Farm*A*Syst
NORTH CAROLINA

Environmental Stewardship for Farmers — #7

Improving Storage, Handling, and Disposal of Livestock Waste

Is your well protected from your livestock waste?

Runoff from animal production facilities carries manure, soil and other debris that may contaminate surface and groundwater sources. If not managed properly, animal wastes from sources such as hog, beef, dairy, horse, poultry, and sheep operations can affect water quality and, potentially, your health. Bacteria in animal wastes can contaminate drinking water and may cause potentially serious illnesses. High concentrations of nitrate, a form of nitrogen that develops naturally from decomposing organic matter (including manure) and from commercial nitrogen fertilizers in drinking water may particularly harm unborn or young infants and young livestock. The best way to protect water quality for human and livestock health is to manage livestock waste so that it does not contaminate nearby waters.

Best management practices are designed to prevent contaminated runoff water from leaving the owner's property and entering surface or groundwater. Along with addressing the potential of animal production facilities to pollute water, sound management practices also improve animal health and make maintenance easier. Proper manure handling, storage, and disposal ensure that farmers reap the maximum fertilizer value from animal wastes, while reducing risks of groundwater and surface water contamination from improper application of nutrients.

Management associated with other aspects of animal production, such as dead animal disposal and feed storage, can also affect water quality. Improper management can introduce bacteria or nitrates to water sources. For this reason, feed storage and animal carcass disposal are included in this self-assessment.

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Helping People Put Knowledge to Work

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How can we help?

We have prepared this publication to help you focus on potential problems with your drinking water that may be caused by an improper storage, handling, or disposal of livestock waste. First, read the publication and gather any records you have about your livestock systems: the type of livestock storage system, and the location of livestock waste, as well as the location and type of well on your property. Then answer the questions in this publication.

Each of the following sections deals with different topics. Next to each topic is a question for you to answer. Your answers will help you to see where you have potential problems.

- If you answer a question either a or b, you have few problems with the storage, handling, or disposal of livestock waste.
- If you answer a question either c or d, there may be potential problems with your livestock waste handling, storage, or disposal.
- If you answer a question either c or d, you will want to consider making changes in your livestock waste handling, storage, or disposal in order to protect your drinking water.

If you would like further help in assessing the condition of your livestock waste plan, please visit your nearest Cooperative Extension Service Center and talk with your Extension agent.

How safe is your drinking water?

If you drink water from a well or spring, the water comes from the ground. Most groundwater in North Carolina is safe to drink. If pollution gets into groundwater, your well or spring water may not be safe. Many things we all do at our homes and farms can pollute the groundwater.

If groundwater becomes polluted, it is nearly impossible to clean it up. Then, the only way to get safe drinking water is to treat the existing water, drill a new well, or get water from another source. All of these options are expensive and inconvenient.

The North Carolina Farm*A*Syst program has a series of publications that can help you keep your drinking water safe. These publications will lead you through an evaluation of your farmstead to determine if your water is in danger of becoming or is polluted with harmful substances from your farmstead area. If there is a problem or a potential problem, the Farm*A*Syst publications have information about how to solve the problems. The publications also list the North Carolina state agencies responsible for helping you solve your drinking water problem.

The goal of the North Carolina Farm*A*Syst program is to help you protect the groundwater that North Carolina residents depend on for drinking water.

North Carolina Farm*A*Syst Publications

- *Protecting Water Supply*, #1
- *Improving Fuel Storage*, #2
- *Improving Storage and Handling of Hazardous Waste*, #3
- *Improving Septic Systems*, #4
- *Improving Storage and Handling of Pesticides*, #5
- *Improving Storage and Handling of Fertilizer*, #6
- *Improving Storage, Handling, and Disposal of Livestock Waste*, #7
- *Grazing Livestock and Water Quality*, #8
- *Stream Management in the Piedmont and Mountains*, #9
- *Agriculture and Natural Resource Protection*, #10
- *Protecting Your Wetlands*, #11
- *Wildlife on Your Farm*, #12
- *Christmas Tree Production Best Management Practices to Protect Water Quality and the Environment*, #13
- *Managing Pests*, #14

Animal Production and Waste-Handling Facilities

To protect water quality, your animal waste management system should be properly designed, built, and maintained.

1. How far are your waste storage and treatment facilities from water resources?

North Carolina regulations require all livestock waste storage and treatment facilities be located a minimum of 100 feet from wells. This distance should be increased if the well is located down hill from the waste storage facility or animal lot. While maintaining these separation distances may help to protect your own well, poorly designed or poorly maintained animal lots and waste storage facilities can still contaminate the groundwater that supplies other wells. Protecting the groundwater resource as a whole is important for protecting drinking water supplies for future generations.

Some farms may use springs or surface waters as their water source. Surface waters are susceptible to contamination as well as groundwater. Streams that flow through or near feedlots, exercise lots, heavy-use areas, or areas where stream banks have no vegetative cover should be fenced to restrict animal access. Wetlands or spring-fed watercourses may also need to be fenced. Streams in pasture or wooded areas where streambank integrity is maintained and stream edges with permanent wooded or vegetated buffers may not need to be fenced to protect stream bank integrity, but they may need to be fenced to prevent animals from loafing in the streams. Animals are a direct source of pollutants if allowed to loaf in streams.

2. Do you have diversions around your animal waste storage facilities and livestock feeding, grazing and loafing areas?

One way of reducing water pollution from animal production farms is to reduce the amount of clean water entering the waste storage facilities and livestock feeding, grazing and loafing areas. Careful site selection can minimize or eliminate the provisions needed to divert clean water away from these areas. For established sites, water diversion structures can be built. In all cases, these structures need to be inspected regularly and maintained:

- Waterways, small terraces, and roof gutters direct water away from animal production facilities.
- An earthen ridge or diversion terrace can be constructed across the slope upgrade from animal production facilities to prevent runoff from entering the lot.
- If a diversion terrace is not practical, a catch basin with a tile outlet can be installed upgradient of the waste storage facility or livestock feeding, grazing and loafing areas.

