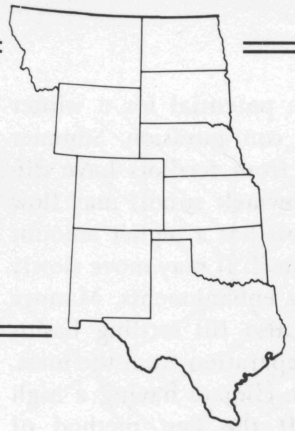

COOPERATIVE EXTENSION SERVICE—GREAT PLAINS STATES

GREAT PLAINS
BEEF CATTLE FEEDING HANDBOOK

Texas A&M University
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Principles of Feedlot Runoff Control

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Good management of an open feedlot includes control of runoff caused by rainfall or snowmelt. The runoff from an open feedlot carries a large amount of organic matter. This organic matter has an oxygen demand that may deplete the oxygen in public streams. Oxygen depletion may cause fish kills.

Most states in the Great Plains now have regulations to prevent feedlot runoff from reaching public streams. The Federal Water Pollution Control Act Amendments of 1972 establish a goal of complete elimination of pollutant discharge into the nation's water by 1985. Regulations will no doubt make runoff control mandatory by this time in all states.

Runoff control can be achieved by planning a system which consists of five basic elements, the five D's of runoff control:

1. Diversion
2. Drainage
3. Debris Basins
4. Detention (Holding) Ponds
5. Disposal

Diversion

The first step in control of feedlot runoff is to prevent outside surface water from entering the lot. If the feedlot is located near or at the top of a slope, the problem of diverting surface runoff from higher land is eliminated.

When runoff from higher ground flows across the area, a diversion terrace will divert excess water around the lot. If the feedlot site includes a small, wet weather stream, consider a stock water dam upstream or protective diversion berms along the side of the stream.

Drainage

The feedlot surface should have adequate drainage. Shape the surface of the lot to provide the shortest route for runoff water to get to a drainage channel or pipe. Proper grading will prevent ponded water. A definite drain from each pen is desirable.

UNIVERSITY OF NEBRASKA PHOTO.

The five factors to consider for feedlot runoff control are diversion, drainage, debris basins, detention pond and disposal area. Debris basins can be located in the pens if a vertical outlet is used.

The slope will not change the volume of runoff but will affect the velocity of flow. Slopes of 1% to 6% are acceptable but a 2% to 3% slope is ideal. A 2% to 3% slope is enough for good drainage with minimum erosion.

Permanent mounds within the lot are strongly advised in regions with less than 30 inches net evaporation per year. Mounds are optional in other areas, but appear desirable in most situations. If mounds are used, they should be constructed with clay soil and should be well compacted and shaped. Mounds should have a broad crown to enable all of the animals access to dry ground. The height of the mound should be 4 to 5 feet above the lowest point in the pen. Arrange the mounds to provide dry access to the feed bunk and waterers.

UNIVERSITY OF NEBRASKA PHOTO.

Example of well shaped mounds Note that most of the cattle can occupy the mound without crowding.

The pen surface should be maintained to the original grade when manure is removed. The use of a blade or grader equipment is recommended. Attempt to remove only half of the manure pack during each cleaning. If necessary, fill dirt should be added to maintain the original surface.

Avoid high piles of manure within the pen. During cold, wet weather, when space is needed, these piles disrupt the drainage, the steep slippery sides prevent all of the cattle from using the pile, and the manure eroded from the pile adds to the accumulation in the pens.

Debris Basins

Design debris basins to intercept the total feedlot runoff, allow the solids to settle, and allow the liquids to be drained into a detention (holding) pond. The settling of solids and management of the debris basin is important. A debris basin prevents manure and earth solids from reducing storage capacity in the detention ponds. Debris basins will reduce the amount of solids reaching the holding pond by 50% to 85%. This solids reduction will minimize odors from the detention pond. Feedlot runoff that has passed through a debris basin is much easier to pump through irrigation systems.

