Cow-munity Water Systems as Compared to Rural Community Water Systems

Cooperative Extension South Dakota State University

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

SDSU Extension

For current policies and practices, contact SDSU Extension

Website:	extension.sdstate.edu
Phone:	605-688-4792
Email:	sdsu.extension@sdstate.edu

FS 641

"Cow"-munity Water Systems as Compared to Rural Community Water Systems

Cooperative Extension Service
South Dakota State University
U. S. Department of Agriculture

"Cow"-munity Water Systems as Compared to Rural Community Water Systems

By F. F. Kerr, water resources specialist, Cooperative Extension Service, South Dakota State University

Adequate supplies of good quality water available at water distribution points on the western range is essential for efficient livestock production. This is equally true in pastures of eastern South Dakota. These eastern pastures, however, are small and carrying capacity per acre is high as compared to western range land. Therefore the problem of distribution is less. As a general rule, water supplies can also be developed more cheaply in eastern South Dakota. Low population densities in the west further aggravate the problem when we consider feasibility criteria presently used in evaluating proposed systems.

In 1973 South Dakota State University's Agricultural Experiment Station and the Water Resources Institute undertook research to: (1) determine what criteria are pertinent to the economic justification of rural water supply systems in predominately livestock production areas; and (2) determine the feasibility and relative merits of various rural water supply systems for predominantly livestock producing areas in South Dakota.

Research was requested and partially funded by a group of ranchers that organized the Cheyenne River Water System Association in an attempt to do something about their problems. The main problems they described were (1) inadequate water in stock dams during dry seasons; (2) poor quality water; (3) stock dams silting in and the absence of good replacement sites; and, (4) high costs of their present watering system.

This publication summarizes these research findings, points out some of the inherent problems, and attempts to suggest some possible solutions.

PART I
Research Findings

The research study area included 199 water users of which 171 were operating ranches. The study area is shown on the accompanying map. The area is considered representative of predominately livestock producing regions in South Dakota. A mix of 171 operating ranches and 28 users who were not operating ranchers was also considered representative. Costs based on operating ranches only is available on request.

To determine costs of livestock watering systems presently being used, personal interviews were held with the 199 users. This sample constituted approximately 90% of all users in the study area.

Total land in the research area is 1,121,178 acres or an average of 5,634 acres per user. Animal numbers and yearly water demand are shown in Table 1.

Table 1. Animal numbers and yearly water demand.

	Totals In Study Area	Average Per User
Beef and buffalo cow-calves and bulls	51,185	237.0
Yearlings	30,950	156.0
Dairy cattle	259	1.3
Swine	5,100	25.6
Poultry	2,685	13.5
Sheep	1,088	5.5
Horses	1,151	5.8
People	1,087	5.5
Total animal equivalent units*	91,765	461.1
Yearly water demand (in thousands of gallons)	551,707	2772.0

*An animal equivalent unit is based on the consumption of 15 gallons of water per day or what one beef cow and calf, dairy cow, horse or buffalo would require. Other animals require some fraction of 15 gallons per day.

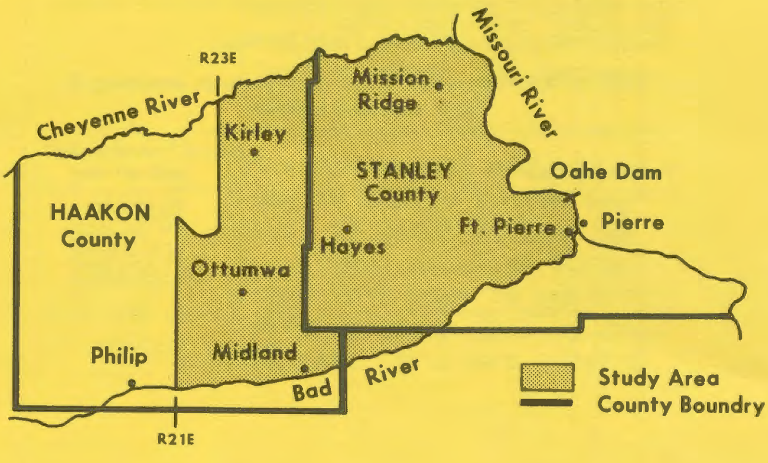
Table 2 shows the number of watering facilities presently in the study area and their cost.