1. Circle the statement that best describes the location of waste storage and treatment facilities on your farm.

a. Your animal waste storage and treatment facilities are more than 100 feet downhill from a well, stream or other water resource.

b. Your animal waste facilities are more than 100 feet on grade with a well, stream or other water resource.

c. Your animal waste facilities are more than 100 feet slightly uphill from a well, stream or other water resource.

d. Your animal waste storage and treatment facilities are uphill or on-grade and less than 100 feet from a well or water source, or pollution from facilities reaches a well, stream or other water resource; OR do not know.

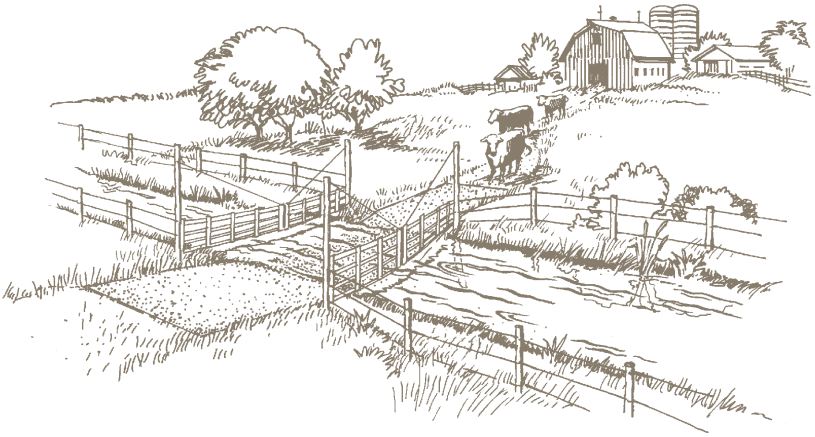
2. Circle the statement that best describes the water diversion around your animal waste storage facilities and livestock feeding, loafing and grazing areas.

a. Your animal waste storage facilities and livestock feeding, grazing and loafing areas are designed so all runoff water and roof water is directed away from the storage area.

b. Most runoff water and most roof water is directed away from animal waste storage facilities and livestock feeding, grazing and loafing areas.

c. No runoff water or roof water is redirected before it reaches your animal waste storage facilities and livestock feeding, grazing and loafing areas. Water may flow through the facility during heavy storms.

d. Water regularly runs freely through your animal waste storage facilities and livestock feeding, grazing and loafing areas; OR do not know.



3. How far are your livestock confinement areas from your well and surface waters?

Surface runoff from feedlots, loafing or grazing areas occurs when the rainfall intensity exceeds the infiltration rate of the soil. This can be caused by high rainfall rates or compacted or disturbed soils (such as animal paths or wheel traffic). Surface runoff also occurs during heavy rainfalls when soil is not compacted. One technique for reducing runoff of contaminated water from feedlots and loafing and grazing areas is to locate these areas away from wells. A buffer of at least 100 feet should provide sufficient filtration of water moving from areas with a high number of animals on the ground toward a well. These buffer zones can consist of a permanently vegetated managed area or natural, unmanaged vegetation or forest.

Surface water near feedlots and loafing and grazing areas can be protected by limiting the access animals have to streams. Surface waters can become contaminated by manure if animals are allowed to loaf in streams. Furthermore, streambanks can become eroded if constant animal traffic prevents vegetation from growing on and stabilizing streambanks. Streams should be fenced to prevent animals for loafing in the water and destroying streambank vegetation.

4. Do you have runoff control systems?

Runoff from adjacent cropland, pasture, roads, or building roofs can flush manure from loafing areas and feedlots into nearby surface water. Contaminated runoff may puddle in areas adjacent to the feedlot or loafing area and then flow vertically through the soil, threatening groundwater quality. This risk is particularly high on sites with sandy soils.

Runoff control systems can help to remedy such problem situations. These systems collect runoff from livestock lots, settle out manure solids, and direct the remaining water to holding ponds, which collect and store runoff for later land application. Another option is to direct the runoff for even distribution on open grassed areas or filter strips, away from streams, ditches, waterways and areas of sandy soils. The runoff flowing through the grass filter strip will soak into the soil. The nutrients that were in the runoff can then be used by the vegetation in the filter strip.

3. Circle the answer that best describes the location of your livestock feeding and loafing or grazing area.

a. Your livestock feeding and loafing, or grazing areas are more than 100 feet from all wells. Livestock have no direct access to a stream or waterway.

b. Your livestock feeding and loafing, or grazing areas are 100 feet from all wells, or livestock have limited access to a stream or surface water source.

c. Your livestock feeding and loafing, or grazing areas are less than 100 feet from all wells and livestock have limited access to a stream or surface water source.

d. Your well is located within a livestock feeding and loafing, or grazing areas and livestock have unlimited access to a stream. Animal wastes enter a stream or other surface waters; OR do not know.

4. Circle the answer that best describes the runoff control systems for your animal loafing areas and feedlots.

a. You collect and store all runoff from your loafing areas and feedlots for later application to crop fields.

b. You channel all runoff from your loafing areas and feedlots through a grassed infiltration area so that the grass can utilize the nutrients.

c. Only a portion of the runoff from your loafing areas and feedlots is channeled through a grass filter strip or collected and stored for later land application.

d. You do not have any runoff control systems for your loafing areas and feedlots; OR do not know.

5. How often do you scrape your loafing areas or feedlots?

Manure typically accumulates on the surface of open feedlots or any other area where there are many animals. Decaying manure is mixed into the soil by animal traffic. Plants will often not grow in these areas of dense animal population. Such an area will often stay muddy due to excess accumulations of manure and urine. This is especially true if manure is not routinely scraped and removed. Proper management of a feedlot includes the frequent scraping and removal of accumulated manure. Once the manure is removed, it should be applied to growing crops or properly stored for land application at a later date.