Debris basins should be designed and managed so that the solids can be removed at a convenient time during the year with conventional manure loading equipment. The depth of the accumulated solids should be kept less than a foot.

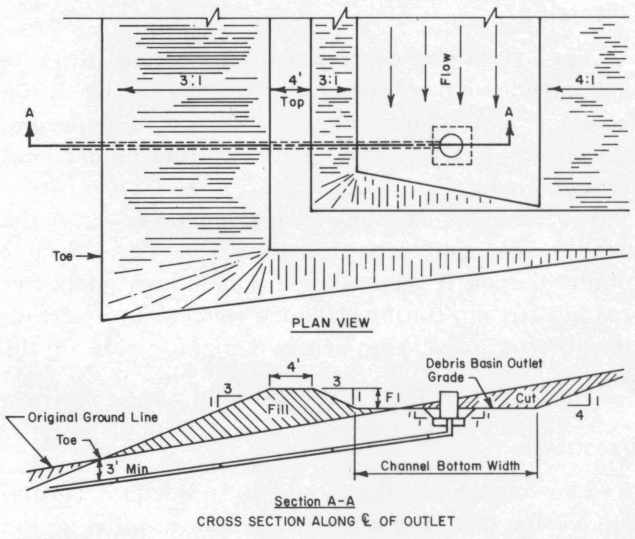
The best basic structure for settling solids is a wide flat channel. The channel should be at least 10 feet wide with a depth of 3 feet or less. This will enable conventional manure handling equipment to remove manure solids easily. The channel can either be located within the pen or outside of the pens as a part of the overall surface drainage collection system.

The primary factors to consider in selection of the debris basin location are: the potential for a winter snowmelt runoff and feedlot configuration. Summer runoff and snowmelt runoff from feedlots have different characteristics. The snowmelt runoff may flow like cold lava. Snowmelt runoff has a higher amount of solids than summertime runoff. It may move slowly and tend to overflow shallow enbankments. Manure laden snowmelt runoff may also fill settling basins rapidly without major water separation from the mass.

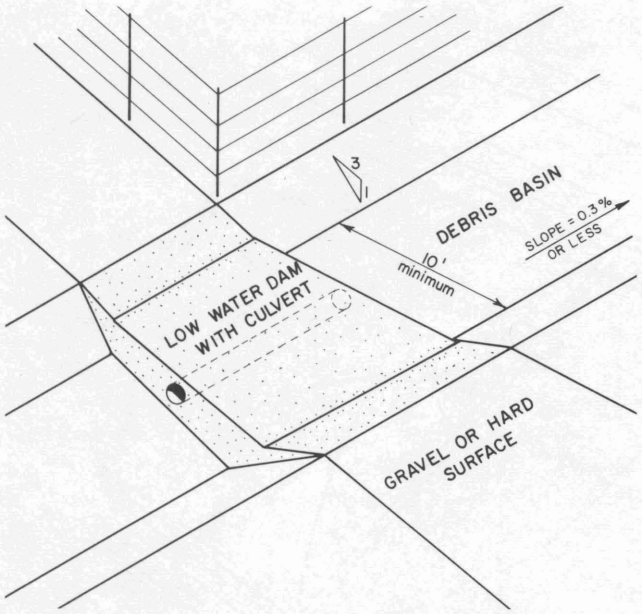
If a feedlot is located in a climate having a high potential of snowmelt runoff the best method of settling solids is a debris basin within the confines of the pen. The liquids should be drained by underground pipe connected to a vertical riser. Construction of these systems is easiest during the initial stages of feedlot construction. The use of debris basins with underground drain might provide better drainage for certain pens in any feedlot.

Where snowmelt and freezing is not a problem, the settling of solids is best done by using a debris basin system outside of the pens. The wide flat channel can be used both to collect the runoff and to settle the solids. Basically the channel settling system is a ditch with less than 0.15% slope. The runoff velocity is reduced to less than 1 foot per second. The manure solids then settle out of the slow moving runoff. The ditches should be cleaned once a year or after an unusually large runoff event.

