the participants at that event were farmers from the Winooski basin. Similar comments were also received at public meetings held in 2007 and 2008 in conjunction with efforts to develop the Winooski Basin Water Quality Management Plan (Vermont DEC, 2008).

Review of and comments on the Recommendations section were made by the Farm Services Agency County Committee (for Chittenden County) and District Supervisors of the Winooski Natural Resources Conservation District for Washington and Chittenden counties at their January, 2011 meetings.

No formal ranking of importance of the recommendations was done by any of the groups. However, the conversations from each focus group led to a general sense of relative importance of the recommendations. Therefore, they are listed in order from those that were most enthusiastically endorsed by the groups to those that received less emphasis. No consideration was given to the length of time needed to accomplish the recommendations. Some recommendations may be accomplished in the short term, while implementing others will require efforts over longer periods of time. Furthermore, some recommendations have already been accomplished however it is noteworthy that those efforts have not reached the broader agricultural community and perhaps enhanced education and outreach is warranted.

Recommendations for Agricultural Structures: Management of Barnyards and High Use Areas

Increase implementation of Accepted Agricultural Practices (AAPs) and water quality Best Management Practices (BMPs)

Strategies

- Continue efforts to design and implement barnyard improvements and innovative bio-solid and waste management practices, alternative watering systems, riparian buffers and fencing, and keeping diversion ditches cleaned
- Find funding for alternative ways of moving waste, such as storing, pumping through a pipeline, and irrigating liquid waste and/or spraying or pumping it under a river instead of using roads
- Increase awareness and development of improved manure storage, including sizing of manure pits, and handling practices and wastewater treatment
- Provide field soil checks for the amounts and rate of application of waste on farm fields
- Increase funds available for programs like FAP that provide financial support for use of liquid manure injectors and/or use of aerators with liquid manure application
- Review the potential for temporary, short-term, no interest, operating loans for high cost practices
- Allow more flexibility in state/federal conservation programs so that purchasing equipment for manure management could be available through cost-share programs
- Identify and rank areas throughout the watershed in need of additional AAP and BMP practices
- Increase one-on-one technical assistance to farmers who don't wish to participate in federal/state assistance programs.
- With regard to manure spreading ban, use weather conditions to guide regulations rather than specific calendar dates, possibly guided through regional field checks by VAAFM staff and partners
- Hire additional staff to increase capacity to regulate the AAPs, including those for stream buffers, cover crops, and rotational grazing to reduce violations

Partners
VAAFM, NRCS, WNRCD, FSA, VANR, UVM Extension, NOFA-VT, Watershed groups, Farm operators

Funding
FSA, NRCS, VAAFM, UVM Extension, USFWS, VANR, TNC

Recommendations for Land-Based Activities: Management of Fields, Crops, Animals, and Streambanks

Increase awareness and use of farm soil health improvement practices

Strategies

- Provide more opportunities for financial support, including 100 percent cost share and graduated payments (based on timing of seeding) for practices that improve soil health and water quality
- Provide technical assistance for soil health improvement practices like cover cropping, crop rotation, composting, conservation tillage, and soil sampling techniques

- Offer field trips to demonstration areas and local workshops regarding how to use new equipment and techniques for soil testing, measuring compaction, using tillage implements, cover cropping, mulching and seeding
- Re-institute more single practice efforts across sub-watersheds including cover cropping (especially rye), soil aeration for corn fields, and fencing

Partners
WNRCD, NRCS, VAAFM, UVM Extension, NOFA-VT, Farm operators

Funding
USDA-NRCS, VAAFM, VANR, UVM Extension, NOFA-VT, Nonprofit watershed organizations

Make available opportunities to share high-cost tillage conservation equipment and practices

Strategies
- Offer financial and administrative support for district purchase or rental of smaller (6-8 feet) manure injectors, soil aerators, custom applicators, no-till zone seeders, compost turners, and field levelers (graders), and for replacement parts and repairs
- Support insurance for equipment maintenance
- Explore ways of sharing ownership of equipment used for farming with non-farmers—e.g., replicate the Addison County model set up by the RPC where town public works directly holds equipment, dealer applies a conservation practice, and support is provided by nonprofit watershed groups
- Provide an incentive for dealers to lease equipment to local farm operators
- Enable all farmers on the list for custom manure applicators to receive them in a timely manner so they have time to use them

Partners
VACD, WNRCD, VAAFM, FSA, NRCS, UVM Extension, NOFA-VT, VFB, Farm operators, FWR, Local dealers of custom applications

Funding
VAAFM, VANR, USDA-NRCS and RC&Ds

Involve the equine community in proactively adopting the Accepted Agricultural Practices (AAPs)

Strategies
- Contact equestrians through veterinarians, riding clubs, stable owners, hay suppliers, grain stores, out-of-state events, dressage events, those with indoor arenas, and the County 4-H clubs and Hippology champions to disseminate AAP info
- Locate equestrians who follow the AAPs and offer a stipend to those willing to host workshops or create and show a demonstration area, such as a structure for manure handling, rotational pasturing instead of turn-out areas, composting manure, roof run-off control
- Continue to offer workshops that present examples of good horse pasturing and help equestrians understand impacts of horses on water quality
- Make soil test kits readily available and provide assistance in how to collect samples and interpret tests
- Look for ways to partner with equestrians to improve their accountability to the AAPs

Partners

UVM Extension, Vermont Horse Council, 4-H clubs, VANR, WNRCD, VAAFM, USDA-NRCS

Funding
USFWS, VAAFM, VANR, NFWF

Continue to work with farmers to develop and implement Nutrient Management Plans (NMP)

Strategies

- Provide educational outreach that will review the economic benefits to farmers, in spite of the cost to them, of preparing and using the NMPs
- Increase technical assistance and funding to farms for developing and implementing NMPs, including those not served by federal cost share programs
- Evaluate the relative importance of each aspect of NMPs and consider removing or simplifying some of the requirements such as applying manure to distant field where a lot of equipment is needed to do this (tractor, spreader, and two trucks)
- Work with farmers through outreach and education regarding MFO and LFO regulations and how SFOs may be affected in the future
- Provide support for record-keeping and loans for equipment that allows for more efficient use of fertilizers to help improve water quality
- Work with farmers whose practices may be of concern for the watersheds of Shelburne Pond (2008 TMDL list), Bliss and North Montpelier ponds (from VT DEC documents), and for sections of Graves Brook and the East Branch of the Little River (draft 2010 303(d), Part C list of priority waters in need of further assessment).

Partners
VACD, VAAFM, WNRCD, NMP, NRCS, UVM Extension, NOFA-VT, VFB, Farm operators

Funding
VAAFM, VANR, NRCS, TU, NOFA-VT, UVM Extension

Provide more support for grazing and Small Farming Operations (SFOs)

Strategies

- Develop financial support programs to cover livestock operations with small animals and diverse operations
- Increase technical assistance to farmers for transitioning dairy herds to grazing systems
- Sponsor more pasture walks to demonstrate best practices by the Grass Farmers Association and farmer discussion groups, offering pay as an incentive for farmers to attend
- Increase information sharing for alternative pasturing and feeding methods such as having cows eat invasive plants along streams and using concrete pads where feeders can't be moved

Partners
Vermont Beef Producers Association, Vermont Grass Farmers Association, VAAFM, VANR, NRCS, TU, UVM Extension, Vermont Horse Council, Watershed organizations

Funding
USFWS, NRCS, TU

Increase establishment of buffers on agricultural lands along surface waterways and wetlands

Strategies

- Identify and rank streambank and shoreline areas that are at high risk for nitrate leaching, phosphorus loss, and soil erosion
- Seek voluntary exclusion of livestock and horses from streambank and shoreline areas and establish alternative water sources for them where feasible
- Increase technical and financial assistance to farmers and landowners willing to exclude animals from streambanks and shorelines, allow shrubs and trees to grow, and plant trees for buffers, such as through CREP and Trees for Streams
- Offer educational information and workshops about the need for buffers along field ditches and farm roads; the benefits of excluding animals from surface waters and wetlands; and how wetlands store water during flood conditions
- Improve enforcement of AAP regulations, particularly regarding the distance between surface waters and where manure is spread
- Offer workshops and visits to demonstration sites where farmers can learn that cropping to the edge of shorelines and streambanks increases their costs in the long run and that maintaining aesthetically pleasing, manicured buffers does not necessarily help water quality
- Some producers suggest that nutrient management be considered on a site-by-site basis to allow for more flexibility in buffer widths instead of the minimum 35-foot average
- Offer workshops about how management practices affect rivers including the effects of rip rap and removing gravel as well as using conservation easements and planting large shrub species with more flexible stems than trees

