Off-Site Water Development

The Drinks are On Us

By Roger Ingram, UC Farm Advisor, Placer-Nevada Counties

The amount of water an animal needs depends on the weather, the animal's size and the physiological condition of that animal *(e.g. big animals need more water than small animals; lactating animals need more water than dry stock, etc.)*. As the temperature rises, so does the amount of water our animals need.

Beef Cattle

The table below shows the water requirements for various classes of cattle at different temperatures.

Water Requirements for Beef Cattle (gallons/day)				
		Temperature		
Class	Wt. (lb)	50	70	90
Steers & Heifers	400	4.3	5.8	9.5
	600	5.8	7.8	12.7
	800	6.8	9.2	15.0
Finishing	800	7.9	10.7	17.4
	1,000	9.4	12.6	20.6
Wet Cows	900+	12.6	16.9	16.2
Dry Cows	900	7.2	9.7	**
Bulls	1,600+	9.4	12.6	20.6
From Feeds & Nutrition Digest, 1990. **Value not reported				

Sheep

A non-lactating ewe typically drinks about a gallon a day, but several factors may increase or decrease her requirement. The weather has a big influence. Sheep can consume 12 times more water in summer than in winter. The type of feed a ewe eats also affects her water needs. High protein, concentrate, and feeds high in salt increase the water requirement.

Sheep can get by on once-a-day watering when temperatures are below 104ºF without reducing feed intake or weight gains.

Goats

Meat type goats will drink approximately one gallon a day. This may he a bit higher during the summer. I recently visited an operation that utilizes their goats for fire suppression out on 60,000 acres of a private timber company. They are hauling water to the goats and water usage in August was around one gallon a day. Dairy goats may need more water because of the milk production.

Horses

The average daily water requirement of mature horses is about one gallon per 100 pounds of body weight *(e.g., a 1,200 pound horse needs about 12 gallons per day).* Young horses tend to need more water per unit of body weight than older horses. Hot weather, lactation, and work also significantly increase the requirement. Intense work can triple a horse's water requirement.

Water Sources

We know how much we need. The next issue is how to we get the water to the livestock. We need a water source. This can be a pond, river, or stream. We can also pump water and store it in tanks. These tanks can either be large and permanent, or small and portable. Hauling water may be an alternative, provided the capital investment is low.

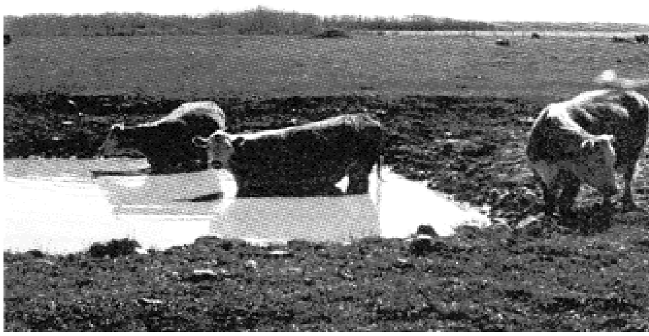
Here you see an old fire pump being used by a goat producer to store and gravity feed water from a 200 gallon tank that sits in the back of a pickup. Typical cost for smaller sized storage tanks range from $160 for 200 gallon tank to $360 for a 500 gallon tank.

I want to challenge you to provide alternative water sources for livestock if they are currently watering directly out of a pond, river, or stream.

Allowing cattle direct access to surface water can lead to: environmental problems, herd health and performance problems, and poor pasture and range utilization. An example of water impacts on animal performance and range utilization are given below.

Water From Dugouts can Reduce Livestock Performance

By Dr. Walter Willms and Dr. Doug Colwell, Agriculture and Agri-Food Canada and Orin Kenzie, Alberta Agriculture, Food and Rural Development



Field trials at the Agriculture and Agri-Food Canada Range Substation near Stavely, Alberta, have shown that the source of drinking water for livestock has a major effect on animal performance. Most water quality concerns have focused on salts or toxic blue-green algae, but our trials have shown that other factors, which are mostly unknown, may be equally important for the profitability of a ranch and the well-being of livestock.

