

# Maine Farm-A-Syst

Farmstead Assessment System

Fact Sheet 8

## Reducing the Risk of Groundwater Contamination by Improving Livestock Yards Management

Besides addressing the potential of livestock yards to pollute groundwater, other good reasons for improving management practices include improved herd health, ease of maintenance and quality milk or meat production.

### Distance from well

Wells should be located in an elevated area upslope of the livestock yard, so that runoff will not drain into the vicinity of the well. With good farmstead planning, livestock facilities should be at least 100 feet away if downgradient, and at least 300-400 feet from the house and well if upgradient.

### Site characteristics

Groundwater protection is a major consideration in sighting a livestock yard. Soil characteristics are the most important factor when considering groundwater protection. Important soil characteristics include:

- ◆ Surface and subsoil texture.
- ◆ Depth to bedrock.
- ◆ Soil permeability and drainage class.

The best site has a deep, well-drained soil with moderate permeability. A very poor site has soil shallow to bedrock, a high water table or a very sandy/gravelly soil with excessive drainage and high permeability. (For more assistance in assessing your site's vulnerability to groundwater contamination, see Worksheet #11, Site Evaluation.)

For existing livestock yards on poor sites, the best options for protecting groundwater might be eliminating the yard and using total confinement for the livestock or providing paved yards and liquid-tight basins to store yard run off or roof the area .

### Clean water diversion

One way of reducing water pollution from livestock yards is to reduce the amount of clean water entering the yard (Figure 1). In all cases, these structures need to be maintained.

#### Topics Covered:

Distance from well

Site characteristics

Clean water diversion

Runoff control systems

Yard cleaning or scraping

Concentration of animals and type of yard surface

Livestock storage and waste utilization

Abandoned livestock yards

Source Water Protection/ Wellhead Protection Area

Contacts and References

- ◆ Waterways, small terraces and roof gutters direct water away from livestock yards.
- ◆ An earthen berm or diversion ditch can be constructed across the slope upgrade from a livestock yard to prevent runoff from entering the yard.
- ◆ In some areas, if a diversion is not practical, a catch basin with a tile outlet could be installed above the livestock yard. For a shallow groundwater table a curtain drain may be recommended.

