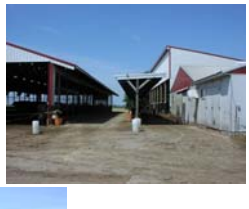
Parlor Wastewater Irrigation Treatment System

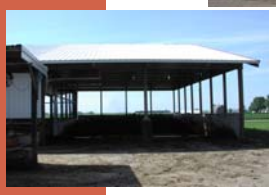
Paul Spartz

Site Data

210 Jersey dairy cows

Existing compost barns with covered storage for feed alley





Site Data (cont.)

Updating milking parlor

Existing parlor wastewater storage pond considered a pollution problem by MPCA

2,400 gal cooling plate water (1/2 to wash parlor, ½ into tile)

Parlor Wastewater Design Alternatives

- Storage: landowner did not want to rely on someone to empty
- Barkbed
  - Typically milk house wastewater from 100 head or less
  - Not intended for treatment and disposal of effluent from parlors
- Irrigation system
  - Have been designed to handle milk house or parlor wastewater, but more data is needed for the parlor systems
  - Cleaning of milking parlors generates higher volume of wastewater per cow with high concentrations of solids and nutrients
  - Landowner consulted with other successful operators and contractors of parlor wastewater irrigation systems

Irrigation System Components

-Settling Tank

-Gravity Pipe From Settling Tank to Pumping Tank

-Pump Tank

Irrigation System Components (cont.)

-Pasture Irrigation Area

-Irrigation heads

-Effluent Pump

-Distribution Pipe

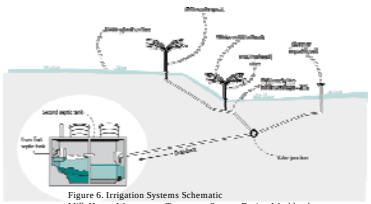
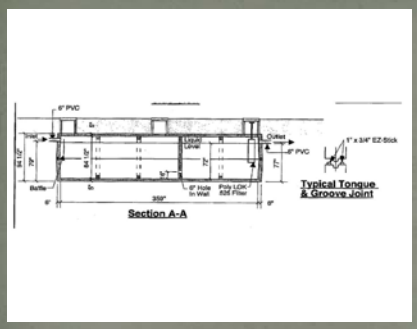


Figure 6. Irrigation Systems Schematic
Milk House Wastewater Treatment System Design Workbook.
University of Minnesota Extension

Design Discharge

- U of M extension milk house estimate 5 gal/cow/day
- Landowner estimate of parlor discharge = 5 gal/cow /day x 210 cows + 1200 gpd parlor washwater = 2250 gpd



Settling Tank

Primary settling chamber, 3 day HRT = 3 x 2200 gpd = 6600 gal

Secondary settling chamber, 3 day HRT = 3 x 2200 gpd = 6600 gal

Settling Tank (cont.)

- Used 13,100 gal 2 chamber concrete septic tank, (instead of 4 smaller tanks)
  - did NOT require PE certification of septic tank
  - required licensed septic installer
  - tank construction and installation in accordance with MN Rules 7080
  - required manufacturer's recommendations to be followed

Settling Tank (cont.)

Settling Tank (cont.)

Settling Tank (cont.)

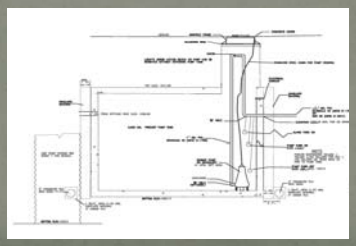
- Effluent filter required
  - Stops scum & hair

Gravity Pipe From Settling Tank to Pumping Tank

- From AWFMH Chapter 10 gravity pipelines for parlor wastes have a narrow range of slopes where they will operate properly and avoid separation of solids and liquids. A 6" PVC pipe should be installed on a 1% grade.
  - A clean out was installed
    - Distance > 100 feet
    - Grades 6.5%-10% after the settling tank
    - Only liquid to pumping tank.

Pumping Tank

- 1 day HRT = 2200 gal
- Used 3000 gal concrete septic tank



Pumping Tank (cont.)

- High water table soils
  - Septic tanks are typically installed without perimeter tile
  - Used perimeter tile with sump & pump, because tank is empty daily in high water table soils

Pasture Irrigation Area

- 0.9 acre area is required based on nitrogen removed by the grass in a year. Note these equations are intended for milk house wastewater not parlor wastewater.
- Soils: ≥ 20% passing the #200 sieve min. 2 feet below buffer surface
- Watertable: 2' minimum separation to the seasonal high watertable
- Slope: < 3% required (NRCS Practice Standard 629)
  - Variance to use 4.5%
- U of M Extension Handbook
  - Vegetated areas up to 15% slopes
  - Cropland less than 3%

Pasture Irrigation Area (cont.)