The trials compared two water sources: fresh water delivered to a trough and water in a dugout. The fresh water came from a well in one trial and from a flowing creek in the other. The dugouts were about 43 years old, at least two meters deep, and recharged from surface runoff. Twelve cow-calf pairs on rough fescue pasture in good condition were monitored.

Over a 33-day period to the end of September, cows drinking from the dugout lost 0.2 kg and their calves gained 26.3 kg. On the other hand, cows drinking from the trough gained 7.4 kg and their calves gained 33.9 kg.

A similar study in 1990 and 1991 used steers and found that over the course of 71 days, 18-month old steers gained 1.21 kg/day drinking fresh water and 0.93 kg/day when drinking from the dugout. This translates to a 23 per cent reduction in weight gain.

Water quality analyses did not show any reason for the differences in animal performance. Total dissolved solids, sodium, bicarbonates, and other chemical constituents were not excessive for livestock and were slightly lower in the dugout water, indicating that salts were not responsible for the effect. Algal growth was scarce and the blue-green species were absent during the trials. Therefore, other factors affected the performance of animal s drinking from the dugout.

The immense difference in weight gains warrants further research to pinpoint the cause and find whether simply pumping water into a trough is a solution. We are developing research projects to answer the many questions posed by these trials. Harmful organisms in the water could cause the lower weight gains associated with dugouts. Another possible factor is the reduced palatability of dugout water caused by organisms or the release of methane, ammonium, or hydrogen sulfide from the muck disturbed by the animal. Reduced water intake can result in lower forage consumption and, consequently, reduced weight gains.

Evaluating New Approaches to Improve Livestock Grazing Distribution Using GPS and GIS Technology

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ABSTRACT. Uneven distribution results in many of the natural resource concerns associated with livestock grazing in extensive rangeland pastures. Cattle may heavily graze portions a pasture (e.g., bottoms or riparian areas) while abundant palatable forage exists on upland slopes.

With the help of Global Positioning System (GPS) and Geographical Information System (GIS) technology, livestock grazing behavior and management can be evaluated with greater resolution. Movement patterns of cattle are recorded GPS tracking collars and used to compare grazing management treatments. These GPS collars are accurate within 6 to 11 yards (5 to 10 m) and record cattle locations on a 24-hour basis for long periods (days to weeks). The goal of this research is to develop practical techniques that ranchers and land managers can use to increase uniformity of grazing and improve the stewardship of western rangelands.

Two approaches for improving grazing distribution are currently being examined. In the first study, the potential of selecting cattle for improved grazing distribution is being evaluated. A cattle breed developed in the French Alps (Tarentaise) used rugged foothill rangeland more evenly than a breed developed in more gentle terrain of England (Hereford). This suggests that grazing distribution can be improved by using cattle breeds that were developed in mountainous terrain. Grazing patterns of individual animals within a breed also vary.

Cattle were observed and separated into two groups (hill climbers and bottom dwellers) based on their previous grazing patterns. Hill climbers used steeper slopes and higher elevations and bottom dwellers used gentler slopes near water. These groups are being observed in similar, but separate, pastures. If uniformity of grazing is greater in pastures grazed by hill climbers than in pastures grazed by bottom dwellers, ranchers may be able to select cattle that grazed rugged rangelands more evenly and minimize resource degradation associated with concentrated grazing in localized areas.

In the second study, highly palatable supplement was placed in steep rugged terrain to lure cattle to underutilized rangeland. Livestock grazing patterns and forage measurements showed that grazing use increased in areas within 660 yards (600 m) of supplement. In similar terrain where supplement was not placed (control), grazing use by cattle was minimal. Strategic placement of low-moisture molasses supplement should allow land managers to modify cattle grazing patterns and help alleviate resource concerns associated with uneven grazing.

