Site Development for Hoop Barns

Richard R. Brunke P. Eng.
Regional Agricultural Engineer
Manitoba Agriculture and Food

Introduction:

In discussing site development, we must understand how to determine and find a good location for the development of hoop structures. In a typical hog barn the buildings' environment is controlled and the pigs are raised on concrete floors. In comparison, pigs are raised on a straw bed covering bare soil in hoop structures. The straw is used to protect the pig from the cold; as well as, absorption of urine produced by the pigs. A manure pack accumulates inside the hoop structure over time. This manure pack is then pushed out into an area where it will be exposed to the environmental elements (i.e. rain and snow). If this area is not designed appropriately, the potential for environmental contamination is very high. Therefore, an ideal site for these hoop structures would be in an area that minimizes and/or eliminates any effects on the environment.

Also, an appropriately designed layout of the site, will increase overall functional efficiency for the facility and reduce operating costs.

Site Location:

The key in site location is to understand what type of land one needs. Majority of the time, effects on the environment are due to the movement of water. The source of this water is from precipitation, (i.e. rain and/or snow), which results in the flow of water through and off the site (runoff). This runoff can carry manure nutrients off the site into the waterways with the potential of affecting (altering) aquatic environments. This precipitation not only runs off the site; but may also infiltrate into the soil, altering the groundwater quality.

The main objective in site location is to have minimal runoff and infiltration into the soil.

Water infiltration into the soil is the most difficult process to control. It is directly related to the soil type at the site location and the depth of ponding water. The rate of water infiltration depends on the type of soil. On very sandy soils, water infiltrates very quickly; whereas, on clay soils, water infiltrates very slowly. This is easily noticed within many areas of Manitoba. After an intense rainstorm, on heavy clay (i.e. gumbo clay) fields, one will see a great deal of ponding water. In contrast, sandy soil fields will have little or no evidence of ponding water.

There are also different types of soil varying from sandy to heavy clay. For site location, it is best to find a site with a high content of clay, (greater than 60%). At least one foot in depth and preferably deeper. This will ensure that the proposed facility will have a minimal affect on the groundwater. If a site cannot be found or is not available clay can be moved onto the site to give the similar results.

To assist in locating the above criteria for site location, Manitoba Agriculture and Food have soil maps of Manitoba available for viewing and may be purchased. These maps illustrate and classify the various types of soils in Manitoba. Descriptions of the underlying soil and drainage classifications are included on these maps. Once an area has been determined, then a site inspection will be required to confirm the soil types conducive to hoop structures. I cannot stress enough the importance of the soil type in relation to site location.

Step two is to find the topography of the land so that it can facilitate in the development of the site. Find a site that is naturally sloped. The ideal topography would be a high spot where all the water drains away from the site with no water draining onto it. There are very few sites like this that exist. A site not wanted is one within a low spot where all the field runoff is draining into the area with minimal drainage moving the water out of the area (wet area or old swamp location). Usually if the correct soil type is located, the facility can be constructed.

You must also be aware of the local waterways in relationship to the proposed site. It has to be remembered that the proposed operation **must** meet the *Livestock Manure and Mortalities Management Regulation MR 42/98* as for the set back distance of 330 feet from all wells, all waterways and all property lines.

Overall to minimize costs, try to find a site where the topography works best for you.

Site Development:

Planning stage is the next step. This is an area that takes a significant amount of time; but is very beneficial. Think seriously of how you want your site designed. i.e. handling of pigs, traffic patterns, storage areas, year round accessibility etc. Have a plan drawn up to scale and mentally walk through the layout repeatedly. Remember that after the facility is constructed, it can be very costly to make changes.

Site Survey

The importance of a site survey can not be under estimated. The survey will measure the elevations of the site giving a better idea of what you have to work with. A survey is a tool needed to determine how water can be diverted away from the proposed site if necessary and volume of soil movement required.

Plan Development

With the use of the survey, the layout of the facility can be determined. Identify the proposed location of the lanes, buildings and shelters (Figure 1). The manure storage area will normally be behind the shelters. The lane and shelters must be

built high enough and the surrounding land sloped so that the precipitation will drain away from the centre of the operation. The ideal slope is 2% from the front of the shelter to the back of the manure storage area. In doing this, it must be understood that the runoff water has to be directed to an appropriate location. If the facility is greater than 330 feet away from a watercourse or any type of drain and the land is continuously in forage, it may then be allowed to have the runoff drain into this area. If this is not available, a holding area (collection basin) must be constructed to retain all the runoff from the facility.

