

# Chapter 8. SURFACE WATER MANAGEMENT

This chapter explores:

- runon and runoff – what they are, and the risks associated with them.
- various management options – runon reductions, runoff catchbasins, vegetated filter strips, and constructed wetlands

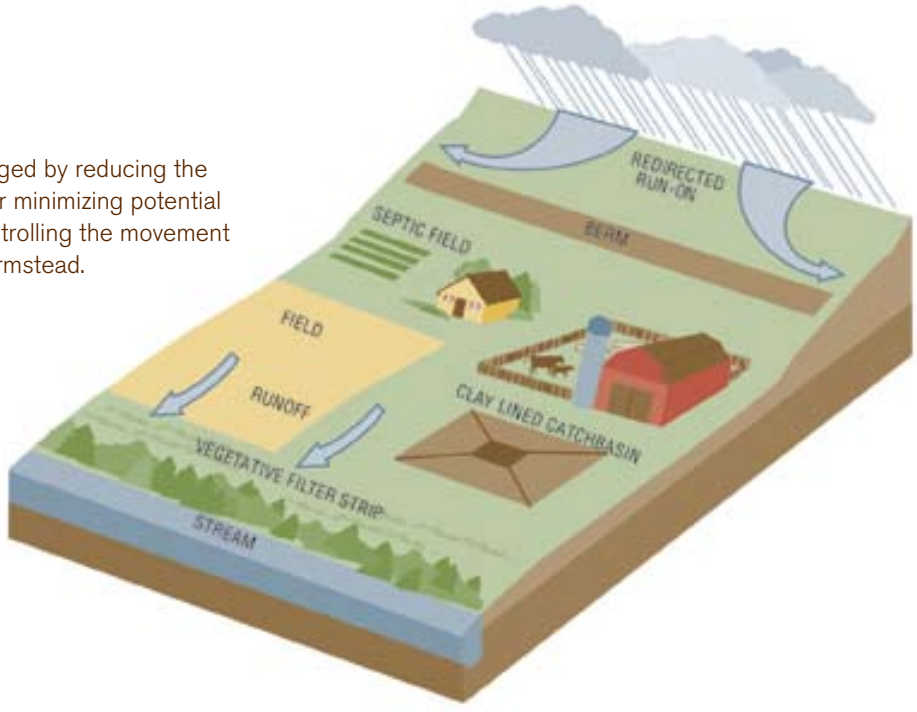
Livestock operations may have outside facilities such as yards, feedlot pens and outside manure storages that have the potential to contaminate surface water with manure. Other possible contaminants include fuel, pesticide, milk parlour washwater, silage leachate, cleaning products and disinfectants.

Controlling runon and runoff:

- Helps to protect water quality by preventing organic matter, phosphorus, nitrogen and pathogens in runoff from entering local surface waters or leaching to groundwater.
- Conserves valuable, nutrient-rich manure for use on crops.
- Aids compliance with provincial and federal regulations.
- Helps to ensure clean, dry lots, which enhance livestock health and are easier to maintain.

**PERMITTED OPERATIONS** may be required to have an approved runon/runoff control system. For more information, contact an Alberta Agriculture and Rural Development (ARD) Confined Feeding Operation (CFO) Extension Specialist or Natural Resources Conservation Board (NRCB) staff.

Water pathways can be managed by reducing the volume of water, eliminating or minimizing potential contaminant sources, and controlling the movement of surface water within the farmstead.



## 8.1 RUNON AND RUNOFF FLOW

One of the best ways to understand runon and runoff flow around your livestock operation is by mapping your operation, including its surface water flow patterns and other water sources, as listed below. This will help you understand where water is flowing from (runon water), how it is flowing through the operation, and where potential sources of contamination may be.

Sources of surface water flow can include:

- direct rain
- snow and snowmelt
- roof water
- overflowing waterers
- water from manure
- upslope runon waters

## 8.2 RUNOFF VOLUME

Solid manure storages, livestock yards and outdoor exercise areas should be equipped with a runoff management system that handles all the runoff generated by the facility. Runoff should not be allowed to negatively affect surface water.

The runoff volume will determine what options are available for managing your surface water. Volume depends on the precipitation received and the area being drained. Rainfall considerations include the intensity, frequency and duration of typical rainfall in the area as well as snowmelt. This information can be obtained from weather information service providers. The area drained can be determined from maps. For assistance in calculating runoff volume, contact your local ARD Confined Feeding Operation Extension Specialist.

## 8.3 RUNON MANAGEMENT

Runon should be minimized to reduce the volume of runoff. Methods to do this include:

- Maintain waterers and repair any leaks.
- Divert runon waters around the farmstead using natural topography or man-made structures

A clean water inlet pipe collects clean runon water upslope of a livestock yard and discharges it below the yard through a drain outlet.

**BEFORE CONSIDERING A RUNOFF MANAGEMENT SYSTEM,** divert all clean water away from the solid manure storage, livestock yard or permanent outdoor confinement area. This will reduce the volume of contaminated runoff that has to be managed.



such as ditches, dykes, berms or pipes to avoid water contact with manure, sewage or other potential contamination sources.

- Collect or divert runoff from roofs.
- If possible, locate the livestock yard, pens and manure storage on higher ground to prevent runon.
- Remove accumulated snow from the livestock yard or pens to minimize snowmelt runoff.

## 8.4 RUNOFF MANAGEMENT

Consider the following guidelines when assessing runoff management options:

- Locate potential contaminant sources such as manure storage areas away from water flow pathways and potential flood zones, or protect these areas with ditches, dykes or berms so contact with surface water flow is minimized or eliminated.
- Modify water pathways to reduce the risk of contaminant movement. For example, designing and planting a vegetative filter strip in a pathway can slow down water movement and allow suspended solids to settle. Another option is a constructed wetland. Constructed wetlands slow down water movement and contain it for a period of time, allowing biological activity to help reduce nutrient levels.
- Release the collected manured runoff in a controlled manner that allows for infiltration and treatment by vegetation and soils.

