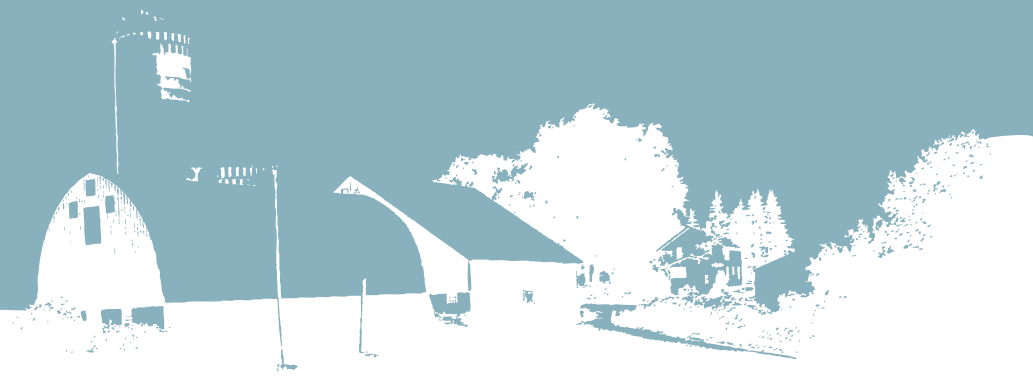
MILK HOUSE WASTE



SURFACE IRRIGATION - A MILK HOUSE WASTEWATER TREATMENT OPTION

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Publication 1202

Funding for this project was provided to the Bioproducts and Biosystems Engineering Department through two US EPA 319 grants administered by the Minnesota Pollution Control Agency. Additional significant matching funding was provided by other state and local agencies and the cooperating dairy producers. The purpose of the project was to design, install and monitor sixteen milk house wastewater treatment systems in four counties in Minnesota. The results were used to develop design and management guidelines. Additional information can be found at www.manure.umn.edu/applied/milkhouse_waste.html.

This fact sheet was updated September 2007.

Introduction

Milk house wastewater includes residual milk (i.e. milk that remains in the pipeline, milking units, receiver and bulk tank after emptying) and the wash water that cleans them, the miscellaneous equipment, and the milk house floor. This wastewater commonly includes, cleaning chemicals (i.e. detergents, sanitizers and acid rinses) water softener recharge water, and small amounts of manure, bedding, feed grit and dirt. Concentrations of this material require that this wastewater not be discharged to the environment or discharged to a standard septic system. Several options are currently available to treat and disperse milk house wastewater. Each of these systems has site specific requirements that must be considered in the design, construction and maintenance. This publication provides an overview of the Surface Irrigation System option.

What is a Surface Irrigation System?

Surface irrigation systems are used to distribute milk house wastewater at agronomic rates to large areas with minimum erosion potential. The areas can be flat soil areas with minimal ground cover (e.g. cropland) or well vegetated areas with up to 15% slopes (e.g. pasture). Components of the irrigation system include one or more primary septic tanks, a dosing tank, pump, piping, and irriga-

tion heads. The irrigation system is designed to land apply the milk house wastewater daily throughout the year with special frost proof irrigation heads used during cold weather. Two or more operating zones are used to allow the areas to dry during times when the area is being grazed or crops harvested. Often the zones are divided by winter and summer operation. More zones provide additional flexibility in irrigation management.

Wobbler® head

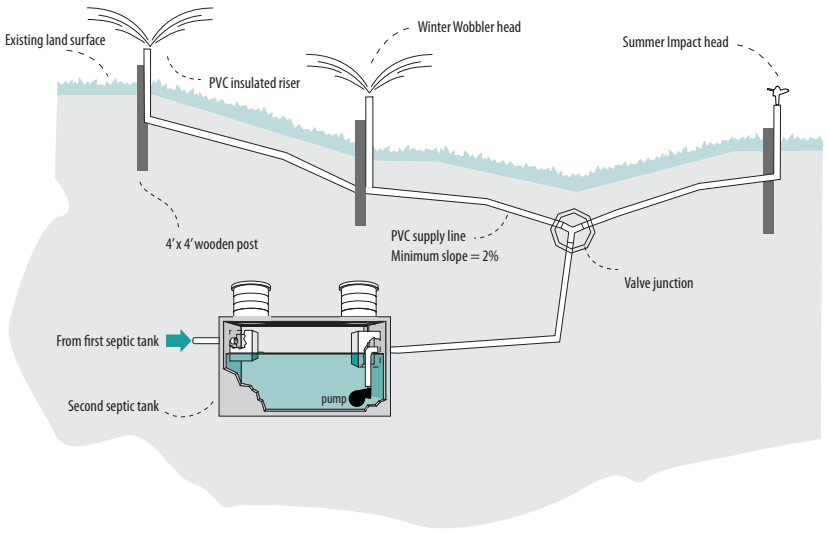
Impact head

How Much Land is Required for a Surface Irrigation System?

