

FARMSFACTS

Holding pond site selection and design

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Livestock operators may need to contain contaminated runoff from feedlot facilities, silage pits or manure piles to prevent surface water pollution. Control works consisting of diversion ditches/dikes and holding ponds may be needed to contain the runoff. Include holding ponds as part of the feedlot design, which incorporates proper pen slopes to provide good drainage and pen drying. Construct holding ponds in impervious soils, or use man-made materials or imported clay as a liner to provide ground water protection.

The site selection process for the facility and the holding pond is a step by step process. The cost to the developer (time and financial) will increase with each step along the path. The geotechnical nature of the site and regulatory requirements will influence the required commitment from the developer. All sites require **prescreening** and an **initial soils evaluation**. For some sites this work will identify the need for a **detailed site investigation**.

Prescreening

Prior to a site visit or site work, prescreen the site by reviewing available well logs within a 1.5 km radius of the site to provide information about the geology of the area.

These well logs will provide data on well depths, depths to water bearing formations, well water levels and types of soils beneath the surface. Topographical maps and air photos will provide information about surface features in the area and the proximity of surface water bodies and watercourses. If prescreening determines the site has potential then proceed to an initial soils evaluation of the site.

Initial soils evaluation

Several research studies show there is no risk to ground water from an active feedlot. The compaction by cattle on the soil, combined with the manure, seals the soil surface and prevents ground water contamination. During corral cleaning take care to ensure the impervious organic layer at the base of the manure pack remains intact.

Runoff collected from the feedlot surface has the potential to contaminate ground water if not properly stored. Construct holding ponds in soils which will prevent ground water contamination. If the on-site materials cannot achieve this it may be necessary to use imported clay liners, synthetic liners, or other proven technologies.

Collect soil samples from the area of the holding pond. Dig three test holes around the perimeter of the proposed pond and collect representative samples for analysis. The test holes should extend a minimum of 1 metre (39") below the final holding pond bottom elevation. This depth may not be known at the time of investigation so the deeper the initial holes the less chance that deeper holes will be required at a later date. In most situations a backhoe is sufficient for collecting these samples.

Monitor at least one of the holes for a minimum of 24 hours and record the quantity of water that collects in the hole. If water appears try to determine the source. Water in the test holes may trigger the need for a detailed site investigation.

Obtain representative sample(s) of the soil. Analyse one or two samples (representative of the material that will line the pond) for percentage of clay, silt and sand. Store the remaining samples for future analysis if required. Where the water table is within 1 metre (39") of the holding pond bottom, in soils with less than 15% clay or less than 50% fines a detailed site investigation will be required. Determination of whether a detailed site investigation is

required will be based on the result of the soil analysis and the information gathered in the pre-screening process.

Detailed site investigation

A detailed site investigation will help determine if construction of a holding pond is feasible, and establish the holding pond's design and construction requirements. A detailed site investigation will require the developer to engage the services of an engineering and geotechnical consultant. These consultants will assemble the site-specific data, evaluate the data and if feasible prepare a plan with recommendations on location and construction standards for the holding pond.

They may also make recommendations about future monitoring of the site. Construction may be approved only if a compacted clay liner, geotextile membrane or other method of ground water protection is used.

Once a safe site and the design requirements for the holding pond have been identified, prepare a topographical survey of the site.

Surveying the site

A topographical survey will define the contributing area for runoff, allow the design of control works which take advantage of natural slopes and depressions and facilitates laying out the site for construction. The topographical survey can be used to show where dykes and diversion ditches are required. The design should minimize the contributing area by diverting uncontaminated runoff around the facility so that the volume of contaminated runoff to be contained and the holding pond volume

is minimized.

A topographical survey is the first step to an engineered design. An engineered design provides details on the volume of earth moving required to create the proper pen slopes and control works. With an engineered plan the owner of the facility can contract the earth moving work on the basis of volume rather than time. Often the cost saving realized by the contract will pay for the cost of the engineering.

Holding pond design

Design holding ponds for at least 7.5 cm (3 inches) of runoff from the contributing area. Many jurisdictions use the volume of a 1-year in 25 year-24 hour rainfall event to determine the holding pond volume. For Saskatchewan this corresponds very closely to 7.5cm. Some locations may require additional volume based on site-specific details.

Small holding ponds are usually designed as evaporation ponds that allow natural evaporation to remove some, or all, of the water that collects. This requires a large surface area in relationship to the liquid depth, which is usually about 30 cm (12"). The shallow depth may allow the operator to seed the pond to grass. With shallow side slopes on the holding pond, it is often possible to drive through the pond to cut hay in it. The shallow water depth reduces the risk of seepage.

Holding ponds are usually located at the low end of the pens. Ditches can be used to direct runoff to a holding pond from another location on the site. Deep holding ponds are com-

monly used in large feedlots. They do not require as much surface area and may fit better into the site, but may require emptying.

All holding ponds should be designed with at least 30 cm (12") of freeboard (the vertical depth above the fully supply level (FSL) which is provided as a factor of safety against overflow). Operators should have a plan and be prepared to reduce the liquid level below the Full Supply Level (FSL) when necessary. This will more likely occur with deep holding ponds than with shallow ponds.

Holding pond construction and monitoring

The construction technique used for holding ponds will determine the effectiveness of the soil seal formed. The basic construction standard for holding ponds is to disc the final surface on the bottom and sides to a 6" depth and then compact with a sheepsfoot packer. Place soil for dykes in 6" lifts and compact with a sheepsfoot packer. Do not use topsoil for the construction of dykes.

Some porous soils can be made effective by using the proper construction techniques. A detailed site investigation will allow an engineer to recommend construction techniques that will ensure ground water safety.

