United States Department of Agriculture

Illinois Grazing Manual Fact Sheet

LIVESTOCK WATERING INFRASTRUCTURE

Water Resources Development for Managing Intensive Grazing of Beef

Why a Watering System

Development of a good pasture watering system can make or break a grazing system. Several considerations for the producer are:

- Water quality and quantity
- Supply equipment
- Groundwater protection
- Human and animal safety

Water Quality

Water requirements for beef animals vary from about 9 gallons of water per 1000 lbs. bodyweight per day in winter; to nearly 30 gallons per 1000 lbs. bodyweight per day on hot summer days. For management intensive grazing applications, the total water supply must be adequate for the herd; but may have much more constant demand on the flow rate than in non-intensive grazing applications where the entire herd goes to water at once. If the water tank is placed within 500-800 feet of the paddock, cattle will visit the tank one at a time or a few at a time, creating less demand for access to the water tank.

Supply Equipment

Tank Sizing: Many producers are using water tanks that only hold 20-50 gallons. Ample valve sizing and proper sized water pipe combine to keep the tank water level near full as cattle are drinking reducing the risk of cattle tipping the tank over. Only in the case where a slow or intermittent pumping source is used, for example, a direct-connect solar pumping system, will a large tank be required that holds a day's water supply or more.

Tank valves: Select tank valves based on the maximum flow rate needed at the tank. Some inexpensive float valves can only supply 2-3 gallons per minute, which will often be insufficient for small tanks where two or more cattle are drinking at a time. Slightly more expensive, full–flow floats can deliver up to 20 gallons per minute with the proper pipe and system design. A bottom-inlet float device on the tank controls the water level but is generally out of reach of the cattle.

Wellhead Protection: Protect wells and groundwater from pollution by proper construction at the wellhead. Guidelines for wellhead construction and upgrading are set by the Illinois Department of Public Health. Abandoned wells need to be sealed according to accepted practice.

There is a potential danger of groundwater contamination from livestock watering equipment. Any tank or waterer supplied by well water or a water district pipeline should be fitted with a vacuum-break or backflow prevention device to prevent tank water entering the water supply in the event of a line pressure loss. Most top-mounted commercial float valves have an air gap or anti-siphoning valve, but plumbing codes and/or health department regulations may require specific backflow prevention equipment.

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Energy-free or electrically-heated permanent waterers should be sized for one watering space (1 cup or 2 lineal feet of tank) per 25 head. Midwest Plan Service, MWPS-6, Beef Housing and Equipment Handbook, has details on pasture tanks and freeze-proof waterers.

Refer to Midwest Plan Service MWPS-14, Private Water Systems Handbook, for information on how to develop various types of springs for a water supply.

Ponds and streams can provide water for cattle in pasture systems, but it is desirable to fence cattle away from such surface water when possible, allowing only a small access to the water. A good alternative is to provide an appropriate pumping system to deliver the water from the pond or stream to a pasture tank.

Siphons: When a pond or other static water source is not too distant from the pasture being developed, it is sometimes preferable to keep the cattle away from the pond by routing pond water to a tank through a siphon. A siphon is a gravity-feed water delivery system that encounters a rise in the pipe between the inlet and the outlet; for example, you might want to deliver water from a pond over (instead of through) the pond bank and down to a water tank at some elevation lower than the pond water surface. The siphon outlet must be lower than the level of the pond, and the water pipe must be guaranteed to be leak-proof from the pond waterline up, to prevent losing the prime. Friction losses in the pipe must be taken into account in order to get adequate water delivery. A float valve on the tank is adequate for controlling the system. Use a floating inlet or gravel screen inlet in the pond, keeping in mind that any screen on the inlet will add to the total pressure drop and reduce the flow rate to the tank.

Ram Pumps: In rare instances, there is a spring-fed stream with adequate flow and gravity head to install a ram pump that will water cattle uphill from the stream. No other power source is needed. Check with the manufacturers for specifications; remember that a ram pump will deliver only a fraction of the water that goes through the pump. One manufacturer's literature suggested a ram pump with 1-foot drop to 10-foot lift should deliver approximately 15 to 20 percent of the water that it uses.

Solar Powered Pumps: Some pasture operations have a water source available but no electric utility power nearby. In this case a solar-powered pumping station may make sense. Solar systems are usually set up with a large tank, with up to five day's supply of water, so that cattle will have water during cloudy periods when solar pumping is reduced. Contact University of Illinois Extension or USDA Natural Resources Conservation Service for help on sizing these systems; the technology is well established and there are several sources of equipment. The economics of solar pumping won't be favorable for every situation. It's possible to use solar energy for virtually any application; but the deeper the well or greater the lift, and the more flow rate required, the more expensive the system.