Partners
VAAFM, VACD, WNRCD, NMP, FSA, FWS, NRCS, VANR, UVM Extension, NOFA-VT, VFB, Farm operators

Funding
EPA, FWS, VAAFM, VANR, NFWF, TNC

Prevent agricultural pesticide movement to surface waters

Strategies

- Increase technical assistance and spot checking on pesticide use, safety, and alternatives and Integrated Pest Management (IPM) guidelines and training, including help with the cost of classes on using custom applicators
- Request that a manual about application procedures be developed for those who study to be certified

Partners
VAAFM, WNRCD, FSA, NRCS, VANR, UVM Extension, VFB, Farm operators

Funding
USFWS, VAAFM, VANR, NFWF, TNC

Provide additional local learning opportunities for farmers

Strategies

- Make stipends available to established farmers for mentoring new operators, along the lines of the Intervale program, including peer advisory groups for problem solving at as local a level as possible

- Distribute widely, hold workshops, and keep updated information about funding sources for conservation practices as part of support for farm business management outreach programs
- Provide information about invasive species and the potential for spreading them and methods for control/eradication when seeding and mulching farm roads and ditches
- Provide workshops or demonstrations to share results of studies done on test plots and comparisons between whole and split field trials
- Set up meetings for farmers and river scientists and with USDA staff for guidance and information about the latest scientific understanding of management practices that will improve water quality
- Provide information in a variety of formats such as peer-to-peer sharing, adding on a water quality component to other meetings, newsletters, list serves, twilight (5-7 pm) tours--as local as possible--on a theme, handouts, and a website—like a YouTube about local options for farmers
- Offer informational workshops about maximizing land productivity and how over-fertilizing and erosion are very costly and can have negative impacts on water quality
- Provide workshops or demonstrations to share innovative and emerging technologies

Partners
ARS, VACD, WNRCD, VAAFM, FSA, NRCS, UVM Extension, NOFA-VT, VFB, Farm operators

Funding
VAAFM, VANR

Infrastructure Recommendations: Actions in General Support of Agriculture in the Basin and Beyond

Increase funding opportunities for water quality Best Management Practices and more flexible and equitable distribution of funding

Strategies
- Encourage more flexibility with use of cost share funds so that different levels of compliance can be funded—not just the "Cadillac" version—so farmers don't feel they're being penalized (can't get funding) for doing the right thing
- Work toward one-stop shopping regarding applications for funding and programs, perhaps having more ARS district specialists as the liaison between farmers and all the agencies
- Allow stand-alone equine operations to qualify for EQIP funding by changing the eligibility requirement that's based on percentage of food and fiber produced
- Change the definition of farms so that production thresholds are based on the amount of phosphorus in the waste and not just the size of operations
- Increase cost share funding through NMPs, the FAP, and/or CIG aerators to help manage manure spreading in floodplain areas
- Work with the USDA to increase funding for conservation programs including EQIP, CRP, CREP and WHIP
- Work with VAAFM to increase funding for conservation programs including VABP, NMPIG, and FAPP
- Work with USFWS to increase funding for PFW to install alternative watering systems, riparian buffers and fencing

- Work with state, federal, and local organizations and legislators on statewide equitability, including adjusting the share of Clean and Clear funds available for projects outside St. Albans Bay, e.g. for an aerator

Partners
VACD, VFB, WNRCD, VAAFM, VANR, FSA, NRCS, RC&D, UVM Extension, NOFA-VT, Farm operators

Funding
VAAFM, VANR

Provide support for the agriculture industry in Vermont, emphasizing farm viability and profitability to ensure the adoption of sustainable practices

Strategies

- Increase funds for holistic agricultural business plans through NMPs, LTPs, and grazing plans so that carrying capacity can be calculated for new operations and demand on USDA-inspected slaughtering facilities becomes more manageable--to end the bottlenecks for preparing meat for markets
- Re-establish granges and other local support systems for the farming community
- Increase funding for agronomists and other TSP to work with farmers in a one-to-one capacity
- Provide funding to create advisors available to farmers to assist with applications for funding
- Provide increased funding for business management, marketing, and technical service providers to be available to all farmers including those who don't want federal assistance
- Support methods of stabilizing the farm economy such as dealing with milk pricing, establishing infrastructure for transport, storage, and processing of products, and getting local farm products to various markets
- Begin a program that develops standards and labels for goods produced in a water quality friendly manner at the point of sale to encourage conscientious consumption
- Subsidize and create partnerships with industry dealers and their representatives
- Provide insurance for small organic producers through national standards for potential losses, disasters, contamination by GMOs, etc.
- Create a system for labeling GMO crops, as many are sprayed with Roundup
- Create public policy with funding that supports agricultural processing infrastructure, not just support for production
- Continue support a local foods system, advertising about buying from local producers, and the Farm to Plate initiative

Partners
VACD, VAAFM, VANR, UVM Extension, Northern VT RC&D, USDA-NRCS, NOFA-VT, WNRCD, RPCs, VHCB, VFB, VFF, Farm operators, Conservation organizations

Funding
VAAFM, VHCB

Support tax programs and mechanisms to keep land in agriculture

Strategies

- Work with legislators, RPCs, and town selectboards to identify and protect agriculturally productive soils and prime farmland
- Work with towns to support zoning that encourages farms in residential areas
- Work with legislators to address tax programs affecting farmland

Partners
VACD, VAAFM, VANR, UVM Extension, NOFA-VT, VT League of Cities and Towns, WNRCD, VHCB, VFB, Farm operators

Funding
VAAFM, VHCB

Provide education about agriculture for recreationists, students, and the general public

Strategies
- Inform recreationists and the general public about impacts on crop productivity by glider landings, flower and corn picking, taking trees, ramps for ATVs, and cutting fences, for example, using signage and other methods
- Have the VAAFM and conservation groups advocate for farmers, explaining the financial crisis of the industry, how farms serve as floodways to slow water flow, their vulnerability to losing land, and the value of the working landscape
- Support use of Vermont agricultural curricula in local schools
- Support and replicate school local food programs
- Provide support for programs such as 4-H, FFA, agricultural trade schools, and Conservation Field Days

Partners
Foodworks, Local schools, Northern VT RC&D, WNRCD, VAAFM, NOFA-VT, VACD, UVM Extension, VFB, Conservation organizations

Funding
VAAFM, RC&D, UVM Extension

Conduct research to improve information about the farm industry

Strategies
- Set up a system for compiling agricultural statistics on a watershed basis
- Help farmers apply to the CIG and SARE programs for funding to subsidize trials of agricultural practices using test plots, whole farm trials, and split field trials

Partners
VACD, VAAFM, VANR, FSA, NRCS, NOFA-VT, WNRCD, Conservation organizations

Funding
VAAFM, VANR, USDA-NRCS

Help farmers who allow recreational use of their lands

Strategies

- Study the feasibility of adding public recreation as a category for the Use Value Appraisal Program for landowners who allow recreation on their land
- Encourage organizations to compensate landowners for use of their land by formal agreement as happens through trail use groups like VAST
- Develop a working agreement between farmers and conservation/recreation organizations, using models such as the agreement between the Mad River Path Association and a local farmer

Partners
VACD, VAAFM, VANR, NRCS, WNRCD, Northern VT RC&D, Conservation organizations

Funding
EPA, VAAFM, VANR, USDA-NRCS

COOPERATING PARTNERS

- **State**
  - University of Vermont, Extension
  - Vermont Agency of Agriculture Food & Markets - VAAFM
  - Vermont Agency of Natural Resources – VANR

- **Federal**
  - US Army Corps of Engineers - USACE
  - USDA Farm Service Agency - FSA
  - USDA Forest Service - FS
  - USDA National Agricultural Statistics Services - NASS
  - USDA Natural Resource Conservation Service – NRCS
  - USDA Resource Conservation and Development – RC&D
  - USDA Rural Development - RD
  - US Environmental Protection Agency - EPA
  - US Fish & Wildlife Service – FWS

