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An Economic Analysis of Selected Impacts of the Lincoln County Rural Water System

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AN ECONOMIC ANALYSIS OF SELECTED IMPACTS OF THE LINCOLN COUNTY RURAL WATER SYSTEM

BY

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THE LINCOLN COUNTY RURAL WATER SYSTEM

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable for meeting the thesis requirements for this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Adviser	Date
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Chapter I

INTRODUCTION

The present status of rural water system development in South Dakota is summarized in this chapter. Then the nature of the policy issue and the research problem are described. Specific objectives of this thesis are outlined. Finally an overview of the remaining chapters is presented.

A rural community water system is a system for piping water from a central water source to individual rural users. The service provided to rural residents is similar to the water service provided to urban residents. In South Dakota, the legal organization for operating the water system may be a political subdivision, such as a Water Users district and Sanitary District, or it may be a non-profit corporation.[1]

These systems began to be developed in South Dakota in the 1960's and now there are thirty systems in various stages of being proposed, constructed, or in operation. The location of these systems can be best shown by Map I. The systems are clustered to the east of the Black Hills, along the western side of the Missouri River and adjacent to the eastern border and in the south eastern corner of the state.

The number of customers in operational systems, those under construction, and proposed systems are shown in Tables I-1, I-2, and I-3.

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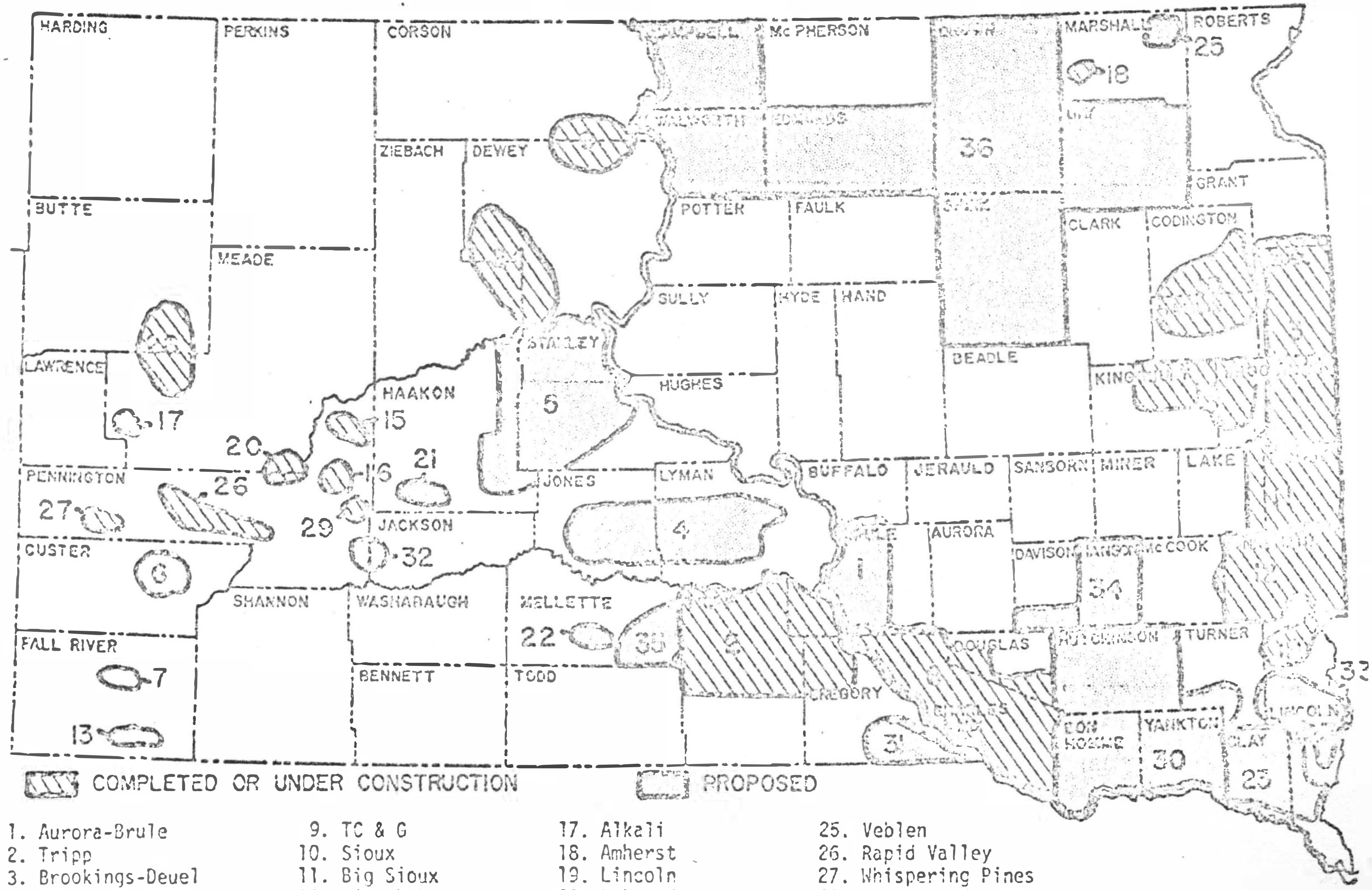
[1]For a discussion of the differences in these organizational forms, see F. F. Kerr and Leonard Nelson, "Selecting a Legal Organization to Administer the Affairs of a Community Sewer and/or Water System".

APPROXIMATE LOCATIONS OF RURAL WATER SYSTEMS



1. Aurora-Brule
2. Tripp
3. Brookings-Deuel
4. Lyman-Jones
5. Cheyenne
6. Hermosa
7. Cascade
8. Randall
9. TC & G
10. Sioux
11. Big Sioux
12. Minnehaha
13. Horsehead
14. Kingbrook
15. Johnson
16. Squaw Creek
17. Alkali
18. Amherst
19. Lincoln
20. Lakeside
21. Old Trail
22. White River
23. Clay
24. Fox Ridge
25. Veblen
26. Rapid Valley
27. Whispering Pines
28. Butte-Meade
29. Peno-Basin
30. B-Y
31. East Gregory
32. Cedar
33. South Lincoln
34. Hanson
35. Wood
36. WEB

Map I-1

Table I-1. Number of Customers Of Operational Rural Water Systems In South Dakota, 1977.

Rural Water System	County	No. of Customers	
Tripp	Tripp	Rural	510
		Urban	40
TC & G	Corson & Dewey	Rural	58
		Urban	25
Sioux	Codington & Hamlin	Rural	619
Big Sioux	Moody	Rural	900
Squaw Creek	Pennington	Rural	8
Amherst	Marshall	Rural	25
Lincoln	Lincoln	Rural	265
		Urban	200
Lakeside	Pennington/Meade	Rural	21
Rapid Valley	Pennington	Urban	747
Whispering Pines	Pennington	Urban	15
Butte-Meade	Butte-Meade	Rural	300
Peno-Basin	Pennington	Rural	5
Total Rural 2,711	Urban 1,027	Both 3,738	

Source: South Dakota Department of Natural Resources, June 1977

Table 1-2. Number Of Customers In Rural Water Systems Under Construction In South Dakota, 1977.

Rural Water System		County	No. of Expected Customers
Brookings-Deuel		Brookings-Deuel	Rural-Small Towns 950
Randall		Charles Mix-Douglas	Rural 1,370
Minnehaha		Minnehaha	Rural 1,494
Kingbrook		Kingsbury-Brookings	Rural 559 Urban 272
Johnson		Pennington	Rural 7
Fox Ridge		Ziebach-Dewey	Rural 10 Urban 704
South Lincoln		Lincoln-Union	Rural 1,000
Total	Rural 5,390	Urban 976	Both 6,366

Source: South Dakota Department of Natural Resources, June 1977

Table I-3. Number Of Expected Customers For Proposed Rural Water Systems.

Rural Water System	County	No. of Customers	
Aurora-Brule	Brule	Rural	369
Lyman-Jones	Lyman-Jones	Rural	652
Cheyenne	Stanley & Haakon	Rural Urban	125 1,000
Hermosa	Custer	Rural	22
Cascade	Fall River	Rural	30
Old Trail	Haakon	Rural	8-15
White River	Mellette		
Clay	Clay-Union	Rural Urban	947 30
Veblen	Marshall	Rural	12
B-Y	Bon Homme & Yankton & Hutchinson	Rural Urban	800 870
East Gregory	Gregory	Rural	172
Cedar	Pennington-Jackson	Rural	14
Hanson	Hanson-Davison	Rural Urban	600 1,200
Wood	Mellette	Rural Urban	50 200
WEB	Walworth Edmunds Brown Campbell Day Spink	Rural Urban	12,159 52,952
Total	Rural 15,962	Urban 56,252	Both 72,214

Source: South Dakota Department of Natural Resources, June 1977

Twelve systems are currently delivering water to customers. Their size ranges from 5 to 900 members. In total, 2,711 rural customers and 1,027 urban customers are served by these twelve systems. Seven additional systems have been organized and construction is in progress. They will serve an additional 6,366 customers. Fourteen other systems have completed some or all of the organizational work and await funding. These systems will serve an estimated 72,214 customers. The total number of customers that will be served by completed systems, those under construction, and proposed systems is 82,318. If each hook-up serves an average of 3 people a total of 246,954 persons will be served by these systems or approximately 35 percent of the state's population.[2]

There were many events leading to the development of the rural community water systems in South Dakota. These systems were instituted by state and federal legislation enabling organizations to form a political subdivision or incorporate for the purpose of distributing water in rural areas. Their development was encouraged by loan programs through the Farmers Home Administration, state government and other sources. Advances in technology, like the polyvinyl chloride pipe and new techniques for burying the pipe, reduced the cost of the systems so they became feasible in even sparsley populated areas in South Dakota. While these events make possible and encouraged the development of rural water systems, the initiative must be taken by a local organization to plan,

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[2] Additional detail on these systems is provided in Appendix A.

build and operate a system.[3]

The Policy Issue

Recently urban planners have suggested that rural water systems may have negative impacts on local units of government. Likewise they have suggested that urban centers near these rural areas may suffer from an out-migration of current residents to live in more attractive rural areas.

Proposals have been made to give the urban center a voice in the location and establishment of rural water systems. Some rural water system directors fear that this procedure would retard or halt the development of their systems.

One of the key unanswered questions is: what impacts do rural water systems have on local units of governments' public finances? To answer this question it is first necessary to examine several more fundamental issues, including the reasons people join rural water systems.

Reasons for joining rural water systems in North Dakota were examined by William C. Nelson and Clayton O. Hoffman.[4] Listed by order of importance, the reasons they found for individuals were the following: convenience, increased quantity of water, stable quantity of water, community pressure, cost of hauling water, improved quality of water,

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[3] For a discussion on organizing a rural water system see: Kerr, F. F., Sequence of Events in Community Sewer and/or Water Service Development, Cooperative Extension Service, S.D.S.U., Brookings, South Dakota, #FS538, November 1972.

[4] Nelson, William C., Hoffman, Clayton O., Rural Water Users Associations in North Dakota - Why? How? Who? Agricultural Economics Report No. 105, North Dakota State University, Fargo, 1975.

effect on housing value, effect on land value, cost of well, and a reserve supply of water.

The above advantages of a rural water system may encourage people to move into rural areas served by these systems. In areas close to urban centers there may be people who will move in response to the development of a rural water system. Planners have expressed concern that population movement due to rural water systems may have a negative impact on the financial standing of local units of government. An increase in the number of residents may increase total expenditures for government services. A change in the composition of the population resulting from additional non-farm residents may increase expenditures made for each person in the area. The increase in expenditures for new residents may not be matched by the increase in revenues derived from the new residents. This situation would have an adverse effect on local government finances and the original local residents.

The influence of a rural water system on the local units of government involves more than changes in population. The value of many items included in the tax base may be affected by the initiation of a rural water system. The market value of houses served by the water system may increase. The potential of using land for residential purposes may increase residential land value. Any increased livestock productivity or improved farm management may be capitalized in agricultural land values over time. Effects on the tax base through changes in property values should be included in a study of the impact of a rural water system on the financial status of local units of government.

Objectives of This Study

The overall purpose of this study is to estimate selected impacts of a rural community water system on variables which may influence the fiscal status of local units of government. All of the impacts that may result from a water system are not considered by this study. Only selected impacts which influence the revenues or expenditures of local units of government are included. The variables to be estimated correspond to the specific objectives given below.

A. Estimate the change in agricultural land values due to the rural water system.

B. Estimate the change in the value of residential acreages due to the rural water system.

C. Estimate the change in the value of housing due to the rural water system.

D. Estimate the change in the number of residents due to the rural water system.

E. Estimate the change in the number of students due to the rural water system.

These estimates will provide information necessary to simulate impacts of rural water systems on the fiscal status of local units of government.

Overview of Thesis

This chapter has included a description of South Dakota rural water systems, the policy issue and research problem, and the objectives of this study in relation to that problem. A review of literature on

other rural water systems research is the content of the second chapter. The third chapter describes the research methods used in this study. In the fourth chapter, the analysis and interpretation of the data is presented; and conclusion and recommendations are presented in the last chapter.

Chapter II

REVIEW OF LITERATURE

With the introduction of rural community water systems into South Dakota, the living conditions of individuals in rural areas may change in various ways. Some aspects of these changes have been investigated by researchers in other areas. While their results are based on other areas, the types of changes they reported may be expected in South Dakota. This chapter will review the results of studies made on other rural water systems.

A rural community water system provides water for domestic and livestock uses. For the agricultural sector of the rural economy, the major impact of a rural water system is on changes in income derived through livestock production. Field irrigation is seldom allowed from rural water systems. Thus, the income from grain crops is not affected.

In addition to increased livestock production, rural water systems may reduce costs and inconveniences of private domestic water sources. This may stimulate additional residential development. The increased agricultural production and the increased competition for residential development sites may lead to higher land values. Research on each of these impacts will now be explored in more depth.

