WATER MANAGEMENT

DESCRIPTION

The availability of clean, high quality water is essential to life. Prevention of water pollution is critical to maintain ground water that is safe for drinking. Surface waters must also be protected to maintain healthy aquatic ecosystems, provide industrial and municipal water supplies, and support recreational enjoyment. In Vermont, Lake Champlain, a critical water resource, is experiencing a serious decline in water quality, in part due to sediment and nutrients from agricultural runoff. Many drinking water wells have been found to have nitrate-nitrogen levels exceeding the Vermont public health standard (caused by nitrogen leaching through soil).[144] Nitrate contamination can make drinking water unsafe for infants or young livestock and fecal bacteria in drinking water (from manure) can cause infectious diseases such as dysentery, typhoid and hepatitis.[145] While Vermont dairy farms are certainly not the only source of this pollution, contributions from these sources can be significant and participation from the dairy farmer community is therefore essential to correcting this water quality problem.

Though Vermont does not have a shortage of water, the availability of potable water is increasingly becoming a concern. A drought in Frederick County, MD, in the summer of 2004, illustrates that "while water may be abundant in many areas, it is not limitless, and even our nation's most water-rich regions can run dry."[146] While irrigation is a significant user of water, it is important to note that livestock are as well. Even in Vermont, sources say the "Demand for ground water from the bedrock aquifer is continuously increasing as new sources of surface water decrease and the cost of surface-water treatment increases."[147]

This module will focus on best management practices dairy farmers can use to minimize and prevent water pollution and, to a lesser extent, to promote appropriate water use. General areas to be covered include preventing pollution from livestock yards, storage areas and milkhouse waste, general land management strategies and management of water use.

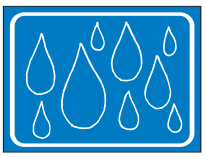
INCENTIVES FOR CHANGE

- **Regulations.** As water pollution becomes an ever-larger issue throughout the U.S., legislation supporting the Clean Water Act is becoming increasingly broad reaching and stringent. In 2002, the EPA approved a new regulation requiring that certain "concentrated animal feeding operations" implement best management practices to improve water quality in order to gain a permit to operate. In Vermont, there are many programs to address water quality issues, and dairy farmers may find themselves subject to increasing pressure and/or regulations to take steps to improve water quality. Local Vermont programs to protect overall water quality include the State's Accepted Agricultural Practices (AAPs).

- **Governmental cost sharing.** USDA and state-level programs provide support in the form of cost sharing, technical assistance and economic incentives to implement agricultural NPS pollution management practices. Recently, on a nationwide basis, 40% of section 319 Clean Water Act grants were used to control agricultural NPS pollution.[148] The National Environmental Quality Incentives Program (EQIP) authorizes the Secretary of US Dept. of Agriculture to provide cost-sharing incentives up to $450,000 per farmer to implement management practices that will protect water quality.[149]

- **Cost Savings:** Conserving and reusing water can have economical benefits. While current prices for water are reasonable, as water shortages become more common, frequent occurrences, water costs will increase. Therefore, the more water that can be collected, conserved, and reused, the more flexibility the farmer has regarding water demand.

- **Improved On-farm Water Quality:** Minimizing impact on surface and ground water is beneficial to the extent that these water resources become inputs on the farm. Maintaining healthy drinking water can reduce the chance for illness, and associated costs, from contaminated water.



ASSESSMENT QUESTIONS

For all questions, please choose the categories that best identify your current management practices. Use the Summary sheet on the last page of this module to evaluate overall performance.