- **Local**
  - Central Vermont Regional Planning Commission - CVRP
  - Chittenden County Regional Planning Commission - CCRPC
  - Green Mountain Power – GMP
  - Southern Vermont Nutrient Management Program (SVNMP)
  - Town Governments, Selectboards & Conservation Commissions
  - Vermont Association of Conservation Districts – VACD
  - Vermont Housing and Conservation Board – VHCB
  - Winooski Natural Resources Conservation District (WNRCD)

- **Other, including Regional**
  - Farm Operators
  - National Fish & Wildlife Foundation - NFWF
  - The Nature Conservancy, Vermont Chapter – TNC
  - Northeast Organic Farmers Alliance of Vermont – NOFA-VT
  - Northern VT RC&D
  - Vermont Farm Bureau – VFB
  - Vermont Land Trust – VLT

PROGRAMS THAT ADDRESS AGRICULTURAL ISSUES

Vermont Agency of Agriculture, Food & Markets Programs

Accepted Agricultural Practices (AAP)--the base level of management required for all farms in Vermont—are easy- to-implement, low-cost solutions for addressing water resource concerns. The AAPs were designed to reduce non-point pollutant discharges through implementation of improved farming techniques rather than investments in structures and equipment. State law requires that these practices must be technically feasible as well as cost effective for farmers to implement without governmental financial assistance.
www.vermontagriculture.com/ARMES/awq/AAP.html

Alternative Manure Management Program (AMM) provides funding to farmers interested in implementing new technologies dedicated to enhancing water quality and improving waste management. Projects funded through this program have included solid separation, nutrient removal, and waste treatment systems. Maximum cost share is limited to $100,000 through the AMM program. Total VAAFM payment is limited to 35% if the project is coupled with federal cost share.
www.vermontagriculture.com/documents/BMPApplication.pdf

Best Management Practices Program (BMP) provides cost share payments for installation of conservation practices to address water resource concerns. While farmers may realize an economic benefit from BMPs, it is unlikely that they will be affordable without governmental cost sharing. Commonly funded production area practices include waste storage facilities, silage leachate systems, milkhouse waste systems, and barnyard runoff collection. Production area practices are eligible for up to 90% cost share. Field practices, such as animal trails and walkways, are eligible for 50% cost share. If coupled with federal cost share, Agency cost share is limited to 35%. The yearly maximum payment for a single practice is $50,000 and $75,000 for two or more practices.
www.vermontagriculture.com/documents/BMPApplication.pdf

Conservation Reserve Enhancement Program (CREP) in partnership with the USDA, encourages the installation of conservation buffers along waterways by providing land owners with a yearly rental payment and by covering the cost of planting the buffer. Additionally, CREP covers the cost of installing fencing and livestock watering systems where animals on pasture are excluded from waterways. Contracts are either 15 or 30 years in length and payment is dependent upon past land use and whether the buffer is comprised of either trees and/or grasses. Minimum buffer widths are 25 feet for grass and 35 feet for tree buffers. Buffers cannot be harvested under this program. Payments can cover up to 100% of practice costs (for fencing, watering systems and plantings) and include a signup incentive and annual rental payments.
www.vermontagriculture.com/ARMES/CREPwebsite/Home/Home.htm

Farm Agronomic Practices Program (FAP) provides farms with state financial assistance for implementation of soil-based practices that improve soil quality, increase crop production, and reduce erosion and agricultural waste discharges at up to $5,000 per farm. FAPP will provide funding incentive for NMP update, implementation, and maintenance with the aim of improving outreach education on agricultural water quality impacts and regulations. Eligible practices are: Cover Cropping ($30/acre); Nurse Crops ($10/acre); Strip Cropping ($25/acre); Conservation Crop Rotation ($25/acre); Alternative Manure Incorporation ($25/acre); Cross-Slope Tillage ($10/acre); Conservation Tillage ($12/acre); and Educational and Instructional Activities (up to $1,000).
www.vermontagriculture.com/ARMES/awq/FAP.html

Large Farm Operations Program (LFO) is an individual permitting process for farms with more than 700 mature dairy cows, 1,000 beef cattle or cow/calf pairs, 1,000 youngstock or heifers, 500 horses, 55,000

turkeys, or 82,000 laying hens without liquid manure storage. Like the MFO program, the goal of this program is to provide large farms with a Vermont-based alternative to federal permitting while assisting those farms with maintaining economic viability. A LFO permit prohibits the discharge of wastes from a farm's production area to waters of the state and requires the farm to land apply manure, compost, and other wastes according to a nutrient management plan. Unlike the MFO Program, LFO permits are individual to each farm and also regulate odor, noise, traffic, insects, flies, and other pests.
www.vermontagriculture.com/ARMES/awq/LFO.html

Medium Farm Operations (MFO) All dairies with 200-699 mature animals, whether milking or dry, qualify as a MFO. Other common MFOs include beef operations (300-999 cattle or cow/calf pairs), horse operations (150-499 horses), turkey operations (16,500-54,999 turkeys), and egg facilities (25,000-81,999 laying hens without liquid manure handling system). The MFO program provides a cost-effective alternative to a potentially burdensome federal permitting program by allowing medium sized farms to seek coverage under a single Vermont state General Permit. The General Permit prohibits discharges of wastes from a farm's production area to waters of the state and requires manure, compost, and other wastes to be land applied according to a nutrient management plan.
www.vermontagriculture.com/ARMES/awq/MFO.html

Nutrient Management Incentive Grant Program (NMPIG) provides for development of a nutrient management plan (NMP) and three additional years of updates. The initial payment to develop NMP is $9 per acre, $15 per soil test, and $35 per waste storage facility test. Up to $5,000 is available for plan updates for following three years (not to exceed $14,000 total for NMPIG). Plans must meet state requirements for nutrient management, as explained in the General Permit for Medium Farm Operations, before receiving payment. Farms with NMP's that have completed the NMPIG or farms that developed their plans through alternate means can apply for annual update payments of $3 per acre (up to $1000). Funding is also available for Pre-sidedress Nitrate Tests ($8 per test).
www.vermontagriculture.com/ARMES/awq/NMPIG.html

Pesticide and Groundwater Monitoring Program (PMP) collects water samples from drinking water sources near agricultural lands to evaluate whether or not agricultural chemicals are reaching Vermont groundwater. The types of water supplies sampled by the PMP include: drilled, driven point or dug wells and springs, ponds or lakes used as drinking water supplies for human or livestock consumption and irrigation. The PMP tests wells in agricultural areas to help farmers learn about practices that prevent pesticide leaching and conserve the nutrients in fertilizers and manure in the soil. The water quality information provided by this program also helps farmers decide if tillage practices and crop rotations are working to reduce the amounts of nutrients and pesticides lost to groundwater or surface run-off. Sharing this information with farmers, agricultural dealers, landowners, conservation organizations and other departments of state government helps to improve agricultural practices, protect groundwater, raise public awareness and provide for clean drinking water and a healthy environment in Vermont.
www.vermontagriculture.com/ARMES/pidagchem.htm

Vermont Agricultural Buffer Program (VABP) offers a five-year maximum rental contract for the installation of conservation grassed buffers on cropland. Unlike the CREP program, VABP consists of planting harvestable grassed buffers. Areas in crop fields that are prone to erosion caused by flood events, which can be classified as flood chutes, are also eligible under this program to be planted into grass and harvested. Additional program details include that, No manure can be spread in the buffer area; Fertilizer can be used with soil test and nutrient recommendation; Payment of $123/ac to cover the establishment costs of new filter strips *in addition* to the annual incentive payments of $90 to $150 per acre per year; Forage in buffer can be harvested between June 1st and September 1st only; and Most buffers are 25 feet wide unless a water quality concern deems the need for a larger buffer
www.vermontagriculture.com/documents/VABP.pdf

Local Government Programs

Agricultural Resource Specialist Program (ARS) is offered by the Vermont Association of Conservation Districts (www.vacd.org) and is supported by funding from the VAAFM. Three main services are offered to farmers: AAP Assistance, AEM and well water testing:

> **Accepted Agricultural Practices** (AAP) **Assistance** offers farmers free technical assistance and information to help them meet the requirements of VAAFM's AAP regulations. The ARS works with farmers on developing strategies specific to the farm, accommodating seasonal changes and soil characteristics. If strategies involve implementation costs, the ARS provides information and referrals for State and Federal cost-share programs.
>
> **Agricultural Environmental Management** (AEM) is a statewide, voluntary program that assists farmers in environmental stewardship, protecting the quality of the farm natural resources as the foundation of the farmer's long-term economic viability. Assessments cover farmstead water supplies, nutrient management, pesticide use, and many other farm practices. Suggested actions are linked with technical resources for design and implementation and financial resources for cost-share opportunities.
>
> **Farm Well Water Testing** is a free drinking water protection service for farms. Water testing for farm wells provides information on bacteria, nitrates and common pesticide levels. If a water quality problem is found, ARS staff will assist the landowner in trying to determine the cause of the contamination and to find the best solution.