Livestock Production

From a study made of one rural water system in Kansas, forty-three percent of the respondents who specialized in livestock production indicated they increased their livestock numbers because of the

rural water system.[1] The estimated value of the increases in all classes of livestock, including dairy, beef and feeding cattle and hogs, was over $150,000 over a six year period.

A University of Missouri study[2] reported that in one rural area, seven percent of the farmers increased their cattle herds because of the assured source of water. Also, three percent of the farmers increased their number of hogs. With these changes in livestock practices, there was no change reported in cash crops grown in the area. As suggested before, a rural community water system may affect livestock production, but rarely changes cropping practices.

In both the Kansas and Missouri study, respondents were asked to estimate the change in livestock in numbers of head handled as a result of being on a rural water system. While individuals ought to be aware of the total change in livestock numbers it may be difficult for them to accurately respond to this type of inquiry. Many other factors may lead to changes in total numbers of livestock, including prices of the livestock, prices of feeds, cost of labor, availability of financing. If these factors had changed since the rural water system was introduced, it may be difficult for an individual to determine the percentage of the total change which can be attributed to each factor.

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[1]Smythe, Patrick E.; Economic Impact of a Rural Water District. Community Resource Development, Department of Economics, Kansas State University, Manhatten, Kansas, #C-409, August 1969, p. 4.

[2]Blase, Melvin G.; Matson, Arthur J.; Green, Parman R.; McNabb, Coy G.; Public Water Supply Districts, Impacts In Two Areas. Cooperative Extension Service, University of Missouri, Columbia, Missouri, #MP268, February 1972, p. 4.

However, this direct approach has an advantage of avoiding the problems inherent in selecting control areas or designing a regression model which captures the impact of the rural water system.

Previous research suggests that there may be increases in income from improved livestock production due to a rural water system. As these impacts are realized, the value of land in that area may increase in response to these benefits.

Land Values

In Kansas, the change in land value attributable to a rural water system was estimated in two different ways by Patrick Smythe.[3] From a questionnaire that asked how land values had changed due to the rural water system, ninty-three percent indicated prices had increased. The average of these estimates was $26.47 per acre.[4] Seven percent indicated there had been no change attributable to the rural water system.

The other estimate of change in land values came from the comparison of actual land sales from within the area served to a nearby area. The comparison showed that there were fewer sales of land within the area served, and that land values averaged $43.50 per acre more in the rural water system area. Although no controls for other factors affecting land values were used in this study, it suggests that a rural water system increases land values in the area served.

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[3]Smythe, op. cit., p. 3.

[4]Note: This system had been in operation slightly over six years serving 97 members, of which 60% responded to this 1969 questionnaire. Respondent's estimates of increases were $27.68 for cropland and $22.00 for pastureland.

In a rural water system in North Dakota, 0.8 and 2.6 percent of members and non-members respectively felt that land values had increased as a result of the rural water system.[5]

In the one Kansas experiment and the case in North Dakota, the research procedure used to estimate the impact of rural water systems on land involved respondent estimates. In the other Kansas study, no check was made as to how similar land prices were before the rural water system was installed. Also, no control was made for other factors that may influence land prices in the two areas.

Along with increases of livestock production and land values, the presence of a rural water system may affect aspects of the households served. Cost reductions from using a rural water system compared to alternative water supplies is an impact that varies with the alternative supplies available.

Cost Reductions

In Kansas, Patrick Smythe has reported that rural water systems are less expensive to use than hauling water.[6] In a survey conducted by the Farmers Home Administration in Kansas, eighty-five percent of the users of rural water systems indicated they had previously hauled water averaging 84 miles per month. Using recent mid-west studies that estimated trucking expenses at 30¢ per mile, Smythe estimated that the rural

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[5]Nelson, William C., Colla Janecek, Richard L. Witz, Evaluation of North Dakota's First Rural Water System, North Dakota Agricultural Experiment Station, Research Report No. 65, North Dakota State University, Fargo, North Dakota, July 1976. p. 23-25.

[6]Smythe, op. cit., pp. 3-4.

water system saved users an average of $302.40 a year from trucking costs alone.

Depending on the cost of existing water supplies, a rural water system may reduce the water costs. From a study of two water systems in Missouri, the average cost of hauling water and the average cost of water from a rural water system were almost the same on one system, around $2.10 per thousand gallons, but these costs differed by over $3.00 on the other system, $5.57 per thousand gallons of water hauled compared to $2.22 from the rural water system.[7]

In a study of the first rural water system in North Dakota, a comparison was made to show the cost of a rural water system to various alternative water supplies. Table 4 shows the cost per month of obtaining water from a North Dakota rural water system, private wells, and commercially hauled water. At 5,000 gallons per month, the rural water system is less expensive than wells which are 200 feet or deeper. At 10,000 gallons the rural water system charge is less than all wells of 300 feet depth or greater. Wells were estimated to be less expensive at 25,000 gallons or greater. At all levels the rural water system charge was less than the estimated charge for commercial hauling.[8]

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[7]Blase, et. al., op. cit., Pp. 3-4.

[8]Nelson, et. al., op. cit., p. 67.

Table II-1. Number Of People And Livestock Supported By Various Levels Of Water Use Per Month And Cost Per Month.

	Gallons Per Month			
	5,000	10,000	25,000	432,000
Consumers				
People	3.33	6.67	16.67	288.00
Steers	13.88	27.78	69.44	1,200.00
Dry Cows	11.11	22.22	55.55	960.00
Milking Cows	4.76	9.52	23.81	411.43
Hogs	41.67	83.33	208.33	3,600.00
Cost Per Month				
100-Foot Well	$ 20.70	$ 21.00	$ 21.30	$ 34.80
200-Foot Well	25.80	26.10	26.40	39.90
300-Foot Well	38.40	38.70	39.00	52.50
Rural Water System	$ 23.10	$ 34.20	$ 55.50	$ 462.60
Commercial Hauled Water ($7.24/ 1,000 gal.)	$ 36.30	$ 72.30	$180.90	$ 3,127.68

SOURCE: Nelson, William C., N.E. Toman, and C.O. Hoffman, "Impact of Rural Water Systems in North Dakota," paper presented to the North Dakota Society of Farm Managers and Appraisers, Fargo, January 5, 1976.

In the same North Dakota study,[9] the four most important reasons for joining a water association were convenience, increased quantity of water, stable quantity of water, and community pressure. The fifth most significant reason given by respondants was the cost of hauling water. These results suggest that as well as reducing the cost of water supplies, a rural water system may improve the quality of rural living conditions.

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[9]Nelson, William C., Hoffman, Clayton O., Rural Water Users associations in North Dakota, Why? How? Who? North Dakota Agricultural Experiment Station, N.D.S.U., North Dakota, #105, March 1975.

Standard of Living

A rural water system may result in a change of water consumption affecting the water users general living conditions. In Mississippi, Landry, Carter, and Williams point the reduction in the number of households without water as one impact of the introduction of a rural water program.

> "In 1950 approximately 30% of Mississippi households were without a water supply. By 1960, this figure had been reduced to about 28 percent and in 1970, further reduced to approximately 14 percent. The large number of water systems constructed since the program's beginning in 1962 thru 1970 no doubt made a marked contribution in the reduction of the number of households classified as having no water supply between 1960 and 1970 Census of Housing."[10]

In Missouri, reports from two systems, one in a predominately rural area and the other in a rural-urban fringe area showed differing increases in water consumption.[11] Estimates of average consumption per user were made for people who had previously hauled water and compared to the average consumption per user after installation of the rural water system. Of the respondents in the rural area, forty percent had previously hauled water, and thirty percent of the respondents from the rural-urban fringe area had hauled water. The percentage of the hauled water used for domestic purposes was estimated at eighty-five percent for the urban fringe area.

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[10] Landry, Brenda M.; Cartee, Charles P.; Williams, D.C., Jr.; Economic and Related Impacts of Rural Water Systems In Mississippi. Water Resources Institute, Mississippi State University, Mississippi State, Mississippi, July 1973, p. 39.

[11] Blase, et. al., op. cit., p. 3-4.

Average monthly consumption per user increased in the rural area from 4,283 to 4,667 even though the cost of hauling water in that area was close to the cost of water from the rural system. In the rural-urban fringe area where the cost of hauling water was more than double the cost from the rural water system, the estimated average monthly consumption per user increased thirty-seven percent, from 2,218 gallons to 3,031 gallons. The latter change in water consumption can be related to reduced water costs. But in the first case, where costs were the same, the change in consumption appears to be related to improved convenience or water quality.

If a water system delivers pure water in a dependable and convenient way, then water using appliances may be used more. William Nelson and Clayton Hoffman[12] asked users of a new water system in North Dakota what appliances they expected to buy after the water association began. Responses covered automatic clothes washers (26%), water softeners (28%), electric water heaters (22%) and other related appliances. If these sample percentages held for all 1,230 members of the water association, and actual purchases matched the reported expectations, the value of these new water related appliances, based on 1973 Montgomery Ward prices, would be over $300,000. The problem with this estimate is that it is based on expectations rather than actual purchases. In contrast to expected purchases reported in North Dakota, Smythe reported that in one new water association in Kansas, purchases of water

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[12] Nelson, op. cit., p. 8.

related appliances that approximately sixty respondents indicated they had actually purchased as a result of the rural water system were estimated at $135,000.[13]

Both of these studies reported estimates based on survey respondents indicated purchases related to the introduction of a rural water system. A problem with this is that other factors may affect the purchasing of new appliances. Prices may fluctuate on new appliances or old ones wear out. Besides these other considerations, respondants answers may be biased by their attitude towards the rural water system.

Addition of new appliances may be accompanied by home improvements. A study conducted in Missouri, reported that for members in one rural county who made home improvements, the investment averaged at a value of $672, and for a rural-urban fringe area, the average investment was $1,126.[14]

Nelson et.al. reported that 20.6 percent of the members of the North Dakota system remodeled their homes compared to only 7.7 percent of the non-members.[15]

These results are consistent with the view that investments will be higher in areas with water systems. One reason this may occur is that home owners feel home improvement investments will appreciate more rapidly in areas with a rural water system.

The approach used in this study is inadequate to test this

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[13]Smythe, op. cit., p. 5.

[14]Blase, et. al., op. cit., pp. 3-4.

[15]Nelson, op. cit., pp.

hypothesis. Possibly a positive relationship between home improvements and membership in a rural water system exists because individuals in areas with higher incomes both join the water system and remodel their homes. To test the hypothesis that remodeling is a result of the new system it would at least be necessary to control for income.

As rural water systems have an impact on home improvements, they may also affect the building of new homes for the existing residents, or encourage new residents.

New Housing

In Mississippi,[16] a survey of water associations reported over 5,000 new houses, not including increases in trailer parks and mobile homes. Ninty-six percent of these houses were served by the rural water system. Rural water systems did not cause all this increase in housing, as patterns of increase seemed to depend upon proximity of commercial or industrial centers to areas served by water systems. However, one third of the responding associations indicated that increased housing within their area was at least partially attributable to the increase to the water systems. Forty-five of three hundred and sixteen water associations indicated new housing planned for construction pending extension of existing systems. These estimates may be overstated by the water associations as they promote their own systems.

Several associations in Mississippi held the opinion that in certain rural areas, water associations helped stabilize population num-

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[16] Landry, et. al., op. cit., pp. 14-21.

bers.[17]

New Residents

In two areas of Missouri, one a rural area and the other a rural-urban fringe area, population movement in response to rural water systems was noted.[18] One hundred and twelve new residents comprised twenty-five percent of the responses to a questionnaire in rural Barton County. Of the new residents, thirteen percent said the planned or existing water system influenced their decision to move to that county. In the other area, Boone County, 82 respondents (40%) were new residents after installation of the water system. Of these 82 new residents, twenty-one percent indicated their decision to move to Boone County had been influenced by the rural water system.

It has been suggested that rural water systems near urban centers attract non-farm residents to the rural area. One way to examine this would be to determine whether rural water systems near urban centers grow more rapidly than similar systems located further from urban areas.

Factors affecting growth of rural water systems were documented by Gordon R. Sloggett and Daniel D. Badger.[19] They looked at age of the system, income of users, and distance to nearest growth center. Only distance was found statistically significant at the one percent level.

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[17] Ibid. p. 38.

[18] Blase, et. al., op. cit., pp. 3-4.

[19] Sloggett, Gordon R.; Badger, Daniel D.; Economics and Growth of Rural Water Systems in Oklahoma. Agricultural Experiment Station, Oklahoma State University, U.S.D.A., Bulletin B-716, pp. 23-25.

Distance explained about fifteen percent of the variation of growth between systems. The authors' reported that the growth rate fell by .385 percent for each mile between the edge of the growth center and the edge of the area served by the rural water system.

study are: "Characteristics of growth centers near the system; philosophy of water systems management and/or landowners towards growth; and physical capacity of the system to serve more customers."

While this suggests that rural water systems may attract new nonfarm rural residences, information was not collected on the specific type of new customer. It is likely that much of this growth is due to non-farm rural residents. However, not all farmers sign up initially, so without specific data on the type of user it is difficult to draw firm conclusions.

Summary

The purpose of this chapter is to review studies made on the impacts of rural water systems. This chapter does not review all the available literature on rural water systems. Rather it focuses on studies measuring the effects of rural water systems on livestock production, land values, reduction of water costs, living conditions, new housing, and new residents. Although not all the reported results are the same or conclusive, the information suggests the effects that a rural water system may have on these variables.

Briefly, a rural water system may allow expanded livestock production, and encourage higher land values. Depending on the type and the cost of alternative water supplies, the use of a rural water system may

improve living conditions and reduce water costs. New housing and new residents may result from the introduction of a rural water system. The studies reviewed provide some empirical support for these hypotheses. However, each study suffers from one or more weaknesses in its research methods. Consequently, firm conclusions cannot be drawn from the results. In this study an attempt is made to overcome some of the weaknesses in the previous work. The next chapter describes the research methods used in this study.