Pumping Water

Several technologies exist for pumping water. These include surface pumps, submersible pumps, and many other variations.

Submersible pumps can lift water from deep in the ground, but have a lower gallons per minute output.

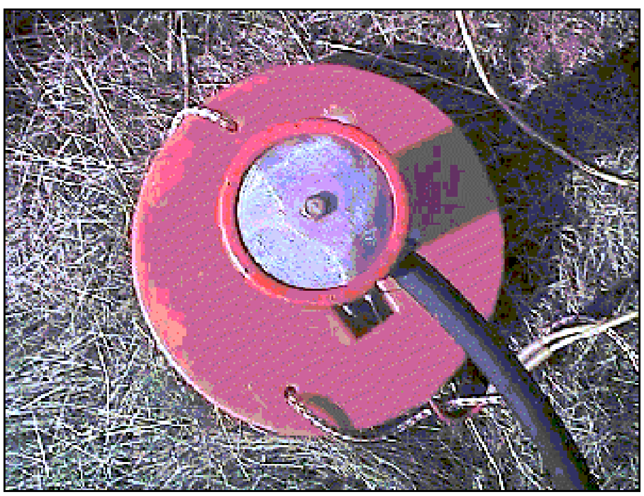
Surface pumps do not have the lift capabilities of submersibles, but their output is higher.

All pumps need to be powered by some sort of fuel. The fuel can be:

1. ***Solar***
2. ***Gravity***
3. ***Wind***
4. ***Flowing Water***
5. ***Cow-powered***

The following pages contain information about pumps that have been used at the Sustainable Ranching Research and Education site during 1996-1999.

Solar Pumping

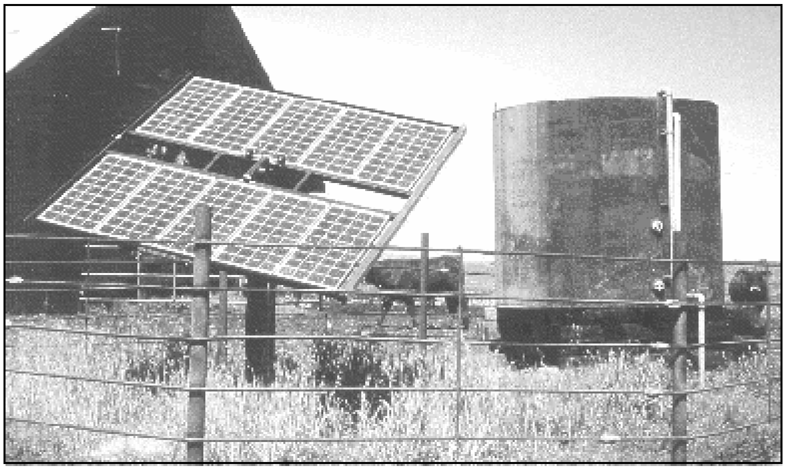


The **M3 solar pump** (541-592-6903**)** will deliver up to 7.5 gallons per minute at three feet and can pump 2.5 gallons per minute at a maximum head of up to 23 feet. The pump floats in the water and has a 50-foot cord that plugs into a 75-watt solar panel. This is a portable system and costs $1,500.

Two other pumps — the M10 and M20 — have been developed. Both of these pumps float in the water and have an electrical cord that plugs into the solar panels.

The **M10** delivers up to 10 gallons per minute at 30 feet and can pump up to a maximum of 65 feet. The **M20** pumps up to 20 gallons per minute at 20 feet and operates to a maximum head of 35 feet.

Both models are powered by four 75-watt solar panels. These would be more of a permanent type system and cost approximately $4,000.



There are also other centrifugal and submersible solar powered systems which can work. The cost will be around $2,000 to $11,000 depending on the configuration. Most will fall in the $4,000 to $6,000 range.

