NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

BARNYARD RUNOFF MANAGEMENT

(No.)
CODE 707

DEFINITION

A planned system to reduce, collect, and treat or utilize runoff from a barnyard, including concentrated livestock areas.

PURPOSE

To control the amount, rate, and quality of runoff or leachate from barnyards, including concentrated livestock areas.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies:

- As part of an Agricultural Waste Management System (Standard 312);
- Where the barnyard water runoff results in a potential for water pollution;
- Where barnyard soils, site conditions, and topography are suitable for successful implementation of the component practices.

CRITERIA

Planning

Runoff from barnyards must not be discharged directly into streams, watercourses, lakes, aquifers, or other water bodies. Necessary components must be planned and designed to eliminate most outside water from entering the barnyards. The runoff water discharged from barnyards shall be collected for treatment, utilization, or storage when a potential pollution hazard exists.

To minimize pollution potential, relocation, reduction, or elimination of the barnyard area will be evaluated, especially where a stream or watercourse flows through or is adjacent to the site.

All federal, state, and local laws, rules, ordinances, and regulations governing waste management, pollution abatement, health, and safety shall be followed.

General Design

Barnyard runoff management systems shall be designed in accordance with the individual practice standards, and be compatible with each other in capacity and function. The system will be designed to be capable of handling the 25 year, 24 hour storm event.

Outside Water Exclusion

All components that are needed to keep uncontaminated runoff from entering the barnyard shall be installed. This includes runoff from:

1. Outside land area: Runoff from outside land areas shall be excluded from the barnyard area by use of diversions (NRCS Conservation Practice Standard 362), drop inlets with underground outlets (NRCS Conservation Practice Standard 410), etc. Practices that divert clean runoff from barnyards and manure storage facilities shall be designed for the 25 year, 24 hour storm event.
2. Roof runoff: Runoff from roof areas draining to barnyards shall be excluded using NRCS Conservation Practice Standard 558, Roof Runoff Management System.
3. Ground water seepage: Ground water seepage shall be intercepted by a drainage system sized to carry the anticipated seepage water. Installation of drainage systems in the vicinity of silos and barnyards shall not allow silage juices or contaminated barnyard water to enter clean water drainage systems. Conduits under farm roadways or concentrated tractor traffic areas shall withstand the intended load. Refer

to NRCS Conservation Practice Standard 606, Subsurface Drainage.

4. Other water sources: Measures will be installed to prevent all other water sources, such as overflowing waterers or cooling water from draining into the barnyard.

Polluted Water Control

Polluted runoff and seepage from a barnyard shall be excluded from all watercourses and streams. This may be accomplished by one or more of the following:

1. Barnyard Relocation: Relocate the barnyard to an area that minimizes the risk of polluted runoff.
2. Barnyard Size Reduction: Evaluate the purpose of the barnyard and size according to Table 1.

TABLE 1

Barnyard Sizes
(square feet per animal)

Purpose	Cows 1,400 lbs.	Cows 1,000 lbs.	Heifers 500 lbs.
Holding	15	12	8
Feeding	30	24	18
Resting	50	35	25
Heat Detection & Exercise	70	55	45

3. Barnyard Grading: The barnyard shall be graded when there is a need to redirect the runoff to an acceptable land area or collection point for storage or treatment. Any animal waste and loose soil mixture will be removed to expose a suitable foundation for subgrade preparation. This material shall be disposed of in a suitable manner.

4. Barnyard Paving: Barnyards shall be paved with a durable material suitable to the intended use of the paved area. Paving allows for easier cleaning and scraping, improves cleanliness of the animals, and minimizes animal hoof discomfort. The choice of paving material will depend on the amount and type of animal or vehicle traffic, scraping frequency, and the costs of installation and maintenance.

- ***Subgrade Preparation and Base Course***: The subgrade shall provide uniform support to the paving.

  For concrete slabs, if the subgrade is a soil *other than* free draining SW, SP, GW or GP (Unified Soil Classification System), then a compacted base course with a minimum thickness of 6 inches shall be placed on the compacted subgrade and beneath the slab. The base course shall consist of granular material (sand, gravel, crushed stone, or sand/gravel mix) meeting the quality and gradation requirements of Massachusetts DPW 1988 Standard Specification for Highways and Bridges, Sections M1 or M2, except with a maximum stone size of 2 inches and a maximum of 10 percent passing the #200 sieve size.