Chapter III

RESEARCH METHODS

Conceptual Framework

The question raised in the first chapter was: How will a rural water system affect the finances of local units of government? New residents may be drawn to the area by the water system and may require increased expenditures. On the other hand, additional housing for the new residents would add to the tax base. The value of existing housing and land may increase as a result of the rural water system. This would also add to the property value included in the tax base. Any increase in the tax base will result in a proportionate increase in the revenues to local units of government. Will the additional expenditures exceed the revenues gained or vice versa?

The advent of a rural community water system can be related to the finances of local government by a conceptual framework. The purpose of this section is to develop a conceptual model to use for this study.

The finances of local units of government can be separated by revenues and expenditures. Property tax revenues depend on the assessed market value of the tax base, the assessment/sales ratio used to determine the taxable value of the property and the mill levy, or rate at which tax is charged against the taxable valuation. Expenditure of local units of government depends on the projects and programs initiated through the political process. Both the number of people served and the quality of service demanded influence the level of expenditures. The impact of a rural water system on the value of property included in

the tax base will be discussed first. The mill levy, which is determined through the political process, will be discussed with expenditures.

Property values will be affected by real and pecuniary gains. Real impacts on property values due to a rural water system come from reductions in cost of water use and increases in livestock productivity. As indicated in the literature review, rural water systems may result in lower investment and operating costs for a water supply, depending on an individual's alternatives for a water supply. If the water system provides better quality water than alternative supplies, the usable lifetime of water related appliances may be increased. This would spread out the time period in which the investment must pay for itself and reduce the cost of using it at any one time. Actual gains in livestock production may be realized by expanded herd sizes on the same farm, increased gains per head due to the improved quantity and quality of water, and the use of labor saving equipment such as automatic livestock watering tanks. These real changes in water costs and livestock productivity may be capitalized into either land values or farm building values. Increases in the market value of these items would expand the tax base of local units of government.

The other way the tax base of local units of government may be affected by the development of a rural water system is through pecuniary gains for land, farm buildings or housing. These price changes are the result of changes in demand for these items in response to the real or perceived changes in the quality of rural living and agricultural production resulting from the services of a rural water system. This can be illustrated in the following manner. Assume the rural community wa-

ter system delivers cleaner, purer water, at a price falling below the effective demand for water, at least for many individuals: the consumer surplus will increase the demand for living within that area. The same illustration can be given for other features of the rural water system, such as the enlarged available supply of water, the convenience of pressurized water supply and the security of a dependable water supply. As people realize these additional features, or perceive that these features may be available through a rural community water system, they may have an increased desire to live and work in that area. The extent to which this will happen will depend on individual's tastes and prefrences in water consumption and water related activities. If the demand for living in this area does increase, the market prices for residential acreages and agricultural land will be bid up. This will enlarge the tax base and tax revenues.

On the other side are changes in expenditures related to the rural water systems. The level of expenditures by local units of government is related to the number of people served in that area and the demands of these people for government services as expressed through the political process. The services of a rural community water system are expected to change the population that local units of government must serve. As the number of residents increases, total expenditures by local units of government will increase, assuming no economies of scale in the services provided nor shifts in effective demand.

As population changes, the demand for local government services may change. This may occur because immigrants may desire services from local government that are similar to those pro-

vided in urban areas. It has been suggested that immigrants may also be more influential in the expression of desires through the political process. If these hypotheses are valid, the effective demand for local services may increase. However, there is no _a priori_ reason to expect this increase. Immigrants may move to the country to avoid higher urban taxes. If so, they may be willing to accept lower levels of services. Even if immigrants desire higher levels of expenditures, their influence or numbers may be insufficient to achieve this. The age distribution of the immigrants would also influence their demands.

Operationally, the changes in effective demand will be examined through expenditures per capita (or per student) as a proxy for demand. This operational definition is justified if the average and original costs for local services are identical. For the small shifts in service size required it is unlikely that economies or dis-economies of scale will be experienced.

This conceptual framework shows the relationship between the creation of a rural water system and corresponding changes in revenues and expenditures of local units of government. This model does not take into account all the impacts of a rural community water system or changes in financial status of local government. Only those impacts that are directly related to local government are considered.

Scope

This study estimates the impacts of a rural community water system on selected variable which influence the fiscal status of local units of government. This study is not an analysis of all the bene-

ficial and adverse effects which may result from the formation of a rural water system. It is limited to those variables that influence the revenue and expenditures of local units of government. A complete analysis should estimate the economic value of water supplied for industrial and commercial uses, the value of labor and other resources used in construction and operation of the system, and the impacts on environmental quality. From a regional point of view, the net income generated from construction expenditures and new residents would be considered a benefit of the system. However, it is beyond the scope or the resources of this study to collect information on these influences of a rural water system. Therefore, only the impacts of a water system on five selected variables are considered.

1. Market value of agricultural land.
2. Market value of residential land.
3. Market value of rural housing.
4. Number of residents.
5. Number of school children.

These are the primary public finance variables which a rural water system might affect. Given these estimates it would be possible to simulate the impacts on local revenues and expenditures under current conditions.

Next the methods used to measure these impacts will be discussed.

The Operationsl Framework, Sampling Procedure and Data Treatment

This section describes the operational framework used in this study. It is the applied part of the conceptual framework as limited by the scope of the study. The concepts and methods of the sampling procedure

used in this survey are presented next. Last, the coding and data processing are discussed.

Implications of the conceptual framework outlined above are relevant to local units of government in an area served by a rural water system and in a nearby urban center. The scope of this thesis is confined, however, to the estimation of impacts within the one area modeled. The parameters estimated may be particular to this one rural water system. However, the types of relationships described here may exist for other rural water systems in similar areas.

The unit of observation or unit of measurement for this study is the membership of the Lincoln Rural Water System. This water system comes to the southern edge of Sioux Falls.[1] The influence of a water system on the finances of local units of government would be observed by changes in individuals' financial and residental situation. The conceptual framework explains the relationship of the rural water system to changes in residency and water use habits of effected families. The survey population consists of all the members of Lincoln Rural Water System and a nearby control area. The control group consists of all rural residents in Benton, Wayne and Split Rock townships. These townships were chosen for their close proximity to Sioux Falls. It is thought that variables exogenous to this study would be similar in both areas. The USDA Soil Conservation Service (SCS) classifies land resources,

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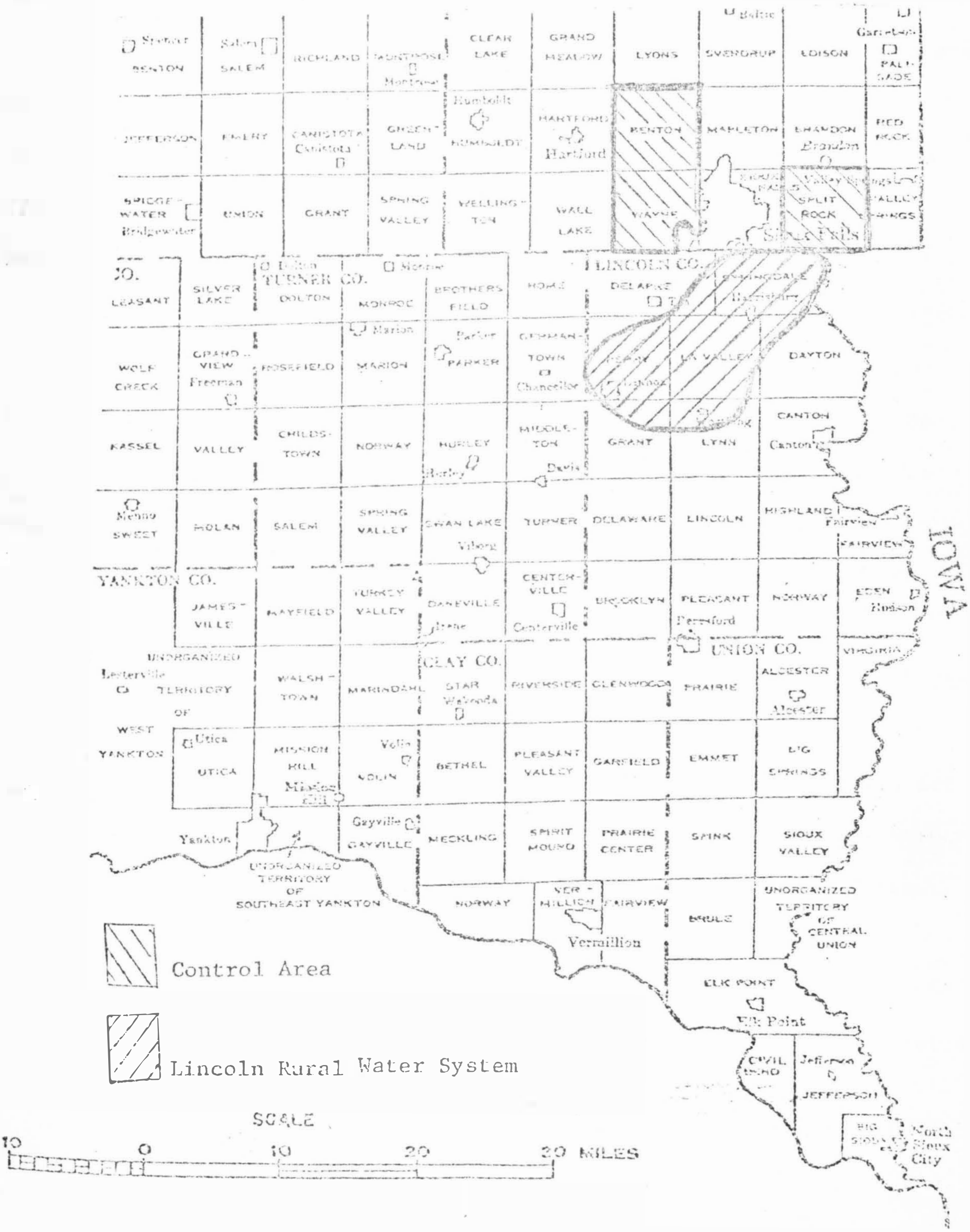
[1]Data was also collected for the TC&G Water System in Corson-Dewey County. The data are not analyzed in this thesis.

Map III-1. Location Of Lincoln Rural Water System And The Control Area, Benton, Split Rock And Wayne Townships, Minnehaha County, South Dakota.



land use and types of farming. According to the SCS, the study and control areas are in the same land type and use classifications.[2] The location of the study and control areas are shown on Map III-1.

The sampling frame is the actual list that the sampling units are drawn from. The list of members came directly from the rural water association. The list of residents for the control area came from the "Atlas of Minnehaha County, S.D."[3] This list in effect defines the survey population.

The sampling method used is an approximation of a longitudial study. On some questions, respondents were asked to provide information from 1970 and 1975. The sampling design is a stratified-random model. Because some of the questions on the questionnaire were aimed at individuals specializing in livestock production, farmers were separated into a special group for survey purposes. For Lincoln Rural Water System, information as to which members had livestock was provided by the association. For the control, a list of people in agriculture, including livestock producers, was obtained from the Minnehaha County Extension Agent. Approximately thirty percent of all the people on the lists for both areas were sent questionnaires. Of these, 41.5 percent were farmers or livestock producers. The others were non-farming rural residents.

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[2] South Dakota Facts: An Abstract of statistics and Graphics Concerning the People and Resources of South Dakota. Office of Executive Management, South Dakota State Planning Bureau, 1976, p. 56.

[3] Atlas of Minnehaha County, South Dakota, Midland Atlas Company, Inc., Milbank, South Dakota.

This procedure helped assure a balanced proportion of non-agriculture rural residents in the survey.

Alphabetical lists of persons within the populations sampled were numbered in sequence. Then names were drawn by use of a random numbers table. The completion rate for usable questionnaires sent to the study area was 62 out of 130, or 47.7%. The numbers of farm and non-farm responses were 18 and 16, respectively. In the control, the completion rate was 34 out of 118, or 28.8%. The numbers of farm and non-farm responses were 30 and 32, respectively. The overall completion rate was 96 out of 248, or 38.7%. While the completion rate is satisfactory, because not everyone answered all the question, the responses from some subgroups were not sufficient to allow statistical tests of significance.

Data were collected by a questionnaire that asked the respondents to estimate values of agricultural land, residential acreages, and house values. Those surveyed who lived within the study area were asked to estimate the changes in these values that they attributed to the rural water system. The questionnaire also contained a question asking if the rural water system influenced their decision to live in that area. (A copy of the questionnaire is shown in Appendix B.) The specific questions used for estimation and hypothesis testing are presented and discussed in the following chapter.

Other information, like alternative supplies and water consumption rates, was also collected. Some of this information was not used in this thesis, but was collected for use by the S.D.S.U. Cooperative Extension Service.

The data were processed by the Statistical Package for Social

Sciences. Except where noted otherwise, statistics reported were estimated by the formulas built into the package. Considerable effort was put into the data clean-up process to prevent errors in coding and keypunching from being used in the analysis. For closed ended questions, this was easy to do because of the limited number of responses. Answers to open ended questions that categorically did not fit the question were dropped.

In this section the conceptual framework for analysis of the problem situation and the procedures for collecting and analyzing primary information on changes in living patterns that affect the revenues and expenditures of local units of government were outlined. Results of the data collection and analysis are reported in the next chapter.

Chapter IV

SURVEY SUMMARY AND STATISTICAL ANALYSES

The relationships of a rural water system to five selected variables affecting local units of government are studied on the basis of available data. These variables are: acreage values, housing values, agricultural land values, the number of new residents and new students. Where possible, the statistical significance of these relations are tested. However, all the relations are estimated.

