Plastic Pipelines for Livestock Water in Northwest Nebraska¹

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Highlight

A shortage of good quality livestock and household water has plagued northwest Nebraska ranchers. The development of Polyvinyl-chloride pipe has provided a method of piping good water into this area. Five hundred forty five miles of PVC pipe have been installed, or are planned, on 108 ranches watering approximately 300,000 acres of rangeland. This productive grassland area can now be grazed safely and efficiently with a stable, good quality water supply.

When discussing the resources of Nebraska, water is one resource that seems to be plentiful. There is an abundance of water in Nebraska's many streams, rivers and lakes. Good quality water is available from shallow wells throughout the Sandhills region.

The Problem

The water situation in Sioux and Dawes Counties in Northwest Nebraska is somewhat different. This area is called the "Gumbo Country"

and the small amount of ground water available is highly mineralized and not fit for human consumption.

The livestock dams and dugouts used to store water have a relatively short life due to siltation, and sites for new impoundments are scarce. In late winter and early spring when runoff is frequent the water quality is fairly good, but in late summer and fall when evaporation is rapid the concentration of salts in the water becomes quite high. Livestock often get mired in the mud when these dams are low. A survey in 1967 by the Nebraska Extension Service (U. S. Dep. Agr., 1967) indicated that livestock dams are dry for an average of 3 out of 10 years with the water being poor quality for an additional 3 of 10 years.

In the past, the ranchers in this area have relied on dams and dugouts to store surface runoff to supply the needs for livestock water. To obtain water for household use ranchers had to haul water from the nearby towns of Chadron, Crawford, or Harrison. Another source of water was the runoff from houses, sheds, and barns equipped with downspouts that drained into a cistern and the water stored here for later use. Wells with a 3 foot diameter have been tried, but met with limited success and no improvement in water quality.

Resources

This area is in the Pierre Shale Plains and Badlands Resource area in the 14 to 16 inch precipitation zone. The mean length of the frost free period is approximately 120 days.

The major soils are Samsil, Pierre and Kyle clay. These are upland soils (U. S. Dep. Agr., 1969), developed in the weathered, gray shale of the Pierre formation. All have clay surfaces and subsoils, but differ in the thickness of the soil material over the unweathered parent shale. Samsil is shallow, Pierre is moderately deep, and Kyle is a deep soil.

The vegetation is dominantly western wheatgrass (*Agropyron smithii*), green needlegrass (*Stipa viridula*), blue grama (*Bouteloua gracilis*), sideoats grama (*Bouteloua curtipendula*), and buffalograss (*Buchloe dactyloides*).

These ranges yield from 500 to 1500 pounds of air dry forage per acre (Jensen, 1968). This is a valuable grass resource that the ranchers have not been able to use efficiently because of the water situation.

The ranches in this area are primarily cow, calf, and yearling operations with some sheep production. The hay supply is limited and the livestock are ranged year round. The antelope population is quite high and there are some deer.

This "Gumbo" area is fortunate

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FIG. 1. Trenching for livestock water pipeline on Antelope Pipeline, Sioux County, Nebraska.

in having a source of well water nearby in the sandstone formation along the Pine Ridge escarpment. This Pine Ridge escarpment angles across the northwest corner of Nebraska. Most of the wells are 8 inches in diameter, are 50 to 250 feet deep, and produce 10 to 40 gallons per minute.

Materials and Methods

Prior to the development of Polyvinyl-chloride pipe (PVC), livestock water pipelines were impractical. The cost of metal pipe was too high to make pipelines feasible and the soils in this area are highly corrosive to metal pipe. PVC comes in 40 foot lengths, is resistant to corrosion and damage by rodents, and has a low friction loss.

Ranchers and farmers interested in installing a pipeline contact the Soil Conservation Service for technical assistance. Surveys are made to get the elevations along the proposed pipeline and other information is gathered that is necessary to design the pipeline. Cost sharing is provided by the Agricultural Conservation Program (ACP) or the Great Plains Conservation Program. When there are several ranchers interested in a pipeline, they can form a nonprofit organization and make application for a

pooling agreement for participation in one of the cost sharing programs. When the pipeline design is completed the organization puts the pipeline up for bids, or negotiates with the contractor for construction of the line.

Each ranch is allotted a certain percentage of the cost sharing payment and is assessed with a percentage of the maintenance costs. The percentage is generally based on the acres, and/or cattle numbers, served by the pipeline on each ranch.

The pipelines are designed to provide 20 gallons per day per animal unit and 500 gallons per day per ranch headquarters. Irrigating of lawns and gardens is not allowed.