Land Treatment Planners (LTP) are available to assist farmers in developing land treatment plans, which provide detailed information on farm soil and water resources, recommendations for continued stewardship and compliance with state and federal regulations. Land treatment planning is the foundation of a nutrient management plan (NMP). Although LTP is not itself required for Vermont farms, it provides the core data needed to develop a NMP. A NMP, however, is required for all Medium and Large Farm Operations and is encouraged for Small Farm Operations (SFOs). This free program is provided to farmers through a partnership between the USDA NRCS, Conservation Districts, and VAAFM.
www.vermontagriculture.com/ARMES/awq/LTP.html

Southern Vermont Nutrient Management Program (SVNMP) is a joint project of the Ottauquechee, Poultney-Mettowee, Rutland, Bennington, White River and Windham Conservation Districts, started in 1999. Funding has come from the EPA, VAAFM, the Environmental Defense Fund, the Vermont Community Foundation, USDA NRCS and the Lake Champlain Basin Program. The purpose of the SVNMP program is to help agricultural producers address nutrient management needs with the help of on-farm consultant assistance. The program aims to improve management practices to increase farm sustainability while also working to improve local water quality. Employees work one-on-one with agricultural producers, as well as coordinate educational events in the SVNMP region. A key part of the outreach is to assist in implementation of USDA on-farm contracts.
www.pmnrcd.org/nutrient_management/svnmp.php

Winooski Natural Resources Conservation District (WNRCD) was created in 1940. The WNRCD supports agricultural operators through a variety of programs. In 2010 a Conservation Tillage Incentives Program (CTIP) was started to help implement conservation tillage practices by providing incentive payments beyond those offered by the Farm Agronomic Practices program. The WNRCD assists with cover cropping of winter rye and other technical agricultural support programs, and offers programs for the public in conservation and education. The district supplies other conservation items including tree seedlings and maintains a listing of contractors.
www.vacd.org

Federal Government Programs

Agricultural Management Assistance (AMA) program assists agricultural producers to manage risk and voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation practices into their farming operations. Producers may construct or improve water management or irrigation structures; plant trees for windbreaks or to improve water quality; and mitigate risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming. An AMA plan of operations, developed with NRCS, is required. Participants are expected to maintain cost-shared practices for the life of the practice. Contracts are for 1-10 years. Applicants must own or control the land and comply with adjusted gross income limitation provisions. Eligible land includes cropland, rangeland, grassland, pastureland, non-industrial forestland, and other private land that produces crops or livestock where risk may be mitigated through operation diversification or change in resource conservation practices. Total payments shall not exceed $50,000 per year.
www.nrcs.usda.gov/programs/ama

Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners. Through CRP, you can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers on eligible farmland. Participants enroll in CRP contracts for 10 to 15 years. CRP protects millions of acres of American topsoil from erosion and is designed to safeguard the Nation's natural resources. By reducing water runoff and sedimentation, CRP protects groundwater and helps improve the condition of lakes, rivers, ponds, and streams. Acreage enrolled in the CRP is planted to resource-conserving vegetative covers, making the program a major contributor to increased wildlife populations in many parts of the country. Eligible producers must have owned or operated the land for at least 12 months prior. Eligible land must be either cropland that is planted to an agricultural commodity 4 of the previous 6 crop years or pastureland that is suitable for use as a riparian buffer or for similar water quality purposes. Payments include; Annual Rental Payments for establishing long-term, resource-conserving covers; Maintenance Incentive Payments for certain practices; and Cost-share Assistance at up to 50% of participants' costs in establishing approved practices.
www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp

Conservation Stewardship Program (CSP) is a voluntary program that encourages agricultural and forestry producers to address resource concerns by (1) undertaking additional conservation activities and (2) improving and maintaining existing conservation systems. CSP provides financial and technical assistance to help land stewards conserve and enhance soil, water, air, and related natural resources on their land. CSP is available to all producers, regardless of operation size or crops produced. Eligible lands include cropland, grassland, prairie land, improved pastureland, rangeland, nonindustrial private forest land, and agricultural land under the jurisdiction of an Indian tribe. CSP pays participants for conservation performance—the higher the performance, the higher the payment. An annual payment is available for installing new conservation activities and maintaining existing practices. A supplemental payment is available to participants who also adopt a resource conserving crop rotation. NRCS makes payments for activities installed and maintained in the previous year. Contracts may not exceed $40,000 in any year or $200,000 in any five-years.
www.nrcs.usda.gov/programs/new_csp/csp.html

Environmental Quality Incentives Program (EQIP) is a voluntary conservation program that provides financial and technical assistance to farmers and ranchers who face threats to soil, water, air, and related natural resources on their land. NRCS develops contracts with agricultural producers to implement conservation practices to address environmental natural resource problems. Payments are made to producers once conservation practices are completed according to NRCS requirements. Persons engaged in livestock or agricultural production and owners of non-industrial private forestland are eligible for the program. Eligible land includes cropland, rangeland, pastureland, private non-industrial forestland, and other

farm or ranch lands. An EQIP plan of operations, developed with NRCS, is required. NRCS provides conservation practice payments to landowners under these contracts that can be up to 10 years in duration. Program payments are limited to a person or entity to $300,000 during any 6-year period.
www.nrcs.usda.gov/programs/eqip/

Farm and Ranch Lands Protection Program (FRPP) is a voluntary program that helps farmers and ranchers keep their land in agriculture. The program provides matching funds to State, Tribal, or local governments and non-governmental organizations with existing farm and ranch land protection programs to purchase conservation easements. From 1996 through 2007, FRPP has enrolled over 533,000 acres in cooperation with more than 400 entities in 49 States. The program allows for long term agreements with cooperating entities. Such agreements may be 3-5 years in duration. The share of the easement cost must not exceed 50% of the appraised fair market value of the conservation easement. As part of its share of the cost of purchasing a conservation easement, a state, tribal, or local government or nongovernmental organization may include a charitable donation by the landowner of up to 25% of the appraised fair market value of the conservation easement. As a minimum, a cooperating entity must provide, in cash, 25% of the appraised fair market value or 50% of the purchase price of the conservation easement.
www.nrcs.usda.gov/programs/frpp/

Grassland Reserve Program (GRP) is a voluntary program for landowners and operators to protect grazing uses and related conservation values by conserving grassland, including rangeland, pastureland, shrubland, and certain other lands. The program emphasizes support for working grazing operations; enhancement of plant and animal biodiversity; and protection of grassland and land containing shrubs and forbs under threat of conversion. Eligible land includes privately owned or Tribal grasslands; land that contains forbs for which grazing is the predominant use; or land that is located in an area that historically has been dominated by grassland, forbs, or shrubland that has the potential to serve as wildlife habitat of significant ecological value. GRP rental contracts and easements prohibit crop production other than hay. A grazing management plan is required. GRP enrollment options include: Rental Contracts of 10-20 years, Permanent Easements or Restoration Agreements. USDA can also enter into cooperative agreements with entities to enable them to acquire easements.
www.nrcs.usda.gov/programs/GRP/

Partners for Fish and Wildlife Habitat Restoration Program (PFW) was established in 1987 for on-the-ground wetland restoration projects on private lands. At the heart of the Service's mission are the conservation and management of the Federal Trust Species: migratory birds; threatened and endangered species; inter-jurisdictional fish; certain marine mammals; and species of international concern. The Partners Program provides technical and financial assistance to private landowners and Tribes who are willing to work with us and other partners on a voluntary basis to help meet the habitat needs of our Federal Trust Species. The Partners Program can assist with projects in all habitat types which conserve or restore native vegetation, hydrology, and soils associated with imperiled ecosystems such as longleaf pine, bottomland hardwoods, tropical forests, native prairies, marshes, rivers and streams, or otherwise provide an important habitat requisite for a rare, declining or protected species. Locally-based field biologists work one-on-one with private landowners and other partners to plan, implement, and monitor their projects. Partners Program field staff help landowners find other sources of funding and help them through the permitting process, as necessary.
www.fws.gov/partners/