The system pictured here was pumping water out of a creek. The solar centrifugal pump was powered by ten 51-watt solar panels. The system was pumping 17 gallons a minute with approximately 20 foot of lift. This translates to 1,020 gallons per hour. Water was pumped into a storage tank which then gravity fed into 3 watering troughs. The system was installed to provide an alternative water source to the creek for cattle.

The panels powering the pump were mounted on a tracking frame. The frame tracks with the sun's movement and can increase pumping time. Research done in Kern and Tulare County by Farm Advisors Ralph Phillips and Jim Sullins found a 28% improvement in water movement in summer. The trackers advantage during the winter was reduced to around 10%.

According to the November-December 1994 California Agriculture Progress Report, Phillips prefers not to use the tracker in the winter because the tracking device stops with the panels facing west, then in the morning it has to heat up before it turns toward the sun. A non-tracking unit may start working at 9:30 or 10:00 AM. Sullins and Phillips also learned that controllers should be placed in the shade where there is air movement to prevent overheating.

Gravity Pumps

Using a simple siphon out of a pond or stream may be all that you need if your water tank or trough is below your water source. At the project site, we have 200 feet of fall to help us get water around the property. For every 3.1 feet of fall, you pick up one psi.

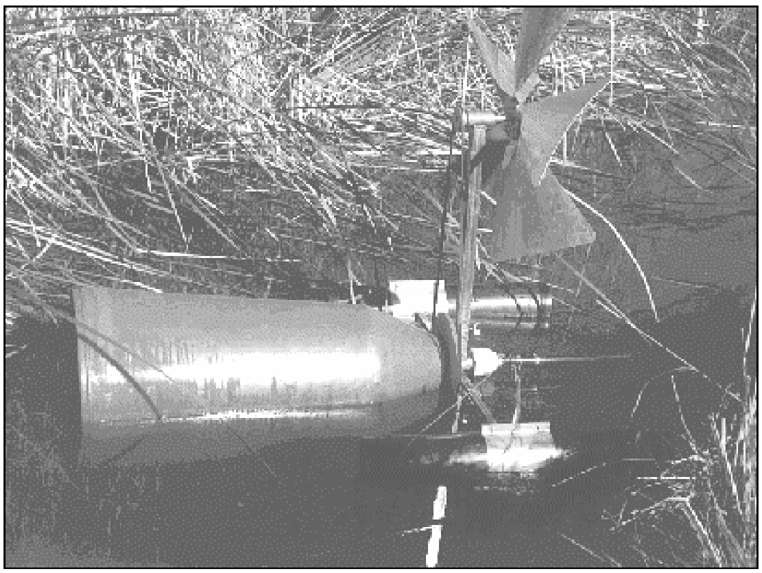
Ram pumps (804-277-8511)use the force of gravity to pump water. They will pump uphill as high as 10 times the "fall" or "drop" of water to the pump according the Fleming Hydro-Ram Company (800-277-8511). Ram pumps use the energy generated by the weight of falling water to pump part of the water back uphill. The greater the fall of water to the pump, the greater the output of the water pumped uphill. Flow of water is also important. A flow of one gallon per minute is needed for a one-inch ram, while a two-inch ram needs three gallons a minute.

During Grazing Academies taught at the Sustainable

Ranching site, we would set up one inch and a one and a half inch ram pumps. There was 4.5 feet of fall for the pumps. The one inch could pump 15 gallons an hour, or one gallon every 4 minutes.

Ram pumps are very reliable, require no other source of energy and work 24 hours a day. They do take a little time to set and work properly, but once going, they are pretty much maintenance free. There is more detailed information on ram pumps included in your packet from Fleming Hydro-Ram Company.

