EC98-755 Farm*A*Syst Nebraska's System for Assessing Water Contamination Risk Fact Sheet 13: Improving Milking Center Effluent Treatment

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Farm•A•Syst

FACT SHEET 13

Nebraska's Farm Assessment System for Assessing the Risk of Water Contamination

Improving Milking Center Effluent Treatment

Effluent from the dairy milking center, including discharges from the milking parlor (manure, feed solids, hoof dirt) and milkhouse (bulk tank and pipeline rinse water and detergent used in cleaning), is commonly disposed of in a variety of ways. Milking center effluent offers several unique challenges due to the presence of:

- Large volumes of contaminated water which can overwhelm soil absorption systems.
- Milk solids and fats and manure solids which plug many systems.
- Cleaning sanitizers which reduce bacterial breakdown of solids.

When these systems fail, effluent will become a risk to surface and groundwater quality.

From an environmental perspective, delivery of milking center effluent to a manure storage facility, if available, makes the most sense. Discharge options, from most to least desirable, are: field application, treatment lagoon, overland flow, slow surface infiltration, below ground absorption fields, and rapid surface infiltration.

Your drinking water is less likely to be contaminated if you follow appropriate management procedures or dispose of effluent in a location off the farm site. However, proper offsite land application practices are essential to avoid risking contamination that could affect the water supplies and health of others.

1. Combine with dairy manure

Combining milking center wastes with manure has the advantage of using a single system for both by-products. A slurry or liquid manure storage facility, properly constructed and sized, provides the additional flexibility of storing all discharges until they can be land applied at the right time (see *Figure 1a*).

This option is limited, however, to dairy farms that handle their manure in slurry form. While it adds to transportation and spreading costs, nutrients from milking center effluent can be used to meet crop requirements, thus reducing fertilizer costs.

Applying milking center effluent with manure to fields at rates that do not exceed crop needs for nitrogen is least risky for groundwater contamination. Care must be taken, however, to avoid buildup of soil phosphorus levels in the soil.

Milking center effluent combined with runoff (from solid manure storage or livestock yard) can also be stored in a detention pond (see *Figure 1b*). The contents of the pond can be applied to fields when conditions are appropriate.

2. Pretreatment before discharge

If milking center effluent is not to be handled with the manure or livestock yard runoff collection system, some pretreatment of the effluent is

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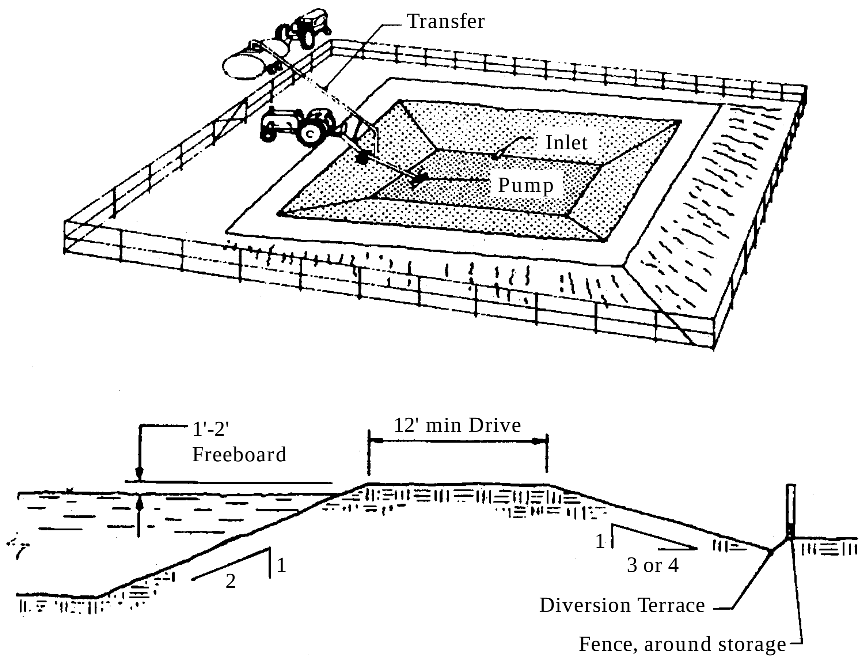

Figure 1a. Earth basins for manure and dairy effluent storage. *Source:* Dairy and Equipment Housing Handbook, MWPS-7, Midwest Plan Service, Ames, Iowa.