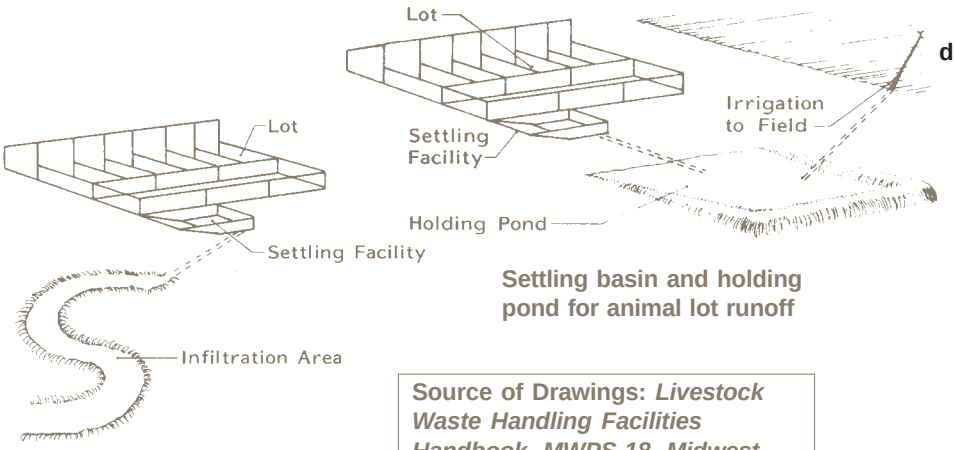
5. Circle the statement that best describes the frequency with which you scrape your livestock yard.

a. You clean and scrape your livestock yard daily to prevent heavy waste accumulation. Wastes are land-applied at least weekly to avoid sanitation problems.

b. You clean and scrap your livestock yard once a week. Wastes are land-applied every couple of weeks.

c. You seldom clean and scrape your livestock yard. Waste is allowed to accumulate for longer than a month and causes sanitation problems.

d. You never clean and scrape your livestock yard. Waste is allowed to accumulate indefinitely; OR do not know.



Settling basin and holding pond for animal lot runoff

Vegetative infiltration strip for animal lot runoff

Source of Drawings: *Livestock Waste Handling Facilities Handbook, MWPS-18, Midwest Plan Service, Ames, Iowa*

Storage of Animal Waste — Solid Systems

6. How do you temporarily store your solid manure?

Manure can be temporarily stockpiled. Stockpiling manure allows producers to hold animal wastes:

- During periods of bad weather when spreading may not be feasible.
- When crops are growing and land is not suitable for applying manure.
- When there is not enough land area to allow for frequent spreading of manure. For example, manure should not be applied to bare soil unless a crop will be planted within 30 days.

Stockpiled manure should be kept on a concrete pad, compressed clay pad, or plastic sheet at least 100 feet from all wells and water sources. This prevents water from flowing down through the manure pile and into the ground. If the manure is stacked in an open field, it should be covered with plastic sheeting weighted down to prevent the cover from blowing off in the wind. Manure should be piled to form a peak so that water will run off the pile.

Temporary storage of solid manure

7. How do you store your solid manure for extended periods of time?

Many farmers have pole sheds where wastes are stored for extended periods of time. By law, these structures must be located at least 100 feet from wells and surface waters. Roofs on these structures keep rain and snow off the manure. These structures protect water quality if there is no surface water runoff through sheds and if adequate bedding is provided to absorb liquids in the wastes. To minimize water quality impacts, divert runoff water around the storage facility and clean storage sheds as often as possible. The type of flooring beneath the shed can also affect the potential for pollution from solid manure storage structures. Concrete floors will prevent water from seeping from the manure into the soil where it may contaminate groundwater. A packed clay floor will also minimize seepage into the soil from solid manure structures, such as those used to store dry litter or manure scraped from feedlots. Sandy soils are generally very susceptible to contamination from seepage.

6. Circle the statement that best describes how you store solid manure in an open air stack.

a. Animal manure stored in an open air manure stack is on a concrete slab and more than 100 feet from a well or water source. All surface water runoff is diverted away from the stack. Stack is covered with plastic tarp.

b. Animal manure stored in an open air manure stack is on compacted clay soil or plastic sheeting and is located more than 100 feet from a well or water source. Stack is covered with plastic tarp.

c. Animal manure stored in an open air stack on the soil more than 100 feet from a well or water source. Stack may or may not be covered with plastic tarp.

d. Animal manure stored in an open air stack on the soil and is less than 100 feet from a well or water source. Stack may or may not be covered with plastic tarp; OR do not know.

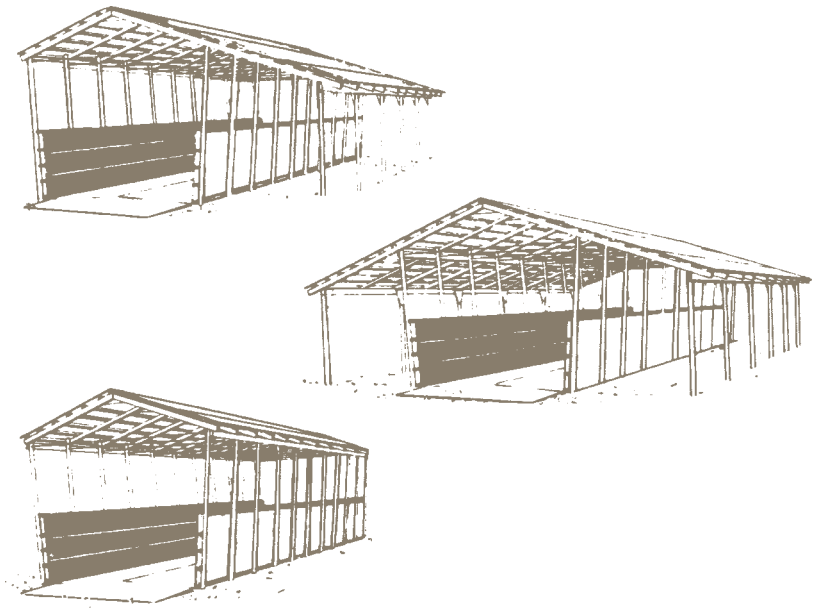
7. Circle the statement that best describes how you store solid manure.

a. Solid animal manure is stored in a building with side walls and a concrete floor and is more than 100 feet from a well or water source.

b. The area where solid animal manure is stored has a roof and a packed clay soil floor and is more than 100 feet from a well or water source.

c. The building where solid animal manure is stored has a leaking roof, a sandy soil floor, or is less than 100 feet from a well or water source.

d. You do not store your solid manure in a building with walls and roof. Instead, it is left uncovered in the field near a well or water source; OR do not know.