In climates where freezing is not a major problem, a low level dam with a small culvert may be used where truck traffic will have to cross the ditch. The dam and the culvert will restrict the water flow causing the solids to settle.



Plan view and cross section of typical debris basin with vertical outlet. (Nebraska, SCS, 1971).



Sketch of low water dam and culvert used to slow velocity of water in the debris basin. Use only in climates where freezing is not a major factor.

Detention (Holding) Ponds

Detention ponds are designed to be temporary holding storages for runoff. The ponds are *not* for waste treatment. Most states in the Great Plains have guidelines for the design of holding ponds. If no guidelines exist the recommended holding pond capacity should be large enough to hold the runoff from the maximum 24 hour rainfall expected to occur only once in the next 10 years.

The sizing, layout, and construction of the dams and terraces should be done by qualified personnel. This assistance can be obtained from the Soil Conservation Service or from consulting engineers. Designs are dependent upon the storm intensity, the drainage area, and the runoff characteristics.

In areas where the annual evaporation normally exceeds rainfall by 30 inches or more the detention pond can be designed as an evaporation area. Evaporation ponds should be shallow to maximize the surface area for evaporation. In some parts of the Great Plains natural shallow depressions are suitable for use as detention and evaporation ponds.

Disposal

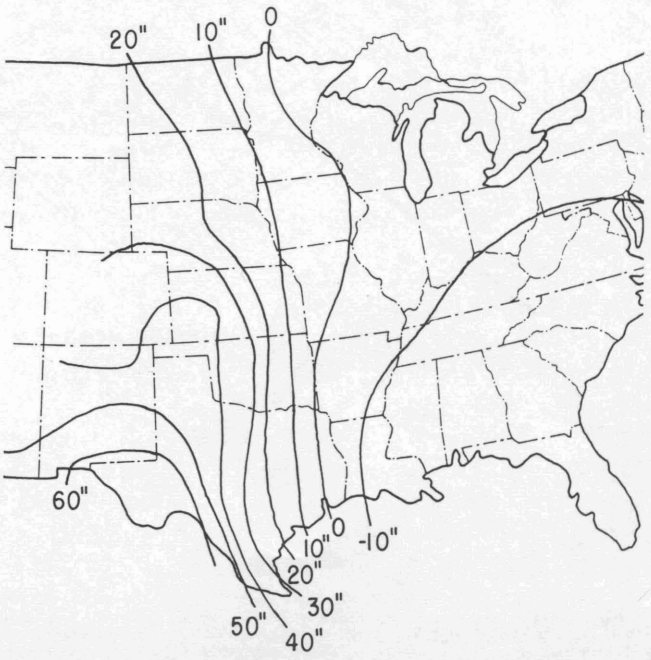
As the final step in runoff management, the collected water can be disposed of by irrigation on land or by evaporation. Detention ponds should be pumped to insure enough space for holding future runoff. The pumping rate and frequency may be specified by state guidelines. If there are no guidelines the pump down time should be estimated by the frequency of the major runoff events. This frequency will vary from one area to another. Local weather bureau records should be consulted to determine the probable frequency of major runoff events occurring within a few days of each other. Select a pump down time that would have failed no more than once in ten years based upon the nearest weather bureau records.

Liquid disposal systems should be capable of keeping all of the runoff water on the land. Therefore, these systems should be patterned after tail-water irrigation systems. Also fresh water may have to be available for flushing the equipment and for supplemental irrigation during dry weather. Also in arid regions, water with low salt content may have to be used to dilute the feedlot runoff to prevent salt accumulation or to leach salts out of the root zone for crops and grasses.