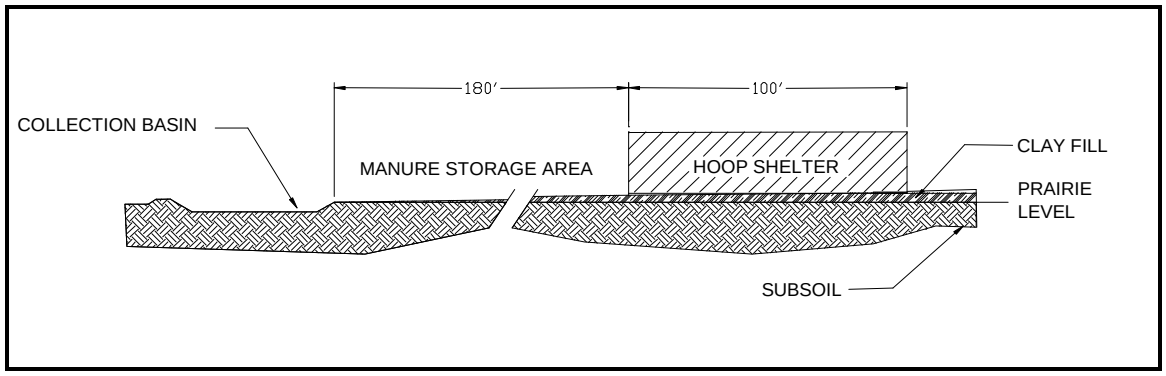

Figure 1: Site layout

Earth Work

Prior to any soil work, the volumes of soil to be moved should be calculated so that most of the soil can be extracted from the site layout, if possible. Strip the topsoil from the site, this will then expose the subsurface clay layer.

Move this subsurface clay onto the proposed area in lifts of 6 to 8 inches at a time. Pack down this layer with a fully loaded “sheepsfoot” packer. Repeat this process until the required elevation is met. This will ensure an excellent compacted soil base, which will maintain a low infiltration rate.

Manure storage area should be large enough to hold a minimum of 200 days of manure. This area should be constructed for minimal water ponding and infiltration. Once the constructed area is sloped, the base should be disced six inches deep and compacted with a sheepsfoot compactor to ensure maximum compaction.

Collection Basins:

Collection basin is for holding water runoff from the facility. It must be constructed to minimize environmental effects. The pond is sized to store a minimum of four inches of runoff from the collection area not including one-foot free board. The collection basin depth should be no deeper than two to four feet. The surface

area of the collection basin should be about 2 ½ percent of the collection area. This gives the basin a large surface area and therefore increases the evaporation from the collected runoff. The collection basin should be emptied as soon as possible after snow melt or high intensity storm to ensure that sufficient storage capacity will be available for the next runoff event. The runoff water must be applied onto an area where crops or forage can utilize the nutrients. The method of application (i.e. sprinkler system) must not induce ponding or runoff in the field.

Access Route Construction:

The lane must be accessible all year round and under all weather conditions. There must be an area for the feed and livestock trucks to enter and turn around on site. This area should be user friendly and open. The minimum turning area required for livestock trucks is 115 feet in diameter. The easiest way to construct a lane to support this load, is by using geotextile fabric. Geotextile fabric is a porous fabric that separates the existing subgrade soil from the fill material and prevents the fill material from mixing with soft subgrade material. The fabric helps reduce the impact of surface loads and redistributes the pressure across the existing subgrade soil. After the earthwork and the compaction are completed, unroll the geotextile fabric over the lane and turning areas. Apply a layer of coarse aggregate and cover it with a layer of fine aggregate. This will provide a strong and durable surface.

Straw Storage Area:

The straw storage area must be accessible all year round and should be on a high point of the facility. This area should be sloped to reduce ponding water and facilitate drainage. The reason for this is to reduce the moisture from the ground up into the straw bales. This is reduce loss with good drainage on a

Shelterbelts:

Shelterbelts will greatly help in diffusing and diluting odours emitted by the manure storage structures. Rows of trees planted around the facility will also considerably improve the appearance of the facility.

Conclusion:

Appropriate site location and development for hoop structures ensures the continuous operation of the facility with minimal environmental effects. This will increase the overall functional efficiency for the facility and reduce operating costs for the producer year after year.