Rural Energy for America Program (REAP) Grants and Loan Guarantee funding are available from USDA Rural Development's REAP to assist agricultural producers and rural small businesses with costs for the purchase and installation of renewable energy systems and energy efficiency improvements. Solar, wind, biomass, geothermal, and efficiency projects are eligible. The grants are awarded on a competitive basis and can be up to 25% of total eligible project costs. Grants are limited to $500,000 for renewable energy systems and $250,000 for energy efficiency improvements. Grant requests as low as $2,500 for renewable energy systems and $1,500 for energy efficiency improvements will be considered.

www.rurdev.usda.gov/rbs/busp/9006grant.htm

Socially Disadvantaged, Limited Resource and Beginning Farmers/Ranchers (SLB) program addresses the unique circumstances and concerns of socially disadvantaged, limited resource, and beginning farmers and ranchers. It offers voluntary participation, incentives, and applies equity in USDA programs and services. It also provides up to 90% of costs associated with conservation planning and implementation for socially disadvantaged and beginning farmers or ranchers. Up to 30% of such payments may be provided in advance for purchasing materials or contracting. A socially disadvantaged group is defined as a group whose members have been subject to racial or ethnic prejudice because of their identity as members of a group, without regard to their individual qualities. Beginning Farmer or Ranchers must have operated a farm or ranch for less than 10 consecutive years. Farmer must have direct or indirect gross farm sales less than current indexed value in each of previous 2 years and have a total household income at or below national poverty level for a family of 4, or less than 50% of county's median household income in each of the previous 2 years.
www.nrcs.usda.gov/programs/SLB_Farmer/

Value-Added Producer Grant (VAPG) may be used for planning activities and for working capital for marketing value-added agricultural products and for farm-based renewable energy. Eligible applicants are independent producers, farmer and rancher cooperatives, agricultural producer groups, and majority-controlled producer-based business ventures. Grant funds for feasibility analysis and economic planning activities for projects where energy generated on-farm comes from agricultural commodities is also available. Awards may be made for planning activities or for working capital expenses, but not for both. The maximum grant amount for a planning grant is $100,000 and the maximum grant amount for a working capital grant is $300,000.
www.rurdev.usda.gov/rbs/coops/vadg.htmm

Watershed and River Basin Planning and Installation - Public Law 83-566 (PL566) Technical and financial assistance is provided in cooperation with local sponsoring organizations, state, and other public agencies to voluntarily plan and install watershed-based projects on private lands. The purposes of watershed projects include watershed protection, flood prevention, water quality improvements, soil erosion reduction, rural, municipal and industrial water supply, irrigation management, sedimentation control, fish and wildlife habitat enhancement and create/restore wetlands and wetland functions. Technical and financial assistance can be provided for installation of works of improvement specified in the plans. Project sponsors get assistance in installing land treatment measures when plans are approved. Technical assistance is furnished to landowners and operators to accelerated planning and application of needed conservation on their individual units.
www.nrcs.usda.gov/programs/watershed

Wetlands Reserve Program (WRP) is a voluntary program that provides technical and financial assistance to private landowners and Tribes to restore, protect, and enhance wetlands in exchange for retiring eligible land from agriculture. Over 1.9 million acres are currently enrolled in WRP. Wetlands provide habitat for fish and wildlife, including threatened and endangered species; improve water quality by filtering sediments and chemicals; reduce flooding; recharge groundwater; protect biological diversity; and provide opportunities for educational, scientific, and limited recreational activities. Permanent Easements are paid at 100 % of the easement value and up to 100 % of the restoration costs. Thirty-Year Easements are paid at up to 75 % of the easement value and up to 75 % of the restoration costs. For both permanent and 30-year easements, USDA pays all costs associated with recording the easement in the local land records office, including recording fees, charges for abstracts, survey and appraisal fees, and title insurance. Restoration Cost-Share Agreements are established to restore or enhance the wetland functions and values without placing an easement on the enrolled acres. USDA pays up to 75% of the restoration costs with payments not to exceed $50,000 per year.
www.nrcs.usda.gov/programs/wrp/

Wildlife Habitat Incentive Program (WHIP) is a voluntary program for developing or improving high quality habitat that supports fish and wildlife populations of National, State, Tribal, and local significance. WHIP provides technical and financial assistance to landowners for the development of upland, wetland, aquatic, and other types of wildlife habitat. Land eligible for WHIP includes: Private agricultural land

including cropland, grassland, rangeland, pasture, and other determined by NRCS to be suitable for fish and wildlife habitat development; Non-industrial private forest land including rural land that has existing tree cover or is suitable for growing trees; and Tribal land. Cost-share agreements for practices are 1-10 years. NRCS will reimburse up to 75% of the cost to install practices for priority fish and wildlife habitat. Participants are expected to maintain the cost-shared practices for their anticipated life spans. For contracts with long-term cost-share agreements (15 years or longer), NRCS can pay up to 90% of the cost.
www.nrcs.usda.gov/programs/whip/

Additional Programs

Barn Preservation Grants Program (BPGP) The Division for Historic Preservation offers grants to repair and preserve historic agricultural buildings. The grant program is open to all owners of historic agricultural buildings eligible for the National Register of Historic Places in Vermont. Funds will be awarded for a variety of projects such as foundation, framing, and/or roofing repair.
www.historicvermont.org/financial/barn.html

Clean Energy Development Fund (CEDF) is a loan program available to fund a wide variety of clean and/or renewable energy projects. Eligible technologies include, but are not limited to: solar photovoltaic (PV); wind energy; farm, landfill, and sewer methane recovery; combined heat & power (CHP) systems; solar thermal, biomass thermal and geothermal generation systems; small hydroelectric systems; thermal energy efficiency; and emerging energy-efficient technologies. Eligible projects must be over 15 kW in AC rated capacity; over 1 million Btu per day for solar thermal or per hour for combustion ; or over 15 tons of capacity (geothermal). Loans cover up to 90% of project cost, require at least 10% to be financed with equity and a maximum award of $750,000 per project.
publicservice.vermont.gov/energy/ee_cleanenergyfund.html

Farm and Residential Heating Oil Tank Removal Grants (FRHOTR) The Petroleum Cleanup Fund (PCF) offers grants to residential tank owners towards the removal, replacement, or upgrade of underground storage tanks (USTs) used to heat a residence located in Vermont. The PCF also offers grants to such tank owners towards the removal, replacement, or upgrade of aboveground storage tanks (ASTs). The Department of Environmental Conservation may grant up to $2000 per household.
www.anr.state.vt.us/dec/wastediv/ust/ustgrantapplication.htm

Farmland Access Program (FAP) goal is to provide farmers with opportunities to purchase or lease affordable farmland so that they can start up or expand agricultural businesses. Supporting local communities, local food production, and the long-term productive use of farmland are all objectives of this program. Gaining access to high quality, affordable farmland is one of the most difficult obstacles for beginning farmers and expanding agricultural operations. The challenge is especially acute for enterprises that depend on being near Vermont's economic growth centers—areas where land values remain strong even in the current economic climate. Minimum qualifications require candidates to have 3 years of commercial farming experience, strong agricultural references, plans to develop an agricultural enterprise that would gross $100,000 per year within 5 years of start up, and sufficient financial resources (or ability to be financed) for start-up expenses. Our focus is on farms producing food and fiber that would use at least 25 acres of land.
www.vlt.org/initiatives

Farmland Preservation Program (FPP) is focused on retaining the state's quality agricultural land base in strong farming regions of the state. The purchase of conservation easements on farmland preserves Vermont's working landscape--the open farm fields, woodlands and farmsteads that comprise the third largest sector in the state's economy and draw visitors that make tourism the largest sector. Because of VHCB's investment in conservation easements, some of Vermont's most productive farmland will remain undeveloped and the best soils will remain available for farming in the future. Selling conservation easements

enables a landowner to keep land in agricultural use and be compensated for potential development value of the land, recognizing the asset value of the land. The landowner retains title and agrees to terms of a conservation easement limiting future ability to subdivide and develop the land.
www.vhcb.org/conservation.html