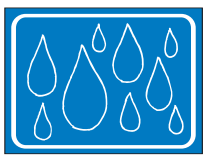
LIVESTOCK YARD MANAGEMENT

- ❑ 1. Livestock yard is unroofed and on course-textured (sands, sandy loam) soil less than 100 feet from waterways and streams. Yard is rarely cleaned and runoff water is uncontrolled.
- ❑ 2. Livestock yard is open or partially roofed on medium- or fine-textured soils (loam, silt loam, clay loams, clay) greater than 100 feet from waterways and streams. Yard is cleaned once a month and some effort is made to collect runoff water or divert to manure storage area.
- ❑ 3. Livestock yard is open or partially roofed on concrete or medium- or fine-textured soils greater than 100 feet from waterways and streams. Yard is cleaned once per week and has protective barriers to prevent runoff. An effort is made to prevent water from entering/flooding yard and any runoff is collected or diverted to manure storage area.
- ❑ 4. Livestock yard is open or partially roofed on concrete greater than 100 feet from waterways and streams. Yard is cleaned at least once per day and water is diverted so that flooding or runoff from yard never occurs.

Livestock yards (barnyards, holding areas and feedlots) are concentrated areas of livestock wastes and are therefore vital to protection of water quality. These yards, especially when on permeable soils or near on-farm water sources, can cause nitrate and bacteria contamination in ground or surface water. To minimize the possibility of contaminants leaching to groundwater or running off to surface water, such yards should be located on concrete or fine- to medium textured soils over 100 feet from water sources such as wells, surface water, adjacent property, drainage ditches, or other areas that could result in the runoff reaching water sources. The best means to achieve this is to prevent flooding in livestock yards by diverting rain and/or floodwaters from the area. Having a roof over the yard, and effective use of rain gutters, or otherwise diverting water from yard is the best way to prevent runoff. This is especially important if yards are on a slope. If it is impossible to prevent runoff completely, other practices, such as keeping the yard clean, diverting runoff to manure storage areas or collecting and re-using runoff (e.g. as nutrients on fields), can minimize potential pollution to water sources.

MANURE STORAGE SYSTEM

- ❑ 1. Storage structures allow for contact of stored material with porous/non-clay soils (because of leakage/cracks or overflow) and are subject to flooding. Storage structures are located without regard to proximity to waterways and streams.
- ❑ 2. Storage structures are lined with clay or cement, though some leakage may occur due to cracks or overflow. Some effort is made to divert water from site and proximity of storage structures to bodies of water is considered in their placement.
- ❑ 3. Storage structures are lined with clay or cement, are of sufficient capacity to hold all materials for 180 days, and cracks/leaking are minimized. Some effort is made to divert groundwater from site and proximity of storage structures.
- ❑ 4. Storage structures are lined with clay or cement, are of sufficient capacity to hold all materials for 180 days, and are maintained to allow for no leakage. Water is prevented from entering/flooding storage area. Storage structures are all located downslope from farm buildings and at a maximum distance from bodies of water that may be effective.



FERTILIZER STORAGE SYSTEM

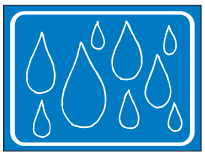
- ❑ 1. Storage structures allow for contact of stored material with porous/non-clay soils (because of leakage/cracks) and are subject to flooding. Storage structures are located without regard to proximity to waterways and streams.
- ❑ 2. Storage structures are lined with clay or cement, though some leakage may occur due to cracks. Some effort is made to divert water from site and proximity of storage structures to bodies of water is considered in their placement.
- ❑ 3. Storage structures are lined with clay or cement, are of sufficient capacity to hold all materials, and cracks/leaking are minimized. Some effort is made to divert clean water from site and proximity of storage structures to bodies of water is considered in their placement.
- ❑ 4. Storage structures are lined with clay or cement, are of sufficient capacity to hold all materials, and are maintained to allow for no leakage. Water is prevented from entering/flooding storage area. Storage structures are all located downslope and at a maximum distance from bodies of water.