Pole barns for storage of dry litter

REMINDER

If you circle c or d for any question, there may be a problem with your drinking water caused by the condition or practice described in the question.

Storage of Animal Waste — Liquid and Slurry Systems

Lagoons or storage pits are usually used for liquid and slurry waste systems. Lagoons are earthen storage structures that function as digestors allowing bacteria to decompose the organic matter in liquid wastes. In addition to this treatment function, lagoons are also designed for temporary storage of wastewaters. Unlike a lagoon, a storage pit is only designed for the temporary storage of manure slurries. Usually minimal biological treatment of the manure will occur in a storage pit.

8. What is the inspection schedule for your waste storage facility?

Liquid and slurry storage systems use pipelines and/or pumps to move wastes from barns or collection areas to the storage facility. These pipes and pumps must be carefully installed and maintained to ensure that they do not leak. Each time you pump from the facility, carefully check all pipes for cracks or the loss of watertight seals. If any breaks are apparent, repair them immediately. Likewise, check the walls of earthen waste storage pits and lagoons regularly to be certain that liner materials are not cracked or eroded away. Check the storage facility frequently for the level of waste. If too much manure is in the facility, it may overflow during a heavy rainfall and potentially contaminate ground or surface water.

8. Circle the answer that best describes your inspection schedules for the waste storage facilities on your farm.

a. You regularly check animal waste storage and treatment facilities for leaks, spills, or overflow and make repairs before any losses occur.

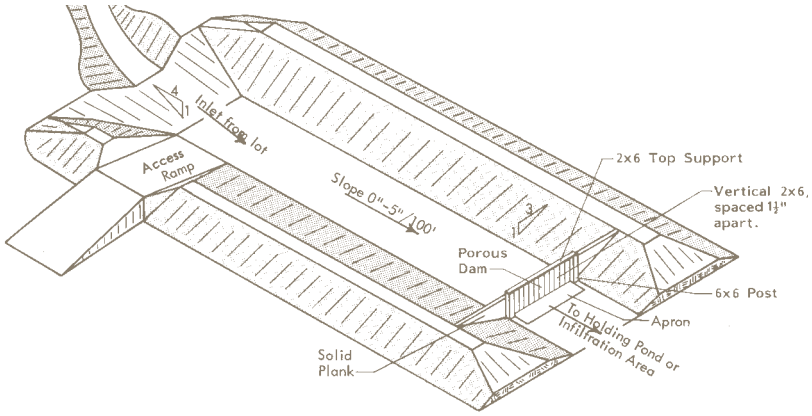
b. You occasionally check animal waste facilities and make repairs at the first sign of leaks, spills, or overflows.

c. You check animal waste facilities yearly and make plans to repair leaks, spills, or overflows.

d. Your animal waste facilities are generally ignored and not checked for leaks, spills, or overflows; OR do not know.

9. What are the design specifications for your liquid waste storage facility?

Current engineering specifications for lagoons and storage pits require clay or synthetic liners if the existing soil on site is not suitable for preventing waste seepage from the structure. If the pit or lagoon was constructed under older engineering standards, it may not have a synthetic or clay lining and therefore it may not be sealed. Pits or lagoons that are not sealed may allow wastes to seep into the underlying soil, especially if the lagoons or pits were built in sandy soils. Groundwater contamination will result if the subsurface earth materials do not have sufficient ability to break down contaminants contained in the seepage. While seepage from in-ground waste storage facilities is not always easy to recognize, there is one telltale sign of trouble. A properly designed structure has the capacity to handle waste from a specific number of animals for a known number of days. If a lagoon designed for 180 days of storage receives designated waste amounts but does not fill to the design level in six months, the lagoon may be leaking.



Semi-solid manure storage facility. ***Source: Livestock Waste Handling Facilities Handbook, MWPS-18, Midwest Plan Service, Ames, Iowa***

10. What is the storage capacity of your waste treatment lagoon or pit?

Liquid waste systems are designed to store and treat a specific volume of waste. Usually these designs are based on the number of animals to be produced on the farm and generally allow 90 to 180 days of storage. A properly managed system will have land application as a component.

For example, a system designed for 180 days storage will require land application of liquid within 180 days. If land application does not occur during the 180 day storage period, then the lagoon or storage pit may overflow causing a risk for water pollution. Another cause of overflow is increasing the number of animals on the farm without increasing the treatment and storage capacity of the system. Sludge can also build up in the waste treatment lagoon or pit thereby reducing the volume available for waste storage. Keep a visual check on the levels of liquid waste in the lagoon or pit.

9. Circle the answer that best describes the design specifications for the liquid waste treatment facilities on your farm.

a. Your animal waste lagoon is designed and installed according to the latest approved engineering standards and is site-specific to your farm. The system holds all liquids and is more than 100 feet from a well or water source.

b. Your animal waste lagoon is designed according to older standards, or is built in silt or clay loam soil and holds all liquids. The system is more than 100 feet from a well or water source.

c. Your animal waste lagoon is not designed to approved standards, or is built in sandy soils without clay or other interior lines. The lagoon does not hold all liquids and is less than 100 feet from a well or water source.

d. Your animal waste lagoon is not designed to approved standards, or is built in sandy soils without clay or other interior lining. The lagoon does not hold all liquids and is less than 100 feet from a well or water source; OR do not know.