Wind Powered Pumps: During the May-September grazing period, wind energy in Illinois is much less reliable than solar energy. Economic and operational studies show that solar is a better buy than wind for pasture pumping. However, a hybrid wind/solar system may be economical in some situations and may work well with an extended grazing season. Contact the University of Illinois Department of Agricultural and Biological Engineering for more information on wind energy.

Nose Pumps (cattle-operated): For lifting water up to about 20 feet and for fairly short distances, the nose pump will work well. The animals pump water a stroke at a time via a piston/valve arrangement by pushing the plunger back during drinking. Only one animal can access it at a time, so it won't be too practical for larger herds. Figure each nose pump will serve about 25 head.

Shallow-well Pumps: The simplest type of pump for use on a well is a shallow-well suction pump. A restriction on such a pump is the maximum suction lift (depth to water plus friction head in the suction line) allowable. A good foot valve is necessary, to avoid loss of prime when the pump shuts off. Many shallow well pumps are not self-priming. Theoretically, atmospheric pressure will let a

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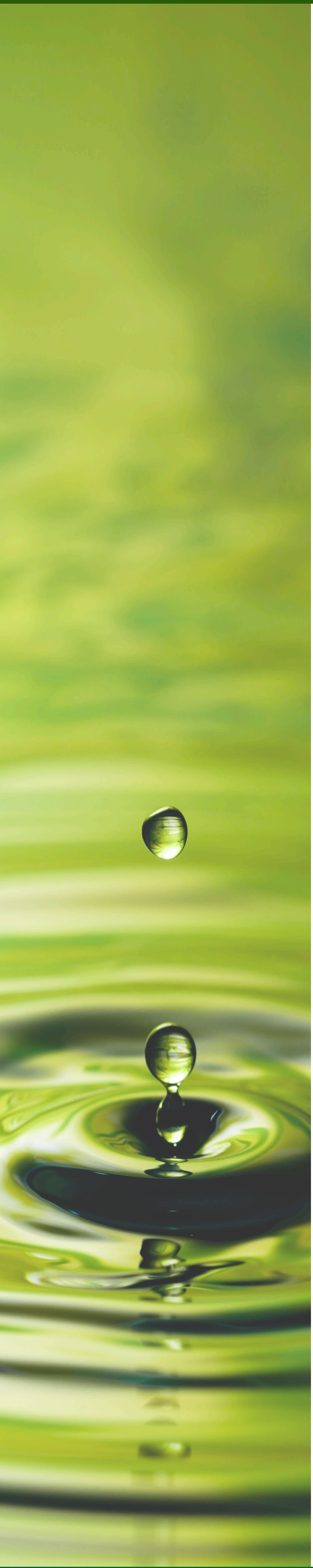

pump lift water nearly 30 feet from the water surface; practically speaking the limit is more like 15 or 20 feet. To figure out whether a shallow-well or a deep-well pump is needed where water is within a few feet of the surface, the well draw-down under actual cattle-watering conditions must be known.

Electric Power Supply: Getting electric power to a pump requires adequately-sized wiring to keep the supply voltage sufficiently high. Low voltage at the pump motor, caused by poor wiring or too-small wire size, can cause the motor to overheat and fail prematurely. Wire sizes for pumps depend on two factors: full-load motor amps (FLA) and length of wire run. Tables for figuring wiring sizes can be found in Midwest Plan Service MWPS-28, Farm Buildings Wiring Handbook. Also consult the Handbook for advice on grounding pumps and electrically-heated waterers.

If you can gravity flow the water, linear low-density polyethylene (LLDPE) pipe is sufficient. For pressurized systems, use a rolled high-density polyethylene (HDPE) with a minimum of 150 PSI rated pressure. Use a pressure-flow chart to select the minimum size needed.

The ideal system is to provide water to every paddock. Sometimes you will have to use a lane to get cattle to water, using the same water tank for several paddocks. Economic analyses of grazing systems indicate that the money spent to provide water to several locations or to each paddock pays back rapidly.

Setting up the System

Ideally, distance to water should ideally be no more than about 800 feet from any point in the paddock.