Food Works at Two Rivers Center was founded in Montpelier in 1987 to address the root causes of childhood hunger by returning students and their communities back to the land through hands-on food and gardening educational opportunities. Today, Food Works has emerged as central Vermont's hands-on food and agricultural education center working to strengthen local food systems and empower children, families, and seniors to grow, prepare, eat and preserve their own foods.
www.foodworksvermont.org

(The) Intervale Center has been dedicated to preserving agricultural resources in Vermont by helping farmers bring their products to market, build and sustain their businesses, and maintain Vermont's working landscape since 1988. The center promotes land use that protects Vermont's water quality; sustains Burlington's treasured Intervale; and shares innovative work and knowledge with communities around the world. The center has helped to build a community food system that honors producers, values good food, and enhances the quality of life.
www.intervale.org/

Mad River Valley Localvore Project was founded in 2006 to celebrate and support local food—those who eat it and those who grow it—through education, community connections, and collective wisdom. The organization offers many educational programs, a blog and website, and many networking opportunities and sponsors gatherings for people to learn about locally grown food and the slow food movement.
www.vermontlocalvore.org

Microloan Fund for New England Farmers (MFNEF) addresses the difficulty that some farmers have in obtaining credit for projects that improve their operations and increase income, as well as for emergency needs. The founding organizations are Strolling of the Heifers and The Carrot Project. Applications are limited to farms in VT/MA, with a primary focus on loans to small- and mid-sized farms that use sustainable or organic methods and are marketing at least a portion of their products to local markets. Eligibility is limited to farms with 250 or fewer acres in active production, and annual gross revenue of $250,000 or less. Loans are up to $10,000, with terms of 1-5 years. Acceptable purposes for loans are: capital investments and expenses that help improve efficiency or quality, or expand production and sales; repairs necessary to maintain farm operations; short-term operating needs such as inventory, supplies, or labor; and emergency funds to deal with business interruptions due to fire, natural disasters, or other unforeseeable events.
www.strollingoftheheifers.org/

National Fish and Wildlife Foundation (NFWF) conserves healthy populations of fish, wildlife and plants, on land and in the sea, through partnerships, sustainable solutions, and better education. The Foundation meets these goals by awarding challenge grants to projects benefiting conservation education, habitat protection and restoration, and natural resource management. Federal and private funds contributed to the Foundation are awarded as challenge grants to on-the-ground conservation projects. Challenge grants require that funds awarded are matched with non-federal contributions, maximizing the total investment delivered to conservation projects.
www.nfwf.org/programs.cfm

Northern Vermont Resource Conservation and Development (RC&D) Council was started in 1964 to promote wise use and development of natural resources to improve the local economy and people's standard of living. It is a nonprofit, nonpartisan organization comprised of a network of people dedicated to helping local citizens meet their needs.
http://www.vt.nrcs.usda.gov/rc&d/NoVT/index.html

Richmond Land Trust was founded in 1987 to preserve the rural character and quality of life in Richmond, Vermont, and its surrounding communities through land conservation, historic preservation, land stewardship, and community service and education. Voluntary agreements with landowners are used to protect agricultural lands, forests, scenic vistas, recreational areas, wildlife habitat, historic sites and watersheds. These agreements are individually tailored to meet the family and financial objectives of each landowner.
www.richmondlandtrust.org

Stowe Land Trust was founded in 1987 to conserve scenic, recreational, and productive farm and forest lands for the benefit of the greater Stowe community. SLT has protected over 3200 acres of critical habitat, wild and productive lands, and unsurpassable recreational resources—28 completed projects, five of which are owned and managed by Stowe Land Trust.
www.stowelandtrust.org

The Nature Conservancy (TNC)--Conservation Easements (CE) Land ownership carries with it a bundle of rights—to occupy, lease, sell, develop, construct buildings, farm, restrict access or harvest timber, among others. A landowner can give up one or more right for a purpose such as conservation while retaining ownership of the remainder. Private property subject to a conservation easement remains in private ownership. Many types of private land use, such as farming, can continue under terms of a conservation easement, and owners can continue to live on the property. The agreement may require landowner to take certain actions to protect land and water resources, such as fencing a stream to keep livestock out or harvesting trees in certain way; or to refrain from certain actions, such as developing or subdividing land. Conservation easements do not mean properties are automatically opened up to public access unless so specified in an easement. The terms of a conservation easement are set jointly by landowner and the entity that will hold easement.
www.nature.org/aboutus/howwework/conservationmethods/privatelands/conservationeasements/

Small Scale Renewable Energy Incentive Program (SSREIP) was developed to accelerate and increase market demand for high-quality solar, small wind and micro-hydro systems. Commercial and Industrial program incentives are capped at 59.9 kW solar electric; 1000 kBtu/day solar hot water; 1 turbine up to 59.9kW Wind; or $8750 micro-hydro. Electric, wind and micro-hydro systems must be grid connected. Hot water systems must have an output of at least 15 kBtu/day. Commercial and Industrial customers have a two-year maximum customer incentive amount of $110,000. Customers that have received incentives through this program previously may apply for an additional incentive up to the maximum for their customer category.
www.rerc-vt.org/incentives/

Sustainable Agriculture Research & Education Grants (SARE) through the Northeast Sustainable Agriculture Research & Education Network are offered to farmers, researchers and others in the agricultural community who are working on innovative and interesting approaches to sustainable agriculture. Farmer grants are offered at up to $15,000. Farmer Grants are for commercial producers who have an innovative idea to test using a field trial, on-farm demonstration, or other technique. A technical advisor--often extension agent, crop consultant, or other service professional--is required as a project participant. Projects should seek results other farmers can use, and all projects must have the potential to add to our knowledge about effective sustainable practices.
www.*nesare.org/get/farmers/*

Technical Assistance Programs (TAP) through Northeast Organic Farming Association are free to farmers - made possible by grants from the VHCB's VFP and VAAFM. *Vegetable and Fruit Technical Assistance* provides technical assistance to organic farmers in Vermont seeking production and financial assistance on small fruit and vegetable operations. *Dairy and Livestock Technical Assistance* provides Information, Services and Support for Vermont's Organic Dairy & Livestock Community.
www.nofavt.org/programs

Use Value Appraisal Program (UVA) was created in the 1970's as a companion to legislation that required towns to list property at 100% of fair market value. Because of escalating land values, these property taxes were placing a heavy burden on owners of productive farm and forestlands. The UVA offers landowners use value property taxation based on productive value of land rather than traditional "highest and best" use of the land for parcels of at least 25 contiguous acres. Use value of qualifying forest land is assessed at up to $122/acre and agricultural land at $215, far less than the fair market value. The UVA includes a Land Use Change Tax as a disincentive to develop land. The tax is 20% of fair market value of a property, or, in case of the sale of part of a property, a pro rata share of the fair market value of the entire property. The program is administered by the Vermont Department of Taxes.
www.vtfpr.org/resource/for_forres_useapp.cfm

Vermont Farm Viability Enhancement Program (FVP) offers business planning and technical assistance services to Vermont farmers as part of a statewide effort to improve the economic viability of Vermont agriculture. The program is funded by the VHCB, VAAFM and NRCS. Farmers enrolled work with a farm business planner provided through cooperating organizations, or directly with an individual consultant. The planning process involves the farmer in an assessment of farm operation's strengths and weaknesses and in exploration of management changes that could increase profitability. Examples include consultations on keeping better production or financial records, financial benchmark analysis, meetings with crop or animal health specialists, new farm enterprise analysis, estate and farm transfer planning, labor management, and value-added processing. Farmers who have completed plans with the program are eligible for grants for capital expenses or additional technical support in implementing the business plan.
www.vhcb.org/viability.html

Vermont Farm Women's Fund (VFWF) mission is to sustain and assist women pursuing a secure farming future with innovative agricultural businesses and stewardship of the land. The Farm Business Development Fund is provides funds for education and travel related to helping recipients improve some aspect of the business. The fund will pay 75% of cost (up to $750) of travel, registration, lodging and other costs of attending business classes, conferences, workshops, trainings or other professional development opportunities. The Leadership Development Fund is provided to ensure that women have the skills, access and opportunity to become leaders in agricultural policy development. Funds help defray costs of tuition for leadership training, travel expenses, and/or related costs associated with participation in agricultural policy work that addresses barriers encountered by women in agriculture.
www.uvm.edu/wagn

Vermont Foodbank. In 2009 the Vermont Foodbank made substantial progress toward increasing the amount of locally sourced produce available in its system. Significant steps taken include the incorporation of a statewide farm gleaning operation and the purchase of the Kingsbury Farm, from which the Foodbank is able to produce its own crops and manage the harvest distribution.
www.vtfoodbank.org