- Consider locating out of public eye (i.e. discolored snow). This irrigation area is visible from the township road at a distance of 500'.

Irrigation Heads

Wobbler heads are required in the winter and used year round

1' maximum elevation difference of head in a zone, installed on the contour.

Using a 55' irrigation diameter from the extension literature

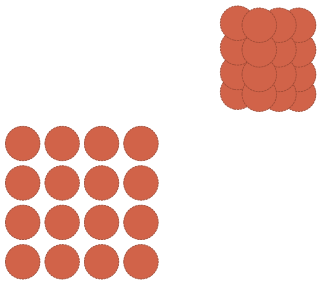
16 Wobbler heads with a 9/32" orifices are required.

Layout and Effective Area

For the purposes of wastewater distribution, spacing between the heads can be greater because even distribution is not as critical.

To do that would require twice as many heads spaced closer together with smaller orifices.

Observed diameters are 55', except the farthest head is less.

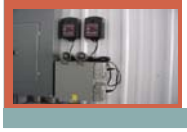


Effluent Pump

To minimize the pump size, the area is divided into 4 zones

The landowner used a 2 week rotation for the zones.

Alarms installed for the pump tank, & perimeter tile sump

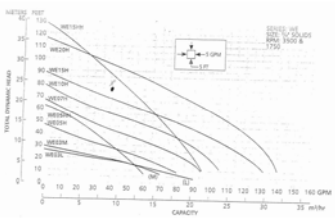


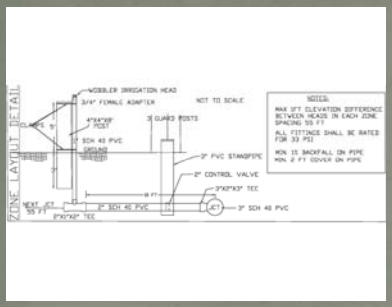
Effluent Pump (cont.)

Pump selection is based on the zone with highest pressure and flow requirements.

Required pump flow =10.2gpm/heads x 4 heads =41 gpm.

Maximum pressure =20' elevation difference + 10' pipe friction loss + 46' (20psi) irrigation heads = 76' (33psi)





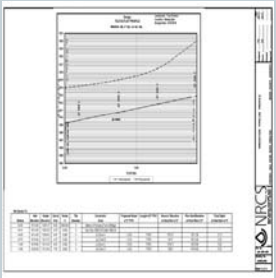
Distribution

Schedule 40 PVC pipe, 3" dia. main, 2" dia. zone, 1" dia. to each zone

Fittings: pressure rated for at least 33psi

Distribution Pipe (cont.)

- Freezing protection: pipes shall drain back to the pump tank on a 1% minimum grade and 2' minimum cover



Distribution (cont.)

- Control valves for zones: 2" dia. brass ball valve
- 4' deep, 2" dia. PVC stand pipe
- 2.5' above ground, valve handle extension, located along fence so no guard

Distribution (cont.)

-Wobbler riser: 4"x4"x8' long treated wood post, 5' above ground. (based on tables for 55' distribution and snow depth in the pasture) and 3' below ground.

-Has not had to protect the risers from the cows with electric fence.

Safety

- Pump removal without entering tank
- Warning Signs

Resources

- NRCS Practice Standard 629
- U of M Extension Publication
- Joint Powers Engineer's Kate Bruss & Pete Fryer

Operation & Maintenance

- Pumps solids from settling tank every 3 months
- Considering an additive to break up the solids in the settling tank
- Effluent pump runs twice a day for about 20 minutes.
- Has a backup effluent pump
- Effluent filter in secondary settling chamber cleaned only once in 4 months
- Water in control valve stand pipes, but did not freeze
- Changes zones every 2 weeks
- Minor odor when irrigators run and changes with the weather
- Vent in pump tank line helped with odor
- Pasture is flash grazed. The grass is bitter but the cows will eat it.
- Landowner is satisfied with project, considers it low maintenance

Cost Data

- NRCS cost estimate = $55,000
- Project cost = $43,000 (does not include landowner labor)
- EQIP Payment
  - Septic Tanks
    - P.S. 313 Concrete Tank = $16,500
    - Took the entire storage volume (settling and pumping tank) and applied to payment rate.
    - $12/CF for first 1300 cf and $0.90 cf for additional
    - Did NOT take the first 1300 cf rate for each tank.
- Total payment with concrete tanks as separate line item
  - $37,500 or 87% Cost Share Rate
- Total payment assuming septic tanks are included in PS 629 Wastewater Irrigation.
  - $21,000 or 49% Cost Share Rate

Final