SILAGE STORAGE SYSTEM

- ❑ 1. Storage structures allow for contact of stored material with porous/non-clay soils (because of leakage/cracks) and are subject to flooding. Storage structures are located without regard to proximity to waterways and streams.
- ❑ 2. Storage structures are lined with clay or cement, though some leakage may occur due to cracks. Some effort is made to divert water from site and proximity of storage structures to bodies of water is considered in their placement.
- ❑ 3. Storage structures are lined with clay or cement, are of sufficient capacity to hold all materials, and cracks/leaking are minimized. Some effort is made to divert water from site and proximity of storage structures to bodies of water considered in their placement.
- ❑ 4. Storage structures are lined with clay or cement, are of sufficient capacity to hold all materials, and are maintained to allow for no leakage. Water is prevented from entering/flooding storage area. Storage structures are all located downslope and at a maximum distance from bodies of water.

Storage areas for manure, fertilizer and silage can be potential sources of water pollution if not managed properly. It has been found that silage leachate and cow manure have 140 and 200 times the oxygen depleting potential of untreated municipal sewage, which can lead to eutrophication in water bodies.[150] Silage leachate is also highly acidic and leachate from 300 tons of high-moisture silage has been compared to the daily sewage generated by a city of 80,000 people.[151] The best way to prevent such pollution is to ensure that storage systems are well-maintained (allowing for no leakage of stored material), are of adequate size (to avoid spillage due to overflows), are not subject to water infiltration or runoff, and do not allow for contact of stored material with porous or course-textured soils. Runoff prevention can be achieved by using closed or covered storage and by ensuring that diversion ditches or other techniques are used to prevent moving clean water from coming into contact with the stored material. If it is impossible to prevent runoff completely, other practices, such as collecting and re-using runoff as fertilizer, can minimize potential pollution to water sources. Finally, locating these storage systems an adequate distance (preferably at least 100 feet) from wells, surface water, adjacent property, drainage ditches, or other areas that could result in runoff reaching water sources, can prevent or minimize water pollution.

Protection of farm inputs such as silage and fertilizer can also improve efficiency and cost-effectiveness on farms. For example, preventing water from coming into contact with silage can help to maintain the freshness and quality of the silage, thereby minimizing additional feed costs. Preventing impact to fertilizers can also ensure that these materials remain useful for their intended life.



MILKHOUSE WASTE

- ❑ 1. All waste is poured down a drain that leads to the farms leachfield system, or indirectly into an open field drainage ditch. or is sent to a leach field, usually also washing down feed and manure.
- ❑ 2. Most waste is diverted to the manure storage area, though some goes to the municipal drainage system or is sent to a leach field. No effort is made to remove excess feed and manure from the parlor prior to wash down.
- ❑ 3. All waste is diverted to the manure storage area, though the first rinse is sometimes used as fertilizer. Some effort is made to remove excess feed and manure from the parlor prior to wash down.
- ❑ 4. All waste is diverted to the manure storage area. Any field application of first rinse is matched to field nutrient needs. Most manure and excess feed is removed from the parlor prior to wash down.

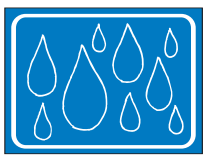
Water used to clean the milkhouse and milkhouse equipment contains high levels of organic matter, nutrients, chemicals and microorganisms, which can contaminate water with ammonia, nitrate, phosphorus, detergents and disease-causing organisms if not disposed of properly.[152] Milkhouse wastewater is made nutrient-rich by virtue of having cleaners and high amounts of milk residues or being washed down the drain with manure and feed. This nutrient-rich water can lead to pollution if it is untreated before it reaches water bodies. To minimize this potential impact to water, wastewater should be diverted to manure storage areas. Nutrient-rich first rinse water can also be re-used by applying it directly to fields as fertilizer. When applying first rinse to fields, care should be taken to match field nutrient needs with nutrient content of first rinse. Cleaning the parlor of feed and excess manure prior to wash down will minimize the amount of this material that enters water and can minimize the volume of water needed for cleaning.