### 8.4.1 Runoff Control Options

Runoff control options include the following:

**Catchbasins**
Catchbasins can be used to collect contaminated runoff water and prevent the water from leaving the property. The catchbasin provides some treatment of the water, but releases from the catchbasin must be properly managed.

To minimize an accumulation of sediment in the catchbasin, a two-stage collection system works well, with the initial stage to settle out solids and the second stage to store the runoff.

If the facility requires permitting, the catchbasin will require engineering design and construction that meet provincial regulations and standards. Catchbasin siting should take into consideration the distance to neighbours and should be located above stream or river flood levels, at least 100 m or more from any water well or spring, and more than 30 m from any

Contact your ARD CFO Extension Specialist for assistance in designing catchbasins.

**KEEP IN MIND** that large-scale diversions are regulated by Alberta's *Water Act*. Farm runoff management systems must not significantly alter regular water flow, must not affect or alter a non-flowing water body and must not be located on a fish-bearing water body.

common body of water. The catchbasin should have a natural protective layer or a liner that provides adequate protection to the groundwater.

Catchbasins should be monitored to identify any possible risks and maintained to prevent soil and water contamination. Visual inspections will ensure that the liner is not damaged and that the walls are not eroding. Monitor liquid levels, and check for wave damage to the liner, erosion damage at entry and pumping points, cracking and slumping of the liner, seepage on the outside of the berm, and liner damage due to rodents and trees. Maintenance should be done to rectify any problems identified by monitoring the above. Having sampling wells to monitor groundwater conditions can also help minimize risks to groundwater.

Catchbasins should be emptied as they fill so they are ready for the next rainfall event or snowmelt. The catchbasin must be emptied in such a way that the contents do not create an environmental risk by leaving the land to which they are applied or by entering an open body of water. Options for managing the catchbasin effluent include: application to crops by releasing the effluent at a low flow rate when soil is thawed to ensure infiltration into soil and reduce the erosion risk; slow release into a vegetative filter strip; or release into a wetland.

Nutrient content of catchbasin effluent varies widely, although typically it contains low levels of nitrogen and little phosphorus, but high concentrations of sodium.

The catchbasin should be secured from access by animals or unauthorized persons.

**Vegetative Filter Strips**

A vegetative filter strip is a width or length of vegetation that acts as a filter to trap and use sediments and nutrients from runoff.

Vegetative filter strips may be sufficient to minimize runoff contamination from some livestock operations including feeding pens, manure stockpiles, wastewater pump-outs and manure spread on fields.

Factors influencing the effectiveness of a vegetative filter are:

- Season in which the filter is being used: it will not work well when soil is frozen.
- Drainage area upslope from the filter strip.
- Amount and form of precipitation (snow, rain, or both).
- Slope of the site and whether the natural topography lends itself to sheet or channel runoff.
- Vegetation cover in the filter strip area (stubble, grass or trees, etc.).
- Soil type (sandy, loam or clay).

**Constructed Wetlands**

Constructed or man-made wetlands can be used to collect and treat contaminated runoff or discharge from livestock operations. Constructed wetlands are man-made systems that are designed, built and operated to imitate natural wetlands.

To design and develop a wetland for effective wastewater treatment, it is necessary to understand the processes that occur in wetlands. Primary processes include:

- Breakdown and transformation of nutrients by micro-organisms and plants.
- Filtration and chemical precipitation through contact with plants and soil.
- Settling of suspended particles.
- Absorption and ion exchange on the surfaces of plants, sediment and litter.
- Predation and natural death of pathogens.
- Periodic harvesting of wetland plant material to prevent wetland nutrient overload.

Livestock producers must consider the advantages and limitations of such a system to determine whether a constructed wetland is suitable for their operation.



***Advantages of a constructed wetland:***

- Provides a high level of treatment. Test results show that phosphorus, nitrate-nitrites, ammonia, biological oxygen demand (BOD) and suspended solids can be reduced to acceptable levels.
- Can be relatively inexpensive to construct. A site with accommodating specifications keeps establishment costs low.
- Inexpensive to operate. A well-designed wetland transfers water through the system. Once established, properly designed and constructed wetlands are largely self-maintaining. Costs can be offset by harvesting forage from the area.
- Reduces, if not completely eliminates, odour. Unlike lagoons, research shows that odours from wetlands are minimal or non-existent.
- Handles variable wastewater loadings. Properly designed wetlands show tolerance for varying amounts of wastewater loading.
- Reduces the land area needed for wastewater application. Constructed wetlands reduce the concentration of contaminants, and therefore, the land area needed for wastewater application.
- Aesthetically pleasing. Constructed wetlands enhance the landscape with colour, texture and plant variety.
- Provides wildlife habitat. Wetlands attract wildlife and can improve the usefulness and attractiveness of an area.

***Disadvantages of a constructed wetland:***

- Requires a continuous water supply. Water must be added if the wastewater supply is insufficient for sustaining plant populations during dry periods.
- Can be relatively expensive to construct. Changing the lay of the land, adding soil amendments, liners and/or incorporating pumps add extra cost.
- Affected by seasonal weather conditions, which may reduce reliability. Seasonal weather conditions, such as cold and drought, reduce the effectiveness of the system.
- Can be destroyed by an overload of solids or ammonia. High ammonia levels caused by inadequate removal of solids destroys plant life in the wetland.
- Removes nutrients. Nutrients removed by the wetland system are unavailable for land application and crop production.