Vermont Land Trust. Since 1977, VLT has permanently conserved more than 1,650 parcels of land covering more than 500,000 acres, including more than 700 working farms. Chittenden County, among other Vermont counties, contains more than 100,000 acres of soils rated as prime and statewide-significant, and less than 20 percent of this soil is protected. These precious and highly productive soils are the lifeblood of Vermont's agricultural economy. Conserving this land is crucial to maintaining Vermont's food security, rural landscape, and farming heritage. If this land is developed, or used for purposes other than agriculture, the productive value of these soils will be lost forever. Only through conservation will there be assurance that the best soils are available for Vermont's farmers. See Farmland Access Program above.
www.vlt.org

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ACRONYMS

AAP Accepted Agricultural Practices
ACOE U.S. Army Corps of Engineers
AEM VAAFM Agricultural Environmental Management Programs
AMA USDA Agricultural Management Assistance Program
AMM VAAFM Alternative Manure Management Program
AMP VANR Acceptable Management Practices
ANR Vermont Agency of Natural Resources
ARS VACD Agricultural Resource Specialist

BMP Best Management Practices
BPGP Vermont Barn Preservation Grants Program
C&C VANR Clean & Clear Watershed Planning Grants
CC Vermont Conservation Commissions
CCPI USDA Cooperative Conservation Partnership Initiative
CEDF Vermont Clean Energy Development Fund
CREP Conservation Reserve Enhancement Program
CRP USDA-FSA Conservation Reserve Program
CSP USDA Conservation Stewardship Program
CVPS Central Vermont Public Service

DEC Vermont Department of Environmental Conservation

EPA U.S. Environmental Protection Agency
EQIP USDA Environmental Quality Incentives Program

FAP VAAFM Farm Agronomic Practices Program
FEH Fluvial Erosion Hazard
FEMA U.S. Federal Emergency Management Agency
FERC U.S. Federal Energy Regulatory Commission
FPP VHCB Farmland Preservation Program
FPR Vermont Department of Forests, Parks & Recreation
FRHOTR VANR Farm & Residential Heating Oil Tank Removal Grants
FRPP USDA Farm & Ranchland Protection Program
FS USDA Forest Service
FSA USDA Farm Services Agency
FVP Vermont Farm Viability Enhancement Program
FWS USDI Fish and Wildlife Service
FWWT VACD Farm Well Water Testing Program

GMP Green Mountain Power Corporation
GRP USDA Grassland Reserve Program

HFRP USDA Healthy Forests Reserve Program

LCBP Lake Champlain Basin Program
LCC Lake Champlain Committee
LCRA Lake Champlain Restoration Association
LEAP Logger Education to Advance Professionalism
LFO VAAFM Large Farm Operation
LID Low Impact Development

LLV UVM Extension Land Link Vermont
LTP VACD Land Treatment Planner

MFNEF Microloan Fund for New England Farmers
MFO VAAFM Medium Farm Operation

NASS USDA National Agricultural Statistics Service
NFIP National Flood Insurance Program
NFWF National Fish and Wildlife Foundation
NMP Nutrient Management Plan
NMPIG VAAFM NMP Incentive Grant Program
NOFA-VT Northeast Organic Farming Association of Vermont
NPS Non-Point Source (pollution)
NRCC Vermont Natural Resource Conservation Council
NRCS USDA Natural Resource Conservation Service

ORW Outstanding Resource Water

PFW USDI Partners for Fish & Wildlife Habitat Program
PL-566 USDA Public Law 83-566
PMP VAAFM Pesticide & Groundwater Monitoring Program

RC&D USDA Resource Conservation & Development Centers
RD USDA Rural Development
REAP USDA Rural Energy for America Program

SARE Sustainable Agriculture Research & Education
SFO VAAFM Small Farm Operation
SWSI Vermont Small Wind & Solar Incentive Program

TAP Technical Assistance Programs
TMDL Total Maximum Daily Load
TNC The Nature Conservancy-Vermont Chapter

USDA U.S. Department of Agriculture
USDI U.S. Department of Interior
USGS USDI U.S. Geological Survey
UVA Vermont Use Value Appraisal Program
UVM University of Vermont
UVM-Ext. UVM Cooperative Extension Service

VAAFM Vermont Agency of Agriculture, Food & Markets
VABP VAAFM Agricultural Buffer Program
VACC Vermont Agricultural Credit Corporation
VACD Vermont Association of Conservation Districts
VANR Vermont Agency of Natural Resources
VAOT Vermont Agency of Transportation
VAPG USDA Value-Added Producer Grant
VDFW Vermont Department of Fish & Wildlife
VDHCA Vermont Department of Housing & Community Affairs
VDOH Vermont Department of Health
VFB Vermont Farm Bureau
VFWF Vermont Farm Women's Fund

VHCB Vermont Housing & Conservation Board
VLCT Vermont League of Cities and Towns
VLT Vermont Land Trust
VRC Vermont River Conservancy
VYCC Vermont Youth Conservation Corps

WHIP USDA Wildlife Habitat Incentive Program
WMA VDFW Wildlife Management Area
WQS VANR Water Quality Standards
WRP USDA Wetlands Reserve Program

319 U.S. EPA Section 319 NPS Grant

SAMPLE QUESTIONNAIRE FOR FARMER AND PRODUCER INPUT

Farmer Input Wanted for the Winooski Basin Plan, Spring 2010

A management plan is underway for the Winooski River basin to improve and protect water quality and associated resources. Agricultural resources are important to the basin, and producers are invited to share their concerns and ideas for improvements. The following questions are designed to prompt you to offer your perspectives as to what is working and not working with farm programs and cost-share opportunities, especially in these tough economic times. Please continue comments on reverse side if needed or make contact per information below. ***Thank you!***

1. What type of producer are you and where is your location in the watershed?

2. Are there any agricultural practices that make a difference to water quality—positive or negative?

3. What methods to manage your land for protecting water quality have you used or are you still using? Examples include waste management, nutrient/pesticide application and storage, buffers, composting, cover cropping, setbacks from streams.

4. Please describe any challenges you encountered and how you succeeded in using those methods, including any support received from federal, state, or local partners such as NRCS, DEC, Agency of Agriculture, and NRCDs.

5. What other practices would you like to learn about or use to continue efforts to protect water quality?

6. What suggestions can you share that would make it easier to learn or use such practices?

7. Please describe other concerns and share suggestions that could help other agricultural producers, the Vermont Agency of Agriculture, and federal agencies in these efforts.

8. Give your contact information here if you would like to attend focus groups or receive a copy of the final agricultural section of the basin plan.

Learn about the Winooski Basin planning process:
http://www.anr.state.vt.us/dec/waterq/planning/htm/pl_winooskibasin.htm

APPENDIX H –VERMONT ANTI-DEGRADATION IMPLEMENTATION (4/2/08 DRAFT)

EXISTING USE DETERMINATION FOR USE DURING RIVER BASIN PLANNING

It is the policy of the State of Vermont to protect and enhance the quality, character and usefulness of its surface waters, prevent the degradation of high quality waters, and prevent, abate or control all activities harmful to water quality. Further, Vermont's Anti-Degradation Policy requires that the existing uses and the level of water quality necessary to protect those existing uses shall be protected and maintained (Section 1-03, Vermont Water Quality Standards). Determinations on the presence of an existing use can be made during basin planning or on a case-by-case basis such as during consideration of a permit application.[2] The Agency of Natural Resources will use the following process to identify existing uses of contact recreation, fishing, boating and public drinking surface water supplies during river basin planning and the development of river basin water quality management plans.

1. The Agency will presume that all lakes and ponds that exist within a river basin have existing uses of fishing, contact recreation and boating. This simplifying assumption is being used for two principal reasons: first, the well known and extensive use of these types of waters for these activities based upon their intrinsic qualities; and, secondly, to avoid the tedium associated with the production and presentation of exhaustive lists of all of these types of waterbodies across any given river basin. This presumption may be rebutted on a case-by-case basis during the Agency's consideration of a permit application which might be deemed to affect these types of uses.

2. Each river basin plan will include a list of existing uses of contact recreation, fishing, boating in/on flowing waters and a list of public drinking surface water supplies, which will be identified using the criteria set forth below.