Table 2. Present facilities and facility costs (1973 prices).

Kind of Facility	Total Number	Avg. No. Per User	Total Cost	Avg. Cost Per User
Stock dams	2,193	11	$4,736,530	$23,802
Dugouts	134	.67	140,940	708
Wells	350*	1.76	786,667	3,953
Treatment and delivery systems			743,663	3,737
Average Present investment per user				$32,200

*Includes 54 wells an average of 2,100 feet deep and 296 shallow wells averaging 60 feet in depth.

Other figures appearing in Table 3 show that operation and maintenance costs per user averaged $725 per year, $127 of this being power costs and $598 was maintenance. Users reported an average annual loss of $175 to water system related livestock deaths such as drowning in stock dams, etc. The research also addressed the question of inefficient use of range grass because of inadequate distribution of water facilities. Using a grazing rate of 15 acres per beef animal per year, it was estimated that 2,965 additional head of cattle could be grazed in the study



area if watering facilities were adequate to complement the natural grazing habits of cattle. This would average about 15 head per user and would result in an additional net return of $1,809 per year per user.

Annual Present Cost Summary

Table 3 summarizes the above described present costs and puts them on an annual cost basis per user and per calf sold. The summary is, however, misleading if we refer to "out-of-pocket" costs to the rancher because it assumes that there has been *no* subsidy payments for these watering facilities through ASCS, Great Plains or other cost sharing programs.

Accurately computing real "out-of-pocket" costs is virtually impossible because cost sharing arrangements have varied both geographically and over time. The researchers did, however, attempt to address this question by assuming an average subsidy of 50% and 80%. The real figure must be based on individual ranch analysis and probably lies within this range. Table 4 resummarizes the findings considering these assumed subsidy payments. Management ($624) and grazing efficiency ($1,809) per user per year are not included in the resummarization given in Table 4 because these are not "out-of-pocket" costs.

Table 3. Annual cost summary for present water system, 199 users.

	Total, $	Average Per User, $	Average Per Calf Sold $*
Average capital investment for the study area			
Wells	$ 786,647	$ 3,953	
Treatment and delivery	743,663	3,737	
Stock dams and dugouts	4,877,490	24,510	
Total	$6,407,800	$32,200	$133.06
Annual interest on investment and depreciation			
Wells	$ 68,887	$ 351	
Treatment and delivery	$ 86,882	437	
Stock dams and dugouts	456,923	2,296	
Total	$ 613,692	$ 3,084	$ 12.74
Power costs	$ 25,273	$ 127	$ 0.52
Maintenance costs			
~~Treatment and delivery~~	~~30,646~~	~~154~~	
Dam and well	88,356	444	
Total	$ 119,002	$ 598	$ 2.47
Animal loss cost	$ 34,825	$ 175	$ 0.72
Sub-Total (out-of-pocket)		3,984	16.45
Management	124,176	624†	2.58
Grazing efficiency cost	359,991	1,809	7.48
Total Cost Per Year	$1,276,949	$ 6,417	$ 26.51

*An average of 242 calves per rancher.
†Based on 4 hours labor per week at $3.00 per hour.

Table 4. "Out-of-pocket" water costs per user assuming 0, 50% and 80% subsidy.

Percent subsidized	Annual "out-of-pocket" costs per user
0	$3,984.00
50	2,441.00*
80	1,516.00*

*Not all necessary expenditures are cost shared. Compare these figures with similarily marked figures in Table 5.

Cost of Delivering Water to Users Via a Public System

While the research was being conducted at SDSU, a private engineering firm was retained jointly by the parties funding the research to design a system that would deliver Missouri River water to the 199 users in the study area. The firm designed two plans, one that would deliver water with 20 to 90 pounds pressure based on a 12-hour pumping day and one based on a 24-hour pumping day. The main difference was that in the latter plan, clients would need more storage facilities to receive and store water during off-peak use hours to have it available during peak demand hours. Repumping would be required for most water needs. Thus, the cost of water delivered by the system is lower but total costs to users may not be lower. Table 5 summarizes the costs involved.