  For concrete slabs where control of cracking is critical for the use and maintenance of the slab, the base course shall either be compacted sand, or gravel or stone with a minimum of 1 inch of compacted sand added to the top of the gravel or stone to reduce slab friction and cracking potential.

  The water table shall be maintained below the subbase layer, or at least one foot below the bottom surface of the paving if no subbase is required.

- ***Gravel Paving***: Gravel paving shall be considered where redirection of runoff is not critical for collection and in areas where scraping is infrequent.

  A nonwoven geotextile material shall be specified for placement on the completed subgrade prior to placement of the gravel paving.

  The top course of gravel shall be a minimum of 6 inches in thickness where travel is intermittent and scraping is very infrequent. On more heavily used areas, the thickness shall be at least 12 inches. A

thicker top course layer can prolong the time before repaving is needed.

The gravel paving shall meet the quality and gradation requirements of Massachusetts DPW 1988 Standard Specification for Highways and Bridges, Sections M2.01.7 or M1.03.1. Other comparable gradations may be used if previously approved by an NRCS engineer. The frequency of scraping, the cost of gravel material, and maintenance cost of gravel replacement shall be considered when selecting the gravel material to be used. Rock dust may be added to the gravel to provide a smoother and more impervious surface.

- ***Concrete Paving, Non-reinforced***:
  Non-reinforced concrete slabs may be used for slabs subjected to animals only, or to vehicle/equipment loads of less than 10,000 lbs. gross weight. Non-reinforced slabs shall have a minimum thickness of 4 inches with control joints at a maximum spacing of 10 feet, or 5 inches thick with a maximum control joint spacing of 15 feet. The control joints shall be constructed to a depth of 1/4 of the slab thickness.

  The coarse aggregate in the concrete mix shall have a maximum size of at least ¾ inch. However, a 1-inch maximum coarse aggregate size for 4-inch slabs, or 1½ inch aggregate for 5-inch slabs is recommended to reduce cracking potential. The minimum compressive strength shall be 3,000 lbs. The slump of the concrete shall be specified to be between 3 and 5 inches when placed.

  Isolation (expansion) joints shall be placed wherever the slab abuts fixed objects, such as walls, columns, and footings.

  Construction joints in the slab shall consist of a butt joint with a bond preventer placed between the pours. All construction joints shall conform to the floor control jointing pattern (10 feet for 4-inch slabs or 15 feet for 5 inch slabs), and/or isolation joint pattern.

  The surface of the concrete shall be roughened for better traction.

  Concrete slabs subjected to vehicle or equipment loads in excess of 10,000 lbs. shall have reinforcement.

- ***Concrete Paving, Reinforced***:
  Slab designs shall be based on ACI360R-92, “Design of Slabs-On-Grade”. Slab thickness and compressive strength shall be based on the anticipated loading on the slab, but shall be a minimum of 5 inches thick with a minimum compressive strength of 3,000 lbs. Reinforcing steel size and expansion joint spacing shall be based on the subgrade drag theory. The choice of reinforcing steel (bars or wire mesh) to be specified for a job shall consider the requirement that the steel must be supported at a depth of between 2 and 2.5 inches from the top of the slab during and after placement of the concrete. Rolled wire mesh shall not be used.

  The coarse aggregate in the concrete mix shall have a maximum size of at least ¾ inch. However, when control of cracking is critical for the use and maintenance of the slab, a 1½ inch maximum coarse aggregate size shall be used. The slump of the concrete shall be specified to be between 3 and 5 inches when placed.

  Isolation (expansion) joints shall be placed wherever the slab abuts fixed objects, such as walls, columns, and footings.

  Control joints are not required. If control joints are installed, the reinforcing steel must be discontinued across the joint.

  The surface of the concrete shall be roughened for better traction.

- ***Bituminous Paving***: The subbase material and thickness, the thickness of the asphalt course, the kind and size of aggregate, the type of proportioning of bituminous materials, and the mixing and placing of these materials shall be in accordance with Massachusetts DPW 1988 Standard

Specification for Highways and Bridges for the expected loading.

5. Runoff Control: When barnyard runoff presents an actual or potential pollution hazard, the runoff shall be collected and transferred to a filter area or a storage facility.