Wind and Flowing Water Pumps

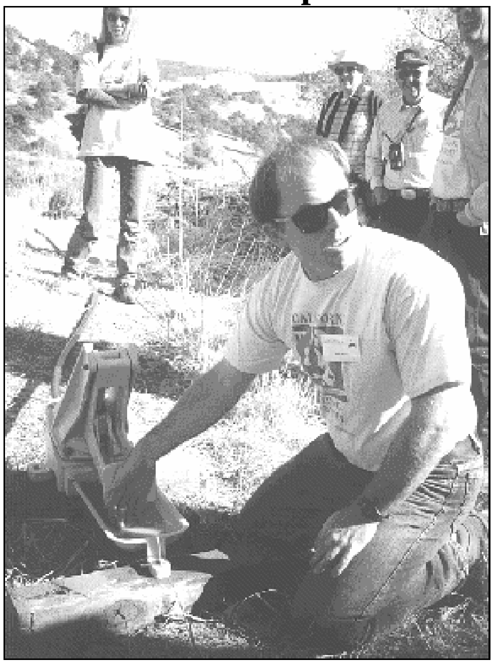


Sling pumps (717-823-5730) may also provide an alternative for streams or ponds. The pump sits in the water and is self-supporting. The power to drive the pump is provided by the water.. You would need a minimum flow of 1.5 feet per second. A windmill attachment can also be used provided you have a minimum wind of 4.5 miles per hour.

Depending on the size of the pump, you can get from 554 to 1,056 gallons per day. Cost is around $1,300 for the pump and windmill attachment. The pump alone is around $950.

We tested this pump in a pond on the project site. It has a windmill attachment. Unfortunately, the pond is too sheltered to run the pump. The pump was moved to a pond site that did have exposure to the wind and it did work. You should make sure you have exposure to the wind at your water source if you are going to use the windmill attachment. There is more information on Sling pumps from Rife included in your packet.

Cow-Powered Pumps



A **Pasture pump** (717-823-5730) uses the animal to do the pumping. The pump must be located above the water source, otherwise, water will just flow through and not stop. The cattle use their noses to push a pendulum unit that pumps water into a small bowl. A one to two day training period is required before the cattle learn to operate the pump effectively. In order to learn, cows will have to be really thirsty.

Most manufacturers recommend one pump to adequately serve between 20 to 30 cow-calf pairs. The pumps are very portable and can be easily moved. These pumps do have some limitations. They are shallow well pumps and can only lift water about 20 feet. The approximate cost of a pasture pump is $350 to $450. More information on the Pasture Pump from Rife is included in your packet.

Transporting Water

Water Pipes

Livestock water was developed for the 250-acre Sustainable Ranching Research and Education Project through the use of gravity pressure. Above ground one-inch 160 psi poly pipe was used to transport water. By the middle of the summer, water was heating to 120° in the pipe. This necessitated the need for burying 4000 feet of pipe to reduce the water temperature to a drinkable 80°F.

Connectors

The above ground one-inch poly pipe came in 600 foot sections. Three types of couplers were used: PVC, polypropolene, and Galvanized steel.

PVC and galvanized steel did a good job of holding the pipe sections together. Polypropylene did not as the weather turned hot. When it does not hold, the pipe uncouples and you have no water.

Distance To Water

The maximum cattle should have to travel to water is 1.5-2 miles. If they are traveling farther, animal performance may be affected. Research done at the University of Wyoming found that cattle grazing a 2000+ acre paddock concentrated 77% of their grazing within 1200 feet of the water source. Approximately 65% of the pasture acreage was more than 2400 feet from the water source but supported only 12% of the annual grazing usage.

The Forage Systems Research Center reported in their April, 1995 Update reported that 600-800 feet between water sources was optimal for land use efficiency. They felt that carrying capacity could be increased by 14% simply by configuring the grazing cell such that the livestock were kept within 800 feet of water.

Clamps

Another learning experience was using clamps. When I bought the pipe, the company gave me clamps that were approximately one-quarter inch wide. These did NOT do a good job of holding the pipe.

Using a wider clamp solved problems with pipes coming uncoupled. Two clamps were used on each side of a coupler. You should not put the clamps right at the edge of the pipe to tighten onto the coupler. Back off approximately one-eighth inch and you will get a better seal.