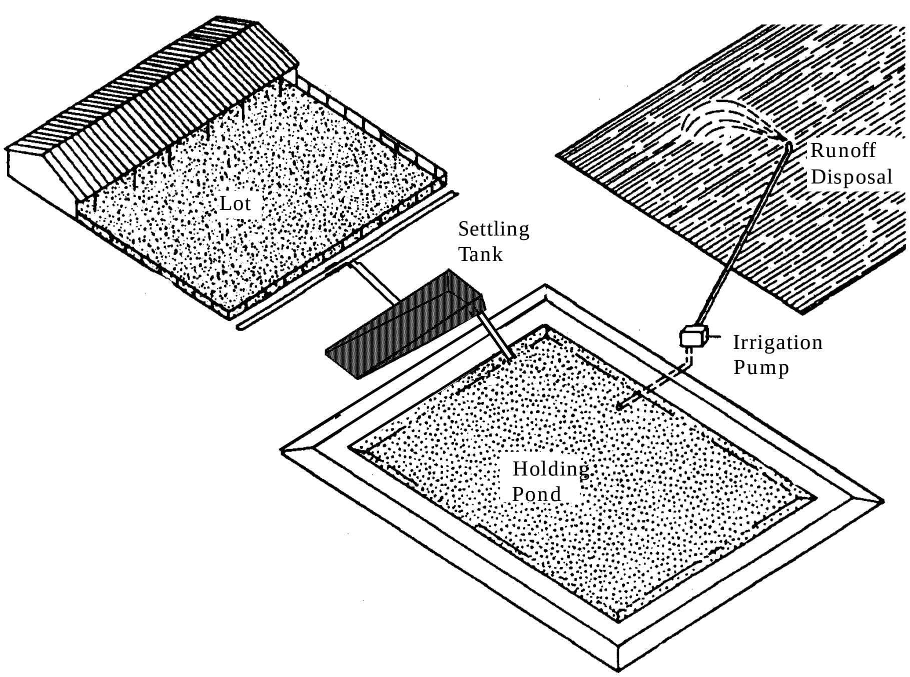

Figure 1b. Detention pond for storage of dairy effluent and livestock yard runoff. *Source:* Dairy Housing and Equipment Handbook, MWPS-7, Midwest Plan Service, Ames, Iowa.

desirable. Minimizing milk and manure additions to the effluent is a critical first step. These steps can minimize those additions:

- Collect waste milk and the first rinse water from pipeline and bulk tank washing for feeding to calves.
- Scrape manure solids from the parlor and holding pen floors before hosing down those areas.

Pretreating milking center effluent to remove some solids can extend the effectiveness of many final effluent treatment systems. Such pretreatment usually consists of a tank that holds the effluent long enough for heavier particles to settle and lighter solids to float (see *Figure 2*). A settling tank also provides a place for bacteria to decompose some wastes before they enter the soil absorption area. A septic tank can perform this function.

Regular removal of these settled solids is required, a commonly neglected task for subsurface disposal systems. Solids settling tanks also accumulate a scum on top of the effluent. Removing the scum layer every few weeks is required to keep the system operating efficiently. Failure to perform these tasks frequently will eventually allow these solids to get into the soil absorption area, clogging the spaces between soil particles and causing effluent to collect on the surface.

