Soil & Crop
Improvement Association
of Nova Scotia

Livestock Watering Systems for Pastures

Factsheet 2006 Revised 2015

Introduction

Direct livestock access to streams or ponds has been the traditional method of watering. While this method may be suitable for low density use, both animal and environmental problems may arise.

Impacts on livestock include reduced health, production and rates of gain and a greater chance of injuries. Impacts on the environment include erosion of banks, siltation of watercourses, loss of vegetation and habitat, nutrient build-up in water, and an increased growth of algae and bacteria, which can all have negative effects on aquatic life and water quality.

Figure 1. An example of a poor source of water; environmental degradation and a decrease in livestock production can occur.

Effects of Poor Water Quality

Livestock can be significantly affected by high levels of coliform bacteria (especially *E. coli*, which indicates septic waste or manure in the water). Cattle weight gain can be reduced by 20-30 percent with the consumption of contaminated water. A recent survey of pasture watering sources in Nova Scotia found some surface waters to have in excess of 100,000 colony forming units/100 mL of water. Livestock generally prefer clean water over contaminated water, and cool water over warm or icy water. Several studies have shown that cattle prefer drinking from water troughs rather than streams or ponds.

Ramps and crossings can be used to reduce riparian damage provided they are well-designed and constructed. Please see the factsheet on *Limited Access Ramps* for further information.

Water Requirements

Table 1 gives water requirements for several types of livestock. (To calculate per-hour herd intake, multiply the given number by the herd size and divide by 24.)

Table 1. Average daily water intake by livestock

Livestock type	Intake§	
	Litres	(Gallons)
Cow-calf pairs	55	(12)
Dry cows (both dairy and beef)	45 - 55	(1012)
Growing cattle* (150-350 kg)	20 - 40	(5-10)
Growing cattle* (350-550 kg)	30 - 55	(7-13)
Dairy cows	75 - 95	(12-20)
Sheep, goats	10	(2)
Horses	30 - 45	(6-10)

§ On days over 25°C, intake can increase by 50-100%.
* Finishing cattle may require more.

Alternatives to Watercourse Access

There are many ways to provide water for livestock while preventing them from entering water sources. There may be several options for a particular site, so before choosing a watering system, there are some details that should be considered.

To determine the right system for you, know:

- Daily total water volume required
- Number of livestock
- Distance from barn water or electrical supply (accessibility)
- Water source specifications (type and location)
- Pasture location(s) and conditions (remoteness, topography, riparian features)
- Grazing intensity (intensive or extensive)
- Time available for labour (maintenance, reliability of system)
- Financial feasibility

Pipeline from a Well

This is the preferred method of watering livestock in Nova Scotia. The source of water usually feeding a pipeline system (Figure 2) is a drilled or dug well, however any other source can be used as long as there is electricity available for a pump to move the water. Wells can provide high volumes of quality water, are very reliable, and pipe can be laid out over a long distance, depending on the head.

Figure 2. Pipeline system: consists of main line with connectors to tubs in paddocks.

The waterline diameter is usually 1 inch, but if pumping uphill, reduce the pressure loss by using a larger waterline. Waterlines can either be buried below the frost line or kept above ground, but then need to be emptied before freezing. In rotational grazing systems, plan the layout of the paddocks to best accommodate the waterline and insert several quick disconnect couplings so that a water tub can be quickly emptied and moved to the next paddock. Cost will depend on the distance of waterline installed, and any excavation costs associated with burying the line.

Gravity Flow

This is a simple system in which the force of gravity is used to bring water from the source to the watering site and into a water tub (Figure 3). Since no power is required, this system can be used with almost any surface water source and anywhere there is adequate slope (the source should be at least 1.5 m higher than the water tub; this increases as the distance increases).

The pipeline should be as straight and level as possible to prevent air locks, but the risk of air locks increases as distance increases. The diameter of the waterline should be at least 1.25 inches for grades over one percent, but if pressure drop is a problem, then up to 1 ¾ inches diameter may be required. The daily volume is completely dependant on the source (i.e. flow from spring or volume of pond).

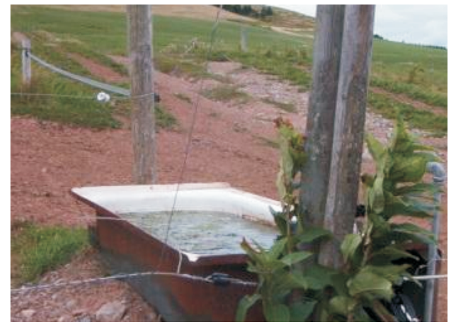

Figure 3. Gravity flow system: source feeding waterline at top of hill and is delivered at water tub.

Solar Powered Pumps

Solar powered pump systems use solar energy to either charge batteries which run a 12-volt pump (Figure 4), or as a direct system which operates the water pump directly. The intake of the water hose can be placed in a stream, pond or shallow well and the outlet should run to a water tank. Three days worth of reserve in either batteries or as a water reservoir is recommended for extended periods of cloud; solar panels can recharge during cloud but at a much reduced rate. The water tub can be fed by gravity from the water tank or reservoir.

Figure 4. A simple set up of a solar panel, batteries and a submersible pump.

Suppliers can help with the system design including panel(s), batteries (optional), pump, controller and float switch. This system also has the potential to power an electric fence at the same time it is powering a water pump. Solar direct systems are at least double the cost of battery operated systems.

