Manure Storage for Horse Facilities

Fact Sheet | Equine Facilities Manure Management Practices | June 2003

A 1,000 pound horse can generate 0.75 cubic feet of manure each day. (See References Cited). Equestrians need to provide proper handling and storage of manure, along with a plan for effective manure utilization, in order to avoid potential environmental/regulatory problems. Manure storage is a temporary containment of equine waste and provides the horse owner or manager with flexibility in scheduling the final utilization, recycling or disposal of the waste. Manure storage practices should be used in combination with other horse keeping management practices contained in a facility's conservation plan for maximum protection of water quality. ☼

Why is Proper Storage Necessary?

Rainfall and storm water runoff that comes into contact with manure, if not properly managed and treated, can carry nutrients, pathogens, salts and other constituents to nearby streams, negatively impacting water quality and aquatic life. As a general rule, manure storage sites should be located 50-100 feet, depending on site conditions, from any stream or drainage course, and likewise away from water wells. County or city agencies may have required setback distances which can be greater than those which may be required by state agencies. Local departments of public health or planning may be a good first place to start for local information about protecting water quality in water wells and creeks. Manure stored in or adjacent to a watercourse can result in the imposition of fines and penalties from regulatory agencies. Manure storage facilities should also be located outside of floodplains. However, if site restrictions necessitate location within a floodplain, the storage area should be protected from inundation or damage from a storm or flood event.

If water, typically rainfall, drains through the pile and the material becomes saturated, the nutrients in the manure can leach or seep out of the manure pile and then percolate down into the ground. "Leachate" is the dark brown liquid, sometimes called manure tea, that can sometimes be seen pooled around manure piles in wet weather. In floodplains and

Roll off storage container.

areas adjacent to streams, the water table may be high. Storing manure in an area with a high water table could potentially contaminate groundwater. Manure should be stored away from any stream or well used as a source of drinking water. The Water Quality Monitoring fact sheet in this series provides background on what contaminants can potentially pollute surface and groundwater, and how to self-monitor the water resources on your own property to see if there are any problems . Water should be tested regularly if it is drawn from wells that tap shallow groundwater sources. Check with your local environmental health department for further information. ☼

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Location and Site Considerations

Proper location of the storage site should take into consideration such factors as access by equipment or individuals, site drainage, slope, soil and aesthetics. Contact the local county planning department prior to siting or building a manure storage facility to see if any regulations are in effect or if special conditions related to construction or siting of a storage facility apply. Contacting a local horse or equestrian organization may also prove helpful.

The manure storage area should be located on a nearly flat surface that is conveniently located and accessible year-round. Manure should be stored in a location that is not subject to incoming flows of stormwater runoff. If situated at the base of a slope or hill the runoff should be routed around and away from the storage area, through use of drainage improvements, such as berms, diversions or ditches. If the storage area has a roof, the roof runoff should be drained away from the area via gutters and pipelines to a protected outlet away from the manure pile.

The goal is to keep the "clean water" from becoming contaminated.

Manure storage bins or piles should be situated on a base of hard-packed, dry soil, or compacted soil under a layer of compacted gravel (or road base material) to limit downward percolation of leachate. The storage site can also have a base of impervious material such as concrete or an impermeable liner can be used. The base should slope slightly so that liquid draining from the pile

Manure storage area.

drains to the outside of the bin, and then to a filter strip or other vegetated areas (see plantings section). Moist, wet, or loose soils should not be used as a base as they are likely to drain nutrients away from the manure storage site into the soil and/or groundwater. Any runoff or leachate from the manure pile should be captured in a vegetated area, allowed to settle, and treated by the vegetation before it reaches a waterway or other water body. Vegetation, especially grass, around the manure storage site can act as a filter strip to effectively capture contaminated runoff and help trap manure particles.

Planting shrubs and trees around the storage site can block wind-borne particles which may blow from the piles when manure is dry. Odors generated by the piles may also be contained in the pile area if dense shrubbery is present downwind of the pile area. Proper location of the storage site should take into consideration such factors as visibility, aesthetics, and compatibility with existing ranch or farm buildings and neighboring residences. ☼

Planning and Design

Manure Storage

An important consideration in planning a manure storage facility is storage size or capacity. Approximately 144 square feet (12' x 12') of confined storage space, at 3-5 feet in depth, will hold a year's worth of manure and bedding from one horse. The number of horses, the number of days of storage desired (the storage period), and the type and amount of bedding will dictate the size and type of storage needed for a facility. Plan to empty the manure from the storage area and properly dispose of or utilize it at least twice a year, or as often as required.