10. Circle the answer that best describes the storage capacity in your waste treatment lagoon or storage pit.

a. Your animal waste lagoon is large enough to handle sludge, wastewater, 90 to 180 days wastewater storage, and stormwater. There are no overflows.

b. Your lagoon meets existing treatment needs, but sludge has built up to where an overflow in heavy rains is possible if the recommended wastewater volume is maintained.

c. Your lagoon does not meet the existing animal waste treatment needs, or overflows occur occasionally.

d. You do not have a lagoon or storage pit and animal waste is not treated before it flows onto the ground toward a well or stream; OR do not know.

11. What is the liquid level of your waste treatment lagoon or pit?

The capacity of a lagoon consists of storage volumes for sludge, permanent liquid treatment area, temporary liquid storage, 25-year, 24-hour storm and freeboard. Sludge is composed of organic solids which cannot be further degraded by bacteria, and accumulates at the bottom of a
lagoon. Permanent liquid treatment is the amount of liquid which should always be present in a lagoon for optimal bacterial activity. Temporary liquid storage includes waste production, rainfall, and extra washwater. It is equal to the volume you must pump out regularly (i.e., every 90 days or 180 days, depending on the design or your lagoon). The 25-year, 24-hour storm is equivalent to the volume added from the most rainfall likely to occur in a 25-year period over a 24-hour duration. And lastly, the freeboard is the difference between the highest level the liquid should be allowed to accumulate (at least 1 foot) and the lowest point of a lagoon dam or embankment. Freeboard is included in lagoon design to avoid overflows.

Permanent visible markers should be located inside the lagoon to assist with liquid level management. The top of the temporary storage volume is the absolute maximum operating level and should be marked to indicate when pumping is needed. The top of the permanent liquid treatment volume is the minimum operating level and should be marked to indicate when pumping should stop. The markers should be routinely cleaned so that the operator can easily observe them.

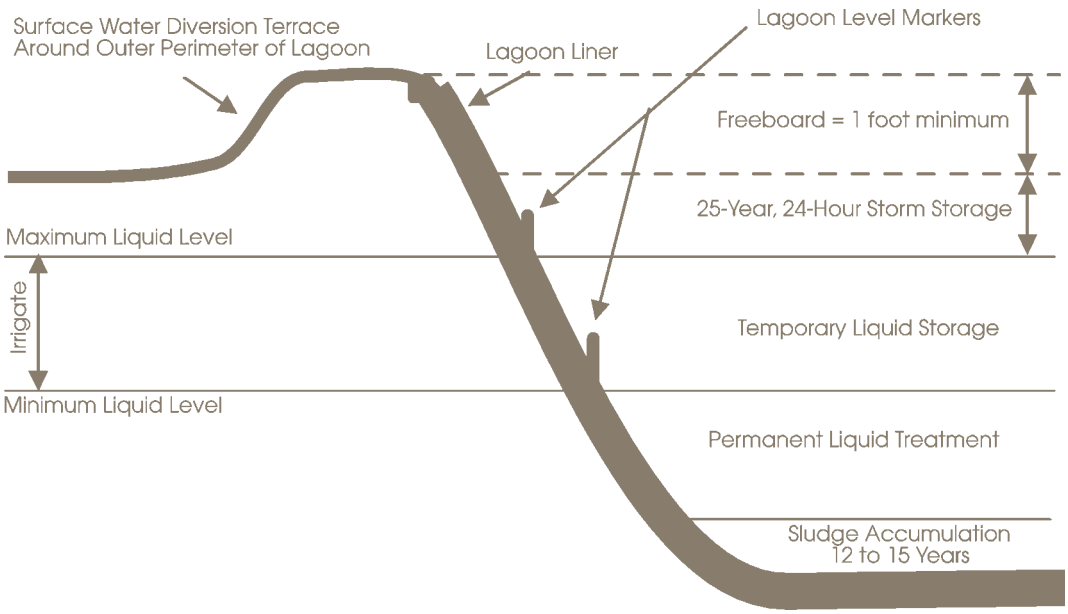
11. Circle the answer that best describes the management of the liquid level in your waste treatment lagoon or storage pit.

a. You regularly pump down your animal waste lagoon according to recommended procedures. Enough liquid is left to meet treatment needs, and enough space is left above the liquid to account for heavy rains and to prevent overflows.

b. You regularly pump down your lagoon, but don't always leave enough space above the liquid to account for heavy rainfall events.

c. Your lagoon is seldom pumped down and overflows happen after rains.

d. Your lagoon is never pumped down and overflows happen during normal use; OR do not know.

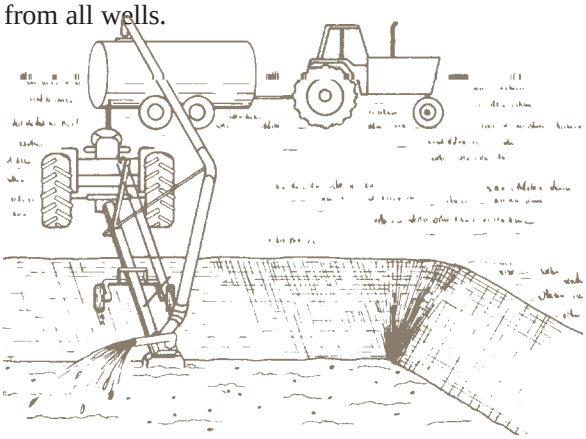


Storage capacity markers for a lagoon or pit

Milking Center Wastewater Treatment

12. How do you treat your milking center wastewater?

Wastewater from the dairy milking center includes wastes from the milking parlor (manure, feed solids, dirt) and milkhouse (bulk-tank rinse water and detergents used in cleaning). Combining these wastes with manure and animal lot runoff has the advantage of allowing a common disposal system for both types of waste. The resulting slurry can be stored in a pit until the contents of the pit can be applied to fields when conditions are appropriate. By law, the storage facility must be 100 feet from all wells.