When using two clamps side by side, stagger them so the tighteners are on opposite ends from each other. You get better torque and seal. Plus, if you are troubleshooting and all you have is a fence tool, you can still tighten the clamps if needed. Otherwise, you have to have a screwdriver or a Swiss Army knife.

Water Troughs

Water troughs can take many shapes and sizes. We have several different types at the project site. Troughs can be either permanent or portable. Correct sizing of the trough can be important as well as the recharge rate. Smaller troughs will mean water temperature will need to be watched more closely than larger ones.

Make sure to site permanent troughs on a well-drained level spot. You can add an overflow connector to the trough and have excess water drain from the connector through an attached piece of pipe 40 or 50 feet away from the trough. This keeps the area surrounding the trough dry.

The recharge rate is important. Once the trough has the demand from drinking animals, it should re-fill quickly. This is especially important with smaller, portable troughs — they need to re-fill at approximately four gallons a minute. Slow water recharge means thirsty cows that translate to damaged troughs.

Trough space is another important consideration. A cow herd requires at least one inch per cow of available trough space. To determine the diameter of a circular trough needed to meet this minimum requirement, use the formula:

Maximum Herd Size / 37.7 = Trough Diameter

For example, a herd of 300 cows needs a trough with a diameter of 8 feet:

300 cattle / 37.7 = 7.96 feet diameter

Jobe valves are one type of valve used in water troughs. These valves are **full flow** until the trough or storage tank fills. They have worked very well. There are three kinds of Jobe valves – side entry, side entry at top, and bottom entry.

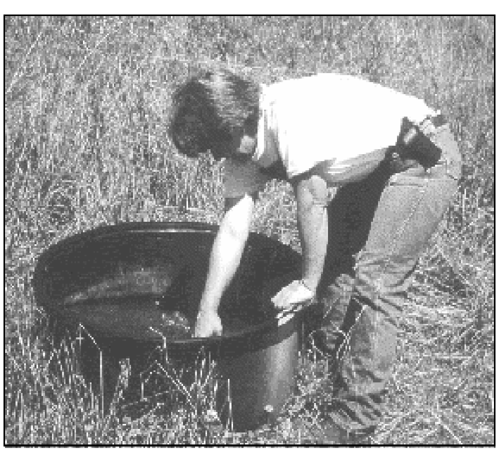
A problem encountered one winter was the filters becoming clogged. It is not difficult to clean the filters, but you do need to monitor water flow into the trough.

Portable Troughs

We have used three different types of portable troughs at the project site. Portable troughs have the advantage of moving the water with the animals. This can be especially useful with temporary paddocks. These troughs hold from 40 to 60 gallons of water.

Drinking behavior changes when the water is always nearby. Rather than coming in to drink in groups of 50 to 60, quenching thirst becomes an individual function with much smaller groups coming up at a time. This lessens the demand and allows a smaller trough the ability to water a larger herd, provided there is an adequate recharge rate.

Python Trough and Hydrants



The design for this portable system was developed in New Zealand. A contact number in the US is Kiwi Fence (724-627-8158). Plastic quick connect hydrants are inserted in the main line. These hydrants have a valve that only opens when a lead pipe from a Python trough is inserted. This allows you to have several hydrants attached to your waterline that allow you to walk the water with the stock. This improves grazing utilization, as animals do not have to travel long distances to water. They spend more of their time grazing in the area they are at versus traveling to water and spending more grazing time close to the water source.

The trough holds 40 gallons and has a hydrant with 20 feet of lead pipe connected to it. The trough can be drug around and then connected to the quick connect hydrants. There is a valve in the hydrant that is closed if no pipe is inserted. When you insert pipe, the downward pressure forces the valve open and water then fills the trough. The trough is beveled on both sides that make it easy to tip and empty when you are ready to move the trough to a new area.

These troughs have worked fairly well. Their biggest drawback is that plastic parts can wear. You can easily replace the parts, but you must monitor on a regular basis.