PROTECTING ON-FARM WATER SOURCES

- ❑ 1. There is no effort made to protect on-farm bodies of water (lakes, ponds, streams, creeks).
- ❑ 2. Some 'buffer areas' (uncultivated land with some natural vegetation) are utilized to absorb farm runoff water and protect some water sources.
- ❑ 3. Buffer areas are utilized along edges of all water sources and an effort is made to maximize vegetation in these areas in order to maximize absorption of runoff water. Cows are generally prevented from entering the water.
- ❑ 4. Buffer areas with maximum vegetation are utilized along edges of all water bodies sources and the width of buffer strips is increased if water is at the bottom of a downslope. Cows are prevented from entering the water at any time.

Buffer areas are natural, uncultivated areas on the farm that are covered with vegetation (either planted or naturally occurring). Maintenance of these areas around water sources on the farm serves to further protect these water sources from pollution due to runoff. The protection comes from the fact that the buffer areas can potentially halt the flow of runoff water or absorb it before it reaches surface waters. Buffer areas should be as wide as possible in order to maximize the benefits they provide. When they are at the bottom of a slope (i.e. protecting water at the base of a slope), it is especially important that they be as wide and densely vegetated as possible.

It is important to note that buffer areas should be untreated by chemicals or nutrients and instead developed and managed in a way that they do not need additional inputs to flourish. In this way buffer areas can benefit from the addition of nutrients to their soils via the absorption of runoff waters from upslope contributing areas. Buffer areas also have the additional benefit of adding to the biodiversity (variance of flora and fauna) on a farm.



In addition to vegetated and undisturbed buffer strips, preventing cows from entering water is vital to maintaining surface water quality. Cows can be harmful to water quality to the extent that they urinate or excrete manure into the water or track these and other substances, such as bedding or feed, into water via their legs or hooves. In addition the trampling and degradation of the streambed leads to further water quality issues. Cows should not come into contact with water sources at any time.

WATER USE PLAN [153]

- ❑ 1. Water use on the farm is not monitored or planned.
- ❑ 2. Water use on the farm is monitored and reported to users with suggestions for decreasing use.
- ❑ 3. In addition to #2, water use on the farm is budgeted and includes action steps to improve water use efficiency by minimizing runoff, water loss, and erosion and pest problems. Areas monitored include wash down and milking equipment clean up, drinking, cooling and irrigation.
- ❑ 4. In addition to #3, imported water use on the farm is minimized by recycling, conserving, and/or collecting water and/or using low demand systems. Water use is further minimized by planting water-conserving varieties and/or ground covers.

While there appears to be plenty of water available for a reasonable to cheap price, it is important to start thinking about a water use plan. As more and more water shortages are realized, water costs are expected to increase. If the market is used to dictate price, this competition, is expected to have significant impacts on agriculture.[154] Once a baseline is established, then proactive steps can be taken in a methodical manner.

WATER USE MANAGEMENT STRATEGIES (Please check all that apply.)

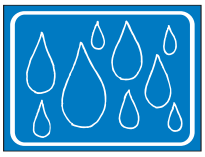
- ❑ I recycle water on the farm, such as using wastewater to flush feeding areas and free-stall barns (ensuring that resulting water flow is directed to the manure storage area).
- ❑ I use grass-based and/or seasonal dairying to reduce the need to wash off manure from high use areas.
- ❑ I use a housing system that keeps cows clean which reduces the need to wash cows before milking.
- ❑ I use water to cool milk by passing it through the cooler plate, while simultaneously using that heated water for the cows to drink.

Using certain management strategies can decrease water use. There are strategies regarding irrigation as well as reuse and recycling water from different activities. While recognizing that irrigation is not a top concern in Vermont, it is worth noting that corn is one of the top six crops in the US that requires 70% of the irrigation.[155] More applicable to Vermont are the management strategies that focus on either reducing the need for water (via type of dairying or housing system) or by reusing wastewater.