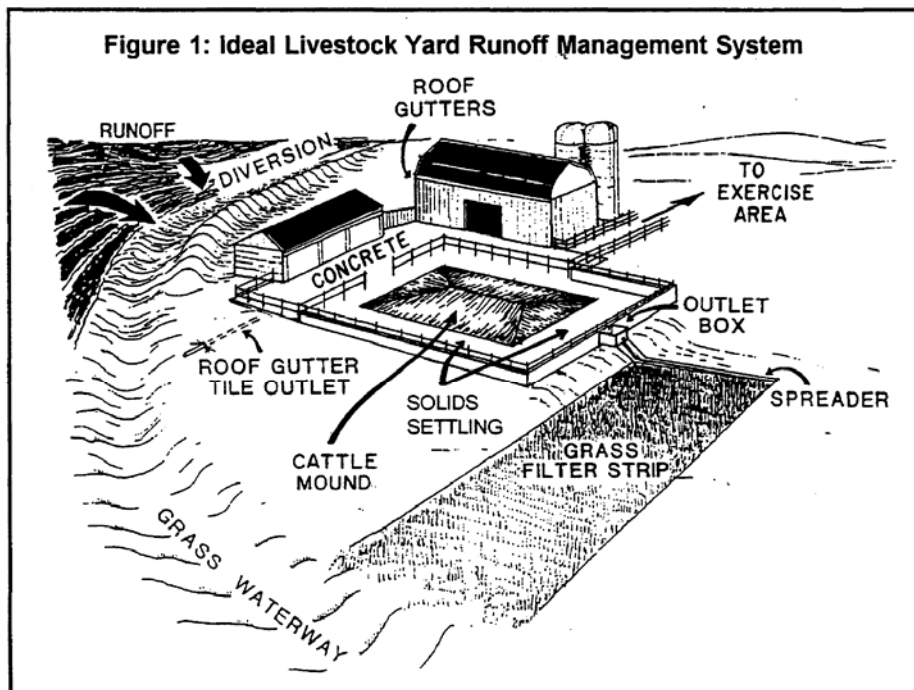
### Runoff control systems

A livestock yard without a runoff control system typically has an earthen surface compacted by animal traffic. This surface is not shaped for water drainage, so it is sometimes dry and sometimes muddy. Manure typically accumulates on the surface, and decaying manure is mixed into the soil by animal traffic. Water running off concrete pads located near barn doors and clean water from roofs and upslope areas can flush manure from the yard and create mud holes.

Such a yard is difficult to manage, and the absence of runoff controls may lead to water quality problems.

Contaminated runoff from an active feedlot that accumulates in areas adjacent to the lot may flow through the soil and threaten groundwater quality. This risk is particularly high on sites with high infiltration and percolation rates, such as sandy soils and other soils with high groundwater tables. Risk is

directly proportional to design.



Adapted from *Barnyard Runoff Management*, Wisconsin Department of Natural Resources and Department of Agriculture, Trade and Consumer Protection, 1987. Adapted by Leonard Massie, with graphic assistance by Andy Hopfensperger, University of Wisconsin-Madison Department of Agricultural Engineering.

**Runoff control systems can remedy such problem situations.** These systems collect livestock yard runoff, settle out manure solids, and direct the remaining water to open fields or wastewater treatment strips, away from streams, ditches, waterways and areas of permeable soils and fractured bedrock. Another option is to collect and store runoff for later

land application. Figure 1 shows an ideal livestock yard runoff control system. Runoff from a livestock yard may also be directed into a manure storage system.

### Yard cleaning or scraping

**Clean livestock yards regularly.** The amount of manure on a livestock yard depends on the number of animals and the hours per day animals spend on the lot. Cleaning and scraping at least once per week is preferable. Heavy concentrations of animals may require solids removal more often. Concrete surfaces are easier to clean than earthen lots. Earthen yards are cleaned when dry, so solids may be removed less frequently.

### Concentration of animals and type of yard surface

**The area needed per animal** for minimizing the risk of groundwater contamination depends on the type of lot surface. The amount of concrete surface area needed is much less than that required for an earthen lot.

The concrete area needed is a balance between traffic on the lot and resting area provided for animals. Too large an area results in manure freezing to the surface for long periods, while too small an area will result in animals having difficulty moving about.

**For dairy operations**, the best protection for groundwater is to confine animals to a free-stall barn or roofed yard. Where a yard is needed, 75 square feet of fenced concrete per cow is recommended (400 square feet of earthen surface) and roughly 2000 square feet of exercise area, if one is used. Direct runoff water carefully from the concrete onto the earthen area. Curbs will keep runoff from flowing off the edges of the concrete lot.

**Yard management involves** considerations other than surface and groundwater protection. A combination of yard surfaces can offer the most flexibility in adapting to weather conditions. Livestock location can be chosen based on the amount of mud in the yard: on concrete in sloppy conditions, on an earthen surface in dry weather, and on a mound in intermediate conditions.

**The type of surface also affects management.** Earthen yards, for example, might be cleaned only once or twice per year.

**If bedrock is close** to the surface where your livestock yard is located, pave the surface with concrete, or totally confine livestock. This won't completely solve your problem, runoff still needs to be dealt with by treating in vegetated areas or eliminating runoff with roofs.

### Livestock storage and waste utilization

In addition to the condition of your livestock yards, your farm animal waste management should consider waste storage and utilization. (Worksheet and Fact Sheet #7, Livestock Waste Storage, provide guidelines for minimizing impact on groundwater.)

Animal waste can be a valuable fertilizer and soil conditioner. When managed properly, the nutrients in manure can be substituted for commercial fertilizers, saving money and protecting groundwater and surface water. Matching nutrient applications to crop nutrient needs is critical.