Slurry storage until land application

12. Circle the answer that best describes the treatment of the milking center waste-water.

a. Your milking center wastewater (dairy farmers only) drains directly into a liquid manure storage facility located at least 100 feet from all wells. The wastewater is later land-applied with other wastes.

b. Your milking center wastewater drains to a grass or vegetated filter strip located 100 feet down hill from all wells.

c. Your milking center wastewater drains outside onto bare soil or a gravel lot and can flow toward a well.

d. Your milking center wastewater drains outside into a ditch that flows to a surface water source or drains to a well; OR do not know.

Land Application of Animal Wastes

13. How often do you sample your soil and calibrate your animal waste application equipment?

Traditional manure application rates are based on the nitrogen (N) needs of the crop. The idea is to apply N at rates no greater than the crop can use because excess N in the form of nitrate can move through the soil and threaten groundwater quality. Some nutrients may be stored in the soil just as one stores money in a bank. These nutrients will generally remain in the soil until needed by plants. When manure application rates are based on the nitrogen content of the manure,
other nutrients, such as phosphorus, copper and zinc, that may not be required, are also supplied. These unneeded nutrients can become concentrated in the soil where they may become a potential nonpoint source of pollution causing surface water contamination. At high enough concentrations, they may also reduce crop yields or become toxic to plant growth. Any properly managed land application program will regularly use soil tests to determine the nutrient and lime needs of

13. Circle the statement that best describes how often you sample your soil and calibrate your application equipment.

a. Every year you soil test the fields that will receive animal waste and regularly calibrate land application and irrigation equipment to make sure recommended, uniform rates are applied.

b. Every 2 years you soil test the fields that will receive animal waste. You usually calibrate land application and irrigation equipment.

c. You seldom soil test the fields that will receive animal waste, or seldom calibrate land application or irrigation equipment.

d. You never soil test fields that will receive animal waste and don't calibrate land application or irrigation equipment; OR do not know.

the crop. Fields receiving land applications of animal manure should be soil sampled every year to monitor nutrient buildup and the potential for plant toxicity.

It is also important to regularly calibrate land application equipment. A waste analysis will predict the available nutrients in a manure sample and report the results in pounds per 1,000 gallons or pounds per ton of manure. But if you do not know how many thousand gallons of manure your system is applying per hour then you will not be applying the proper rate of manure. Ideally, animal waste application equipment should be calibrated before making each application. However, this is not always practical. Application should be calibrated at least once a year before the first application is made in the cropping season.

14. What is your strategy for managing animal waste?

Land application is the predominant method of disposal associated with animal waste management systems. When properly managed, land application allows for safe disposal of animal wastes and beneficial use of the nutrients and water by vegetation. Proper land application poses little danger to ground or surface water due to filtering by the soil or plant uptake of potential contaminants. Both solid and liquid wastes should be applied to land using rates and methods that prevent surface runoff of pollutants or leaching of pollutants to groundwater. Land application of wastes should be tied to a manure nutrient analysis, soil nutrient analysis, and a plan for utilization of these wastes by crops.

15. When do you apply your animal waste?

Land application of waste should be limited to days when:

- There is no precipitation.
- There is minimal wind.
- The ground is not frozen.
- There has been less than 0.5 inch of precipitation within the past week.

In conventional tillage cropping systems, wastes should be tilled into the soil whenever possible.

Animal wastes should also be applied to growing crops or pastures according to approved application rates. Application rates should not exceed the nutrient requirements of the crops growing or to be grown at the site and the nutrients should be credited in the fertilizer program for the site.

14. Circle the statement that best describes your strategy for managing animal wastes.

a. You have an organized plan to manage animal wastes. You know their nutrient content and value, land-apply them as recommended, and keep good records of land applications.

b. You manage and land-apply animal wastes according to a plan, but don't know their nutrient content and value. You keep some records of animal waste land applications.

c. You manage and land-apply animal wastes according to a plan, but don't know their nutrient content and value. No records are kept of any land-applied animal wastes.

d. You have no formal plan to manage and land-apply animal wastes and don't know their nutrient content and value. No records are kept of any land-applied animal wastes; OR do not know.

15. Circle the statement that best describes when you make land applications of animal wastes.

a. You apply animal wastes to actively growing vegetation or crops that will be planted within 30 days according to an approved waste management plan that considers the nutrient content of wastes and crop nutrient needs. You try not to apply wastes within 24 hours after a rainfall.

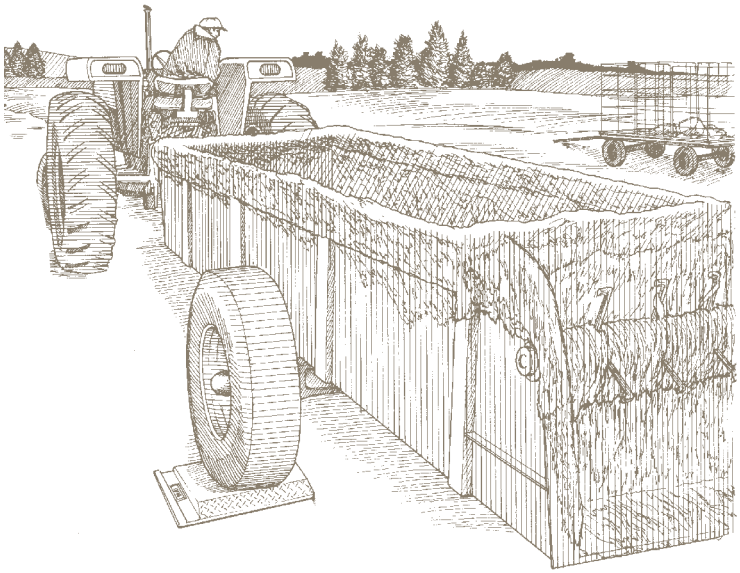
b. You apply animal wastes uniformly to crops or vegetation but without knowing the nutrient content of wastes or crop nutrient needs and you check weather conditions before starting land applications.

c. You apply animal wastes to dormant crops or bare ground without knowing the nutrient content of wastes or crop nutrient needs. You land-apply wastes within 24 hours of a heavy rain.

d. You usually land-apply manure when it is most convenient, even if no crop or pasture is growing or being planted and your applications are always in the same uncropped areas; OR do not know.