The rationale for each estimate and hypothesis is presented. Then the operational framework, definitions, and type of data used to test the hypothesis are described. Where possible, each impact was estimated with three different approaches: respondent's estimates of impacts, experimental design and regression analysis. An interpretation of the results is given to show the strengths and weaknesses of each type of test used. Finally, estimates of each impact are made.

Rural Acreages

With the development of a rural water system, the value of land used for residential acreages is expected to increase. Several studies where this result was found are cited in the literature review. In this section, the rationale for this theorized change in the value of acreages is presented. Information on the value of acreages collected in the study area and in a neighboring control area is described, and regression analysis is performed. This shows the relationship of changes in acreage values and the existence of a rural water system while holding other variables constant.

Conceptual Justification Of Hypothesis

The development of a rural water system may be associated with the increase in value of rural acreages. The use of water from a rural water system may be less expensive than alternative supplies. The demand for acreages with rural water systems may be higher than for other similar acreages.

The cost of existing water supplies varies from one area to another. In the case where a rural water system is less expensive than alternatives, the cost reductions may be bid into the value of the acreage. While this may not always be the case, it is assumed that the private cost of a rural water system is at least comparable to the average cost of alternative supplies. Even if costs are not reduced, there are other aspects of a rural water system that may be preferred over other water supplies.

The rural water system provides treated water to each member through a pressurized line. This water may be purer and better tasting than well water. Even where this is not the case, the similarity of a rural water system to municipal water systems may be more appealing to people who are used to such services. The demand for a rural acreage with these services may be higher than for other similar acreages. For these reasons, the value of rural acreages can be expected to increase with the development of a rural water system.

Hypothesis

Formally, the null and alternative hypothesis are expressed in the following form.

Null hypothesis: The establishment of a rural water system does not increase the value of land used for rural acreages.

Alternative hypothesis: The establishment of a rural water system does increase the value of land used for rural acreages.

Hypothesis Testing

The values of rural acreages vary with many factors other than the rural water system. To understand the impact of a rural water system on acreages, several research methods were used. First, members were asked to estimate the percent change in value of acreages that they attribute to the rural water system. Aecond, the change in the value of acreages was compared with a control area and third, other factors are controlled for with regression analysis.

Members Estimates

The influence of a rural water system on the value of acreages was explored by a direct question to members of the Lincoln Rural Water System. They were asked, "What percentage of the change in the value of acreages since 1970 has been the result of the rural water system?" Their responses are given on Table IV-1. Out of sixty-two questionnaires returned, forty-seven had usable responses to this question.

While the mean of the responses was 37 percent of the change in acreage value resulted from a rural water system, the mode and the median were fifty percent and forty-eight percent respectively. As a measure of central tendency, the mean can be biased by extreme answers. In this case, twenty-one percent of the responses indicated that the rural water system had no effect on the value of acreages. This can pull the mean

down quickly. Forty percent of the respondents stated that fifty percent of the change was due to the water system.

Members may have been uncertain about the effects of the system on property values. This question was not answered on twenty-four percent of the questionnaires. In light of this, changes in the value of acreages within the system were compared with changes in the control area.

Experimental Design

Changes in the values of rural acreages were estimated in the study and control area by the following question: "In your area, how much has the value of acreages for residential use changed since 1970?" The answer was marked for dollars per acre. There were forty-four usable responses to this question in the study area and twenty from the control area.

The mean response for Lincoln Rural Water System was $1,200.56. It was $662.50 for the conrol area. The differential increase between these two areas might be due to the rural water system. In this case, the increase per acre due to the rural water system was $538.06.

A "t" test was performed to show the probability that two samples with these means came from populations with equal means. The "t" test used here tests the difference in population means with two small samples. The "t" value, with 62 degrees of freedom, is equal to 2.5312. This one tailed value is significant at the one percent level, implying that the establishment of a rural water system does increase the value of land used for rural acreages.

Table IV-1. Respondents Estimates Of The Change In The Value Of Acreages Due To The Rural Water System From 1970 to 1975.

Percent Change In Value Due To Rural Water System	Percent Of Responses
0- 24%	27.7%
25- 49%	17.0%
50- 74%	44.7%
75-100%	10.6%

Regression Analysis

Regression analysis is a statistical procedure used to show relationships between a dependent variable and one or more independent variables. The dependent variable in this case is the change in the value of acreages from 1970 to 1975. The multiple linear regression equation used is:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + U$$

Where

Y = The change in the value of rural acreages from 1970 to 1975

B_0 = A constant.

X_1 = A dummy variable for a rural water system. It is equal to 0 in the absence of a system and 1 where a system is present.

X_2 = The distance in miles to Sioux Falls.

X_3 = The distance in miles to the nearest town.

U = Random disturbance.

Rationale For The Regression Equation

The intention of this equation is to estimate the change in acreage values due to the presence of a rural water system while controlling for other factors. The emphasis is not on explaining all the change in the dependent variable. It is on the regression coefficient for the rural water system (B_1) which indicates the effect of a system on acreage values.

The dummy variable for the rural water system shifts the constant, B_0, in the regression equation. In effect the regression coefficient B_1 compares the control area (X_1=0) with the study area (X_1=1) and indicates the influence of a rural water system.

The next two variables were included not only because they influence acreage values, but also because they may be related to a rural water system. Including them in the equation may give a better estimate of the effect of a rural water system on acreage values. The second variable (X_2) was included because it would explain the effective demand for acreages by commuters to the employment center, Sioux Falls. This variable is also related to the effect of a water system may have on acreage values. The regression coefficient, B_2, is expected to be negative because the effect of commuters demand for acreages will decrease as the distance to Sioux Falls increases. The regression coefficient, B_3, is expected to be positive. This is suggested because movement out of the large urban center to be in a rural setting may make acreages away from rural towns worth more.

Regression Results

The regression equation computed from the data collected is:

$$Y_c = 918.16 + 497.36\ X_1 - 67.57\ X_2 + 71.03\ X_3 \qquad R^2 = .21055$$

$$(202.1169) \quad (23.6806) \quad (47.6281)$$

The regression coefficients are shown in front of each variable; and the standard error, in parentheses, are listed below each regression coefficient.[1] This equation explained approximately twenty-one percent of

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[1]The value of the dependent variable, without any influence from the three independent variables equals $915.16. This equation shows that as distance from Sioux Falls increased the value of rural acreages decreased $67.57 per mile. The inferences that might be made based on this estimate are constrained by the range of data for this variable; which was one to fourteen miles from Sioux Falls.

This equation shows that for each additional mile away from the closest town of any size, the value of acreages increased $71.03 per mile. This estimate is only for the range of X_2 values reported, one to eight miles.

the variation in the dependent variable (R^2 = .21055). It shows that the presence of a rural water system raised the value of acreages $497.36 over a five year period. To test the significance of this regression coefficient, a "t" test was run on it. The "t" test used here is the regression coefficient divided by the standard error for the coefficient. The degrees of freedom for this test is the number of cases, less four. The "t" value computed is 2.461 with 60 degrees of freedom. This allows us to say that this coefficient could result from sampling error only once out of a hundred times. It is significant at the .01 level.

The results of this test allow us to reject the null hypothesis and accept the hypothesis that a rural water system does increase the value of acreages. This implies that a rural water system, which may improve the standard of rural living, increases the demand for residential acreages.

Summary Of Estimations

In summary, all three estimation procedures provide evidence this rural water system increased the value of rural residential acreages. The mean of members' estimates of the change in acreage values due to the systems was 37 percent. Using the total increase of $1,200 per acre, this results in a $444 increase due to the rural water system.

The second estimation procedure indicated an increase of about $538 more in areas with rural water systems than similar areas without them. The difference might be due to other factors.

The regression procedure controlled for two of these: distance to Sioux Falls and distance to the nearest town. When these two factors were controlled for, the acreages in the area of the rural water system

were estimated to have increased by approximately $497 more than in similar areas.

Residential Home Values

With the development of a rural water system, the value of housing may increase. The provision of domestic water from a rural water system may reduce water costs and increase the demand for housing with these facilities.

Hypothesis

The hypothesis to be tested here is whether the value of housing increases more with a rural water system than without. The null hypothesis is that housing values are not affected by the rural water system. The alternative hypothesis is that housing values increase faster where homes are served by the rural water system.

The reasons why the alternative hypothesis may be true are the same as presented for rural acreages. A rural water system may reduce costs associated with water use within the household. Not only the cost of the water itself, but the cost of treatment and maintence may be reduced.

Also, the use of water related appliances may be encouraged by a rural water system. Other studies cited in the literature review have reported increased purchases of new appliances after a water system is established. This may lead to an increase in demand for homes with the services of a rural water system.

This situation was explored using an experimental design to compare the study and control area. Then regression analysis was used to estimate the influence of a rural water system on home values.

No qeustion directly asking members to report their estimate of this relationships was made, so their perceptions are not included in the next section.

Experimental Design

Information was gathered by asking respondents to estimate the percent change in market value of their home since 1970. The results of this question are presented on table IV-2. The mean increase in home values was 68.8 percent in the study area and 58.1 percent in the control area. The mode for the control area is 50 percent. It should be noted that the mode was one-hundred percent for the rural water system. This suggests that although the means are close, there is a difference in the increase in home values between the two areas.

To determine whether these two samples came from populations that are significantly different from each other, a "t" test was performed. The "t" value was .6372 with 48 degrees of freedom. The difference in samples is not significant at the twenty-five percent level. As a test of the hypothesis, this procedure was inconclusive. The next step was to use regression analysis to see if controlling for other factors would give a better estimate of the influence of a water system on home values.

Regression Analysis

Estimates of the relationship between home values and rural water systems may be biased by other factors affecting these two variables. Regression analysis was used to control for the age of the house, distance to Sioux Falls and distance to the nearest town. The form of equation used is the following:

Table IV-2. Percent Change In Home Values for Lincoln Rural Water System And Control Area From 1970 to 1975.

	Percent of Responses	
Percent Change	Lincoln Rural Water System	Control Area
0 - 49	47.1	37.5
50 - 99	17.8	37.6
100 and over	35.3	25.1

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + U$$

Where

Y = The percent change in home values from 1970 to 1975.

B_0= A constant.

X_1= A dummy variable equal to 1 where a rural water system is present, and equal to 0 in the absence of a system.

X_2= Age of the house in years.

X_3= Distance in miles to Sioux Falls.

X_4= Distance in miles to the nearest town.

U = Random Disturbance.

The age of a house (X_2) is an indicator of its value and may be related to membership in a rural water system. It may be more probable to install a rural water hookup in a new house than an older one. The cost of installation may not pay off on an older home. Also, the presence of a rural water system is unlikely to encourage the building of a new house.

The distance variables (X_2 and X_3) will affect the extent to which housing is demanded by commuters. This may be related to membership in a rural water system in that commuters may have prefrences for a water system over other alternatives.

The fitted regression equation is:

$$Y_c = 54.56 + 11.58X_1 + 0.42X_2 + 2.80X_3 + 12.57X_4 \qquad R^2 = .2743$$

$$(12.6478) \quad (.2283) \quad (1.5758) \quad (3.4516)$$

The regression coefficient for the water system variable can be interpreted in terms of the change in home values. In the Lincoln Rural Water System, there has been a 11.58 percent increase in the

change in house values compared to the control area.

The significance test of this regression coefficient can be determined by a "t" test. The "t" value is 0.9155 with 58 degrees of freedom. Thus, the null hypothesis can be refuted at the twenty percent level. While this allows us to accept the alternative hypothesis, it is not a strong indication that a rural water system increases home values.

The regression coefficients for 1/2 and 1/3 came out with signs opposite of what was expected. The percent change in home values over a five year period was thought to decrease with older houses. What these results show, is that the percent increase in older homes is greater than the percent increase in newer ones. These houses ranged from new to over sixty years old.

The distance to Sioux Falls was expected to have a negative relationship to the percentage increase in home values. What B_2 and B_3 indicate is that as the distance from Sioux Falls and the nearest town increased (within the range of data for X_2 and X_3) the percentage increase in house values was large.

These results may be due to lower initial values for older homes, farther from Sioux Falls or any town. A more valueable house would show less of a percentage increase from a given increase in value, as compared to a cheaper house.

<u>Summary Of Estimations</u>

In summary, the first procedure showed that there was a 10.7 percent greater increase in home values where they are served by the rural water system. The second procedure, regression analysis, indicated that the influence of a rural water system raised the percentage increase

(11.6) units in home values from 1970 to 1975.

Agricultural Land

The development of a rural water system is expected to result in an increase in the value of agricultural land. As presented earlier, this was the most common result reported in other studies. A rural water system may affect agricultural land in more ways than just the market value, but this is the only aspect considered in this study.

In this section, the expected impact on the value of agricultural land is formulated into null and alternative hypothesis. Then the rational for the hypothesis and the tests used on the hypothesis are discussed. Last, an analysis and interpretation of this procedure are presented.

Hypothesis

Formally, the null and alternative hypothesis are expressed in the following form.

Null hypothesis: The establishment of a rural water system does not increase agricultural land values.

Alternative hypothesis: The establishment of a rural water system does increase the value of agricultural lands.

In these hypotheses, the value of agricultural land values are stated as increasing variables because their value is rising with inflation. This study attempts to indicate the increase in value attributable to the rural water systems.

Conceptual Justification of Hypothesis

The introduction of a rural water system may result in improved agricultural production. The net increase in income from production gains will be capitalized in land values.

The value of pasture land may increase where a rural water system reduces the cost of water used in livestock production. Improved water quality may increase livestock productivity. Better distribution of water with the convenience of reduced mainteince may increase productivity and increase the demand for land served by the rural water system.