## Abandoned livestock yards

With active feedlots or yards, the layer of organic matter mixed with soil at the surface lies over compacted subsurface soil, forming a layer through which water moves very slowly. Therefore, leaching of nitrate and bacteria through the surface seal and compacted layers is

- ◆ Abandoned yards can pose a particular groundwater contamination risk.
- ◆ As the manure pack breaks up from lack of use, water can leach through and reach the groundwater.
- ◆ Any abandoned structure should be completely emptied.

not likely within the livestock yard. If livestock yard runoff is discharged to permeable soils or bedrock, leaching may occur. Studies have found little nitrate in the soil of active feedlots.

In the case of earthen waste storage facilities, liner materials (to a depth of about two feet) should be removed and spread over croplands. Impermeable plastic membranes are sometimes used for liners which would not be placed on fields. The remaining hole should be filled and leveled. Manure packs from pole sheds no longer in use should also be removed and the wastes land applied. If manure is stacked in fields, it should be removed as soon as conditions permit.

If you have a permanently abandoned yard:

- ◆ Dig it up.
- ◆ Spread the manure and soil combination on fields.
- ◆ Refill the former yard with other material.

**Another option** is to till and plant the yard to a high-nitrogen-using crop, which will use the nitrogen released by soil and the manure decomposition process. Remove manure from a feedlot that will not be used for an extended period. Otherwise, cracks developing in the surface may allow leaching of nitrates.

## Source Water Protection/Wellhead Protection Area

Almost half of Maine's population depends on groundwater for its drinking water supply from either private or public wells. We are lucky to have some of the best water supplies in the world, and it is our job to keep them safe. Being aware of potential problems on your property that might pollute drinking water sources is important. You may not even know that there is a potential threat. Taking the time to read and fill out the applicable Farm-A-Syst sections is a great first step. From there you will sit down with a district employee or someone trained in Farm-A-Syst to discuss some possible solutions such as best management practices (BMP) that can be applied. BMPs are a method, measure, or practice that, when correctly installed or performed, will prevent, reduce, or minimize water pollution. In this case, the focus is on drinking water supplies and the areas that provide them with water.

There are some laws that pertain to areas within a source water protection zone that don't apply to other landowners. Be sure to check with your local water district and municipality for local ordinances or if you are unsure if you live in a source water protection area.

It is the landowner's responsibility to know local and state laws pertaining to their land, although it is hard to navigate sites and wade through the legal jargon of written laws.

If you are living or operating in a source water protection area (the surface and subsurface areas surrounding a drinking water supply for a public water system where activities can contaminate the supply) or wellhead protection area (an area used to protect groundwater, a form of source water) you should pay extra special attention. We have tried to find pertinent information pertaining to this section. You can find links to these laws along with helpful information in the following Contact & Reference section as well as in appendices A: Law and Regulations & B: Resources.

## CONTACTS AND REFERENCES

### Who to call about...

#### Design assistance and technical standards for runoff control systems

Your local Soil and Water Conservation District, Natural Resources Conservation Service, or the University of Maine Cooperative Extension.

#### Financial assistance in remedying a risky situation

Your local NRCS office.

### What to read about...

*Publications are available from sources listed at the end of the reference section. (Refer to number in parentheses after each publication.)*

#### Health Effects of Nitrate in Groundwater

Nitrate: Health Effects in Drinking Water. University of Maine Cooperative Extension Water Quality Fact Sheet #22. Bulletin #7107. (1)

#### Management of Livestock Yards

Manure Digestion, Runoff, Re-feeding, Odors. University of Maine .Cooperative Extension Bulletin #1072. 36 pages; \$5.00. (1)

Agricultural Waste Management Field Handbook. 1992. USDA-Natural Resources Conservation Service. (3)

#### Design Criteria and General Information

Beef Housing and Equipment Handbook. Midwest Plan Service. MWPS-6 (2)

[http://www.mwps.org/index.cfm?fuseaction=c\\_Products.viewProduct&catID=736&productID=6369&skunumber=MWPS-6](http://www.mwps.org/index.cfm?fuseaction=c_Products.viewProduct&catID=736&productID=6369&skunumber=MWPS-6)

