Vermont
Farm*A*Syst

Worksheet #7
Assessing the Risk of Groundwater Contamination from

Manure Storage

Why should I be concerned?

Storing livestock waste allows farmers to spread manure when conditions are right for nutrient use by crops. Accumulating manure in a concentrated area, however, can be risky to the environment and to human and animal health.

Facilities for manure stored in liquid form on the farmstead sometimes leak or burst, releasing large volumes of pollutants. Manure in earthen pits can form a semi-impervious seal of organic matter that does limit leaching potential, but seasonal filling and emptying can cause the seal to break down. Short-term solid manure storage and abandoned storage areas can also be sources of groundwater contamination by nitrates. Manure can contribute nutrients and disease-causing organisms to both surface water and groundwater.

Nitrate levels in drinking water above federal and state drinking water standards of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) nitrate-nitrogen can pose health problems for infants under 6 months of age, including the condition known as methemoglobinemia (blue baby syndrome). Nitrate can also affect adults, but the evidence is much less certain.

Young livestock are also susceptible to health problems from high nitrate-nitrogen levels. Levels of 20-40 mg/l in the water supply may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Fecal bacteria in livestock waste can contaminate groundwater, causing such infectious diseases as dysentery, typhoid and hepatitis. Organic materials that lend an undesirable taste and odor to drinking water are not known to be dangerous to health, but their presence does suggest that other contaminants are flowing into groundwater.

The goal of Farm·A·Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

·It will take you step by step through your livestock waste storage practices.
·It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
·It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your livestock waste storage practices.
·It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

Glossary

Manure Storage

These terms may help you make more accurate assessments when completing Worksheet #7. They may also help clarify some of the terms used in Fact Sheet #7.

Concrete stave storage: A type of liquid-tight animal waste storage structure. Located on a concrete pad, it consists of concrete panels bound together with cable or bolts and sealed between panels.

Earthen basin or pit: Clay-lined manure storage facility constructed according to specific engineering standards. Not simply an excavation.

Engineering standards: Design and construction standards available at Natural Resources Conservation Service (NRCS) offices. These standards may come from NRCS technical guides, state regulations or land grant university engineering handbooks.

Filter strip: A gently sloping grass plot used to filter runoff from the livestock yard and some types of solid manure storage systems. Influent waste is distributed uniformly across the high end of the strip and allowed to flow down the slope. Nutrients and suspended material remaining in the runoff water are filtered through the grass, absorbed by the soil and ultimately taken up by plants. Filter strips must be designed and sized to match the characteristics of the livestock yard or storage system.

Glass-lined steel storage: A type of liquid-tight, above-ground animal waste storage structure. Located on a concrete pad, it consists of steel panels bolted together and coated inside and outside with glass to provide corrosion protection.

Poured concrete storage: A type of liquid-tight animal waste storage structure. Located on a concrete pad, it consists of poured concrete reinforced with steel.

Water table depth: Depth to the upper surface of groundwater. This depth is sometimes indicated in the county soil survey, but this varies from county to county. This information may be available from your well construction report or from hydrogeological reports and groundwater flow maps of your area. Your county Extension agent or NRCS specialist may also be able to help you gather this information.

There are two types of water table: (1) the water table typically noted in a well log as an indication of usable water supply; and (2) the seasonal high water table. The seasonal high water table is most important in regard to construction of livestock manure storage facilities, because it may present facility construction problems.

Manure Storage

Resource Concern	Rank 4	Rank 3	Rank 2	Rank 1	Field Number
LONG-TERM STORAGE (180 days or more)					
Steel, glass-lined (liquid-tight design, above ground)	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Leaking tank on low permeability* soil. Greater than 3 feet to water table and bedrock.	Leaking tank on high permeability* soil. Water table or fractured bedrock shallower than 3 feet.	☐☐☐☐☐
OR					
Concrete stave (liquid-tight design)	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Concrete cracked, low permeability* soil. Greater than 3 feet to water table and bedrock.	Concrete cracked, high permeability* soil. Water table or fractured bedrock shallower than 3 feet.	☐☐☐☐☐
OR					
Poured concrete (liquid-tight design)	Designed and installed according to accepted standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Concrete cracked, low permeability* soil. Greater than 3 feet to water table and bedrock.	Concrete cracked, high permeability* soil. Water table or fractured bedrock shallower than 3 feet.	☐☐☐☐☐
OR					
Earthen waste storage pit (below ground)		Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Not designed to engineering standards. Constructed in low permeability* soil. Greater than 3 feet to water table and bedrock. Earthen lining eroding.	Not designed to engineering standards. Constructed in high permeability* soil. Water table or bedrock shallower than 3 feet. More than 10 years old. Earthen lining perforated.	☐☐☐☐☐

*Low permeability soils, like clay, allow water to flow through slowly. High permeability soils, like sand and gravel, allow much faster water movement.