Piling up manure into stacks over 8-10 feet high can pose a fire hazard when moisture levels are low and air temperatures are high. Manure should be contained in an adequately sized storage bin or in organized piles in an appropriate location. A manure storage area may be entirely enclosed or on all sides or three sides with concrete or other wall material that contains the waste.

Manure Composting

The guidelines and considerations provided above for developing a manure storage area can also apply to a manure composting area, however a

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composting area requires additional space for equipment to turn over and move manure piles. Composting on a larger scale is normally undertaken by stacking manure into long rows on a concrete or other similar pad. Smaller amounts of material can be composted in a three-bin system in which material is moved (and turned and mixed) from to bin to bin.

Effective manure storage units for small 1-5 horse facilities include:

- *Plastic garbage cans with lids*

Signs can be effective reminders of good manure management practices.

- *Wood or metal bins*
- *Small, movable dumpsters*

Some effective storage units for larger facilities include:

- *Wooden or concrete storage sheds*
- *Composting system (see Manure Composting fact sheet), and*
- *Storage in piles or wind rows covered in dark plas tic/breathable tarps to in crease heating and prevent leaching due to storm events.*
- *Trucking containers (leave room for two containers so truck has room to leave empty container and pick up the full one)*
- *Bins covered with tarps/other cover*

The type of storage will dictate the degree of control against odor, flies and potential to leach nutrients. For small 1-2 horse facilities, a metal or wood covered bin slightly elevated above the ground to reduce leaching, is an effective storage unit. The ground under the storage con tainer may be covered with wood chips or planted with grass to help collect escaping manure particles and nutrients. The bin should be covered to prevent precipitation from reaching the manure and help control odors.

Manure composting bins for a small horse facility can be constructed of wood or cinder blocks with space between the slats or bricks to allow air circulation and aid decomposition. A rotating three-bin system allows the first bin to be filled, then the second and finally the third bin. By the time the third bin is being used, the material in the first bin is ready for use in the garden. The bins should be covered when the material has reached the optimal moisture content - damp, like a wrung out sponge. To speed up the decomposition process, the first bin, when full, may be turned over into the second bin and watered. The second bin will then be turned over, watered and rotated into the third bin when the first bin fills again and requires moving into the second bin. The first bin will always be the bin receiving fresh manure.

Larger facilities should have a more permanent manure storage structure. The area surrounding the storage site should be graded or sloped to preventsurface and storm water from running over or through manure, potentially ending up in drainages, streams or other surface waters. The surface of prevent leaching of nutrients, bacteria and other potential pollutants from the manure into the ground or away from the storage site. That is, manure needs to be contained within the storage site. The containment area should have a wooden, concrete block or reinforced concrete wall on three sides. A concrete surface and wall will help accomplish two key objectives. 1) minimize seepage and 2) provide a solid surface to aid easy removal of manure with a tractor, front end loader or other piece of suitable equipment. Another advantage to solid walls is a reduction in dust and odor. Ideally, the area should be covered with a roof structure to prevent precipitation from reaching the storage area. Manure storage areas should be accessible with heavy equipment so that loading and unloading of manure is convenient.

The primary materials used in constructing structures for manure storage should be pressure-treated and/or rot resistant wood and reinforced concrete. Metal fasteners should be stainless steel or galvanized to reduce corrosion problems. These materials are suitable for long-term exposure to animal waste with minimal deterioration. ☼

Composting bin.

Plantings Around Manure Storage Areas

If the manure storage area is subject to storm events resulting in runoff, a filter strip should be planted or maintained adjacent to or around the perimeter of the facility to help collect manure particles carried by runoff. The filter strip should be sized according to both the area of the storage site and the maximum amount of water anticipated from storm events. Equestrians may wish to consult with their local Resource Conservation District prior to designing a filter strip. Dense stands of grass work most effectively in filter strips to catch some of the manure particles and organic material, and also utilize nutrients carried by runoff from the manure pile.