Sheep Housing and Equipment Handbook Midwest Plan Service. MWPS-3. (2)

[http://www.mwps.org/index.cfm?fuseaction=c\\_Products.viewProduct&catID=775&productID=6367&skunumber=MWPS3](http://www.mwps.org/index.cfm?fuseaction=c_Products.viewProduct&catID=775&productID=6367&skunumber=MWPS3)

Swine Housing and Equipment Handbook. Midwest Plan Service. MWPS-8. (2)

[http://www.mwps.org/index.cfm?fuseaction=c\\_products.view&catID=771&productID=11509](http://www.mwps.org/index.cfm?fuseaction=c_products.view&catID=771&productID=11509)

Dairy Housing and Equipment Handbook Midwest Plan Service. MWPS-7. (2)

[http://www.mwps.org/index.cfm?fuseaction=c\\_products.view&catID=735&productID=6429](http://www.mwps.org/index.cfm?fuseaction=c_products.view&catID=735&productID=6429)

Livestock Waste Facilities Handbook Midwest Plan Service. MWPS-18. (2)

[http://www.mwps.org/index.cfm?fuseaction=c\\_products.view&catID=719&productID=6341](http://www.mwps.org/index.cfm?fuseaction=c_products.view&catID=719&productID=6341)

USDA-Natural Resources Conservation Service Field Office Technical Guide Section IV.(3)

*Best Management Practices for Groundwater Protection*. 2004. Maine Department of Human Services Drinking Water Program.

This manual is intended for the use of local officials, public water suppliers and landowners in Maine. It is intended to encourage educated decisions, informed practice, and directed planning in regard to groundwater protection, particularly in the vicinity of public drinking water supply wells.

<http://www.maine.gov/dhhs/eng/water/forms/Sections/BMPv2%200A.htm>

### **Publications available from...**

1. Your county Extension office. There may be charges for publications, postage and sales tax.
2. Your county NRCS office.
3. Midwest Plan Service Secretary, Agricultural Engineering Department, 460 Henry Mall, University of Wisconsin, Madison, Wisconsin 53706, (608) 262-3310.
4. USDA-Natural Resources Conservation Service, 967 Illinois Avenue, Suite #3, Bangor ME 04401, (207) 990-9100 ext #3.

### **Websites**

This link will take you to the Natural Resources Conservation Service (NRCS) Conservation Practice Standards. Here you can find technical guides that are the primary scientific references for NRCS. They contain technical information about the conservation of soil, water, air, and related plant and animal resources.

<http://efotg.nrcs.usda.gov/treemenuFS.aspx>

Below is a link to "Manual of Best Management Practices for Maine Agriculture" put out by the Maine Department of Agriculture, Food & Rural Resources Division of Animal Health & Industry. January 2007. This resource has links to many different BMPs that apply to a farm.

<http://mainegov-images.informe.org/agriculture/narr/documents/BMPManual2007.pdf>

This manual doesn't have any of the actual BMPs written out. It is literally a guide that will lead you to other links. To make things a little easier you will find direct links to BMPs suggested by the manual that pertain to this specific section.

- ◆ **Environmental Designs for Healthier and More Profitable Cows.**  
University of Alberta, Agriculture and Agri-Food Canada.  
<http://www.wcds.afns.ualberta.ca/Proceedings/1999/chap28.htm>
- ◆ **Building Freestall Barns and Milking Centers: Methods and Materials.**  
NRAES – 148  
[http://www.nraes.org/nra\\_order.taf?\\_function=detail&pr\\_id=33&\\_UserReference=BD89344C04A748F147BDB550](http://www.nraes.org/nra_order.taf?_function=detail&pr_id=33&_UserReference=BD89344C04A748F147BDB550)
- ◆ **Animal Behavior and the Design of Livestock and Poultry Systems.**  
Proceedings from the Animal Behavior and the Design of Livestock and Poultry Systems International Conference, Indianapolis, Indiana, NRAES – 84.  
[http://www.nraes.org/nra\\_order.taf?\\_function=detail&pr\\_id=143&\\_UserReference=BD89344C04A748F147BDB550](http://www.nraes.org/nra_order.taf?_function=detail&pr_id=143&_UserReference=BD89344C04A748F147BDB550)
- ◆ **IPM for Fly Control in Maine Dairy Barns.** University of Maine Cooperative Extension Bulletin 5002.  
<http://www.umext.maine.edu/onlinepubs/htmlpubs/5002.htm>