3. To determine the presence of an existing use of contact recreation, fishing or boating on/in flowing waters or a public drinking water supply during the river basin planning process, positive findings with respect to several conditions need to be made. The unique set of criteria for each particular existing use is set forth below.

4. The list of existing uses in each river basin plan is not intended to represent an exhaustive list of all existing uses, but merely an identification of very well known existing uses. Additional existing uses of contact recreation, boating and fishing

[2] As per the Vermont Water Quality Standards, "existing use means a use which has actually occurred on or after 11/28/1975, in or on waters, whether or not the use is included in the standard for classification of the waters, and whether or not the use is presently occurring."

on/in flowing waters and additional public drinking water supplies may be identified during the Agency's consideration of a permit application.

Contact Recreation in Flowing Waters

The Agency may base its determination of the presence of an existing use for contact recreation in flowing waters if it can be shown there is more than an incidental level of use of the specified water body. The application of existing use determination criteria for contact recreation shall not apply to contact recreation situations that may be occurring but at a level deemed to be incidental, irregular and/or infrequent or in situations where there is no clearly defined or previously established access to the water. In determining the presence and level of use in a specified water body, positive findings are needed for both condition 1 and 2:

Condition 1. There is documentation and/or physical evidence that people have access to the waters for contact recreation.

Documentation or physical evidence may consist of:

a. Existence of road pull-off areas, public parking areas, and public access trails.
   - ☞ Video and/or pictures taken from adjacent roads and from the water.

and

b. Status of land ownership: public lands and/or public easements defining access locations
   - ☞ Previously designated public contact recreation or public beach area.
   - ☞ Maps of municipal, state, or federal lands (including road rights-of-ways and bridge crossings).
   - ☞ Documents referring to easements on private lands granting public access to the water for contact recreation purposes;

Condition 2. There is documentation and/or physical evidence of attractive contact recreation sites in and along the affected water.

Documentation or physical evidence may consist of:

a. Presence of any sandy or grassy beach or rock outcropping areas where people can comfortably rest out of the water.
   - ☞ Maps, video or pictures taken along the shore land of the affected waters.

b. Presence of area with sufficient depth, deep water holes, cascades, gorges, rock outcroppings or large boulders in or along the affected waters that create a slow and safe water area for swimming, wading, floating, tubing and/or bathing.
   - ☞ Maps, video or pictures taken of the affected waters.

c. Presence of aesthetically pleasing waters.
   - ☞ Observations concerning water clarity and substrate composition.

- ☞ Water quality data concerning level of human health risk (such as E.coli abundance) has been regularly collected.

Recreational Boating on Flowing Waters

The Agency may base its determination of the presence of an existing use for recreational boating if it can be shown there is more than an incidental level of use of the specified water body. The application of existing use determination criteria for boating shall not apply to those recreational boating situations that may be occurring but at a level deemed to be incidental, irregular and/or infrequent or in situations where there is no clearly defined or previously established public access to the water. In determining the presence and level of boating use in, on or along a specified water body, positive findings are needed for both condition 1 and 2:

Condition 1. There is documentation and/or physical evidence that people have access to the specified reach of water for recreational boating.

Documentation or physical evidence may consist of:

a. Evidence of road pull-off areas, public parking areas, and public access to the waters edge for boat put-ins, take-outs and portage routes.
   - ☞ Maps (digital or hardcopy) of designated public boating access points and public pathways to the water.
   - ☞ Video and/or pictures taken from adjacent roads and from the water.
   - ☞ Video and/or pictures taken of specified access area in use.
   - ☞ Video and/or pictures taken of designated public boating access points and public pathways to the water.

and

b.Status of land ownership: public lands and/or public easements defining access locations.
   - ☞ Maps of municipal, state, or federal lands (including road rights-of-ways and bridge crossings) detailing public boating access points and public pathways to the water.
   - ☞ Documents referring to easements on private lands that grant public access to the water for recreational boating purposes;

Condition 2. There is documentation and/or physical evidence of attractive recreational boating in, on or along the specified reach of water.

Documentation or physical evidence may consist of:

a. Features (unique or otherwise noted) valued for recreational boating (whitewater or flat-water).
   - ☞ Video or pictures taken along the shore land of the specified waters and features.

b. Pooled water, rapids, ledges, cascades, gorges, rock outcroppings or large boulders in or along the specified reach that create rapids or pools for boating.
- ☞ Video or pictures taken of the specified waters.

c. Aesthetically pleasing waters.
- ☞ Observation of water clarity and substrate composition.

Recreational Fishing in Flowing Waters

The Agency may base its determination of the presence of an existing use for recreational fishing if it can be shown there is more than an incidental level of use of the specified water body. The application of existing use determination criteria for fishing shall not apply to situations where fishing may be occurring but it is being done at a level deemed to be incidental, irregular and/or infrequent or in situations where there is no clearly defined or previously established public access to the water. In determining the presence and level of use in a specified water body, positive findings are needed for both condition 1 and 2 or for either condition 3 or 4:

Condition 1. There is documentation and/or physical evidence that people have public access to the waters for recreational fishing.

Documentation or physical evidence may consist of:

a. Existence of road pull-off areas with public parking areas, public access trails, publically accessible streambanks or similar features.
- ☞ Video and/or pictures taken from adjacent roads and from the water.

and

b. Status of land ownership: public lands and/or public easements defining access locations.
- ☞ Previously designated public boat launching area with vehicle parking.
- ☞ Maps of municipal, state, or federal lands (including road rights-of-ways and bridge crossings).
- ☞ Documents referring to easements on or across private lands granting public access to the water for recreational fishing purposes.
- ☞ Documentation of private ownership by 501c3 non-profit conservation organizations and/or land trusts that promote or grant public access for fishing.

AND

Condition 2. There is documentation and/or physical evidence of sites to fish in, on or along the specified reach of water.

Documentation or physical evidence may consist of:

a. Presence of any land areas along rivers where people can comfortably engage in angling.
- ☞ Video or pictures taken along the shore land of the affected waters.

b. Presence of pools, fish refuge areas and other habitats in, on or along the affected waters (especially rivers) that create sufficient habitat structure and diversity suitable for fish targeted by Vermont anglers.
   - ☞ Video or pictures taken of the affected waters.

c. Presence of fish populations targeted by Vermont anglers.
   - ☞ Fish population surveys documenting the presence of target species.
   - ☞ Survey data concerning angler use and catch rates.
   - ☞ Water quality data concerning target fish suitability and sustainability has been regularly collected.

OR

Condition 3. There is documentation of reaches where special regulations for fishing have been imposed by the State of Vermont (whether stocked fish or not).

Documentation or evidence may consist of:

a. Type, nature and subject species of special fishing regulation(s).

OR

Condition 4. There is documentation of reaches or affected waters that are stocked as a result of being identified on the State's Managed Request for Cultured Fish.

Documentation or evidence may consist of:

a. Species being stocked and stocking history of affected waters.

Public Drinking Surface Water Supply

The Agency may base its determination of the presence of an existing use for a public drinking surface water supply if there is more than an incidental use of the specified water body as a public drinking surface water supply. The application of existing use determination criteria for public drinking surface water supplies shall not apply to non-public or domestic water supply withdrawals (e.g. single family residence) from a specified surface water. In determining the presence of an existing use of a public drinking surface water supply source in a specified water body, positive findings are needed for one the following two conditions:

Condition 1. Documentation and/or physical evidence exists that the specified waters are used as a source for public drinking water supply.

Documentation and physical evidence may consist of:

a. Recorded regular use of specified water body as an active public drinking water supply source.
   - ☞ Maps and documents detailing supply intake locations, permits, source protection areas and approximate number of connections or people served.

b. Recorded use of specified water body as a designated emergency (not in active use) public drinking water supply source.
   - ☞ Maps and documents detailing supply intake locations and inclusion in source protection areas, plans or permits, etc.

c. A physical intake for treatment and distribution of water for public drinking water supply from specified water body.

OR

Condition 2. Documentation and/or physical evidence exists that the specified groundwater source for public water supply meets the State's criteria for "groundwater under the direct influence of surface water."

Documentation and physical evidence may consist of:

a. Maps and documents detailing surface water infiltration of public drinking water groundwater source from specified surface water body, including but not limited to pumping tests results and microscopic particulate analysis.

b. Infiltration of groundwater sources from specified surface water body.

c. Proximity and depth of groundwater source to adjacent surface water.