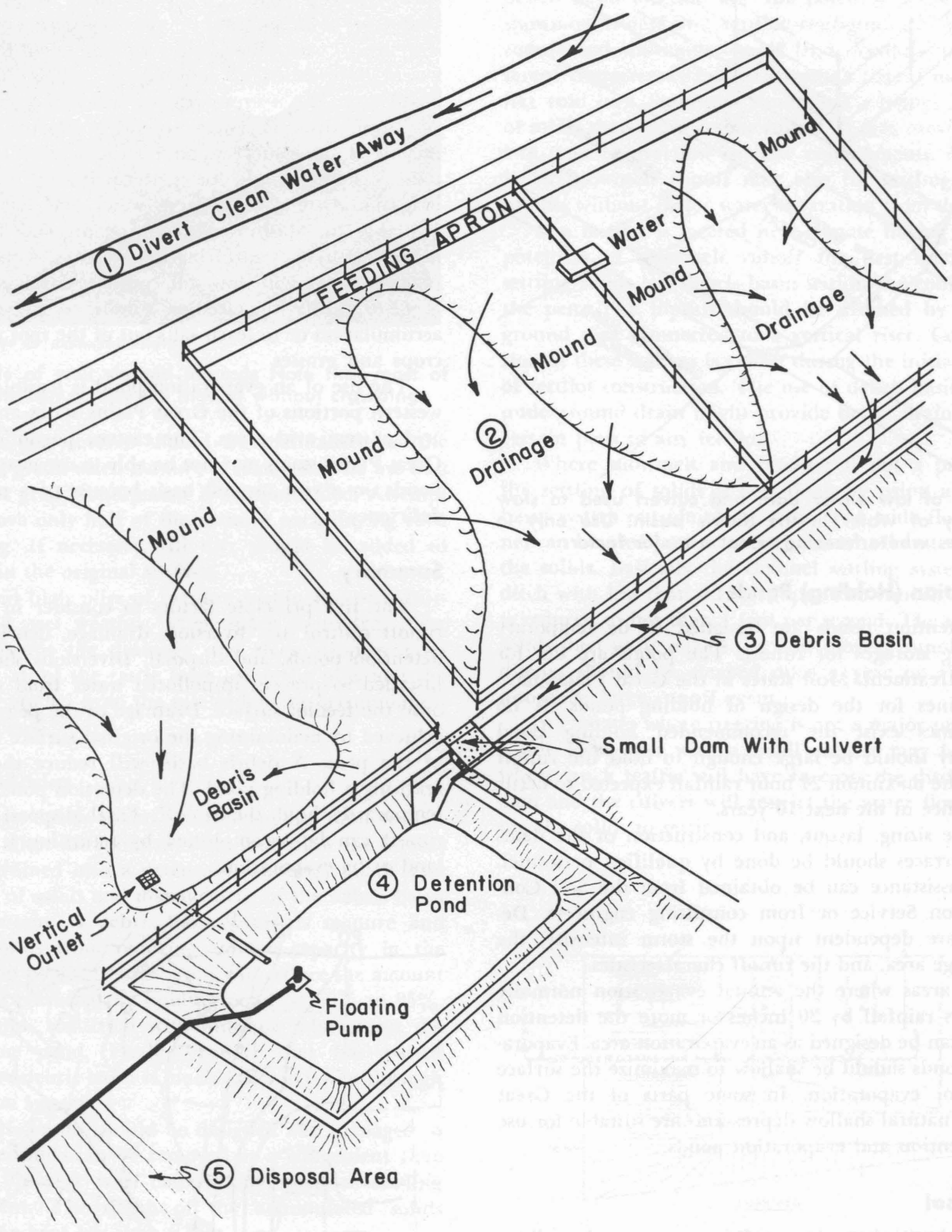
The use of an evaporation pond is feasible in the western portions of the Great Plains states and other arid or semi-arid areas. The eastern portions of the Great Plains states may not be able to use evaporation ponds on a year around basis because of a moisture deficiency.

Summary

The five principle factors to consider in feedlot runoff control are diversion, drainage, debris basin, detention ponds, and disposal. Diversions should be installed to prevent unpolluted water from running onto the feedlot surface. Drainage of the pens can be achieved by maintaining the original surface shaping of the pens. A debris basin will reduce the solids reaching a holding pond. The detention pond should temporarily hold the runoff. Final disposal of the runoff can be accomplished by returning it to the land or by evaporation.



Lines of moisture deficit for the Great Plains.



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