- ◆ **Heavy Use Area Protection, Code 561.** NRCS electronic Field Office Technical Guide. <http://efotg.nrcs.usda.gov/references/public/ME/code412.pdf>
- ◆ **Water Quality for Small-Scale Livestock Operations.** Pennsylvania Small-Scale Livestock Committee. [http://www.agriculture.state.pa.us/agriculture/lib/agriculture/pascfiles/nutrientmanagement/Small\\_Scale\\_Livestock\\_Farm\\_Water\\_Quality\\_Management.pdf](http://www.agriculture.state.pa.us/agriculture/lib/agriculture/pascfiles/nutrientmanagement/Small_Scale_Livestock_Farm_Water_Quality_Management.pdf)
- ◆ **Rules for the Disposal of Animal Carcasses.** Chapter 211, Maine Dept. of Agriculture, 207-287-1132. <http://maine.gov/agriculture/ahi/documents/LicensingRuleFINAL2006.doc>
- ◆ **Watering Pumps for Livestock – Pasture Pump and Hydro Ram.** NRCS Field Office Technical Guide. <http://efotg.nrcs.usda.gov/references/public/ME/code614.pdf>
- ◆ **Watering Systems for Livestock** University of Maine Cooperative Extension, Bulletin 7129. [http://extensionpubs.umext.maine.edu/ePOS/form=robots/item.html&item\\_number=7129&store=413&design=413](http://extensionpubs.umext.maine.edu/ePOS/form=robots/item.html&item_number=7129&store=413&design=413)
- ◆ **Water Conservation on Dairy and Livestock Farms.** University of New Hampshire Cooperative Extension. <http://extension.unh.edu/Pubs/AgPubs/wtrcnsrv.pdf>
- ◆ **High-Tensile Wire Fencing.** NRAES – 11. [http://www.mwps.org/index.cfm?fuseaction=c\\_Products.viewProduct&catID=710&productID=6441&skunumber=NRAES-11&crow=12](http://www.mwps.org/index.cfm?fuseaction=c_Products.viewProduct&catID=710&productID=6441&skunumber=NRAES-11&crow=12)
- ◆ **Planning Fencing Systems for Controlled Grazing.** Virginia State University, Virginia Cooperative Extension, Pub. # 442-130. <http://www.ext.vt.edu/pubs/ageng/442-130/442-130.html>
- ◆ **Livestock Water Development.** Ohio State University Extension Fact sheet ANR-12-02. <http://ohioline.osu.edu/anr-fact/0012.html>
- ◆ **Manure Management Practices to Reduce Water Pollution.** Oregon State University Extension Service, Pub. FS 281. <http://eesc.orst.edu>

University of Maine Cooperative Extension: “Nitrate: Health effects in drinking water”  
[http://extensionpubs.umext.maine.edu/ePOS/form=robots/item.html&item\\_number=7107&store=413&design=413](http://extensionpubs.umext.maine.edu/ePOS/form=robots/item.html&item_number=7107&store=413&design=413)

University of Maine Cooperative Extension: “Nitrate, Groundwater and Livestock Health”  
<http://www.umext.maine.edu/waterquality/Publications/7086.htm>

University of Maine Cooperative Extension: “Barn and Manure Storage Safety”  
<http://www.umext.maine.edu/onlinepubs/htmlpubs/2304.htm>

Natural Resources Conservation Service: Animal Manure management  
<http://www.nrcs.usda.gov/technical/ECS/nutrient/animalmanure.html>

Best management Practices for Groundwater Protection

<http://www.maine.gov/dhhs/eng/water/forms/Sections/BMPv2%200A.htm>

See “Appendix A: Laws and Regulations” and “Appendix B: Resources” for additional links.

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