Detailed engineering may recommend installation of sampling wells to monitor seepage from holding ponds and to determine the effect on ground water quality. A regular

monitoring program will allow corrective action to be taken when necessary.

Other options

Sloughs contained entirely on the operator's property can be used as holding ponds provided they have sufficient capacity and the soils have the proper sealing capacity.

In order to determine if the slough has sufficient capacity to hold current runoff plus the additional feedlot runoff a topographical survey and an estimate of potential volume of the slough is required. Test holes, around the edge of the slough, are required to ensure proper soil types are present and to ensure that the slough is not a ground water recharge site.

Sloughs not entirely contained on the operator's property can be used as holding ponds with the written permission of adjacent land owners or any landowner who's land the runoff flows over. The testing and surveying requirements for a self-contained slough would apply. The livestock operator should place a caveat on the other parties land title to ensure potential purchasers know of the agreement.

Vegetative filter strips may have potential to assist in the removal of nutrients from surface runoff. Vegetative filter strips are not a stand-alone practice but are used in con-

junction with other techniques for preventing pollution of surface water. Some of the factors considered in designing of filter strips are land slope, soil type, vegetation present, climate and the nature of any water receptors.

Maintenance and safety

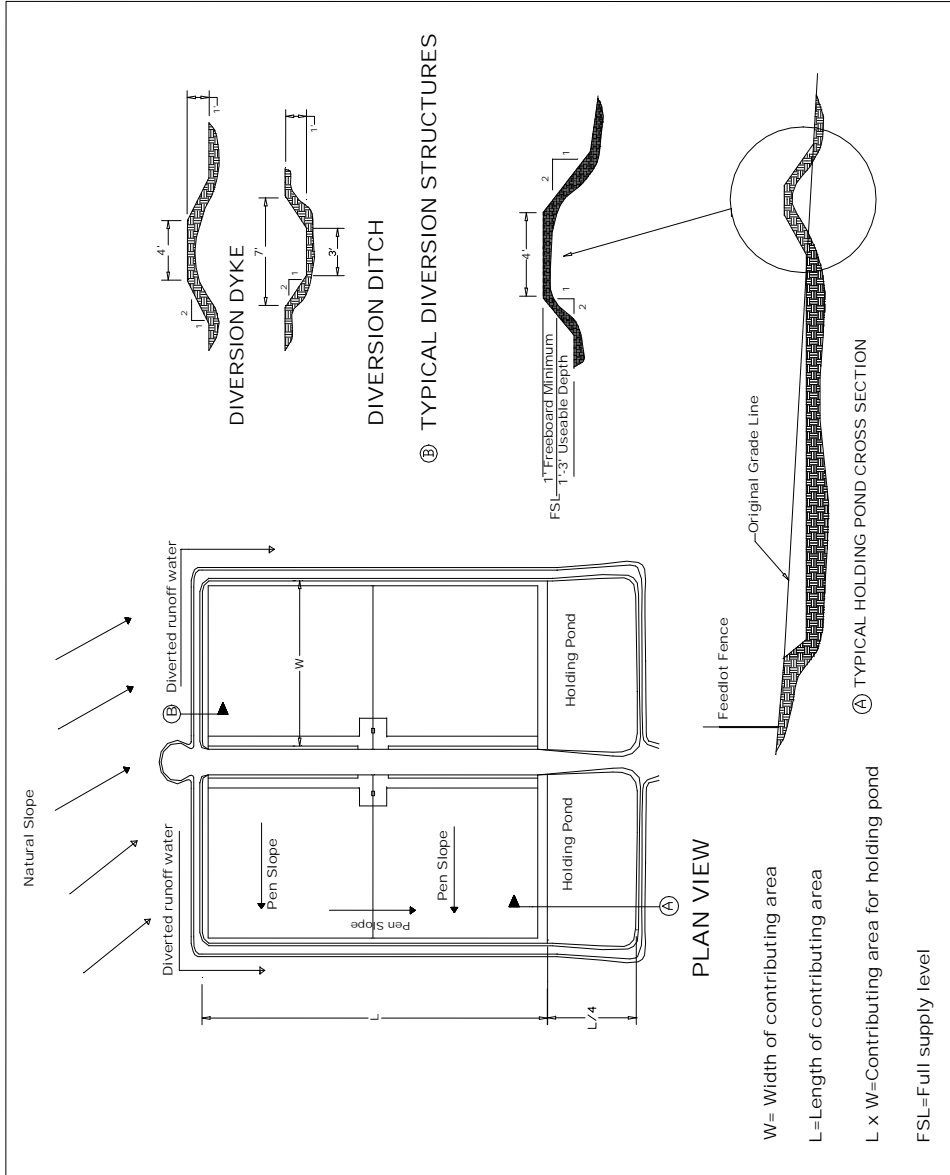
Cattle should not have access to holding ponds, as they will break the surface seal. If the holding pond is located where cattle have access, lower side slopes should be used so hoof action does not reduce the holding ponds effective volume. Deep holding ponds should be fenced as a safety precaution to prevent access by children and livestock.

Apply effluent from holding ponds on the land according to normally accepted agricultural practice. Liquid manure handling equipment can be used for this operation, although solids removal may be required from time to time.

Holding ponds within public view should have the vegetation mowed and be maintained in a neat manner. An unsightly holding pond will reflect on the overall perception of the livestock operation. Trees can be planted to screen the site and to improve appearance. Trees also reduce wind action on the pond and act as an odour filter. Trees should be set back to allow equipment access to the pond and to reduce the effect of snow buildup on holding pond volume in the spring.

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TYPICAL FEEDLOT CONTROL WORKS