A rural water system will probably not increase the value of cropland. Because water from a rural water system cannot be used for field irrigation, cropping practices and productivity will probably remain the same. Consequently, it is unlikely that crop-land value will increase in response to the establishment of a water system. However, many farms are sold as a unit with the house sold with the farmland. In order to own a farm where the house is served by a water system, a buyer may be willing to pay more for the entire unit. Another increase in demand for agricultural land could come from speculation, or actual development, for rural acreages. For these reasons, a rural water system may increase the value of agricultural land.

Hypothesis Testing

This hypothesis was tested by direct estimates of members of the rural water system, then by comparison with a control area through experimental design and regression analysis. Each approach has its own merits and each gave different results.

Members' Estimates

Estimates of the impact of a rural water system on agricultural land came from a series of three questions asked of rural water system members who made some or all their income from agriculture. The questions were:

"In your area, what effect has the rural water system had on land values?"

"What percent of the land in your unit has been affected in value because of the rural water system?"

"What percent of the change in land value has been a result of the public water system?"

The first question asked respondents to indicate if values had increased, decreased, or if the water system had no effect. An increase in land values was indicated by eighty-four percent of the respondents. No effect was reported by thirteen percent. A decrease in land values was the response given by three percent. Only fifty percent of those returning the survey answered this question. This response rate may be due to uncertainty about the effect of a rural water system on land value.

To test whether these results are different from those that might occur by chance due to sampling error, a chi squared test was performed. The chi squared value was 36.0762, which was significant at the twenty-one percent level. Although the results indicate that land values have increased as a result of the rural water system, the chi squared test shows that the distribution of response could be due to sampling

error approximately 21 times out of 100 samples.

The second question asked for the percentage of the farm affected by the rural water system. As Table IV-3 shows, the most frequent answer was one-hundred percent. Over half the responses indicated fifty percent or more of the farm was affected. On the other hand, over forty percent of the responses indicated either none or less than a fourth of the farmland was affected. See Table IV-3 for the distribution of the responses.

The third question asked the respondents to estimate the percentage change in land values that was the result of the rural water system. (The distribution of responses is shown in Table IV-4.) The most frequent response was that fifty percent of the change in land value was due to the rural water system. The mean value of members' estimates was thirty-one percent.

The majority of the respondents to the question on the impact of the system on land values said that the rural water system does result in higher agriculture land values. The response to the question on the amount of land in the farm unit affected by the rural water system was bimodal. Generally, farmers felt either all the farm was affected, or that only a small percentage of the farm was. Farmers on the rural water system estimated land value increased as a result of the rural water system by a mean value of thirty-one percent.

This method has the advantage that land owners are living in the impact area and are familiar with it through their ownership of farm

Table IV-3. Percent of Land Affected in Value by The Rural Water System.

Percent of Land Affected	Number of Responses	Percent of Responses
0	5	18.5
1-24	7	25.9
25-49	0	0
50-74	3	11.2
75-99	2	7.4
100	10	37.0

Table IV-4. Percentage of Change in Land Value Resulting From the Rural Water System.

Percent Change in Land Values	Number of Responses	Percent of Responses
0	4	16.7
1-24	7	29.1
25-49	3	12.5
50-74	8	33.4
75-99	0	0
100	2	8.3

land. However, they may not have any systematic way to compare local changes with changes in similar areas and to control for other factors affecting land value. In times of inflating land values, it may be hard to separate out the effect of the rural water system from that of the general inflation rate. This leads us to try experimental design and regression analysis to study the impact of a rural water system on land values.

Experimental Design

A second way of testing the hypothesis that rural water systems increase the value of agricultural land is to compare the rate of change with a control area. The control area selected for this study is near the rural water system and also near Sioux Falls. The close proximity of the two areas subjects them to similar market price effects and market demands. One of the major differences between the two areas is the rural water system. Consequently, any differential increase may be attributed to the rural water system.

From 1970 to 1975, farm values increased 29.2% more in the area served by the rural water system. Table IV-5 shows the average values reported on the questionnaire. Assuming the price effects are similar in the two areas, the rural water system may account for this difference in the rise of farm values.

As well as an increase in land value, addition to farm size will result in a rise of farm value. To control for this, the increase in value per acre was examined. This is reported on Table IV-6. The average increase in value per acre was \$562.97 in the study area and \$449.02 in the control area.

Table IV-5. Change in Average Farm Value of Agricultural in Lincoln Rural Water System and Control Area From 1970 to 1975.

	Average Farm Value 1970	Average Farm Value 1975	Change in Farm Value from 1970 to 1975	Percent Increase
Lincoln Rural Water System	137,367.50	289,654.06	152,286.56	110.9%
Control Area	155,799.94	283,149.87	127,349.93	81.7%
Difference Between Change in Farm Value For Lincoln Rural Water System and the Control Area			$24,936.63	29.2%

Table IV-6. Change in Average Value Per Acre of Agricultural Land For Lincoln Rural Water System and the Control Area For 1970 and 1975.

	Average Reported Value Per Acre In 1970	Average Reported Value Per Acre In 1975	Change In Value Per Acre	Percent Change
Lincoln Rural Water System	464.96	907.18	442.22	95.1%
Control Area	562.67	1011.60	449.02	79.8%
Difference Between Change in Value Per Acre For Lincoln Rural Water System and Control Area				+15.3

Assuming inflation and other price effects have caused an increase of 79.8 percent in both areas, the rural water system has lead to an additional 15.3 percent increase in the value of agricultural lands. This means that, in the area served by the rural water system, 16.1 percent of the total increase in value per acre appears to be due to the system. In a nominal amount, this equals a $71.15 addition to the value per acre.

Rather than reporting the members perception of price changes, this model compares price changes in adjacent areas. While this would offer some comparison of change in land values with and without a rural water system, it does not separate out the influence of the rural water system alone. This influence can be statistically seperated in regression analysis.

Regression Analysis

The amount of change in agricultural land values that occurs with the development of a rural water system is estimated by the regression coefficient for rural water systems. The equation used here is the following:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + U$$

Where

Y = The change in the value of agricultural land from 1970 to 1975.

U = Random disturbance.

X_1 = A dummy variable equal to 1 with a rural water system and 0 in the absence of a system.

X_2 = The distance in miles to Sioux Falls.

X_3 = The distance in miles to the nearest town.

The intention of this equation is not to explain all the variation in agriculture land values. Rather it is to estimate the amount of change in land values that can be attributed to the establishment of a rural water system. The rationale for the distance variables (X_2 and X_3) is similar to that present for rural acreages. The equation estimated is:

$$Y_c = 469.17 - 62.27X_1 + 5.80X_2 - 9.64X_3 \qquad R^2 = .031$$
$$(93.5367) \quad (11.3904) \quad (22.2279)$$

These results are based on 30 observations. The reason for the low number of observations is that each value of Y_c required data on 4 variables: the value of the farm in 1970, the number of acres in 1970, the value of the farm in 1975, and the number of acres in 1975. In many cases one or more of these values was not reported.

None of the coefficients are significant at the twenty percent level of significance. Furthermore, only three percent of the variation in Y_c is explained by this equation. These results suggest that agricultural land values are not influenced positively by the rural water system. However, the small sample size vakes this a very weak test.

Summary Of Estimations

In summary, eighty-four percent of respondents indicated agricultural land values had increased as a result of rural water systems. They estimated that fifty-three percent of their farmland was affected and that thirty-one percent of the change in value per acre was due to the rural water system. This may be translated into an increase of 16.4 percent for the entire farm.

A similar result was obtained from the experimental design esti-

mation approach. This approach indicated that agricultural lands had increased by 16.1 percent faster in the Lincoln Rural Water System area than in the control area. This equals an increase of approximately $71.15 dollars per acre.

The regression analysis did not confirm these estimates. When distance from Sioux Falls and the nearest town were held constant a negative coefficient was obtained on the rural water system variable. None of these coefficients were statistically significant at the twenty percent level. However, they do cast doubt on the results obtained from respondents' observations. It is reasonable to expect less of an impact on agricultural lands than on residential acreages. However, there appears to be little theoretical justification for the regression results. The lack of significance implies that the sign could easily reverse direction with a few more observations.

Residents

Where a rural water wywtem is developed, the population of the area may change. The number of households increase, and the proportion of various types of residents may be altered. As was stated in the literature review, this is more likely to be the case near growing urban centers like Sioux Falls. This section will explore the change in number and type of residents in Lincoln Rural Water System.

The mean length of residency is 10.7 years in the water system area and 19.7 years in the control area. Although the difference in means may be the result of a trend which started prior to the rural water

system, the difference in modes shows relationship similar to the means. In fact, the difference in modes is even greater. For the rural water system, the mode of length of residency is 4 years compared to 15 years for the control area. It is worthwhile to note that both the mode (4 years) and median (5 years) of residency in the study area fall within the period since the start of the rural water system. This may imply that the water system is attracting new residents to the area.

Since the start of the rural water system, the mixture of residency types have changed proportion. Table IV-7 shows the proportion of farm and rural residencies in the study and control area for the last five years and earlier. The type of residence is classified by the respondents indicated description of their home. This shows not only more new residencies in the study area, but also a large proportion of non-farm, rural residences. New residencies are defined as those 5 years old or less, and established are those residencies older than 5 years.

The change of population may be due to other factors besides the rural water system. To explore this possibility, members of the water system were asked whether their decision to move to the area (or to stay there) was affected by the formation of the rural water system. The possible answers to this question were limited to yes, maybe, and no. Table IV-8 shows responses to this question by new residents, established residents and then all the residents reported in the questionnaire.

It is interesting to notice that all those people indicating that the rural water system definitely influenced their choice of living location, were new to the area. This may be partially <u>ex post</u> rationalizing after their choice of location is already chosen. However, this

Table IV-7. The Proportion Of New And Established Residencies By Farm And Rural Non-Farm Types In The Area Of Lincoln Rural Water System And The Control Area.

Type of Residency	Lincoln Rural Water System: Percent of New Residencies	Lincoln Rural Water System: Percent of Established Residencies	Control: Percent of New Residencies	Control: Percent of Established Residencies
Rural Residency	39.3	13.1	5.9	7.6
Farm Residency	16.4	31.1	11.8	64.7
Total	55.7	44.2	17.6	82.3

Table IV-8. The Influence By The Rural Water System On New And Established Residencies In The Area Of The Lincoln Rural Water System, 1975.

	Influenced By Rural Water System			
	Yes (%)	Maybe (%)	No (%)	Total (%)
New Residents	27.7	2.1	29.8	59.5
Established Residents	0	2.9	37.6	39.6
All Residents	27.7	5.0	67.4	100%

is not likely because approximately half of the new residents indicated the water system did not influence their choice to live in that area. It may be that some of the residents have more flexibility in their choice of where to live and can take advantage of living where there is a rural water system. If this is the case, then the type of residency may show this difference.

The influence of the rural water system on individuals' decisions of where to live, is broken down by type of residence in Table IV-9. All of the respondents indicating that their location decision was definitely influenced by the rural water system were new non-farm rural residents. This suggests that for rural residents, the rural water system was part of the appeal of the area. However, 37.5 percent of all new non-farm rural residents responded that their decision was not influenced by the water system.

None of the new or long established farm residents' location decisions were definitely influenced by the rural water system. Twelve percent of the long established farmers responded that maintaining their current residence may be influenced by the water system. All of the new farmers and eighty-eight percent of the long established farmers said that the water system had no influence on their location decision.

In summary, twenty-three percent of the respondents said the water system definitely influenced their decision to locate in the area. Seventy-two percent said it had no impact on their location decision. The percent of new residents affected in their location decision by the rural water system was 41.2% of all new residents and 58.4% of new non-farm residents.

Table IV-9. Type Of Residency By Influence Of The Rural Water System On The Decision To Locate In That Area, Lincoln County, S.D. 1975.

Type Of Residency		Influence Of Rural Water System On Location Decision: Yes (%)	Maybe (%)	No (%)	Total
Rural Residency	New	23.0	1.6	14.8	39.4
	Established	0.0	0.0	13.1	13.1
	Both	23.0	1.6	27.9	52.5
Farm Residency	New	0.0	0.0	16.4	16.4
	Established	0.0	3.2	27.9	31.1
	Both	0.0	3.2	44.3	47.5
Total	New	23.0	1.6	31.3	55.9
	Established	0.0	3.2	40.9	44.1
	Both	23.0	4.8	72.2	100.0

Students

With the changes in residents described in the previous section, a question naturally arises about changes in the number of students. In this section, students are defined as those children in grades one through twelve. New students are from families living in the area five years or less, and established students are from all other families.

A comparison of students per household between Lincoln Rural Water System and the control area is given in Table IV-10. The combined ratio for all residencies in the control area is less than one third of the combined student per household ratio in the study area. Another difference between the two areas is that for the control area, the student ratio for all new residents is nearly twice that for all established residents. In the area of the water system, the student per household ratio for new residencies is three-fourths the ratio for established residencies.

It is interesting that even with the differences between the two areas, the relationship between students from non-farm and farm residencies is the same in both areas. For both new and established residencies, the non-farm student ratio is larger than the farm student ratio. This relationship may be important in the area of a rural water system because as was shown in the last section, a rural water system attracts more non-farm residents than farm residents.

The information in Table IV-11 shows that only non-farm residents reported the rural water system influenced their decision to live in

Table IV-10. Students Per Household In The Rural Water System And Control Area By Type Of Residency, 1975.

		Rural Water System	Control
Non-Farm Rural Residencies	New	1.48	1.50
	Established	2.29	0.67
	Combined	1.67	0.88
Farm Residencies	New	1.30	0.33
	Established	1.72	0.33
	Combined	1.57	0.33
All Residencies	New	1.42	0.80
	Established	2.08	0.42
	Combined	1.71	0.48

Table IV-11. Students Per Household By Type Of Residency And Influence Of Rural Water System On Residency Location, Lincoln County, 1975.