Keep water systems portable and flexible at first. It is probably best to lay the pipe on top of the ground when you are starting management intensive grazing, in case you want to make changes to paddock layout or the water system. Bury pipe when you are certain the system is configured the way you want it. You can install a main trunk line underground and have risers with quick-disconnects for the tank or tanks.

Other Considerations

Black pipe on top of the ground will heat water somewhat. Usually the heated water is not a problem in summer, because cattle can best use water at near rumen temperature anyway. Furthermore, if pipe is shaded by vegetation the solar heating will be minimized. Keep the pipe under the fence so the taller forage will provide shading.

Temporary or mobile tanks can be placed under an electric fence to keep cattle pressure off the equipment and reduce tank upsets. Locating the tanks in different spots each time the paddock is used can help reduce the forage kill and mud problems around the tank. The area around all permanent tanks should be graveled or otherwise treated to provide all weather access. Consider using a combination of geotextile covered with gravel to form a stable base around permanent water tanks. See Midwest Plan Service AED-45, Using All-Weather Geotextile Lanes and Pads, for more information.

Where to Get Help

For more information about water systems, contact your UI Extension office or the local NRCS office. MWPS handbooks can be purchased from UI Department of Agricultural Engineering or at www-mwps.sws.iastate.edu/.

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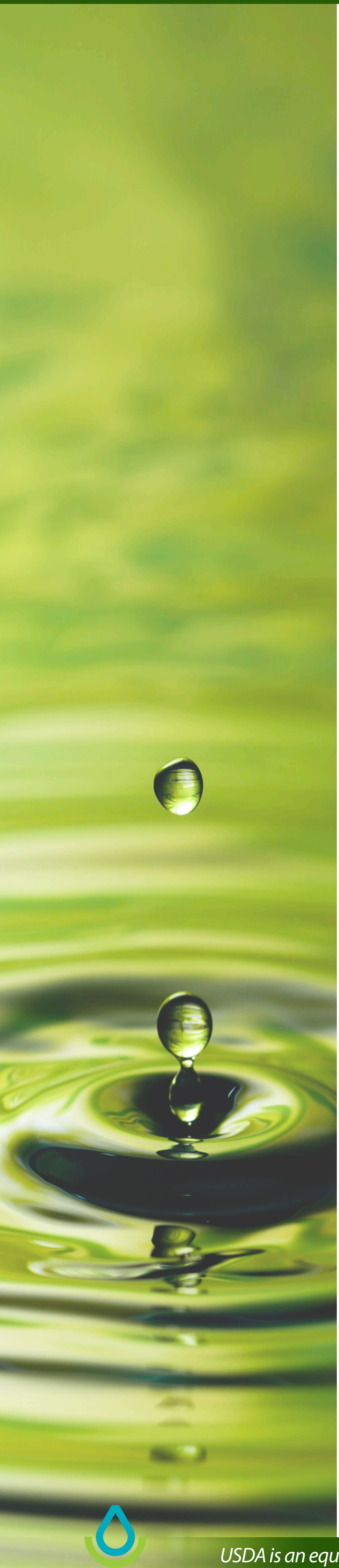

Design Resource Tables

Table 1. Friction loss in feet/100 feet of plastic pipe

Gallons/ Minutes	Nominal Size				
	3/4	1	1 ¼	1 ½	2
2	1.0	0.3			
4	3.7	1.2	0.3	0.1	
6	7.9	2.4	0.6	0.3	
8		4.1	1.1	0.5	
10		6.3	1.6	0.6	0.2
12			2.3	1.1	0.3
14			3.1	1.5	0.4
16			3.9	1.9	0.5
18			4.9	2.3	0.7
20				2.6	0.8
30					1.8
35					2.3
40					3.0

Table 2. Feet – PSI Relationships for Water

Pressure in Feet (of head)	Equals PSI
1	0.43
2	0.87
5	2.17
10	4.33
15	6.5
20	8.66
25	10.83
30	12.99
35	15.16
40	17.32
50	21.66

Pressure in PSI	Equals Feet (of head)
1	2.31
2	4.62
5	11.55
10	23.10
15	34.65
20	46.20
25	57.75
30	69.30
35	80.85
40	92.40
50	115.5
60	138.6

Acknowledgments:

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Stanley Solomon, Extension Educator, Engineering Technology

United States Department of Agriculture
Natural Resources Conservation Service
UNIVERSITY OF ILLINOIS EXTENSION
College of Agriculture, Consumer and Environmental Sciences
Illinois Department of Agriculture
ILGLCI Illinois Grassland Conservation Initiative