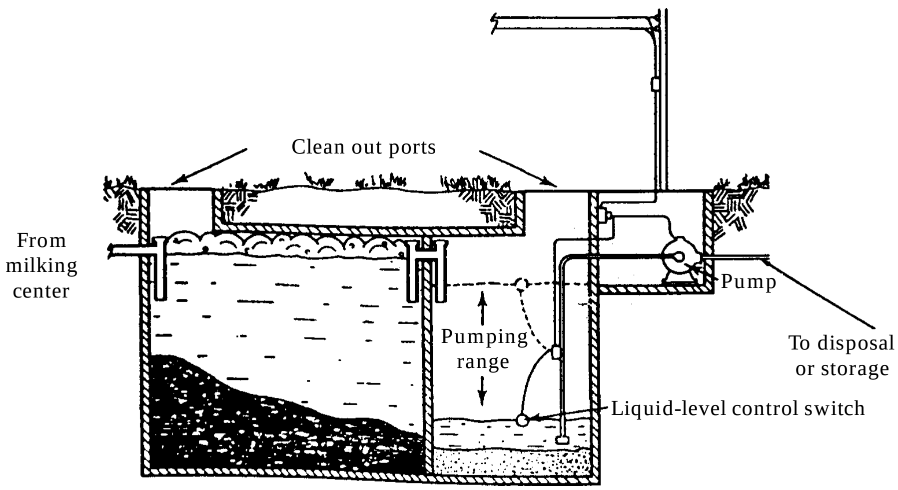

Figure 2. Settling tank with pump to distribution pipes. Adapted from *Effluent Management and Disposal for Milking Centers*, CES Special Circular 207, Pennsylvania State University.

Passing effluent through a shallow treatment pond (also called a facultative lagoon) results in a more thorough pretreatment. Algae growing in the pond generate oxygen, which can help decompose organic compounds without obnoxious odors. Solids that settle to the bottom of the pond usually decompose in the absence of oxygen. To prevent groundwater contamination, such ponds must be built of an impervious material such as packed clay if local soil conditions are not judged satisfactory for minimizing infiltration.

Effluent can be discharged to a lagoon without first going through a settling tank. After settling, the wastes are best applied at low rates to croplands. Be aware that decomposition processes in this arrangement may generate odors.

3. Discharge methods

Treating effluent for direct discharge to a stream or lake is generally too expensive for most dairy farms. Most options fall into one of five categories that utilize the soil as the final disposition for the effluent. These treatments, in decreasing order of effectiveness, include:

- field application
- surface flow
- slow surface infiltration
- subsurface absorption (septic tank type system)
- rapid surface infiltration

Any of these discharge methods that involve application of wastes to the soil surface should be tied to a soil analysis and a plan for utilization of these wastes by crops. These applied nutrients should be credited in your fertilizer program.

Field application

Application of effluent to cropland, at application rates not exceeding the water holding capacity of the soil, poses the least danger to groundwater or surface water. The soil can treat the solids and bacteria and crops can use some of the nutrients, thus preventing them from entering groundwater or surface water.

Effluent can be applied to croplands and pastures by portable irrigation equipment or a liquid manure spreader. Pipes with sprinklers can also be permanently installed to spray effluent over certain areas consistently. Determine application rates that avoid runoff or exceeding the water holding capacity of the soil and utilize nutrients by crop vegetation that is periodically removed. Soils should be monitored for a buildup in salts and phosphorus. Do not saturate areas to avoid rapid percolation to groundwater or runoff to surface water.

The crop or other vegetation should be harvested to avoid accumulation of nutrients at this site. After harvesting the vegetation, feed it to livestock, if appropriate, or use as bedding. If left on the ground, nutrients remain available to move toward groundwater. Forest, windbreak, or woodlot application may also be suitable, in which case routine harvest is not needed.

Surface flow

A properly designed grass filter bed provides an accepted means of treating milking center effluent. Allowing effluent to run slowly in a sheet (uniform layer) over a relatively impervious clay soil might reduce the chances of groundwater contamination (see *Figure 3*). The system is designed like a slow infiltration area, but water flowing across the soil eventually flows from it, especially in winter or wet weather.

Vegetation removes nutrients supplied by the effluent. It is necessary to remove vegetation from the site so that nitrogen and phosphorus are not released when the vegetation dies.

