Developing Off-Stream Water Sources

Ron Sheffield, Animal Waste Extension Specialist
Biological & Agricultural Engineering, North Carolina State University

The view of cattle drinking from streams is largely seen by two distinctively different sets of eyes. One group of people sees a serene landscape of rolling pastures while cattle take a sip of water from a crystal clear stream. Another set of eyes envisions the sediment, nutrients and potential millions of bacteria from the cattle polluting the waterways where their children fish, swim and paddle. These two different pictures are equally valid and foster passion and vigor whenever the involuntary fencing of cattle from streams is mentioned.

Cattlemen have traditionally depended on ponds, streams, creeks and rivers to satisfy their cattle's water needs. These water sources are both convenient and reliable. However, in recent years, these conventional practices have come under scrutiny. Many livestock producers, who have installed these practices to protect the environment, are finding other benefits through developing off-stream water sources.

Cattle access to streams, ponds and rivers can lead to the degradation of our waterways. Cattle damage banks of ponds, streams, creeks and river leading to increased erosion and the deposition of sediment in downstream waters. Deposited sediment may bury fish, amphibian and insect eggs or larvae, decreasing productivity and the value of the water resource. Nutrients, such as nitrogen and phosphorus, from the direct deposition of urine and feces may lead to unnatural enrichment of waters. This enrichment, known as eutrophication, results in the rapid growth of waterweeds and algae. Bacteria from cattle feces may cause the spread of water borne diseases to both humans and cattle. These examples of degradation have lead to the identification of cattle access to streams as a potential source of non-point source pollution. Several organizations and local agencies throughout the county have responded to this potential environmental threat by mandating cattle to be fenced from streams and ponds.

In addition to satisfying a legal mandate, developing off-stream water sources is one of the biggest hurdles to overcome before a producer can upgrade his/her pasture management systems. Systems such as rotational stocking may require additional subdivision of pastures. Water development needs to be considered and planed into the design and management of any pasture management

Allowing Cattle Direct Access To Surface Waters Can Lead To[1]:

- **Environmental Degradation**
  - Damage to banks of ponds, streams, creeks and rivers
  - Erosion, sediment loading and increased turbidity in water source and downstream
  - Nutrient enrichment of waterways
  - Rapid growth of weeds and algae
- **Heard Health Problems**
  - Spread of water borne diseases
  - Foot Rot
  - Mastitis
  - Leg Injuries

[1] Adopted from: F. Henning & B. Segars. Alternative Livestock Watering Systems. Georgia Cattleman. Oct. 1997.

How much water do you need?

	Penned[2]	Pasture[3]
Beef cows	12 - 20	8 - 13
Growing beef	6 - 15	4 - 10
Dairy		
(400-800 lbs)	6 - 15	4 - 10
(800+ lbs)	20 - 35	13 - 23
Sheep & Goats	1 - 3	0.5 - 2

* Gallons of water needed per head each day
**Low values are for temperatures near 35 ^{o}F , high values reflect for temperatures near 95 ^{o}F.

[2]P.Q. Guyer, Univ. Nebraska and Mid West Plan Service, beef housing and Equipment Handbook.
[3]G.J. Harrington. Water Consumption of sheep and cattle in NZ. NZ Agricultural Engineering Institute, Lincoln College and R. Quillin, personal communication

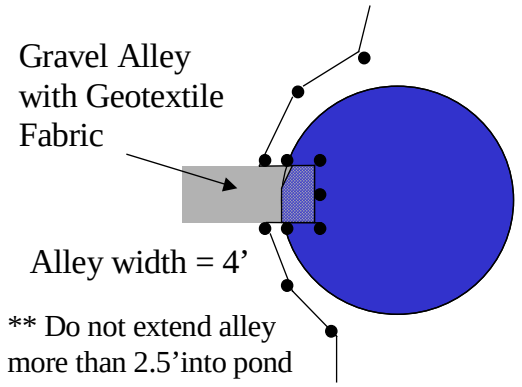
system. Many times off-stream sources will need to be utilized in order to receive any other benefit such as increased forage utilization, average daily gains and ultimately profitability.

Recent research is developing options to mandatory streambank fencing. Researchers from North Carolina State University and Virginia Tech have shown that over 90% of the time, cattle will prefer to drink from an off-stream water source as compared to an unfenced stream. This study showed that when cattle are given an off-stream water source streambank erosion and the concentrations of nutrients and fecal bacteria entering the stream would be reduced without resulting to mandatory streambank fencing. Other studies are underway at North Carolina State University investigating the ability to manage fenced streambanks using high-intensity low-frequency grazing and its impact on vegetative growth and ultimately water quality.