Type Of Residency		Influence Of Rural Water System On Residency Location: Yes	Maybe	No
Non-Farm Rural Residencies	New	2.21	3.00	1.25
	Established	NR	NR	.86
	Combined	2.21	3.00	1.07
Farm Residencies	New	NR	NR	1.30
	Established	NR	.50	1.73
	Combined	NR	.50	1.56
All Residencies	New	2.21	3.00	1.27
	Established	NR	.50	1.45
	Combined	2.21	1.33	1.37

that area. These non-farm rural residents influenced by the water system had the highest student ratio. Also, regardless of the influence of the rural water system, non-farm rural residents had a higher student ration than farm residents.

In summary, the proportion of non-farm to farm residencies grows, the overall students per household ratio will increase. This will happen even faster if the new non-farm residents are the type that were attracted by the rural water system. Of the new students from non-farm residencies, 70.4 percent of them can be attributed to the rural water system. Of all new students, 54.4 percent can be attributed to the rural water system.

Chapter V

SUMMARY, POLICY IMPLICATIONS, AND FUTURE RESEARCH

Summary

Within South Dakota, twelve rural water systems provide water for over 3,800 customers. Twenty-one more systems are proposed or under construction. They will serve over 78,500 customers. If each hook-up serves an average of three people, up to thirty-five percent of the state's population will be served by rural water systems.

The growth of rural water systems can be explained by the benefits provided to customers. In considering the establishment or expansion of a water system, these benefits have been generally considered. Recently, however, it has been suggested that rural water systems may have adverse side effects on local units of governments.

It has been suggested that water systems attract non-farm rural residents. This may lead to higher expenditures for government services. On the other hand, new homes and rising land values for residential acreages also lead to higher tax revenues. This situation raises the question of what the net fiscal impact on local units of government will be when a rural water system is developed. The scope of this study is to provide the data that could be used to estimate these fiscal impacts.

The variables to be estimated correspond to the specific objectives given below.

A. Estimate the change in agricultural land values due to the rural water system.

B. Estimate the change in the value of residential acreages due to the rural water system.

C. Estimate the change in the value of housing due to the rural water system.

D. Estimate the change in the number of residents due to the rural water system.

E. Estimate the change in the number of students due to the rural water system.

A review of literature reports on the impacts of a rural water systems estimated in several previous studies. Results of these studies indicate that in some cases a water system encouraged livestock production. Land values for agricultural and residential uses were reported to increase as a result of the water system. Reports of home improvements and new housing attributed to rural water systems were also presented. These impacts may be the result of new residents attracted to the area by the water system. The results of these studies suggest the impacts that may be found in South Dakota.

Many of these studies reported only members perceptions of the impacts of a rural water system. While members are knowledgable about their own situation, it is hard to separate and compare the effect of a water system in times of inflating land and housing values. In studies where comparisons were made with other areas, the data did not reflect changes over time. Only differences between the two areas are shown. Factors that could cause similar changes in home and land values are not controlled for. This study attempted to improve on the methods used in previous studies to measure the effect of a rural water system in South Dakota.

The sampling design used is a stratified random sample in the area of the water system and a control area. The sample population was divided between those specializing in agriculture and other rural residents. An equal proportion of individuals were randomly drawn from each group. The control area was three townships; Benton, Split Rock, and Wayne, located near the rural water system and Sioux Falls. The control area was chosen such that factors other than the presence of a rural water system would be the same as in the study area. The overall response rate to the questionnaire was 38.7 percent.

Some of the questions asked members to estimate the effects of a rural water system. Other parts of the questionnaire asked for longitudinal data. Members of the water system and residents of the control area were asked to estimate the changes in the value of housing and land from 1970 to 1975. Since the general price effects may be expected to be similar in both areas, the difference between the two areas in changes in land and home values may be attributed to the rural water system. Other factors that may affect the change in land and home values are distance to the Sioux Falls, distance to the nearest town, and for housing, the age of the house. Regression analysis was used to control for these factors and seperate the change explained by the presence of the rural water system.

Results And Policy Implications

The results of this study show the impact of a rural water system on selected variables related to the finances of local units of government: value of residential acreages, value of rural residencies,

value of agricultural lands, number of new residents and number of new students. The study does not give a final estimate of the change in revenues and expenditures for local units of government. The information provided here may make it possible to estimate the final net impact on local government, but such an analysis is beyond the limitations of this study.

The change in the value of residential acreages was the first variable estimated. Members estimates indicated acreages increased $444 per acre. The experimental design estimates indicate that the value per acre for residential land increased $538 more in the area served by the rural water system than in a similar area without a system. Using regression analysis to control for the effect of the distance to Sioux Falls and the distance to the nearest town, the value per acre increased $497 more than in similar areas. Thus, local real property tax revenues from residential acreages may rise with the development of a rural water system.

The increase in home values was 10.7 percent greater where there was a rural water system than in a similar area without one. Other factors that may affect home values, controlled for in regression analysis, are age of the house, distance to Sioux Falls and distance to the nearest town. Using regression analysis the rural water system explained 11.6 percent of the rise in home values when holding constant these other variables. The result for local units of government may be more real property tax revenues in the area served by the rural water system.

The change in value of agricultural land was estimated to be 16.4

percent by members of the rural water system. Experimental design results indicated that changes in the reported value per acre of farm land were 16.1 percent higher in the rural water system area. This represents a differential increase of about $71 per acre. Regression analysis on this variable was insignificant because of small sample size. Based upon the first two estimates, tax revenues from land values may increase.

The estimated numbers of new residents and new students attributed to the rural water system were determined by responses to a question on the influence of the water system on place of residence choices. This showed that forty-one percent of the new residents and fifty-four percent of the new students can be attributed to the rural water system. This means there was a sixty-nine percent increase in the new residents and ninty-eight percent increase in the number of new students. This suggests that residents and students are increased due to a rural water system. Further, nearly all of the new residents were non-farmers. This change in population composition as well as the increase in population size may encourage larger local government expenditures.

Recommendations For Future Research

As the number of rural water systems grow, the effects of related impacts will be more extensive. Fully understanding the extent of these impacts will be more important as more of the state is affected. The information presented here can be used to estimate the fiscal impact of a rural water system on local units of government. However, as more of the state is covered by water systems, similar information may need to be gathered in other locations.

If further studies are made, the procedure used to collect information could be improved several ways. A limitation of this study is that it is over one five year period. If a true longitudinal study is used, the accuracy of data collected may improve. The general factors affecting land and house values can be measured while the rural water system is developed. This may eliminate the need for a control area.

Annual measurement of change in land and home values may show some immediate, one-time, increases and some trends of steady long-run increases. If annual increases in new residencies result from a rural water system, the annual price changes in acreages and housing will reflect this long-run trend.

The sampling design might be improved by a complete survey of the entire population of parts of the area served by the rural water system. Combined with the longitudinal design, this would allow serving all new residents as they moved into the area. Also, a record of the residents who move away would improve the accuracy of the information collected. If these studies are started soon enough, they can collect information on the area before the development of the new rural water systems.

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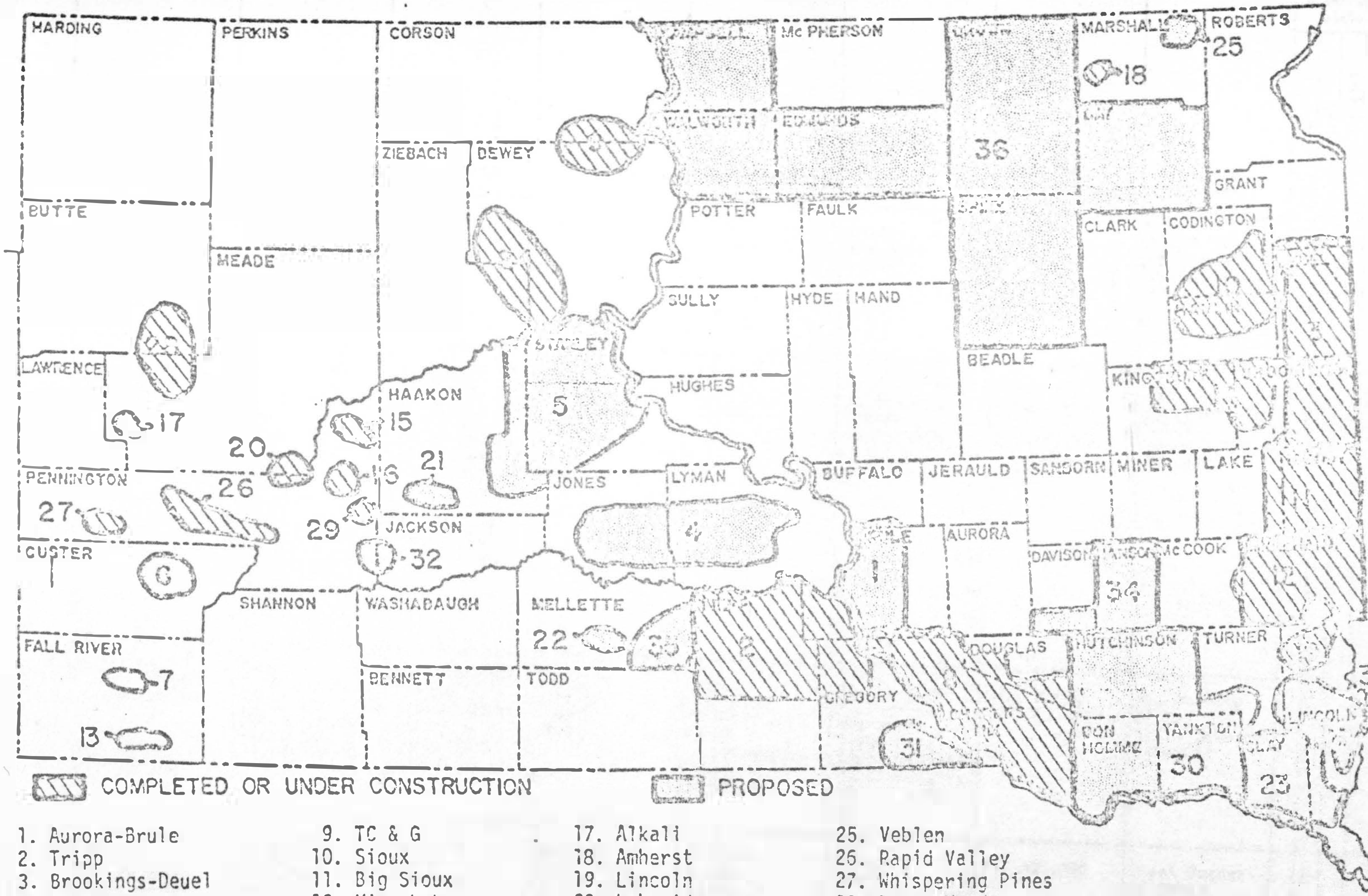
APPENDICES

APPENDIX A: DATA ON SOUTH DAKOTA RURAL WATER SYSTEMS

APPROXIMATE LOCATIONS OF RURAL WATER SYSTEMS



1. Aurora-Brule
2. Tripp
3. Brookings-Deuel
4. Lyman-Jones
5. Cheyenne
6. Hermosa
7. Cascade
8. Randall
9. TC & G
10. Sioux
11. Big Sioux
12. Minnehaha
13. Horsehead
14. Kingbrook
15. Johnson
16. Squaw Creek
17. Alkali
18. Amherst
19. Lincoln
20. Lakeside
21. Old Trail
22. White River
23. Clay
24. Fox Ridge
25. Veblen
26. Rapid Valley
27. Whispering Pines
28. Butte-Meade
29. Peno-Basin
30. B-Y
31. East Gregory
32. Cedar
33. South Lincoln
34. Hanson
35. Wood
36. NEB

Characteristics of Rural Water Systems in South Dakota

	System	Current Status / Eng. Prog.	Area To Be Served	No. of Customers	Municipalities	Source of Water	Estimated Cost	Officers	(X) Organization Status: Committee	Incorporated	Sanitary District	Water User District
1.	Aurora-Brule Rural Water System Hoskins, Western, Sonderegger	Revising feasibility study to cover initial phase of western Brule County	Western 1/2 of Brule County	Rural - 369	None	Surface - Missouri River		Lloyd Keiner Chamberlain, South Dakota 734-6169		X		
2.	Tripp County Water User District Van Gundy & Associates, Bartlett & West	Engineering feasibility study and construction plans completed-Bid letting 4/12/77 Funds: State $200,000 Federal $2,655,000 Public Health $260	E portion of Mellette County N 1/2 of Tripp County West side of Gregory County, South tip of Lyman County South of White River	Rural - 510 Urban - 40	Bulk: Witten, Carter	Well - 9 mi. South of Winner 53,000,000 gal. annually 162.7 ac-ft/yr.	Phase I $2,850,000 Phase II $1,400,000 $33/mo./User	Martin Jorgensen, Jr. Ideal, South Dakota 842-3217				X
3.	Brookings-Deuel Rural Water System DeWild, Grant, Reckert & Associates	Under Construction Phase I: 2/3 Complete Phase II: 1/2 Complete	E. Brookings County & Deuel County touching into Grant County	Rural & small towns 950	Bulk: Toronto, Brandt, White Individual: Goodwin, Altamont	Well - 3 mi. N of Bruce and near Clear Lake 100.2 million gal. annually 307.5 ac.ft./yr.	$4,115,000 $25 mo./user	Wm. Dempsey White, South Dakota 629-6681		X		
4.	Lyman-Jones Water Development Association	In limbo. No progress for sometime	Lyman & Jones Counties	Estimate 2,019 taps 1,239 users 652 rural meters	Oakaton, Murdo, Draper, Vivian, Presho, Kennebec, Reliance, Oacoma	Missouri River	$17,000,000	Frank Woster Reliance, South Dakota		X		