While this system poses a low risk of groundwater contamination from any milking center effluent pollutant, it has a higher risk of contaminating surface water than some other systems.

Slow surface infiltration

Effluent can be applied at one end of a gently sloping grass filter strip or terrace. By spreading pretreated effluent over a vegetated soil surface, organic compounds and bacteria can be treated or filtered out as water flows in sheet form over the sloped, vegetated soil surface and percolates through the soil (see *Figures 4a* and *4b*). This system works best on well-drained loamy soils with at least 3 feet to bedrock or groundwater. The area should be designed to minimize runoff during heavy rain or snowmelt.

Harvesting the infiltration area is needed to keep vegetation from decomposing and releasing nutrients that could seep down to the groundwater.

With an uncontrolled gravity system, the area remains wet, making mechanical harvesting of vegetation difficult. By controlling the flow with a pump, wastes can be applied and then the area can be allowed to dry out.

Administering effluent intermittently may require that the retention tank and disposal area be large enough to handle several days' production of milking center discharges. Alternating between two infiltration areas is another way to allow an area to dry out.

Properly operated, a slow infiltration system poses a moderate risk of groundwater contamination by nitrate and other soluble compounds. There is a low risk of contamination by organic matter, pathogenic (disease-causing) microorganisms, phosphorus, and detergents.

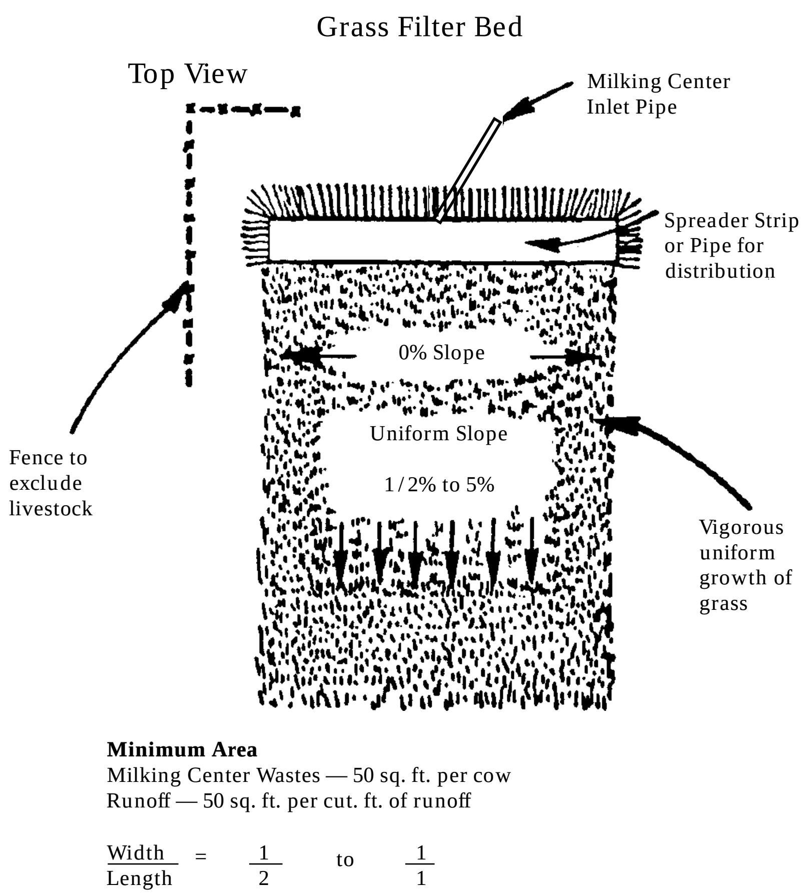

Figure 3. Surface flow (overland). *Source:* Dairy Manure Management—Handling Milk Center Wastes, Northeast Dairy Practices Council 27.B, October 1977.