LINKAGES TO OTHER MODULES

Water quality issues are tied to Nutrient Management, Soil Health, Biodiversity and Animal Husbandry. The table below identifies where you can find more information on some of the topics mentioned in this module.

WATER MANAGEMENT TOPIC	OTHER MODULE(S)
Buffer Areas	Soil Health & Biodiversity
Field Nutrient Applications	Nutrient Management



FURTHER INFORMATION

Additional details and information on the above can be obtained through the following programs.

- **Livestock and Poultry Environmental Stewardship (LPES) Curriculum** provides environmental best management practice recommendations for dairy farms (http://www.lpes.org/les_plans.html). They also provide information on the new Concentrated Animal Feeding Operations (CAFO) regulations and links to funding and additional technical resources (http://www.lpes.org/CAFO.html). Call 1-800-562-3618 for more information.

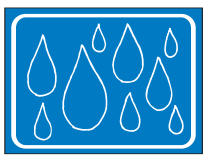
- **The USDA Natural Resource Conservation Service (NRCS)** offers nutrient management information and tools at http://www.nrcs.usda.gov/technical/ECS/nutrient/. The program also provides funding and technical assistance for conservation efforts through Farm Bill 2002 (http://www.nrcs.usda.gov/programs/farmbill/2002/) and its affiliate programs, such as EQIP (http://www.nrcs.usda.gov/programs/eqip/). The Vermont NRCS also manages Farm*A*Syst, a program devoted to national and state-level improvements to ground water that provides comprehensive evaluation and best management sheets specifically for dairy farmers in Vermont. More information can be found at http://www.vt.nrcs.usda.gov/technical/FarmASyst/.

- **The Vermont NRCS State Office:** 802-951-6796.

- **The Vermont Department of Environmental Conservation Water Quality Division** provides a newsletter pertaining to water quality as well as information on best management practices, grants and educational opportunities. See http://www.vtwaterquality.org/ for more information or contact the Water Quality Division at 802-241-3770 or 802-241-3777.

- **The University of Vermont Extension, Water Quality Initiative:** www.uvm.edu/extension.802-656-5459.

- **The Vermont Agency of Agriculture, Food and Markets** provides a clearinghouse of information on controlling non-point source pollution from dairy farms, including accepted agricultural practices (AAPs), best management practices (BMPs) and technical and financial assistance for projects. See http://www.vermontagriculture.com/pidnonpointsource.htm for more information. You can also call the Vermont Natural Resources Conservation Districts
  - Windham, Bennington, Rutland, Windsor, Counties: 802-257-5621
  - Orleans, Essex, Caledonia, Orange, Washington Counties: 802-229-2720
  - Addison, Chittenden, Lamoille, Franklin, & Grand Isle Counties: 802-388-6746



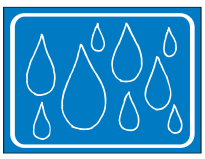
SUMMARY OF RESULTS FOR WATER MANAGEMENT

Instructions: In the table below, please record the score for the answer you selected for each question. For multiple-choice questions, the response number serves as your score for that category (i.e. choice # 2 is worth 2 points). For "check all that apply questions," please see scoring criteria for each question in the chart below. Once all responses have been completed, add up the answers and record the total.

QUESTION	ANSWER/SCORE
1. Livestock Yard Management	
2. Manure Storage System	
3. Fertilizer Storage System (If no fertilizer is stored on property, give yourself 4 points)	
4. Silage Storage System	
5. Milkhouse Waste	
6. Protecting On-Farm Water Sources	
7. Water Use Plan	
8. Water Use Management Strategies (Add 1 for each box checked)	
Total Score (Out of Possible 32)	

Interpretation: The next step in understanding your farm's performance in the category of Water Management is to compare your results to best practices. Below is a table that ranks your performance from best practice (green) to practices that require improvement (red). Compare the number of points you received for your practices compared to optimal practices.