16. Where do you apply your animal waste?

Animal waste land applications should occur no closer than 50 feet from surface waters and 100 feet from wells.



16. Circle the statement that best describes where you land apply animal wastes.

a. You land-apply all animal wastes so that there is more than a 100 foot vegetated buffer between application sites and all wells, streams, or other water sources.

b. You usually land-apply animal wastes so that there is at least a 100 foot vegetated buffer between application sites and all wells or water sources.

c. You usually land-apply animal wastes at least 100 feet from a well or water source, but sometimes apply wastes generously to lawn and gardens near the well without considering the nutrient needs of plants.

d. You frequently land-apply animal wastes less than 100 feet from a well or other water source, or pollution from land-applied wastes reaches a well or water source; OR do not know.

Silage Storage

17. How close is your silage storage structure to your well and surface water?

Manure and fertilizers are not the only source of nutrients on the farm. Water and nutrients can seep from silage and contaminate groundwater and surface water. It is important to locate your silage storage structure at least 100 feet from any well or surface water. Furthermore, locating the silage storage structure downhill from wells and surface waters can ensure that water seeping from the silage does not move towards the well.

18. What is the design of your silage storage structure?

Properly compacted clay soils and concrete floors can limit leachate seepage. Older structures can be relined to be made relatively water tight. Silo caps, covers, or bags keep rain water from entering the silage, preserving a quality silage, but also reducing the potential for producing leachate. Horizontal or trench silos should be covered with a plastic sheet. Tires can be used to keep the cover in place. It is important to divert clean water away from new and existing silage storage structures. For both vertical and horizontal silos, diverting clean water away can protect both groundwater and surface water.

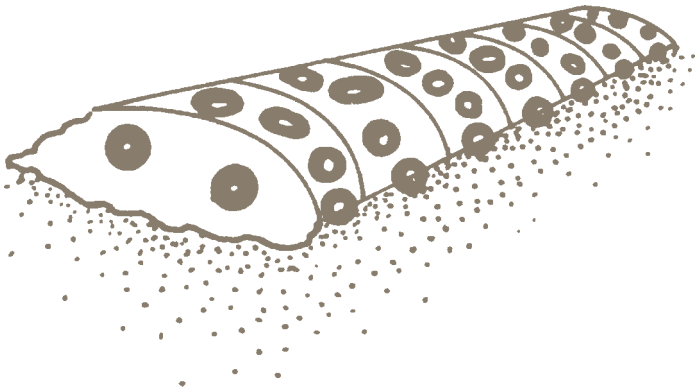
17. Circle the statement that best describes the location of your silage storage facility.

a. Your silage storage facility (any type) is more than 100 feet downhill from a well or other surface water.

b. Your silage storage facility is more than 100 feet on grade from a well or other surface water.

c. Your silage storage facility is more than 100 feet slightly uphill from a well or other surface water.

d. Your silage storage facility is less than 100 feet uphill from a well or water source. Silage liquids drain downhill to a well or surface water; OR do not know.



Aboveground silage storage

19. What is the condition of your silage storage structure?

The type of silo on your farm often has less effect on its potential to contaminate groundwater than the condition of the silo. A well maintained facility will not allow rainwater to move through the silage, thereby eliminating seepage which may contaminate water. A poorly maintained silage storage facility may need repairs in order to reduce the potential for water pollution.

18. Circle the statement that best describes the design of your silage storage structure.

a. Your upright concrete silo has a concrete floor, or your open trench or bunker silo has concrete sides and floor with an outside plastic cover. All silage liquids are contained in the storage area.

b. Your upright concrete silo has a clay floor, or your open trench silo has an interior liner and plastic cover. Most silage liquids are contained in the storage area.

c. Your upright concrete silo has a sandy floor, or your open trench silo has no interior liner but does have a plastic cover. Some silage liquids are contained in the storage area.

d. Your open trench or open pit silo is built in sandy soil with no interior liner or no plastic cover. Silage liquids are not present because they have seeped into the groundwater or drained into a well or water source; OR do not know.

19. Circle the statement that best describes the condition of your silage storage facility.

a. Your silage storage facility (any type) is well maintained and in good condition and needs no repairs.

b. Your silage storage facility is maintained only as needed, but is in generally fair condition with some repairs needed.

c. Your silage storage facility is not well maintained and needs repairs.

d. Your silage storage facility is in poor condition and needs major reconstruction; OR do not know.

20. What is the moisture content of your silage when it is stored?

Silage with a high moisture content is more susceptible to the formation of seepage than drier silage. A simple grab test can tell you whether the moisture content is high enough to possibly produce seepage. Grab a handful of silage and squeeze firmly into a ball. If the ball expands slowly and no dampness appears on the hand, the silage contains less than 70% moisture and will likely not produce seepage. If liquid runs freely or shows between the fingers, the silage contains 75-85% moisture and will likely produce seepage.

20. Circle the statement that best describes the moisture content of your silage when put into storage.

a. You reduce the amount of silage liquid produced during storage by using harvesting methods to keep the silage moisture content below 65% at the time of storage.

b. The moisture content of silage stored on your farm is 65-75% when it is put into storage.

c. The moisture content of silage stored on your farm is 75-85% when it is put into storage.

d. The moisture content of silage stored on your farm is more than 85% when it is put into storage; OR do not know.

Dead Animal Disposal

21. How do you dispose of your dead animals?

If not properly managed, animal carcasses can be a source of nutrient and bacterial contamination for groundwater. North Carolina law requires that dead animals be disposed of within 24 hours in a manner approved by the state veterinarian. Traditional carcass disposal options have been landfilling, burial, incineration, and rendering. On-site burial and pit disposal are receiving close scrutiny in areas with high water tables or soils vulnerable to nutrient leaching. On-site burial should also have a daily soil cap over the pit. Incineration is energy intensive, costly, and contributes to air pollution. Composters are another disposal option that can be approved on a permit basis for certain types of animal operations. This permit process requires proper design and operation to protect the environment. The state veterinary office handles permitting for composters. Another option that may be available in your area is mortality collection for rendering dead animals into usable by-products such as meat and bone meal, animal fat, and other products.