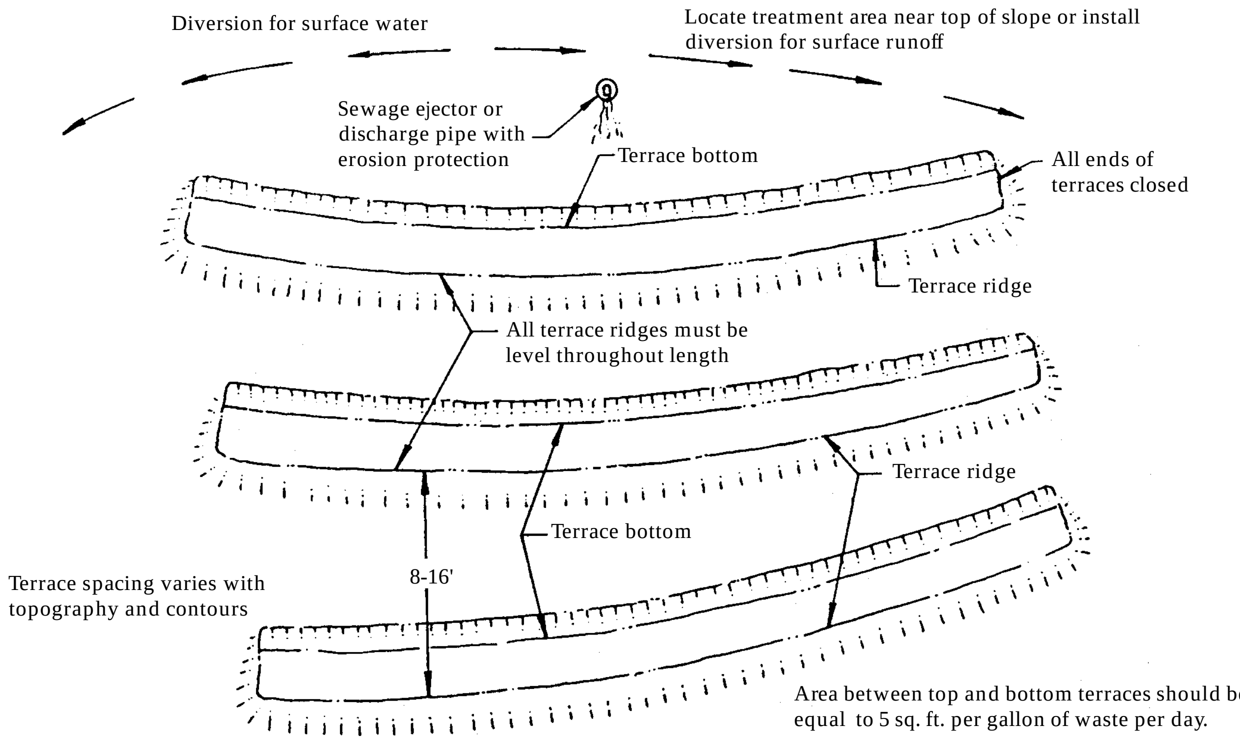

Figure 4a. Contour terraces. *Source:* Treatment and Disposal of Milkhouse and Milking Parlour Wastes, D.W. Bates and R.E. Machmeier, University of Minnesota Agricultural Extension Service, M-159, 1977.