Shrubs and trees planted around the storage area that screen it from view may also help utilize nutrients from runoff, block dust blowing from the pile, and absorb odors. Using native vegetation is recommended as it is generally more adaptable to growing in remote locations with little maintenance after plants are established. Native plants also provide habitat and will attract wild birds and beneficial insects if they produce wildlife- friendly fruits, seeds, nuts, berries, pollen and nectar. The trees and shrubs around a storage area not only benefit the environment, but will also improve the aesthetics of the site.

Drainage is an important consideration when selecting a site for planting to screen a manure storage facility. Will the plantings be located where drainage from the manure piles or roof will collect? Some native shrubs are sensitive to poorly drained soils. If the plantings will be situated on slightly higher ground away from any flow path, there will be a greater likelihood of native plants thriving. Providing irrigation will be necessary for the first two years until plants become established. The amount and characteristics of runoff from the storage area- whether liquid draining from the manure pile that will end up in the plantings or clean water from the roof of a storage facility - will make a difference in the level of nutrients that are being provided to the plants.

Native plants should be selected that are appropriate for the soils, climate, moisture regime, and exposure (amount of sun/shade) where they will be planted. Ask for help at a local plant nursery that can recommend the most suitable plants that will serve the intended purposes, such as screening the manure storage area, utilizing nutrients in the filter strip, or reducing the odors leaving the pile. Don't forget to consider the height and breadth of trees when they reach maturity. Some varieties of native shrubs such as toyon, ceanothus, and coffeeberry may reach the height of small trees- yet keep their lower branches which is helpful in their maintaining effectiveness as a screen. Evergreen plants that are densely foliaged from top to bottom may work best for screening purposes. A row of shrubs can be planted in front of a row of trees if there is sufficient space for more complete screening and visual interest. For odor control, a wider planting may be necessary, and should consider wind shifts, direction, and intensity. Nursery staff can provide appropriate planting instructions given the type of soils, drainage and irrigation system. Alternatively, contact your local RCD for a list of native plant providers in your area. ☼

Trees and shrubs screen storage area from roadside view.

Monitoring and Maintenance

Visual observation should be made during the rainy season to check whether any leachate is leaving the manure pile and determine where the liquid is going. If stormwater and precipitation are reaching the storage pile, resulting in nutrient-laden runoff leaving the site, then efforts should be made to divert the stormwater runoff and prevent it from reaching the pile. Piles can be covered with tarps to prevent them from becoming saturated. The moisture level of the manure should be like that of a "wrung-out sponge".

Improvements should be planned to create more storage capacity if needed or replace worn or damaged equipment.

"Aged" manure should be properly recycled or disposed according to local regulations. Records should be kept regarding the amount of manure being stored and used. Photos may be taken for each season of the year as a means of documentation. ☼

References Cited & Resources

The volume of manure produced daily has been estimated by various writers and researchers. The figures used in this report do not include bedding. The figure used in this fact sheet corresponds with the figure use in the ***Horse Keeping: A Guide to Land Management for Clean Water*** *which was produced as part of a previous 319 grant by the CBARCD and other RCDs. The reference for the .75 cubic feet per day per 1000 lb. horse is: Livestock Waste Facilities Handbook, 1985, Midwest Plan Service-18, Iowa State University, Ames, Iowa.*

- *"Stable and Horse Management in Malibu Creek Watershed", Santa Monica Resource Conservation District, 1997.*
- *"Agricultural Waste Management Field Handbook", Natural Resources Conservation Service, 1992.*
- *"Good Neighbor Guide for Horse-Keeping: Manure Management", New Hampshire Department of Environmental Services.*
- *"Manure Management", Clemson University Cooperative Extension Service, 1994.*
- *"NRCS Field Office Technical Guide", Natural Resources Conservation Service, 2000.*
- *Horse Keeping; a Guide to Land Management for Clean Water , Council of Bay Area RCDs, 2000*

Fact Sheets developed by the Council of Bay Area RCDs (CBARCD) and available from your local RCD office:
Managing Manure: The Role of Riparian Buffers.
Equine Facility Site Assessment Checklist Available from the San Mateo County RCD
Composting Horse Manure, CBARCD, June, 2000
Horse Manure Management, CABRCD, June, 2000
Portable Backyard Garden, CBARCD, March, 1999
Photographic Monitoring, CBARCD, June, 2000

- *RCD Websites:* *1) Marin RCD and Southern Sonoma RCD - www.sonomamarinrcd.org*
  2) Alameda RCD - www.baysavers.org
  3) San Mateo RCD - www.sanmateorcd.org ☼

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