There is a large range of system sizes. Systems can pump as little as 200 L/hour (4,000 L/day) to as much as 5,000 L/hour (120,000 L/day) or more (the latter was tested at an 8 foot vertical lift and 16 foot horizontal with a 102 watt solar panel). In general, 100 watts is the minimum wattage of a panel required to operate a pump with sufficient volume. If higher flow rates of water are required, panels can easily be added to the system to increase its power output and drive a larger pump.

This system works well in more remote areas, since the water reserve only needs to be checked every few days. Theft or vandalism may become an issue. The panel, batteries and water tank can be placed on a trailer and moved to another area of the farm.

Wind Powered Pumps

Both mechanical and compressed air pumps are used, however the latter is more economical and requires less maintenance (Figure 5). The intake of the water hose can be placed in a stream, pond or shallow well and the outlet should run to a water tank. A water reservoir holding three days' water supply may be necessary in case of several calm days, however normally very little wind is required to drive the pump. The water tub can be fed by gravity from the water tank or reservoir. Since there is only one moving part, there is almost no maintenance required, other than to check on water levels in the trough or reservoir.

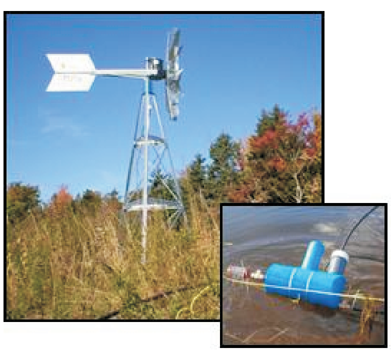

Figure 5. A 12-foot windmill driving a water pump with compressed air.

One manufacturer of compressed air windmills reports a maximum of 16,000 L/day pumped at a 10 foot lift (horizontal or vertical) and 6,000 L/day at a 21 foot lift, with 5-8 km/hr winds. When tested with a 75 foot horizontal and 6 foot vertical lift, the windmill could pump at least 300 L/hr (7,200 L/day). Most regions of Nova Scotia regularly have enough wind. There is an automatic shut off at wind speeds higher than 35 km/hr.

Nose Pump

This is a diaphragm pump powered by livestock, and yields 0.5 to 1 L per stroke. The maximum number of cattle that it can water is 20 cow-calf pairs. Nose pumps are easily set up by placing the intake hose into the water source, like a stream or pond. When the cattle are moved, simply haul the hose out of the water and take the nose pump with them. Winterized versions cost more. A two-day training period is required to allow cattle time to become familiar with the pump.

Where nose pumps are permanently fixed, installing a pad or trough underneath the pump can reduce mess and can provide water to very young calves that otherwise cannot operate the pump (Figure 6).

Figure 6. It is preferable to place a pad underneath the nose pump to avoid a mucky drinking area.

As hose length increases, so does the force required, so a distance of 6-10 m is considered maximum for best results. The amount of lift will depend on hose length, but is generally not more than several metres. Other than needing to prime the pump once in a while, there is little maintenance required. These pumps are very reliable and can be used in more remote locations.

Water Powered Pumps

Both the ram pump and the sling pump are powered by water. Neither is used much in Nova Scotia because they require specific water source conditions. The ram pump requires a minimum of 1 metre fall to drive it, while the sling pump needs a minimum water depth of 40 cm and current speed of 0.6 m/s to operate.

Water source factors such as flow rate, fall and lift requirements will all determine the amount and rate of water delivered. Both pumps have been reported to pump up to 6,000 L/day or more, and the ram pump can lift several hundred feet, depending on the initial fall.

Hauling Water

Hauling water consists of a tank mounted on a trailer or vehicle that supplies water by gravity to a water tub. The flow of water is then controlled by a float valve. Tanks generally hold several thousand litres of water, so that they only have to be refilled once every couple of days (Figure 7).

This system is practical when no other water source is available to the grazing area. It can be used with a rotational grazing system by moving the trailer at the same time as the animals are moved. Like smaller troughs, algae can grow inside tanks, especially in the hottest part of the summer.

Figure 7. Typical tank used to haul and store water in more remote areas.

Pumps Powered by Battery and Fuel Generators

There are many types of pumps that can be run by portable batteries or gas engines. They are useful as backup power sources or when providing water in remote areas. However these can be more labour intensive as the power source needs to be attended to regularly. Theft may also become an issue.

Here again, a water tank can store water and then feed a water tub by gravity. An alternative to having the batteries or generator constantly running a pump is to routinely visit the site with the power source and fill a water tank that can store a large quantity of water.

System Costs

Table 2 shows cost ranges for each system. The costs include the pump and all immediately associated components of the pumping system; they do not include water troughs, floats or any pads that may be required at the watering site. There is also the possibility of excavation costs, which will depend on the size of the task, as well as the soil type that is worked on. Large water tanks or reservoirs to store several days' worth of water will also add to the total cost of the system.

Table 2. Cost of alternative watering systems

Type	Cost of system ($)
Well	3,000 - 20,000
Pipeline	*1,000+
Gravity flow	*1,000+
Nose	400 - 500
Solar	§1,500 +
Wind	§1,500 +
Ram pump	500 + and fuel
Gas engine generator Battery powered	Batteries and charging cost

*Cost depends on total distance of system.
§May have to add cost of reservoir (if needed)

Costs associated with a pipeline system include: a float (under $20); plastic tubs which range from $150 to $250 depending on the size, while metal tubs can cost $100 (or less for used); and waterline (less than $1.50 per foot for 100 psi pipe).

The Nova Scotia Pasture Improvement Initiative (NSPII) has solar and wind powered demonstrations available for viewing. For more information, contact the NSPII at (902) 896-0277.

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