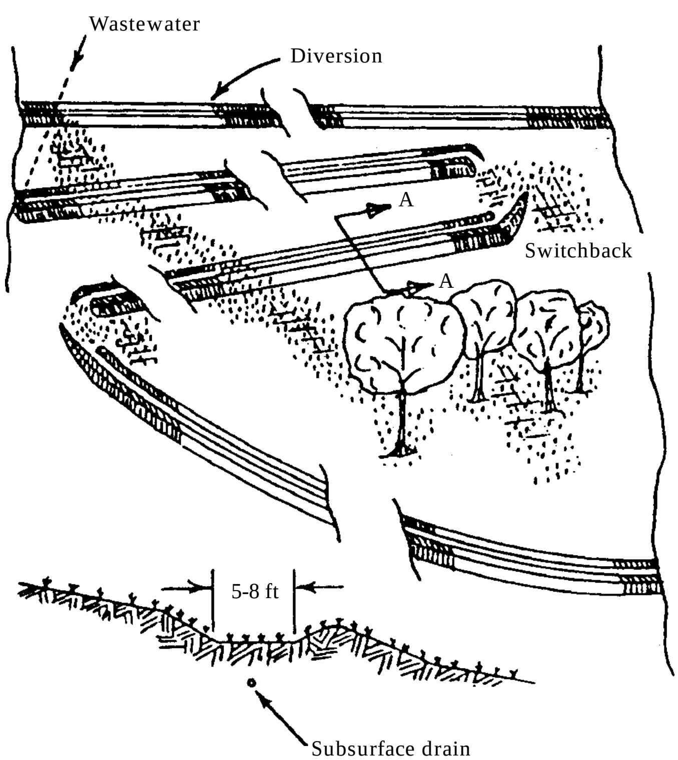

Figure 4b. One to two percent infiltration terrace. *Source:* Milking Center Effluent Disposal, Manure Management for Environmental Protection, Document DM7, Pennsylvania Department of Environmental Resources, October 1986.

Subsurface Absorption

While below ground absorption has been recommended in the past, experience has shown that these systems have a short useful life. Natural processes, failure to remove solids from the effluent, or releasing large quantities of milk into the system can cause the soil to become clogged and allow effluents to back up through the drains. The effluent may collect on the surface until it evaporates or flows into a field or watercourse. Surface discharge could violate both dairy sanitation regulations and surface water quality standards**. As a result, below ground absorption fields are not recommended for milking center effluent.**

Subsurface absorption systems treat milking center effluent best in deep loam. Allowing air to enter the subsurface can help speed organic matter decomposition and keep soil pores open. Aeration can occur by having two absorption fields and switching between them at intervals of six months or less. A settling tank with capacity to store the flow for several days before being emptied by pump or dosing siphon is another way to allow absorption bed aeration. It is important to provide air inlets to the area. Waste milk should not be discharged to these sites.

Even when these systems are operating properly, there is a risk of groundwater contamination by nitrate. As a result, there is no “low-risk” practice associated with this category. If these systems are working properly, there is a low risk of contamination by suspended solids, disease-causing bacteria and detergents.

Rapid surface infiltration

When operating properly, these systems pose a high risk of groundwater contamination by nitrate, phosphorus, ammonia, and other soluble compounds, such as detergents. Experience has shown that these systems have a high incidence of groundwater contamination and operational failure. Sandy soils should not be used, since microorganisms and organic compounds will not be adequately filtered or decomposed by soil bacteria before the effluent reaches groundwater. **As a result, rapid surface infiltration fields are not recommended for milking center effluent.**

CONTACTS AND REFERENCES

Who to call about...

Potential surface or groundwater contamination from your milking center effluent:
Your regional Natural Resources District or Natural Resources Conservation Service office.

Financial assistance for the cost of new control facilities:
Your local Natural Resources District or Natural Resources Conservation Service office.

Review of construction plans:
To be sure that sanitation and water quality regulations are being met, contact a dairy sanitarian, county health department or your Natural Resources District office.

Securing a permit:
Milking center effluent should be viewed similar to livestock manure when determining required waste control facilities and permit requirements. Before committing to a new facility, contact the Nebraska Department of Environmental Quality, Suite 400, 1200 N Street, The Atrium, Lincoln, NE 68509-8922, (402)471-4239.

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.)

Design criteria and general information:

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

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

Alternative Methods for Treating Milking Center Wastes in Milking Center Design NRAES-66. (3)

Publications available from...

1. Your local University of Nebraska Cooperative Extension office.
2. MWPS publications are available through your local University of Nebraska Cooperative Extension office or Agricultural Engineering Plan Service, University of Nebraska-Lincoln, 219A LW Chase Hall, P.O. Box 830727, Lincoln, NE 68583-0727, (402) 472-1646.
3. NRAES, Riley Robb Hall, Cornell University, Ithaca, NY 14853, (607) 255-7654.

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