AEN-98

Alternative Water Source: Developing Springs for Livestock

Steve F. Higgins, Donnie J. Stamper, and Sarah J. Wightman, Biosystems and Agricultural Engineering

Water supply is a key component in livestock production. One option producers have when providing water is to develop an existing spring, which occurs when groundwater running along an impervious rock layer hits a fracture and discharges on the surface (Figure 1).

In Kentucky, there are two basic spring types: "wet weather" and "perennial." Wet weather springs are normally active during periods of high precipitation, which means they are usually dry during the hot summer months. Perennial springs are normally active year-round and are prime candidates for development as a livestock water source.

In addition to providing drinking water for livestock, a developed spring as an alternative water source has several other benefits:

- It can remove excess water from a saturated area in the pasture, allowing the pasture to be safely grazed.
- It is extremely cost effective:
  - Under ideal circumstances gravity will provide drinking water to a tank, so cost to operate the spring is minimal (although some developed springs may require a pump).
  - No electricity will be needed to keep the water from freezing, because a developed spring provides groundwater, which is discharged at a constant temperature (about 55° F).
- The water, which will be cooler in the summer than the surrounding air, can increase livestock productivity.
- A developed spring may also improve the producer's ability to implement rotational grazing, which can increase overall pasture productivity.

Figure 1. This developed spring provides an alternative water source for livestock.

Assessing the Land and Water Source

Several environmental and engineering issues must be addressed in order to assess the land and water source, if you are to successfully develop a spring. These issues include drinkability and flow rate.

Drinkability

The spring's water must be suitable for livestock to drink. Typically, the water quality will be acceptable to livestock if it has been adequately filtered by the soil and has not been contaminated; however, pollution-collecting karst landscapes or above-spring septic systems may make spring water unsuitable. Karst geology, which is common throughout Kentucky, facilitates the movement of pollutants between surface and ground water through features like sinkholes, making it easier for groundwater to become contaminated. Improperly maintained septic systems can leak and cause pollution to flow directly to groundwater. Assess the watershed using Kentucky Geological Survey (KGS) maps, and visually inspect the topography to determine possible contaminants.

You can also collect and submit a water sample for analysis. The Kentucky Cooperative Extension publication *Drinking Water Quality Guidelines for Cattle* (ID-170), available at www.ca.uky.edu/agc/pubs/id/id170/id170.pdf, can provide further reading on drinkability and water testing. A list of certified labs for water quality analysis can be found at the Kentucky Division of Water web site: (http://water.ky.gov/DrinkingWater/Pages/CertifiedLaboratories.aspx).

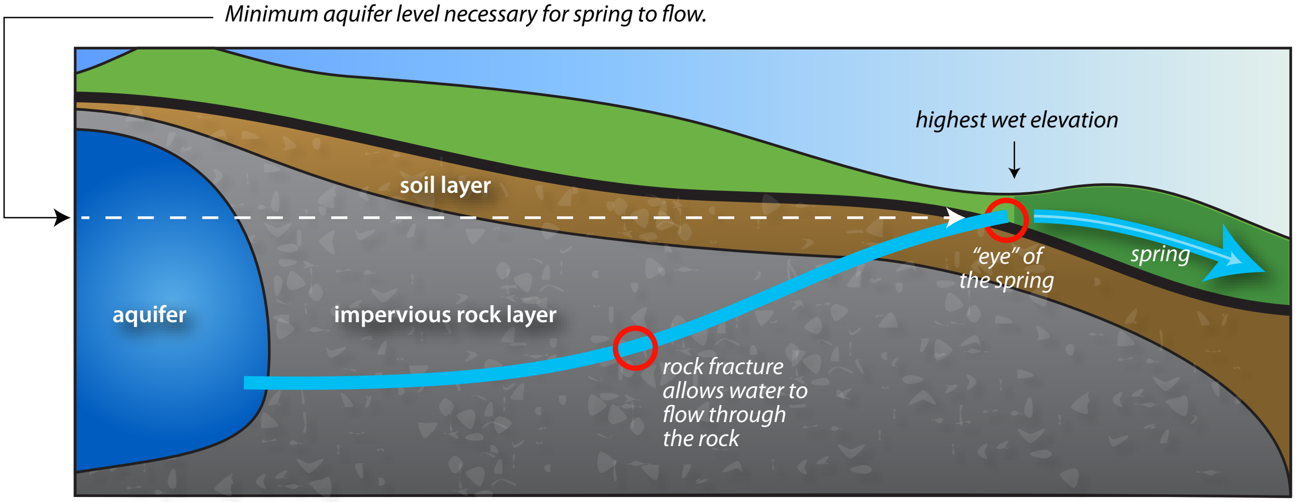

Figure 2. This spring was formed when the groundwater running along the impervious rock layer hit the rock fracture and surfaced above ground. The area outlined in red shows the area of the spring to be developed as an alternative water source.

Flow Rate

You should make sure the spring will provide an adequate supply of water when the pasture is in use. The flow rate should be calculated during the year's driest times (July, August, September, and October) to ensure adequate water supply year-round; however, it may still by economically viable to develop the spring if you have an adequate flow rate for even six months of the year.

