



Minnesota  
Pollution  
Control  
Agency

Regional  
Division  
Feedlot  
Program

# Ground-water Quality Adjacent to Animal Feedlots

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(Reviewed May 2005)

Many Minnesotans are concerned that manure storage basins at animal feedlots could affect ground-water quality. Between 1994 and 2001 the Minnesota Pollution Control Agency (MPCA) conducted four studies to determine how manure storage systems affect ground water.

## What did we find?

### Study No. 1 - Older feedlots

**Methods:** The first study sampled ground water around 14 older manure storage areas. The feedlots averaged 20 years in age and included concrete- and earthen-lined basins, open feedlots, and unlined basins. Ground water samples were collected from eight to 24 temporary wells installed around each site. The feedlots ranged in size from 100 to 3,000 animals. All 14 sites were located on sandy soils and represented geologic conditions where impacts were most likely to be found.

**Results:** At older feedlots (more than 10 years in age), unlined storage systems, which have not been allowed in Minnesota since 1991, had the greatest impact on ground water (Figure 1). Concrete-lined systems had the least effect. The study also showed that setback distances can protect nearby wells. Impacts were most commonly detected at the top of the water table within 50 to 300 feet of the manure storage areas.

### Study No. 2 - New earthen basins

**Methods:** In the second study, ground water was collected from 17 feedlots with new manure storage systems. Monitoring wells

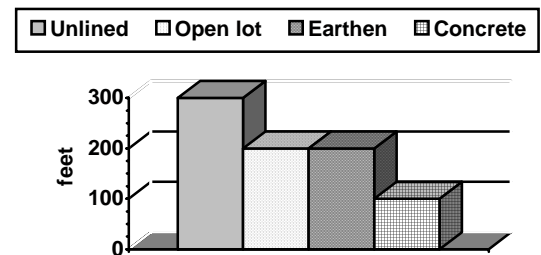


Figure 1: Median distance down-gradient to where ground water impacts from manure storage were observed.

and/or tile lines surrounding the manure basins were sampled at each site. Sampling occurred over a period of four to seven years. These sites are mostly located on clayey soils. This study is intended for long-term trend evaluation.

**Results:** Ground-water impacts at sites with new storage systems (less than five years in age) were evident at one of 17 sites.

### Study No. 3 - Effectiveness of clay liners

**Methods:** In the third study liquids seeping through earthen basins lined with clayey soils was collected and monitored at three sites. The sampling occurred over a period of one to five years. This study focused on the quality and quantity of seepage migrating through earthen liners.

**Results:** Leaching rates through the soil liners have exceeded the construction standards at all three sites, and are greater through the side walls compared to bottoms of manure basins. Contaminant concentrations in the seepage liquids were low, with the exception of chloride and some other salts.

#### MPCA Area Offices:

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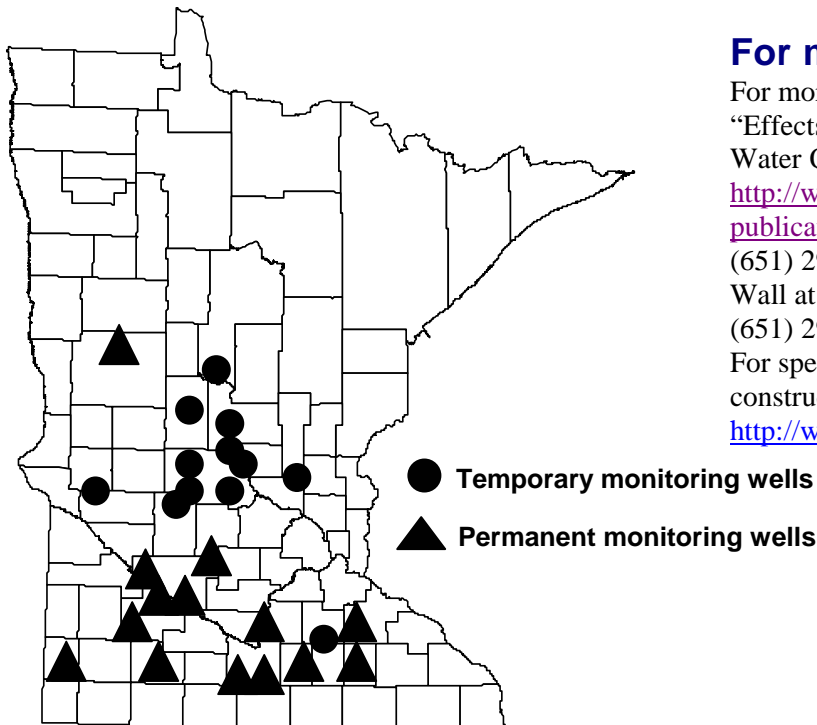


### Study No. 4 - Geomembrane-lined basin

**Methods:** In the fourth study, sampling of ground water occurred around a 40-year-old open feedlot where a geomembrane-lined manure storage basin was constructed on sandy soils. Sampling of monitoring wells occurred quarterly for three years. This site is intended to be a long-term study examining the effects of new liner technology.

**Results:** At the open lot with a new geomembrane-lined manure storage basin, total nitrogen concentrations in ground water beneath the feedlot decreased by 55 percent in the three years after construction.

**Figure 2: Location of temporary and permanent monitoring networks .**



### How can impacts from feedlots be minimized?

In sandy soils, earthen-lined manure storage areas provide more protection to ground water than unlined, and concrete liners provide more protection than earthen liners. In clayey soils, earthen and concrete liners are generally protective of ground water.

At farms where concrete-, geomembrane-, or geosynthetic-lined systems are not used, proper siting of the manure storage areas minimizes the risk to wells, lakes, streams, and other waters.

These studies support existing MPCA rules regarding the importance of properly designed and constructed liners, including use of low-seepage liners in areas susceptible to sinkhole formation.

### For more information

For more information or to get a copy of the full report "Effects of Liquid Manure Storage Systems on Ground Water Quality" on the Web, go to: <http://www.pca.state.mn.us/hot/feedlot-publications.html#reports> or contact Jim Stockinger at (651) 297-5236, Mike Trojan at (651) 297-5219 or Dave Wall at (651) 296-8440.

For specific information on the Web about feedlot construction requirements in Minnesota, go to: <http://www.pca.state.mn.us/hot/feedlots.html>