	System	Current Status / Eng. Prog.	Area To Be Served	No. of Customers	Municipalities	Source of Water	Estimated Cost	Officers	(X) Organization Status: Committee	Incorporated	Sanitary District	Water User District
5	Cheyenne Water Assoc. Dana, Larson, Roubal & Associates	Preliminary Engineering Completed	Stanley County & Haakon County	Rural - 125 Urban -1,000	Bulk: Fort Pierre Hayes Midland	Missouri River	$6,275,000	A.H. Rose 1227 E. Dakota Pierre, South Dakota 224-5094	X			
6	Hermosa Water Users Association SCS	Engineering feasibility study completed construction plans not completed Funds: Federal $500,000	S of Fairburn to N of Hermosa in Custer County	Rural - 22 90 mi. pipeline	Bulk: Fairburn, South Dakota	Well - abandoned titan missle site 34,600,000 gal. annually 106.2 ac-ft./yr.	Not Available	Wesley Harrison Hermosa, South Dakota 255-4136		X		
7	Cascade Water Line Plains Engineering	Engineering feasibility study & construction plans completed Funds: Federal $117,905	From the City of Hot Springs 6-1/2 miles SW along Hwy 71	Rural - 30 6-1/2 miles of pipeline	None	Not Available	Not Available	A.E. Inman Hot Springs, South Dakota 745-5732				
8	Randall Community Water District Van Gundy & Associates	Under Construction Funds: State $ 300,000 Federal $6,209,050 FHA $1,990,000 BIA Public Health Serv. $84,687 EDA $500,000 Individual $406,700	Charles Mix & Douglas Counties, part of Brule Co.	Rural-1,370 1,025 miles pipeline	Bulk: Platte, Geddes, Wagner, Armour, Marty Housing, Greenwood Individual: Dante New Holland	Lake Francis Case 209,000,000 gal. annually 641.4 ac.ft./yr.	Phase I $598,000 Phase II $3,806,000 Phase III $4,621,000 Total $9,927,000	Ken Dvorak Lake Andes, South Dakota 384-3217				X

	System	Current Status / Eng. Prog.	Area To Be Served	No. of Customers	Municipalities	Source of Water	Estimated Cost	Officers	(X) Organization Status			
									Committee	Incorporated	Sanitary District	Water User District
9.	T.C. & G. Water Assoc. Van Gundy & Associates	Completed	Trail City & Glencross Area	Rural - 58 Urban - 25 85 miles of pipeline	Individual: Trail City, Glencross	60' deep well in Timber Lake Basin 14,000,000 gal. annually 43.0 ac-ft./yr.	$295,000 $26/mo./user	Louie Merkel Glencross, South Dakota 865-3319		X		
10.	Sioux Rural Water System, Inc.	Completed	Hamlin County & parts of Codington & Deuel Counties	Rural - 679 370 miles of pipeline	Bulk: Bryant, Hazel, Kranzburg, Individual: Bemis, Vienna, Grover	Wells - 2 @ Hayti & 3-5 miles S of Watertown 85,000,000 gal. annually 260.9 ac-ft./yr.	approximately $27.50/mo./user	Leo Heyn R.R. # 4 Watertown, South Dakota 886-6493		X		
11.	Big Sioux Community Water System, Inc. DeWild, Grant, Reckert & Associates	Completed	All of Moody Co., E 1/2 Lake County, portion of S. Brookings County	Rural - 900 460 miles of pipeline	Bulk: Wentworth	2 wells 1/2 mile East of Egan, South Dakota 800 ac-ft./yr.	$3,300,000 $25/mo/user	Loren Paulsen Flandreau, South Dakota 997-3379		X		
12.	Minnehaha Community Water System Hoskins, Western, Sonderegger, Inc., & Schmitz, Kaida & Associates	Under construction, engineering feasibility study & construction plans completed, Funds: State $300,000 Federal $6,000,000 (5.4 million loan & $600,000 grant) Minnehaha County $33,000	All of Minnehaha Co. & 14 Subscribers adjacent to Minnehaha Co. line in Moody, McCook & Lincoln Co.	Rural - 1,494 Urban - 48 680 miles of pipeline	Individual: Ellis, Lyons, Hartford, Renner, Sherman, Rowena	Wells - 156,000,000 gal. annually 475.8 ac-ft./annually	Section 1: $1,826,297 Section 2: $1,694,723 Section 3: $ 594,585 Section 4: $ 554,765 Section 5: $ 41,607 Section 6: $ 910,938 Section 8: $ 52,265 Total $5,744,081 $24-$26/mo./user	Eric J. Hermanson Garretson, South Dakota 594-3963		X		

	System	Current/Eng. Status/Prog.	Area To Be Served	No. of Customers	Municipalities	Source of Water	Estimated Cost	Officers	(X) Organization Status: Committee	Incorporated	Sanitary District	Water User District
13.	Horsehead Pipeline SCS	Project dropped	SE Fall River County	Rural - 7 40 mi. pipeline	None	Well 5,966,332 gal. annually 18.31 ac-ft/yr.	$125,000	Oscar Cope Oelrichs, South Dakota 535-6321				
14.	Kingbrook Rural Water Syst. DeWild, Grant, Reckert & Associates	Phase I: Under Construction	Bruce to Hwy. 25, Poinsett to Hwy. 14	Rural - 559 Urban - 272 457 mi. of pipeline	Bulk: Wetland, Badger, Lake Norden	Well - 3 miles N. of Burce	$3,458,000	Alec Vedvei Hetland, South Dakota 983-5450		X		
15.	Johnson Water Association SCS	Completed Funds: State $ 9,600 Federal $37,000 FHA $48,000 Individual $ 2,000	7 farms and/or ranches near Creighton, South Dakota	Rural - 7 26 mi. pipeline	None	Well 7,300,000 gal. annually 22.4 ac-ft/yr.	$96,000 $55/mo./user	Veryl Schroeder Creighton, South Dakota 457-2555		X		
16.	Squaw Creek Water Users Association SCS	Complete	8 farms and ranches (includes 1,200 head of livestock)	Rural - 8 families 20 miles of pipeline	None	Well - 3,300' deep	$90,100 $40/mo./user	Harlan Eisenbraun Creighton, South Dakota		X		
17.	Alkali Water Users Association	Early Organization	Small area in SW Meade County	Unknown	None	Titan Missile Site	Not Available	Albert Keffeler Hereford Rt. Sturgis, South Dakota 347-2225		X		

	System	Curren Status/ Eng. Prog.	Area To Be Served	No. of Customers	Municipalities	Source of Water	Estimated Cost	Officers	(X) Organization Status			
									Committee	Incorporated	Sanitary District	Water User District
18.	Amherst Water Works Association, Inc	Completed, FHA loan	Small Unincorporated town	Rural - 25 1/2 mile of pipeline	Amherst	Well - artesian 950'	$2.00/mo./ user	Paul Symens Amherst, South Dakota 448-5775		X		
19.	Lincoln County Rural Water System DeWild, Grant, Reckert & Associates	Completed	SE corner of Minnehaha County, N portion of Lincoln County	Rural - 265 Urban - 200 145 miles of pipeline	None	Well-City of Sioux Falls	Phase I: $1,000,000 Phase II: $ 520,000 Total $1,520,000 $22/mo./user	Richard Lommen Harrisburg, South Dakota 743-2165		X		
20.	Lakeside Water User District SCS	Completed	Parts of townships 3N 13E & 3N 12E BHM 2N 12E & 2N 13E BHM Meade & Pennington Counties	Rural - 21 71 miles of pipeline	None	2 wells	$49.80/mo./ user	Dave Barber Owanka, South Dakota 798-2223				X
21.	Old Trail Rural Water System SCS	Early Organization	5 - 15 miles N of Philip	Rural - 8-15 30 miles of pipeline	None	Well-15 mi. N. of Philip	$250,000		X			
22.	White River (city)	Early Organization	Mellette County area near White River, South Dakota	Not Available	White River	Not Available	Not Available		X			

	System	Current Status / Eng. Prog.	Area To Be Served	No. of Customers	Municipalities	Source of Water	Estimated Cost	Officers	(X) Organization Status: Committee	Incorporated	Sanitary District	Water User District
23.	Clay Rural Water System DeWild, Grant, Reckert & Associates	Engineering feasibility completed	All of Clay County and West and Central Union County	Rural - 947 Urban - 30	Individual: Burbank, Meckling	Two Alternatives: 1) Use Vermillion water supply 2) wells & treatment plant 6 miles South of Centerville	$4,443,000 Approx. $28/ mo./ user	Ernest Schmidt R.R. #3 Vermillion, South Dakota 624-4509	X			
24.	Fox Ridge Rural Water System	Eagle Butte receiving water, rural area not complete	Eagle Butte & rural area between Moreau and Cheyenne Rivers	Rural - 10 Urban - 704 23 miles of pipeline	Bulk: Eagle Butte	Surface Water, Oahe Reservoir, Cheyenne River arm	$2,600,000 $15/10,000 gal. 245.5 ac-ft./ yr.		X			
25.	Veblen Rural Water System	Early organization	S.E. of Veblen	Rural - 12 11 miles of pipeline	Possibly Veblen	Well located North of Veblen	Not Available		X			
26.	Rapid Valley Water Service Co.	Complete	Near Rapid City	747 users, mostly residential 35 miles of pipeline		Wells, Gallery 300 gpm		Sam N. Clausen 2011 Helois St. Rapid City, South Dakota 348-1340				
27.	Whispering Pines Water Association	Complete	Pennington County, 8-10 miles West of Rapid City	15 Users		Well				X		
28.	Butte-Meade Sanitary District	Complete	Vale - Newell area in Butte-Meade Counties	Rural - 300 300 miles of pipeline		Deep Wells	$1,568,000 $30/mo./ user				X	

	System	Current/Eng. Status/Prog.	Area To Be Served	No. of Customers	Municipalities	Source of Water	Estimated Cost	Officers	(X) Organization Status: Committee	Incorporated	Sanitary District	Water User District
29.	Peno Basin Water System, Inc.	Complete	5 ranches	Rural - 5 10-1/2 miles of pipeline	None	Well - N.W. corner of Sec. 29- T2N-R19E	$42,000 $410/yr/ user	William J. Clarke Quinn, South Dakota 386-4251		X		
30.	B-Y Water User District Johnson Engineering	Engineering feasibility study completed, construction plans not complete Bid letting July 1977 Funds: State $ 300,000 Federal $2,170,000 Federal Grant $ 620,000	E 3/4 of Yankton County & part of Turner County	Rural - 800 Urban - 870 400 miles of pipeline	Bulk: Irene, Utica, Volin, Mission Hill	Surface Water - Yankton Treatment Plant 130,000,000 gal. annually 399.0 ac.ft./ yr	Phase I $2,800,000 Total - Approx. $16,000,000 $25/mo./ User	James Stark Utica, South Dakota 665-4623				X
31.	East Gregory County Water District Bartlett & West; Van Gundy & Associates	Engineering study, delay due to water quality	Eastern Gregory County	Rural - 172 Urban - ?	Fairfax, Bonesteel	Well - but had problems with high nitrate levels 250,000 gal. max. daily use	$1,250,000	Alfred Carlson Fairfax, South Dakota	X			

	System	Current/ Status / Eng. Prog.	Area To Be Served	No. of Customers	Municipalities	Source of Water	Estimated Cost	Officers	(X) Organization Status: Committee	Incorporated	Sanitary District	Water User District
32.	Cedar Community Water Association	Engineering Study in Progress	An area of western Jackson & eastern Pennington Counties	Rural - 14 families	None	Well - converted non-producing petroleum test well 3,050	Approx. $400,000	Lyle Jarvis Cottonwood, South Dakota 386-4465	X			
33.	S. Lincoln Rural Water System, Inc., DeWild Grant, Reckert & Associates	Engineering feasibility study completed, construction plans not completed Funds: Federal $3,540,000 Grant $ 525,000 Applicant $ 180,000	South - 2/3 Lincoln Co., North 1/3 Union Co., Northeast Turner Co.	Rural 1,000 486 miles of pipeline	Bulk: Canton, Lennox, Alcester, Hudson, Chancellor	Wells - Big Sioux & Vermillion Aquifers 145,000,000 gal. annually; 445.0 ac-ft./yr.	Not Available	Larry Tideman Canton, South Dakota 987-2756		X		
34.	Hanson Rural Water System, Van Gundy & Associates	Early Organization, engineering feasibility study in progress	All of Hanson Co. W/portions of McCook, Miner, Douglas, Davison Co.	Rural - 600 Urban - 1200	Bulk: Emery, Alexandria, Ethan	Not Available	Not Available	Bert Terveen Emery, South Dakota 449-4545	X			
35.	Wood Rural Water Syst. Van Gundy & Associates	Engineering feasibility study in progress	Southeast corner of Mellette County	Rural - 50 Urban - 200	Bulk: Wood	Not Available	Not available	Milo Koskan Wood, South Dakota 452-3412	X			

	System	Current Status / Eng. Prog.	Area To Be Served	No. of Customers	Municipalities	Source of Water	Estimated Cost	Officers	(X) Organization Status: Committee	Incorporated	Sanitary District	Water User District
36.	WEB Water Development Association DeWild, Grant, Reckert & Associates Howard, Needles, Tammen & Bergendorf	Engineering feasibility study completed	All of Walworth, Edmunds, Brown, Day, Spink & Campbell Counties	Rural: 12,159 Urban: 52,952 2200 miles of rural pipeline 190 miles of main transmission	Aberdeen, Bernard, Bath, Ferney, Claremont, Columbia, Frederick, Groton, Hecla, Houghton, Mansfield/Putney, Verdon, Stratford, Tacoma Park, Warner, Westport, Artas, Herreid, Mound City, Pollock, Andover, Bristol, Butler, Grenville, Holmquist Lily, Pierpont, Roslyn, Waubay, Webster, Bowdle, Hosmer, Ipswich, Loyalton, Roscoe, Athol, Ashton, Brentford, Conde, Doland, Frankfort, Mellette, Northville, Redfield, Tulare, Turton, Akaska, Selby, Glenham, Java, Lowry & Mobridge	Oahe Reservoir 12 miles Southeast of Mobridge	$67,700,000 $1.80-$3.70/ 1000 gal.	Morris Kurle Bowdle, South Dakota 285-6577	X			

APPENDIX B: LETTERS OF INTRODUCTION AND QUESTIONNAIRES

APPENDIX B-1: LETTER OF INTRODUCTION
AND QUESTIONNAIRE FOR NON-MEMBERS
OF RURAL WATER SYSTEM

COOPERATIVE EXTENSION SERVICE

ECONOMICS DEPARTMENT
Economics Building (605) 688-4141
South Dakota State University
Brookings, S.D. 57006

July 9, 1976

Dear Sir:

A number of areas are considering starting rural water systems. People in these areas are interested in the effects of these systems on their communities. We are interested in learning how land values, livestock numbers, and water use has changed in these areas compared to similar neighboring areas that do not have rural water systems. The area you live in is being surveyed so that these comparisons can be made.