Table 5. Costs of delivery via a public system.

	Total Capital Investment	Annual Operation Maintenance and Debt Retirement	Annual Charge Per User to Cover All Costs
Alternate No. 1 (12 Hr. pumping)	$6,275,700	$465,125	$2,337.31
Alternate No. 2 (24 Hr. pumping)	$4,447,900	$304,625	$1,530.78

Research Findings

By comparing the per user costs in Table 5 with the present "out-of-pocket" costs in Table 4 it appears that a public delivery system is competitive with present costs assuming a 50% subsidy for alternative No. 1 and that alternative No. 2 would be competitive at about an 80% subsidy. It should be emphasized, however, that users will need to maintain some storage and distribution facilities as well as pay some repumping costs under the second alternative.

PART II

Problems and Possible Solutions

Another alternative used in some western South Dakota areas is the so-called "cluster well" concept. This concept was not covered in the SDSU research. The concept simply spreads the cost of a deep well over several users. The economics is very simple. When the cost of delivering water to a user from a community-owned well nears the cost of another well or the yield capacity of a community well is being approached, another well is constructed and a new cluster is started.

The principle disadvantage of this concept is the poor quality water found in many deep sandstone formations. This water is usually very high in minerals. Although it may be acceptable for livestock use it often leaves something to be desired for domestic use. Individual wells vary in this respect. Some may have tastes, odors, stain-causing qualities and high heat in the water while others may yield waters that are corrosive or incrusting. However, others are quite acceptable. Generally, deep sandstone waters near the Black Hills have less minerals.

Groups interested in this concept should contact the ASCS, the SCS for Great Plains programs, and the Farmers Home Administration for possible cost-sharing arrangements.

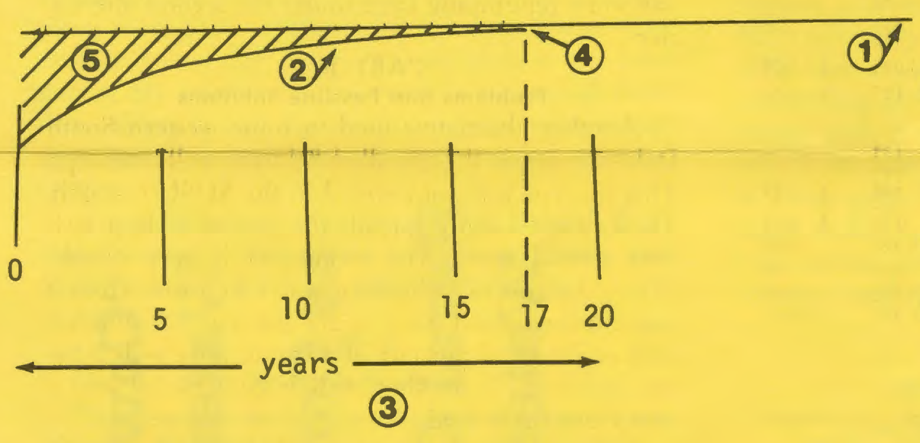
Salvage Value of Present Facilities

Most users have considerable investment in watering facilities which may have several years of life remaining. Unfortunately, these facilities are some form of a "hole in the ground" and holes in the ground have little market value. This situation is no different in the range country than it is in eastern South Dakota except that more dollars are involved per user.

There is no totally acceptable way to recover this salvage value. It can, however, be made less painful through a water rate that compensates the public system for water sales lost while users attempt to recover the salvage value of their existing facilities by continued temporary use. Figure 1 shows this concept schematically.

It should be noted that this scheme does not really recover private salvage values because the public rate structure must be a little higher than would have been necessary in absence of salvage recovery attempts. It does, however, spread the burden over both users and time.

Figure 1. Schematic concept of one method to recover salvage value of declining water facilities.



①-- Line represents design capacity of public system to deliver water.