Off-Stream Water Sources

Access Ramps. Cattle prefer watering sites, like access ramps, that offer a good base and footing. Access ramps allow limited access to ponds, streams and rivers while limiting free access to water bodies. Cattle are given access to only a portion of the water through a sloped stabilized bed to prevent erosion and direct deposition of urine and feces. Improved access to water has been shown to increase water intake and may help prevent leg injuries. Access ramps (Figure 1) need to be constructed with relatively low slopes (6-8 feet of run for every foot of rise) with an alley width of 4 feet. Each ramp should serve at least 30 cows. If the ramp will serve more cattle, construct additional alleys beside each other utilizing the same stabilized bed. Construction is simple, a 1.5 - 2 foot thick run of gravel should be laid into a narrow bank and compacted. Geotextile fabric placed under the gravel will provide additional support and will reduce the amount of stone required.

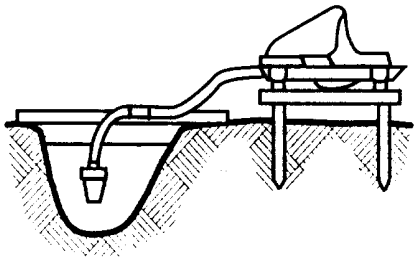
Figure 1. Schematic of Access Ramp



Gravity Flow Systems: systems that use springs, streams water tanks or reservoirs located at a higher elevation to supply tanks by gravity flow. Gravity flow systems can either be continuous flow or controlled flow systems. Continuous flow systems (also known as spring/stream developments) utilize water collected from a spring or stream. Water flows from the spring or stream through a strainer or collection bed, into a trough, and through an overflow pipe. Spring/stream developments are relatively inexpensive ($1200, depending on site layout) and extremely reliable low-maintenance water system. Systems can easily be designed for one spring/stream development to deliver water to three or four trough in series and downhill of each other. Siting of continuous flow systems are often limited by stream slope and pasture topography. Even with limitations, a continuous flow spring development may be the best choice for producers who are blessed with available springs. In controlled flow systems, low-pressure float valves located in troughs are used to control water levels. These systems are extremely effective for supplying water from farm ponds. Local Natural Resource Conservation Service and Soil & Water Conservation personnel can provide technical assistance in the design and siting of both continuous and controlled flow systems.

Nose Pumps. Cattle and horses can be trained to pump their own water using a nose or pasture pump (Figure 2). Cattle use their nose to push a pendulum that pumps water through a pipe whose other end located in a stream or pond. Livestock learn quickly how to operate the pump effectively. Manufactures recommend one pump for every 30 dry cows. Pumps have the ability to lift water 25 feet for a horizontal distance of 125 feet. In areas where lift is not a concern, pumps may deliver water up to a distance of 300 feet. Pumps can easily be moved with cattle, utilizing quick-couples or fixed delivery pipes. Producers may also consider mounting the pump on a frame 22 inches above the ground for cattle and 36 inches for horses.

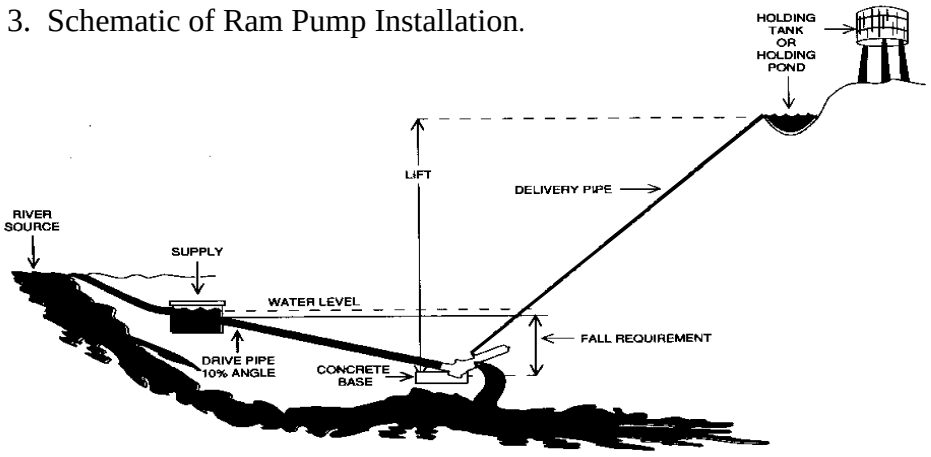
Figure 2. Nose/Pasture Pump with Foot Valve.