The picture to the left shows how a connection is made. The main line is cut and then each end in inserted through an O ring and then a plastic connector is screwed on. The valve is then upright like a T and is where you insert the pipe.

After inserting, rotate the pipe a quarter turn to the right and pull back. To take the pipe out, rotate quarter turn to the left and pull out. The valve will then seal to prevent water coming out of the pipe. If you find the pipe will not come out, there may be too much pressure in the line. Empty the Python trough and that will lower the pressure and make it easier to remove the pipe. The trough and lead pipe coming from it can then be dragged to the next hydrant. This allows you to move water with the livestock.

When the hot summer weather hit, the O-rings and plastic fitting did not do a good job maintaining the connection to the main water line. Pipe would slip out and there would be a leak. It was not with every hydrant, but daily monitoring was required for a while. Luckily, you can put a 1 and ¼ inch bell fitting on the end of each hydrant and then use a galvanized nipple or PVC insert to connect to the waterline. This allowed a more stable connection that did not have constant leaks.

Kentucky Graziers Supply Water Systems

The design for this portable system comes from Kentucky Graziers Supply (800-729-0592). This system uses a quick coupler hydrant in the main line and has a trough that holds 60 gallons. There are other troughs of smaller size. If you have adequate recharge (4 gallons per minute), you can get by with a larger trough. Ralph Quillan owns the company and he uses these products on his own farm. He has been able to water 100 head with a 14 gallon trough!.

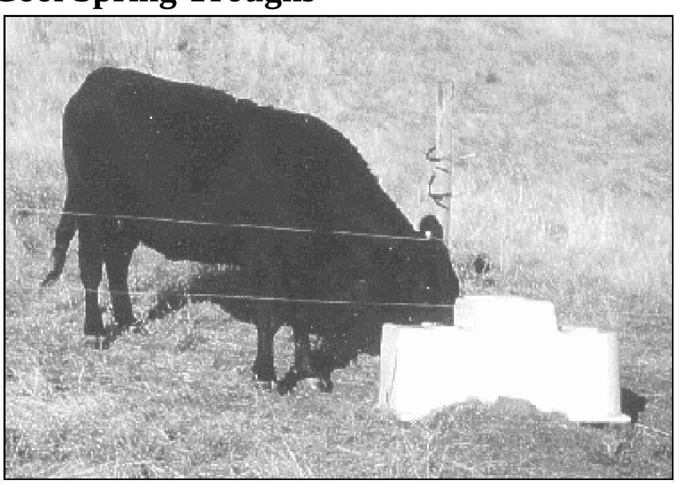
A heavy duty standard water hose comes out from the tank and has a riser attached at the end. This riser is inserted in the coupler and water flows to the tank. When you pull the riser out, the valve closes. The advantage to this system is you can use standard plumbing fitting. The hydrant valve will screw into a standard tee.

While the hydrant sits upright, there have been no problems with animals breaking the fitting. You can minimize the chance of that happening by running the water line under your fence line. This system has worked well but still requires monitoring.

Do It Yourself

You can make your own portable trough by cutting a plastic barrel in half and attaching a Jobe float valve . This is being used to water goats grazing for fire suppression and has worked well.

Cool Spring Troughs



This trough is semi-permanent. It can be moved, but require more effort due to weight and size. The trough has an enclosed top with two holes. Plastic cylinders the size and shape of beach balls float in the holes. The cow has to push the ball down to get at the water. The plastic cylinders ensure that the water is constantly shaded.

The cows seem to pick up on pushing the cylinders down to drink fairly quickly. Young calves will encounter greater difficulty and would need an alternative water source or you need to switch the fitting to keep the beach balls from filling the hole so there is open access to the two water points on the trough.

Final Thoughts

This has been an overview of livestock watering systems. It is not meant to be a complete guide. Contact Roger Ingram at 530-889-7385 if you have questions. Any mention of companies in this guide is for the reader's convenience and is not meant as an endorsement.