②-- Line represents public system's delivery level reached while users attempt to recover salvage value.

③-- Time frame.

④-- Point at which old facilities are no longer used and public system deliveries reach the design capacity.

⑤-- Represents reduced income to public system because of users attempting to salvage existing facilities. This loss to public system must be made up in the rate structure adopted.

THE PROBLEM

As indicated by a comparison of Tables 4 and 5, the studied "cow"-munity water systems which would provide high quality Missouri River water throughout the research area is a viable business alternative as compared to present water distribution techniques.

The problem is one of initial funding. As Table 5 indicates, we are talking about investments of $4- to $6 million to serve only 199 users. This represents a capital outlay of $20,000 to $30,000 per user. Farmers Home Administration criteria for Rural Community water systems as constructed in more densely populated areas and that serve people primarily, allows only about $4,000 capital outlay per user. This makes it obvious that we are talking about two very different "ball games."

In 1975 South Dakota legislature considered but did not pass bills that could address this problem either by direct state loans or by state guarantee of loans made from private sources. The Farmers Home Administration is aware of the problem but cannot justify loans of such magnitude under present criteria even if they had the money to loan. In any event, some kind of acceptable loan plan must be found if "cow"-munity water systems ever become more than a "good idea."

In absence of such loans the cluster well concept can continue to be used in areas where water of acceptable quality is available. In such areas it may prove to be a better alternative than the "cow"-munity concept as researched.

Other Fact Sheets on rural water systems that are applicable to predominately livestock producing areas are: FS 538—Sequence of Events in Community Sewer and/or Water Service Development ● FS 626—Rural Water System Easements ● FS 539 (revised)—Selecting a Legal Organization to Administer the Affairs of a Community Sewer and/or Water System.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. Hollis D. Hall, Director of Extension Service, South Dakota State University, Brookings. The South Dakota Cooperative Extension Service offers educational programs and materials to all people without regard to race, color, religion, sex or national origin and is an Equal Opportunity Employer. (Male/Female).

File: 6.1-9-10—4,000 copies printed at an estimated cost of 6 cents each —2-76—5658.

Cooperative Extension Service
U. S. Department of Agriculture
South Dakota State University
Brookings, South Dakota 57006

OFFICIAL BUSINESS
Penalty for Private Use $300

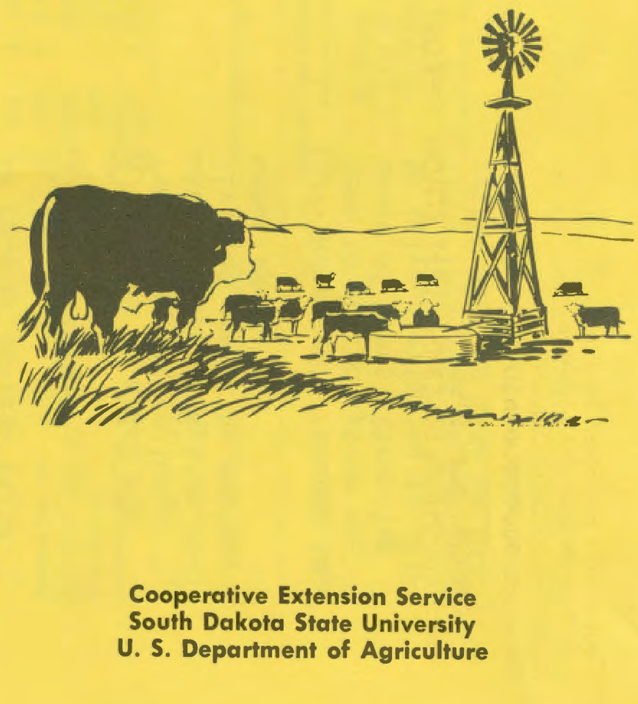
AN EQUAL OPPORTUNITY EMPLOYER

Postage and Fees Paid
U. S. Department of
Agriculture
AGR 101

Third class mail

FS 641

"Cow"-munity Water Systems as Compared to Rural Community Water Systems



Cooperative Extension Service
South Dakota State University
U. S. Department of Agriculture