To measure flow, create a dam below the spring outlet. This dam can be as simple as rocks and dirt clods placed across the flow with a small center opening. The flow across the opening can be used to roughly estimate flow rate.

Flow rate can also be determined by measuring the time required to fill a known volume. An adequate spring flow would be one that yields the maximum amount of water needed per animal times the number of animals in the pasture at any one time. Tables 1-5 provide estimates on the amount of water needed by animal growth stage and species.

Developing the Spring

Location

To develop a spring, you must first find the source of the water. Some people refer to this source as the "eye" of the spring. Locate the eye by carefully excavating the area surrounding the highest wet elevation of the spring and looking for surface flow and/or bubbling ground water. Once you locate the eye, clear the surrounding area of excess soil and small rocks. This makes it easier to locate and expose the bedrock formation below the spring, where the foundation for the dam and collection area will be constructed.

Table 3. Amount of water needed by horses.

Animal Age	Water Requirement (gal/head/day)
Mature	8-12
Brood Mare	8-12
Foal to 2-year	6-8
Stallion	8-12
Pony	6-8
Table taken from UK Cooperative Extension Service Publication Housing for Pleasure Horses (ID-57)	

Table 4. Amount of water needed by goats.

Animal Age	Water Requirement (gal/head/day)
Mature	1-3
Lactating	2.5
Source: Meat Goat Nutrition, Langston University	

Table 1. Amount of water needed by beef cattle.

Animal Age	Temperature	
	50°F	90°F
	Water requirement (gal/head/day)	
400-lb calves	4-7	8-15
800-lb feeders	8	15-18
1000-lb feeders	9-10	18-20
Cows and bulls	9-14	18-27
Source: MWPS-6 Beef Housing and Equipment Handbook		

Table 2. Amount of water needed by dairy cattle.

Animal Type	Temperature		
	10-40°F	70°F	90°F
	Water requirement (gal/head/day)		
Dry Cow	6	8.7	8.7
40-lb Milk	16	21.5	26.5
80-lb Milk	26	34.3	44.9
Source: UK Cooperative Extension Service Publication Pasture for Dairy Cattle: Challenges and Opportunities (ASC-151)			

Table 5. Amount of water needed by sheep.

Animal Age	Water Requirement (gal/head/day)
Rams	2
Dry Ewes	2
Ewes with Labs	3
5-20lb Lambs	.1-.3
Feeder Lambs	1.5
Source: MWPS-3 Sheep Housing and Equipment Handbook	

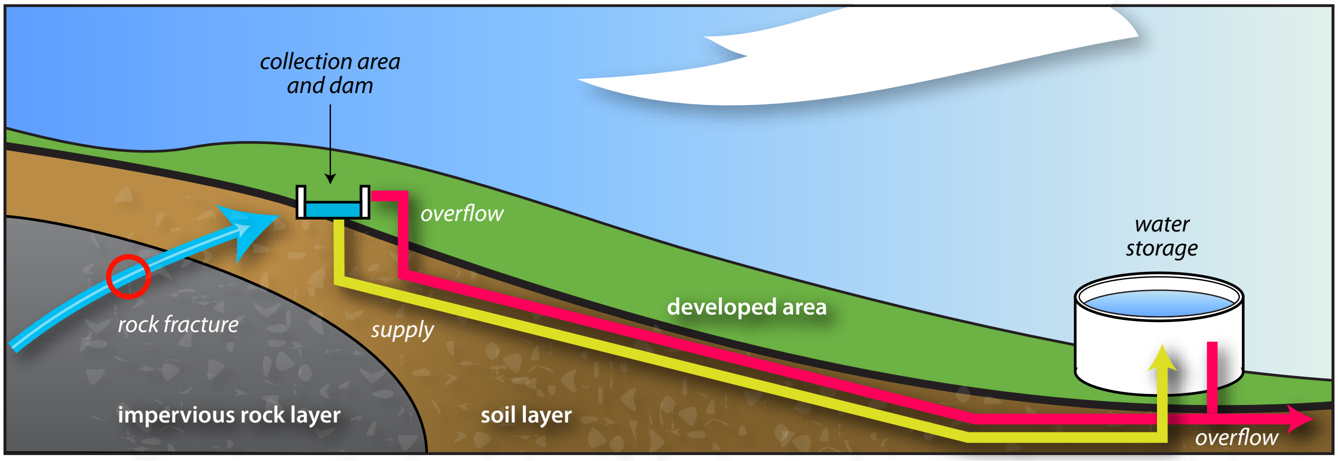

Figure 3. The water from the developed spring flows though the supply pipe and into the storage tank. Overflow pipes prevent damage to the developed area.

After you locate the eye, consider the watering tank location. The difference in elevation of the spring and the watering tank must be enough to allow gravity to provide water flow. If there is not an adequate difference in elevation, pumps will be needed to transfer the water from the spring to the tank. In that case, solar-powered pumps may be able to supply the water effectively, eliminating the need for electric utilities.