CONTACTS AND REFERENCES

Where to read about...

Registration, permit and certification for livestock waste control facilities

- *Water Quality Nondischarge Rule for Livestock Farms in North Carolina*. Available from your county Cooperative Extension Service Center or the Department of Soil Science at NC State University.

Design criteria and general information

- *Poultry Science & Technology Information Sheet: Proper Disposal of Dead Poultry* (PS & T Guide #19). Available from the Poultry Science Department at NC State University.
- *Poultry Science Facts: Composting Poultry Mortality in North Carolina* (PS Facts #11). Available from the Poultry Science Department at NC State University.

21. Circle the statement that best describes your dead animal disposal practices.

a. You dispose of occasional dead farm animals by composting, contacting a local incinerator or rendering company where available, or contacting your local health department or veterinarian for approved sanitary disposal methods. If you compost dead animals, you land apply the compost or use it as a feed additive according to recommendations.

b. You dispose of occasional dead farm animals by covering them with at least two feet of soil more than 100 feet from a well or water source, or by incineration.

c. You dispose of occasional dead farm animals by covering them with only six inches of soil less than 100 feet from a well or water source.

d. You dispose of occasional dead farm animals by dumping in a stream or gully, or by allowing them to decompose in the open; OR do not know.

- *Constructed Wetlands for Animal Wastewater Treatment* (AG-473-13). Available from your county Cooperative Extension Service Center.
- *Greene County Animal Mortality Collection Ramp* (EBAE 186-93). Available from the Biological and Agricultural Engineering Department at NC State University.
- *Lagoon Design and Management for Livestock Manure Treatment and Storage* (EBAE 103-83). Available from the Biological and Agricultural Engineering Department at NC State University.
- *Low-Temperature Anaerobic Digester*. Available from the Biological and Agricultural Engineering Department at NC State University.
- Section IV of the *NRCS Technical Guide*. Available from the Natural Resources Conservation Service at USDA.
- *Swine Manure Solids Concrete Settling Basin Design* (EBAE 183-83). Available from the Biological and Agricultural Engineering Department at NC State University.
- *Swine Production Facility Manure Management: Pit Recharge C Lagoon Treatment* (EBAE 128-88). Available from the Biological and Agricultural Engineering Department at NC State University.
- *Swine Production Facility Manure Management: Underfloor Flush C Lagoon Treatment* (EBAE 129-88). Available from the Biological and Agricultural Engineering Department at NC State University.
- *Swine Production Farm Potential Odor Sources and Remedies*. Available from the Biological and Agricultural Engineering Department at NC State University.
- *Swine Production System Management: Open Dirt or Pasture Lots* (EBAE 179-93). Available from the Biological and Agricultural Engineering Department at NC State University.
- *Dairy Manure Flush/Lagoon Treatment System: Randleigh Dairy Farm* (EBAE 040-77). Available from the Biological and Agricultural Engineering Department at NC State University.
- *Livestock Watering Systems*. Available from the Biological and Agricultural Engineering Department at NC State University.
- *Management of Dairy Wastewater* (EBAE 1060-83). Available from the Biological and Agricultural Engineering Department at NC State University.
- *Organic Composting for Horticultural Use* (EBAE 171-93). Available from the Biological and Agricultural Engineering Department at NC State University.

Land application of livestock waste

- *Soil Facts: Dairy Manure as a Fertilizer Source* (AG-439-4). Available from your county Cooperative Extension Service Center.
- *Soil Facts: Poultry Manure as a Fertilizer Source* (AG-439-5). Available from your county Cooperative Extension Service Center.
- *Soil Facts: Swine Manure as a Fertilizer Source* (AG-439-4). Available from your county Cooperative Extension Service Center.
- *Soil Facts: Best Management Practices for Agricultural Nutrients* (AG-439-20). Available from your county Cooperative Extension Service Center.
- BMPs approved for use in the Agriculture Cost Share Program for Nonpoint Source Pollution Control. Available from your local Soil and Water Conservation District office.
- *Calibration of Manure and Wastewater Application Equipment*. Available from the Biological and Agricultural Engineering Department at NC State University.
- *Managing Pasture and Hay Fields Receiving Nutrients from Anaerobic Swine Waste Lagoons* (AG-506). Available from your county Cooperative Extension Service Center.

Who to call about...

North Carolina water quality regulations

- Division of Water Quality
  Water Quality Section, DEHNR
  Archdale Building
  512 North Salisbury Street
  Raleigh, NC 27604-1148

North Carolina health regulations (sanitation and well separation)

- County health department

Animal carcass disposal

- North Carolina Dept. of Agriculture
  2 West Edenton Street, Room 560
  Veterinary Division
  Raleigh, NC 27601

Technical standards, designing, installing, or maintaining animal waste management systems

- Local United States Department of Agriculture (USDA) Natural Resource Conservation Service office or a private design consultant.

Sources of financial assistance

- Financial assistance for animal waste management practices, including waste storage, may be available as part of a cost-share program. Contact your local county Cooperative Extension Service Center to find out which agencies offer financial assistance.

Soil testing and waste analysis

- Contact your county Extension agent for a list of individuals or businesses performing these services in your area.

For publications that are available from departments at North Carolina State University, the addresses are listed below:

Biological and Agricultural Engineering Extension, Campus Box 7625, North Carolina State University, Raleigh, NC 27695-7625.

Poultry Science Extension, Campus Box 7608, North Carolina State University, Raleigh, NC 27695-7608.

Soil Science Extension, Campus Box 7619, North Carolina State University, Raleigh, NC 27695-7619.

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