Solar Pumps: pumping systems that are comprised of an array of solar panels and submersible or non-submersible pumps. Sunshine is converted into electricity and powers a pump to lift water to a reservoir. Solar pump systems are extremely effective in delivering water to heights as great as 240 feet. When coupled with a gravity flow system from a reservoir, a livestock producer has the ability to deliver water to almost anywhere on a farm. Solar panels may be placed on tracking systems to get the most out of the sun even on the cloudiest of days. However, to accommodate variations in sunshine, a minimum of three days of water or electrical storage is recommended. Solar pump systems range in price from $1,175 to over $5,000 depending on water delivery requirements, lift (elevation), and cost of reservoir. Although costly, solar pumping systems can reliably deliver water out of steep draws to grazing areas high on a ridge top.

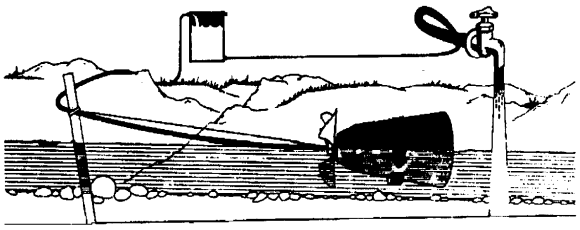
Hydraulic Ram Pumps. Ram pumps use the kinetic energy of falling water from a spring, pond or creek to pump water to a higher elevation, without the need for an external energy source. The fall from the water source must be at least 2-3 feet, and a minimum flow of 1 gallon per minute is required for streams. The performance of ram pumps is highly site-specific. Factors such as pump efficiency, stream slope, stream flow, feet of lift to reservoir and the distance to reservoir effect the amount of water that can be delivered over a 24-hour period. Ram pumps are either constructed out of PVC material or metal (cast iron or aluminum). Prices (not including delivery pipes and troughs) range from $108 to $2000 depending on performance level and material. Ram pumps lack some of the portability offered by other pumps, but make up for it in reliability. Many pumps installed over 50 years ago a still working today.

Figure 3. Schematic of Ram Pump Installation.



Sling/Propeller Pumps: pumps that move water from a flowing stream, creek or river without the aid of electricity or fuel. These devices utilize a propeller attached to the upstream side of a pump. Sling pumps (Figure 4) can lift water 25 to 80 feet (depending on the design). Depending on the pump design, velocity of the stream or river and the pumping distance, these pumps can deliver as much as 4,000 gallons of water per day. A minimum of 1 to 2 feet of flowing water is required to power the pump. Opposite from ram pumps, propeller pumps are very portable, and can be used on swiftly flowing stream with low slopes. Pumps range in cost from $550 -$750.

Figure 4. Diagram of Sling Pump Operation.



Partial List of Manufactures

Nose/Pasture Pumps

Blues Skies West
110 Michigan Hill
Centralia, WA 98531
800-NOSEPUMP

Farm 'Trol
409 Mayville St.
Theresa, WI 53091
920-488-3221

Rife Hydraulic Engine Mfg. Co.
P.O. Box 70
Wilkes-Barre, PA 18703
717-823-5730

Hydraulic Ram Pumps

B&L Associated Industries
Rt. 1, Box 118-B
Rusk, TX 75785
903-743-5555

Folk Water Powered Ram Pumps
2770 White Cour, N.E.
Conyers, GA 30207
770-922-4918

Rife Hydraulic Engine Mfg. Co.
P.O. Box 70
Wilkes-Barre, PA 18703
717-823-5730

The Ram Company
HCR 61
Lowesville, VA 22951
800-227-8511

Sling Pumps

Rife Hydraulic Engine Mfg. Co.
P.O. Box 70
Wilkes-Barre, PA 18703

Solar Pumps

Atlantic Solar Products, Inc.
P.O. Box 70060
Baltimore, MD 21237-4114
410-686-2500

Energy Outfitters
136 S. Redwood Hwy.
P.O. Box 1888
Cave Junction, OR 97523

The Ram Company
HCR 61
Lowesville, VA 22951
800-227-8511