The PVC pipe is of the rigid or semi-rigid type, placed in a minimum of 12 inch wide trench (Fig. 1) and buried 5 feet deep to stay below the frost line (U. S. Dep. Agr., 1967). The pipe is snaked in the trench to maintain some slack for contraction and the joints are glued (Fig 2). The line is tested before backfilling to check for leaks. Care is needed in the backfilling operation to see that no sharp rocks come in direct contact with the pipe. If leaks develop after backfilling the trench, the area over the leak can be excavated with a backhoe and repaired. When leaks occur, the water comes to the surface rapidly because the clay content of the soils prevents deep percolation of the water.

Electric pumps are placed in the wells and at booster stations along the line to maintain operating pressure. The pressure on the line may vary from 20 to 160 psi. The electric pumps vary from $\frac{1}{4}$ to 5 horsepower depending on the length of the line and the total lift. Air release valves are required on apexes in the line to prevent air locks. The safe operating pressure on the majority of PVC pipe is 160 psi. When

FIG. 2. Contractor glueing sections of 2 inch plastic pipe for livestock water pipeline.

Table 1. Summary of installed and planned pipelines in Sioux and Dawes Counties Nebraska.

Name of line	No. of ranches	Length (miles)	Acres watered	No. of farmsteads	No. tanks	Year completed
Jordan-Wasserburger	3	5.7	6,254	1	12	1966
Antelope	7	24.1	16,891	5	33	1967
Isham	1	22.9	16,067	1	32	1967
Prairie Dog	6	28.4	15,385	4	38	1968
Robertson	1	9.7	8,303	1	16	1968
Indian Creek	11	53.5	36,500	8	90	1968
Sugar Loaf	12	50.4	33,700	6	90	1968
Lindekin	1	1.3	2,000	1	5	1967
Stumph	1	1.0	520	0	2	1966
Larsen	1	.9	1,280	0	3	1968
Elleson	1	1.9	900	0	6	1968
Montrose	5	31.6	12,819	4	43	1969
Sand Creek	7	18.8	8,111	4	21	1969
Whetstone	10	45.0	23,000	6	54	1970
Spring Creek	15	86.9	42,000	9	90	Planning
Cottonwood	11	18.2	12,240	0	28	1967
Wayside	14	125.0	51,000	11	150	Construction
Bowen	1	20.0	12,000	2	40	Construction
Total	108	545.3	298,970	63	753	

pressures approach 160 psi, pressure reducing valves or cisterns are installed. Vacuum release valves are installed where there is a danger of the pipe collapsing from negative pressure.

The livestock watering tanks on the pipeline are provided with floats to control the water level and check valves to prevent the possibility of tank water from draining back into the line. The tanks are galvanized steel with concrete, or steel, bottoms and vary in size from 10 to 20 feet in diameter. The larger tanks have been more successful because of the additional storage capacity. Some tank installations have a length of concrete pipe placed over the intake valve and float. This pipe has a cover to prevent freezing, and to protect the float mechanism from breakage. Each tank is provided with a shut-off, so service to the rest of the line is not interrupted when maintenance is required.

Discussion

The pipelines that are completed or are in the planning stages (Table 1) have from 1 mile up to 125 miles of pipe. The longer lines start out with 3 inch inside diameter pipe

and gradually decrease down to 1 inch on the spur lines. To date, these pipelines water about 63 ranch headquarters and approximately 300,000 acres of rangeland with about 760 tanks (Fig. 3). An occasional country schoolhouse is also supplied with water from these pipelines.

The cost of these pipelines is high and without financial assistance from Federal programs, they would not be feasible. The per acre costs

for supplying water through pipelines is, approximately, \$4.00 to \$5.00 per acre. Although the costs are high, the benefits are far reaching. The water supply can be placed where it is needed the most. Planned grazing systems are now possible and areas formerly overgrazed have been rested and non-grazed areas are now providing valuable forage. Livestock distribution is greatly improved and livestock performance has improved with the good quality water being available.

Some ranchers believe that yearling cattle will gain an additional 50 to 150 pounds more with good water. Assuming a calf crop of 85%, there would be about 12,000 calves produced per year. Using an average of 100 pounds additional gain per yearling, this would mean an additional 1,200,000 pounds of beef produced. If beef is worth 25¢ per pound, this would mean \$300,000 additional income, per year, to the area.

PVC pipelines make water available to fight range fires and the clear water will not plug up the nozzles on fire fighting equipment.

It is needless to say that the ranchers' wives are extremely happy with the good quality water brought into their homes by the pipelines. There are no more pipes and faucets clogged with salts and minerals, and there is nothing like being able to get a good, cool drink of water.

FIG. 3. The end product—a supply of good quality water for a registered cow herd.

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