Excavation

After you have identified the eye of the spring, carefully excavate the area (Figure 2). During excavation it is easy to accidently stop water flow or create a new eye, both of which hinder spring development. Keeping the excavated area small will prevent these and other problems associated with excavation.

When excavating a spring, it is important to limit the amount of water held at the collection point to the amount needed for gravity flow. If the top of your dam elevation is too high, more head pressure will be created that may cause the water to take the path of least resistance, come out at another location, and destroy the developed area. You can prevent the containment of too much water by surveying for the correct dam height. This will ensure that you hold only the amount of water necessary for collection and gravity flow to the tank. You can also prevent the containment of too much water by installing a notch in the center of the dam to channel excess flow into a splash apron or by installing an overflow pipe to divert excess water.

Saturated Pastures

If your pasture has excess moisture, you may need to drain and dry it to accomplish full use of the pasture. Some fields will not need to be drained, but if a trench or French drain is required, this section is included to describe how draining would be installed.

Line the trench and dam interface with geotextile fabric and cover with #2 rocks. Leave the rock exposed to allow it to be used as a splash apron for periods of high water flow. Then line the remaining trench with geotextile fabric before pipe placement. The overflow pipe should have a diameter that will provide adequate flow and prevent the system from backing up. A flexible drainage pipe works well for this type of application.

Supplying the Watering Tank

The developed spring area should be used only to obtain water. Watering tanks, connected to the developed spring, are used for collecting and holding water for distribution or consumption. Construct a trench to run overflow and supply lines from the developed spring to the receiving tank (Figure 3). The trench needs to be dug on an angle and at a depth that allows the supply line to connect to the bottom of the receiving tank and that allows gravity to drain the lines.

Plumb the supply lines from the spring to the tank with rigid PVC pipe. (NOTE: A 2-inch supply line was used in the spring development project on which this publication was based.) Lay the pipe in the same trench as the overflow pipes (Figure 3). Then secure the supply line in the bottom of a concrete tank using clamps and hydraulic cement. A 2-inch overflow pipe should then be installed similarly and plumbed to the 4-inch flexible overflow pipes using a Y-fitting.

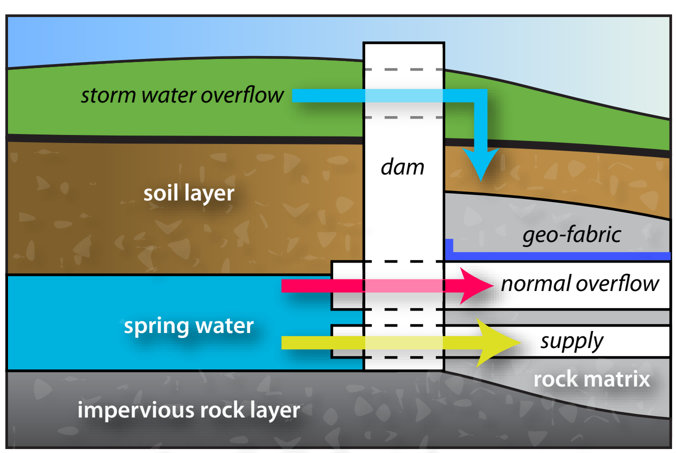

Figure 4. Typical spring head installation components include geotextile fabric, overflow and supply piping, and rock.

The overflow lines should continue in the same trench until reaching their exit point, typically a stream or natural drainage way. Terminate the flexible pipe approximately 10 feet short of the planned discharge point. To prevent the overflow pipe from being crushed by foot traffic and machinery, install a 10- foot section of rigid PVC pipe by sliding it into the flexible pipe. Rat wire or bolts should be installed in the end of the pipe to prevent critters, such as muskrats, from making a home in the pipe. After installing the pipe and removing kinks, partially fill the trench with #2 rock to create a rock matrix within a foot of the surface. Then place geotextile fabric onto the rock and cover with soil to establish a grass stand.

Figure 5. This tank is fed by the fenced developed spring in the background.

Spring Protection

Once the spring has been developed, it can be left exposed, enclosed, or covered with a roof or can be backfilled with rock, geotextile fabric, and soil. NRCS technical staff can help you take any site-specific factors into account.

The developed spring needs to be protected from livestock, and one way to do this is to construct a fence around the developed spring (Figure 5). The spring should also be protected from surface water runoff to prevent pollution of the water source. Construct a diversion ditch above the spring that will divert runoff that would normally pass over the spring.

Shade

Because the water source created by this project can cause a large congregation of animals near the tank, this project presents a prime opportunity to provide shade for animals. A structure can be constructed over the tank to provide shade for grazing animals. This shade also reduces the amount of algae in the concrete tank and the need for expensive maintenance. For more information about shade structure construction, see Cooperative Extension publication AEN-99, *Shade Options for Grazing Cattle*.

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**All "Water for The World" technical notes can be found at www.lifewater.org.*

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This spring development publication was prepared with the assistance of the Natural Resources Conservation Service (NRCS) and the Kentucky Division of Conservation. NRCS technical staff in your county can provide guidance regarding the development of a spring and may even be able to provide cost share assistance to partially fund the development of a spring for livestock.