   - ***Collection and Transfer***: Paved barnyards shall have adequate curbs to prevent solids from leaving the pavement during cleanup. The pavement and curbing shall direct the runoff to desired collection point(s). Curbing may be constructed of concrete, asphalt, wood, earth or other durable material. Curbing shall resist scouring and over turning forces of manure scraping and handling equipment. The minimum curb height shall be as shown in Table 3.

     If the barnyard runoff will be directed to a filter area, then a settling basin or other settling facility must be incorporated into the system to ensure that settleable solids are not carried to the filter area. The settling facility shall be designed to hold the solids resulting from a 25 year, 24 hour storm event from the contributing area. The settling facility must be designed for ease of cleanout. The barnyard may be graded and shaped so that the settling facility is incorporated into the barnyard itself. If the barnyard runoff is to be transferred to a waste storage facility, a settling facility is not required.

TABLE 3

Minimum Curb Heights

Curb Purpose	Minimum Height (inches)
Runoff Control	4
Scraping	8
Bump Wall	18
Runoff Storage	25 yr., 24 hr storm event

   - ***Filter Area:*** A filter area for barnyard runoff shall conform to the criteria set forth in NRCS Conservation Practice Standard 393, Filter Strip. To prevent continual flows onto the grass filter, positive control of urine and other liquid sources must be achieved.

     The filter area shall be vegetated and functioning prior to the use of any paving that could contribute polluted runoff to the filter, unless provisions are incorporated to prevent polluted runoff from leaving paved areas until the filter area vegetation is established.

   - ***Storage and Treatment***: Barnyard runoff storage facilities shall conform to the criteria in NRCS Conservation Practice Standard 313, Waste Storage Facility. The storage facility shall be installed prior to or concurrently with those paved areas that contribute waste to the facility.

6. Silage Leachate: Where leachate from silage is entering surface or ground waters, silage leachate control measures will be provided as part of the overall barnyard runoff management system.

   Concentrated silage leachate must be either stored for later application directly on cropland in an environmentally sound manner, or combined with other animal waste in a storage facility. Caution should be used if silage leachate is diverted to a manure storage facility. Silage juices combined with manure may produce toxic gases, and can be hazardous in enclosed spaces or other areas that are not well ventilated.

   Concentrated silage leachate will kill vegetation, therefore it must not be directed to a filter area. Only leachate resulting from rainfall, which is highly diluted, may be applied to a filter area. Refer to NRCS Conservation Practice Standard 393, Filter Strip, for design criteria.

7. Fencing: The barnyard shall be fenced to contain livestock in accordance with NRCS Conservation Practice Standard 382, Fencing, and to exclude them from filter areas, settling facilities, and storage facilities.

CONSIDERATIONS

Minimize the amount of barnyard paving to what is required for pollution control. Barnyard paving will increase the amount of runoff that must be stored or treated.

The use of an intensive rotational grazing system to reduce or eliminate large barnyards should be considered where appropriate.

PLANS AND SPECIFICATIONS

Plans and specifications for barnyard runoff management shall be prepared to show measures needed to meet the requirements of Outside Water Exclusion and/or Polluted Water Control portions of this standard, and the standards of all component practices.

The sequence of installation shall ensure that all outside water exclusion practices are installed before or simultaneously with any other components for pollution water control.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be provided to the owner or operator that includes the following general recommendations, as applicable. Specific recommendations particular to the job being installed, but not covered by the following shall be added:

- Barnyard scraping interval. Cleaning should be done daily to weekly, depending on manure deposition rates.
- Collection and treatment requirements.
- Cleaning of settling basins after runoff events to minimize manure solids entering filter areas or leaving the barnyard.
- Periodic inspection and repair of surface paving materials, curbing, clean water diversions and structures, roof gutters and downspouts, fencing, vegetated areas, and other appurtenances.
- On gravel barnyards, regrading may be needed on a periodic basis. Replacement of the gravel surface will be necessary, depending on the type of gravel surface and the type and frequency of scraping.
- Refer to the operation and maintenance requirements of component practices in their respective practice standards, and include them in one overall operation and maintenance plan for the barnyard.

REFERENCES

Agricultural Waste Management Field Handbook, Part 651, National Engineering Handbook, USDA-NRCS.

Design of Slabs on Grade. ACI360R-97, American Concrete Institute, 1997.

Subgrades and Subbases for Concrete Pavements. American Concrete Pavement Association, 1995.

Slabs on Grade. Concrete Craftsman Series CCS-1, American Concrete Institute, 1994.

Concrete Floors on Ground. Portland Cement Association, 1983