Sizing of the irrigation area is a function of the nutrient content of the wastewater (nitrogen and phosphorus produced per year), the crop grown in the application area and the erosion potential of the application area. If the area has a slope less than 15% and is covered by vegetation, the application rate is a function of nitrogen. If there is potential for soil erosion, the application area is determined by crop phosphorus uptake by the growing plants. Irrigation to pasture areas requires approximately 150 square feet per cow if the application rate is based on nitrogen requirements. If this same area has a slope greater than 15%, or a high potential for soil erosion the application rate would

Milk house vs. Parlor Wastewater

This publication does not address milking systems which combine parlor wastewater with milk house wastewater. Treatment systems for these combined wastewaters are more challenging due to the amount of manure and larger volumes of wastewater. Also note that toilet waste cannot be handled with any milk house waste system because they are not designed to handle human pathogens.



Schematic of irrigation system

be based on phosphorus and would require approximately 2000 or more square feet per cow. Although this sounds like a considerable area, note that this is not land taken out ofcrop production or pasture but rather land where nutrients are being applied. Sizing of surface irrigation systems is very site specific and assumes that a crop is harvested each year to remove the nutrients. Note that the sizes given here are based on average waste production of five gallons per cow per day; the typical amount coming from a milk house waste only system (not parlor waste).

What Other Things Should I Know?

Wastewater is applied daily to the irrigation area throughout the year at a rate of approximately 0.01-0.04 inches per day. During winter much of this water evaporates leaving only a small amount of ice on the site that will contribute to spring runoff from the area. Typically there are two or more irrigation zones and valves to control which application area is being irrigated. A minimum of two irrigation zones are needed to allow for drying before harvest, tillage, or grazing.

Special irrigation heads are used for winter wastewater application. These heads have a 50-foot diameter spread pattern. To be able to irrigate in below freezing weather it is critical that system is designed to drain completely after each application. All distribution lines should be installed with a slope of 1% or greater to allow drainback to the pump tank. During seven years of research there were no issues with the irrigation systems freezing in Minnesota winters with little snow cover and below zero °F temperatures for several weeks in a row.

Summer Irrigation on corn field

Summer irrigation is accomplished with traditional impact heads. These heads can be a full or part circle irrigation pattern. Sometimes these heads are set up along a fence line to irrigate a crop and only rotate 180 degrees. Experience to date suggests that there is no damage to corn or pasture with this effluent irrigation. Alfalfa is less tolerant to wet soils. Check with your agronomist about the potential impact of daily irrigation on other crops.

Irrigation with Wobbler® heads

During irrigation there are some odors are emitted. Good siting that considers wind direction and location of residences is important. Installation of an application timer is also recommended to control the time when the application and odor events occur.

How Much Maintenance is Required?

Irrigation systems require little maintenance. The pump, float switches, and alarm used to distribute the effluent to the infiltration area may require repair but are generally very reliable.

Septic tanks must be inspected quarterly for solids and scum buildup. Excessive buildup decreases the septic tanks working volume thereby reducing its ability to retain solids, organic matter, and fat. Although some waste milk (milk from fresh and treated cows) can be handled with the irrigation system this additional organic loading will cause excessive buildup in the septic tanks which will require more frequent pumping. Typically, septic tanks require pumping (emptying) once per year with the effluent being applied to cropland. Never enter the septic tank for any reason because of the risk of asphyxiation.

This activity may be performed by a septic system Pumper/Maintainer or the producer. If this effluent is applied on land owned by the producer, it must be applied in accordance with farm's manure management plan.

Under normal operating conditions the irrigation heads should not plug. If plugging occurs heads can be removed and cleaned.

Economics

Capital investment for irrigation systems installed to date, which handled 300 to 500 gallons of milk house wastewater per day, was between $6000 and $10,000. Variability in cost was primarily a function of the distance from the milk house to the irrigation area, elevation differences, and other site specific installation issues. The costs include the materials and installation of the tanks, pipig and electricity. Operating cost is estimated at $150 per year which would include the cost of pumping the septic tank and the electrical costs for running the irrigation pump.

Additional Information

For additional information visit www.manure.umn.edu/applied/milkhouse_waste.html or contact your local Extension office.

Economic Evaluation

In evaluating costs of milk house waste treatment systems it is important to compare the costs of the system to the alternative treatment systems. Is the proposed system cheaper than building long term storage and applying the effluent to cropland using a slurry tank applicator? Manure application costs about $10 per 1000 gallons ($0.01 per gallon). Using average values, each milk cow will produce about 1825 gallons of effluent per year (5 gallons per cow per day). Using this volume, application costs would be $18 per cow per year without any consideration for storage costs. If the useful life of the system is 15 years, the per cost cow is $275. Over 15 years a 50-cow dairy would pay $13,750 ($275 x 50) for mik house waste application. This value should be compared to the cost of the treatment system.