Manure Storage

Resource Concern	Rank 4	Rank 3	Rank 2	Rank 1	Field Number ☐☐☐☐☐
SHORT-TERM STORAGE (usually 30-90 days; in some cases, up to 180 days)					
Stacked in field (on soil base)			Stacked on high ground on low permeability* soil. Greater than 3 feet to water table and bedrock.	Stacked on high ground on high permeability* soil. Water table or bedrock shallower than 3 feet.	☐☐☐☐☐
Stacked in yard*	Covered concrete yard with curbs, gutters and settling basin.	Concrete yard with curbs and gutters. Grass filter strips installed and maintained.	Earthen yard on low permeability* soil. Greater than 3 feet to water table and bedrock.	Earthen yard on high permeability* soil. Bedrock or water table shallower than 3 feet.	☐☐☐☐☐
Water-tight structure designed to accepted engineering standards and specifications	Designed and installed according to engineering standards. All liquids retained. Properly maintained.	Designed and installed according to engineering standards on low permeability* soil. Water table and bedrock deeper than 3 feet.	Designed and installed according to engineering standards on high permeability* soil. Water table or fractured bedrock shallower than 3 feet.	Designed and installed according to engineering standards. Not properly maintained. Water treatment and diversion structures allowed to deteriorate.	☐☐☐☐☐
Stacked in open housing	Building has concrete floor, protected from surface water runoff. Adequate bedding provided.	Building has earthen or concrete floor on low permeabilty* soils, protected from surface water runoff. Water table and bedrock deeper than 3 feet.	Building has earthen or concrete floor on low permeability* soil, subject to surface water runoff. Water table or fractured bedrock shallower than 3 feet.	Building has earthen floor on high permeability* soil, subject to surface water runoff. Water table or fractured bedrock shallower than 3 feet.	☐☐☐☐☐

LOCATION					
Location of livestock waste storage in relation to drinking water well	Manure stack or earthen waste storage pit more than 250 feet downslope from well. Manure storage structure (liquid tight) more than 200 feet downslope from well.	Manure stack or earthen waste storage pit more than 250 feet upslope from well. Manure storage structure (liquid tight) more than 200 feet upslope from well.	Manure stack or earthen waste storage pit less than 250 feet downslope from well. Manure storage structure (liquid tight) **less than 200 feet*** downslope from well.	Manure stack or earthen waste storage pit less than 250 feet upslope from well. Manure storage structure (liquid tight) **less than 200 feet*** upslope from well.	☐ ☐ ☐ ☐ ☐

What do I do with these rankings?

Step 1: Begin by determining your overall well management risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals *	
Rankings total from previous page	number of risk ranking categories ranked (11 if ranked all)

*Carry your answer out to one decimal place.

Example:
26 ÷11 = 2.36
Use 2.4.

Risk Ranking Description

3.6 - 4.0 = low risk
2.6 - 3.5 = low to moderate risk
1.6 - 2.5 = moderate to high risk
1.0 - 1.5 = high risk

This ranking gives you an idea of how your well condition, **as a whole**, might be affecting your drinking water. This ranking should serve only as a **very general guide, not a precise diagnosis.** Because it represents an **averaging** of many individual rankings, it can overlook any **individual** rankings (such as 1's or 2's) that should be of concern. (Step 2 will focus on individually ranked activities of concern.)

Enter your boxed well condition ranking in the appropriate place in the table on the front of Worksheet #12. Later you will compare this risk ranking with other farmstead management rankings. Worksheet #11 will help you determine your farmstead's site conditions (soil type, soil depth, and bedrock characteristics), and worksheet #12 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities.

- **4's - Best:** low-risk practices
- **3's - Provide reasonable groundwater protection:** low- to moderate-risk prac-tices
- **2's - Possibly inadequate protection:** moderate- to high-risk practices
- **1's - Inadequate protection with relatively high groundwater contamination risk:** high-risk practices

Regardless of your overall risk ranking, any individual rankings of “1” require immediate attention. You can take care of some of the concerns right away; others could be major or costly projects, requiring planning and prioritizing before you take action.

Find any activities that you identified as 1's and list them under "High-Risk Activities"on Worksheet #12.

Step 3: Read Fact Sheet #7, "*Improving Manure Storage*," and give some thought to how you might modify your farmstead practices to better protect your drinking water.

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