	Point Range	Interpretation
Green	27 - 32	Best practices regarding Water Management are currently being employed on this farm.
Yellow	20 - 26	Farm is using some good practices regarding Water Management, however there are some key areas that should be improved upon.
Red	7 - 20	Water Management should be carefully evaluated and a strong effort should be made to adopt improved practices in several areas.



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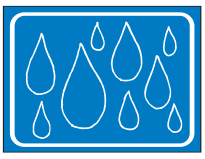

Footnotes

144 Vermont NRCS Farm*A*Syst. "Worksheet #3: Assessing the Risk of Groundwater Contamination from Fertilizer Storage and Handling." May 1998. Vermont Natural Resources Conservation Service (NRCS). 2003. 23 Nov. 2003. <ftp://ftp-fc.sc.egov.usda.gov/VT/Technical/FarmASyst/Worksheet3-Fertilizer_Storage&Handling.pdf>.

145 Vermont NRCS Farm*A*Syst. "Worksheet #8: Assessing the Risk of Groundwater Contamination from Barn Yard Management." May 1998. Vermont Natural Resources Conservation Service (NRCS). 2003. 23 Nov. 2003. < ftp://ftp-fc.sc.egov.usda.gov/VT/Technical/FarmASyst/Worksheet8_Barnyard_Management.pdf>.

146 U.S. Water Scarcity Problems Highlighted At Congressional Hearing. 8 May 2003. 19 Nov. 2003. <http://www.house.gov/transportation/press/press2003/release97.html>.

147 USGS Homepage. "Water Resources of New Hampshire and Vermont, New Hampshire Bedrock Aquifer Assessment." 31 May 2000. 10 Oct. 2003. <http://nh.water.usgs.gov/CurrentProjects/bedrock.htm>.

148 US EPA Website. 3 Dec 2003. Non-Point Source Pointers (Factsheets) "Pointer #6 EPA841-F-96-004F: Managing Nonpoint Source Pollution from Agriculture" 23 Nov. 2003. <http://www.epa.gov/OWOW/NPS/facts/point6.htm>.

149 NRCS National Environmental Policy Act (NEPA) Documents. "Environmental Quality Incentives Program (EQIP): Risk Assessment for the EQIP Program." December 10, 2002. USDA Natural Resources Conservation Service. 23 Nov. 2003. <http://www.nrcs.usda.gov/programs/Env_Assess/EQIP/EQIP_RA_121002.pdf >.

150 Region 5 Water, Water Quality Impacts Website. US EPA. 4 Sept. 2003. 19 Nov. 2003. <http://www.epa.gov/r5water/npdestek/npdcafowaterqualityimpacts.htm>.

151 Vermont NRCS Farm*A*Syst. "Worksheet #9: Assessing the Risk of Groundwater Contamination from Silage Storage." Sept. 1997. Vermont Natural Resources Conservation Service (NRCS). 2003. 23 Nov. 2003. < ftp://ftp-fc.sc.egov.usda.gov/VT/Technical/FarmASyst/Worksheet9-Silage_%20Storage.pdf>.

152 Vermont NRCS Farm*A*Syst. "Worksheet #10: Assessing the Risk of Groundwater Contamination from Milkhouse Wastewater Treatment." Dec. 1997. Vermont Natural Resources Conservation Service (NRCS). 2003. 23 Nov. 2003. < ftp://ftp-fc.sc.egov.usda.gov/VT/Technical/FarmASyst/Worksheet10-Milkhouse_Wastewater_Treatment.pdf>.

153 Question adapted from The Food Alliance. Dairy Inspection Tool for the Pacific Northwest. 2002.

154 USDA Agricultural Research Service Website. National Programs Water Quality & Management "Program Summary: Program Direction." 6 June 2003. <http://www.ars.usda.gov/research/programs/programs.htm?NP_CODE=201>.

155 Ibid.