This study is being conducted by South Dakota State University in cooperation with the local county extension agent. Not all of the questions pertain to you. Please answer those that do.

All individual answers will be kept in confidence and will be used only to get totals and averages. Your name should not be written on the questionnaire. Also the questionnaires do not have any identification numbers on them. This is done to protect your privacy and to encourage you to answer all the questions which pertain to you. Your response is needed to make this study a success.

When you have completed the questionnaire, please return it in the enclosed envelope.

Thank you very much.

Sincerely,

Arthur Young

Arthur Young
Research Assistant

AY/ljk
Enclosures (2)

COOPERATIVE EXTENSION SERVICE

ECONOMICS DEPARTMENT
Economics Building (605) 688-4141
South Dakota State University
Brookings, S.D. 57006

July 29, 1976

Dear Sir:

Recently we mailed you a questionnaire to gain your estimate of changes in livestock numbers and water use in your area. The changes in your area will be compared with a neighboring area that has a rural water system.

This study is being conducted by South Dakota State University in cooperation with your local county extension agent. Individual answers are kept in confidence and used only to estimate totals and averages for the area. If you can't fill in part of the form, please fill in those questions you can answer and return this in the enclosed envelope.

Summer is a busy time of year for individuals working in agriculture, but your response is needed to make this study a success. People considering joining a rural water system in other parts of the state are interested in what changes the system may bring them. Your cooperation in completing this questionnaire will be appreciated.

If you have already returned the previous questionnaire, do not fill out a second one.

Thank you for your cooperation.

Sincerely,

Arthur Young

Arthur Young
Research Assistant

AY/dla
Enclosure

CONFIDENTIAL

South Dakota State University

SURVEY OF RURAL WATER SUPPLY

The information on this questionnaire will be kept in strict confidence.

This survey is comparing alternative water sources and their relationship to agricultural production and recent changes in rural areas. Your cooperation in completing this questionnaire will be extremely helpful. All individual answers will be kept in confidence and will be used only to get averages and totals.

The numbers shown in parentheses in the right hand margin should be ignored; they are included only to assist the processing of your answers.

WATER SOURCES AND USES (c1)

1. Are you a member of a rural water system?

______ No ______ Yes (5)

If Yes, answer 1a. and 1b.

1a. How many gallons of water do you use per month from the system? ________ gallons/month (6-11)

1b. What percentage of this water is used for livestock? ________ percent (12-14)

1c. If No, would you join a system if one became available?

______ No ______ Yes (15)

Why or why not? (16-17)

2. What percentage of your water for household use comes from each source?

Source of Water		
Hauling	________ %	(18-20)
Wells	________ %	(21-23)
Cisterns to collect rain water	________ %	(24-26)
Other ____________	________ %	(27-29)
Total	100%	

NOTE: You may not have exact information for this question (and some of the rest), so simply give your best estimate. Experience with surveys shows that the average answer from a large number of questionnaires are fairly accurate because a slight over-estimate by one person is balanced by slight under-estimate by another.

3. If you haul water please estimate:

3a. The number of gallons of hauled water used in a typical year for both home and livestock use ________ gallons (45-50)

3b. The approximate one way distance the water was hauled ________ miles (51-53)

3c. Of the water hauled, what percentage was used for livestock? ________ percentage (54-56)

4. If you obtain water from wells on your property please estimate the depth each well is drilled and what is it's expected life.

Wells Used	Depth Drilled	Expected Life	
#1	________ feet	________ years	(57-60)
#2	________ feet	________ years	(61-64)
#3	________ feet	________ years	(65-68)
#4	________ feet	________ years	(69-72)
#5	________ feet	________ years	(73-76)

5. Did you have any livestock last year? (c2)
______ Yes ______ No (25)

If Yes, answer 5a.

5a. Estimate the percentage of livestock water which comes from each source.

Source		
Hauling	________ %	(26-64)
Wells	________ %	
Cisterns for collecting rain water	________ %	
Dams or ponds	________ %	
Natural waterways	________ %	
Other ________	________ %	
Total	100%	

CHANGES IN RESIDENCES (c3)

6. What is the best description of your residence? (29)
______ Home in a town
______ Country home not on a farm
______ Full time farmer's home
______ Part time farmer's home
______ Retirement farm residency
______ Other (specify) ________________________

7. In what year was your home built? ________ (year) (30-33)

8. How long have you lived in your present home? ________ years (34-35)

9. Has the market value of your home changed since 1970?
   _____ Don't know since it is part of farmstead
   _____ No change (37)
   _____ Increased
   _____ Decreased

   9a. If it increased or decreased in its market value, what is the approximate percentage change in value? ________ percent (38-40)

10. Approximately how much have you spent on all improvements on your home (remodeling, additions, but not including water appliances) since 1970? ________ dollars (41-45)

11. Did you own a vacant homestead in 1970? (46)
   _____ Yes → 11a. Have you made any improvements on these vacant homesteads since 1970?
   _____ Yes _____ No (47)
   _____ No
   11b. How much did this add to their value? ________ dollars (48-52)

12. In your area, how much has the value of acreages for residential use changed since 1970? ________ dollars/acre (53-56)

13. Please check the household water appliances that you have acquired since 1970: (Do not include replacements)
   _____ Automatic dishwasher (60)
   _____ Kitchen garbage disposal (61)
   _____ Automatic clothes washer (62)
   _____ Automatic dryer (63)
   _____ Water softener (64)
   _____ Water conditioning equipment (65)
   _____ Water heaters (66)
   _____ Other (please list) ____________________ (67)

14. Do any members of your family work in occupations other than farming or ranching? (68)
   _____ No
   _____ Yes

   If Yes, what is their total weekly mileage to and from work? ________ miles (69-71)

15. In a typical year, what percent of your family's income comes from farming or ranching? ________ percent (72-74)

IF YOU MAKE ANY INCOME FROM FARMING, PLEASE ANSWER QUESTIONS 16 TO 20
IF NOT, PLEASE GO TO QUESTION 21 ON PAGE 5.

IMPACTS ON AGRICULTURE (c4)

16. Approximately what is the largest number of livestock you had on your place at any one time in 1970 and 1975?

	1970	1975	
A. Dairy cows	______	______	(5-72)
B. Beef cows	______	______	
C. Cattle on feed	______	______	
D. Other cattle	______	______	
E. Sows	______	______	
F. Other hogs	______	______	
G. Sheep	______	______	
H. Poultry	______	______	
I. Other ______	______	______	

17. Do you have health livestock problems due to your present water source? (76)
_____ No _____ Yes (please describe)

18. How many total acres of your farm operation were used for each of the following categories in 1970 and 1975? (c5)

	1970	1975	
Cropland	______ acres	______ acres	
Improved pasture	______ acres	______ acres	(5-41)
Native pasture	______ acres	______ acres	
Hayland	______ acres	______ acres	
Other ______	______ acres	______ acres	

19. Have you sold any agricultural land since 1970? (42)
_____ No
_____ Yes

If Yes, how many acres were used by the new owner for: (43-54)

Agricultural uses	______ acres
Residential acreages	______ acres
Commercial or industrial uses	______ acres
Other ______	______ acres

20. What was the market value for the entire farm (including both owned and leased land, farm buildings, and homes) in 1970 and 1975?

1970 market value ______ dollars (55-60)
1975 market value ______ dollars (61-66)

GENERAL INFORMATION NEEDED FOR STATISTICAL COMPARISONS

EVERYONE SHOULD ANSWER THE FOLLOWING QUESTIONS.

21. What township (or territory) do you live in? ____________ (74-75)

22. How far do you live from Sioux Falls? ____________ miles (76-78)

23. How far do you live from the nearest town? ____________ miles (c6)

24. How many persons reside in your home? ____________ (5-7)

25. How many of your children will be enrolled in public school next year and in 5 years?

	Next year	In 5 years	
Grades 1-8	______	______	(8-15)
Grades 9-12	______	______	

26. What is the age of the head of the household? ____________ year (16-17)

27. What is your family's average annual income? (Include wages, salaries and net farm or business incomes.) (18)
    - ______ $ 0 to 3,999
    - ______ 4,000 to 7,999
    - ______ 8,000 to 11,999
    - ______ 12,000 to 15,999
    - ______ 16,000 and over

APPENDIX B-2: LETTER OF INTRODUCTION AND QUESTIONNAIRE FOR MEMBERS OF RURAL WATER SYSTEM

ECONOMICS DEPARTMENT
Economics Building (605) 688-4141
South Dakota State University
Brookings, S.D. 57006

July 9, 1976

Dear Sir:

The rural water system has provided water in your area for some time. We are interested in learning how water use has changed and what the possible effects have been in your community.

This study is being conducted by South Dakota State University with the cooperation of the board of directors of your local rural water system. Not all the questions on this pertain to you. Please answer those that do.

All individual answers will be kept in confidence and will be used only to get totals and averages. Your name should not be written on the questionnaire. Also the questionnaires do not have any identification numbers on them. This is done to protect your privacy and to encourage you to answer all the questions which pertain to you. Your response is needed to make this study a success.

When you have completed the questionnaire, please return it in the enclosed envelope.

Thank you very much.

Sincerely,

Arthur Young
Research Assistant

AY/ljk
Enclosures (2)

COOPERATIVE EXTENSION SERVICE

ECONOMICS DEPARTMENT
Economics Building (605) 688-4141
South Dakota State University
Brookings, S.D. 57006

July 29, 1976

Dear Sir:

Recently we mailed you a questionaire to gain your estimate of changes occuring since you joined a rural water system.

This study is being conducted by South Dakota State University in cooperation with your local county extension agent. Individual answers are kept in confidence and used only to estimate totals and averages for the area. If you can't fill in part of the form, please fill in those questions you can answer and return this in the enclosed envelope.

Summer is a busy time of year for individuals working in agriculture, but your response is needed to make this study a success. People considering joining a rural water system in other parts of the state are interested in what changes the system may bring them. Your cooperation in completing this questionnaire will be appreciated.

If you have already returned the previous questionnaire, do not fill out a second one.

Thank you for your cooperation.

Sincerely,

Arthur Young

Arthur Young
Research Assistant

AY/dla
Enclosure

CONFIDENTIAL

South Dakota State University

SURVEY OF RURAL WATER SUPPLY

The information on this questionnaire will be kept in strict confidence.

This survey is comparing alternative water sources and their relationship to agricultural production and recent changes in rural areas. Your cooperation in completing this questionnaire will be extremely helpful. All individual answers will be kept in confidence and will be used only to get averages and totals.

The numbers shown in parentheses in the right hand margin should be ignored; they are included only to assist the processing of your answers.

WATER SOURCES AND USES (c1)

1. Are you a member of a rural water system? (5)
______ No ______ Yes

If Yes, answer 1a. and 1b.

1a. How many gallons of water do you use per month from the system? ______ gallons/month (6-11)

1b. What percentage of this water is used for livestock? ______ percent (12-14)

1c. If No, would you join a system if one became available?
______ No ______ Yes (15)

Why or why not? (16-17)

2. What percentage of your water for household use came from each source before you joined the system and now?

Source of Water	Before Joining System	Now
Hauling	______ %	______ %
Wells	______ %	______ %
Cisterns to collect rain water	______ %	______ %
Rural water system	NONE %	______ %
Other ______	______ %	______ %
Total	100%	100%

(18-44)

NOTE: You may not have exact information for this question (and some of the rest), so simply give your best estimate. Experience with surveys shows that the average answer from a large number of questionnaires are fairly accurate because a slight over-estimate by one person is balanced by slight under-estimate by another.

3. If you hauled water before joining a system please estimate:

3a. The number of gallons of hauled water used in a typical year for both home and livestock use ________ gallons (45-50)

3b. The approximate one way distance of water was hauled ________ miles (51-53)

3c. Of the water hauled, what percentage was used for livestock? ________ percentage (54-56)

4. If you obtained water from wells on your property please estimate:

4a. The depth each well is drilled and the depth water was pumped from each well you no longer use because of the water system.

Wells No Longer Used	Depth Drilled	
#1	________ feet	(57-60)
#2	________ feet	(61-64)
#3	________ feet	(65-68)
#4	________ feet	(69-72)
#5	________ feet	(73-76)

4b. For each well you still use, what depth is it drilled and what is it's expected life.

Wells Still Used	Depth Drilled	Expected Life	
#1	________ feet	________ years	(c2)
#2	________ feet	________ years	(5-24)
#3	________ feet	________ years	
#4	________ feet	________ years	
#5	________ feet	________ years	

5. Did you have any livestock the year before the system started? (25)

_____ Yes _____ No

If Yes, answer 5a. and 5b.

5a. Estimate the percentage of livestock water which came from each source before you were on the water system and now. (26-64)

Source	Before joining system	Now
Hauling	_____%	_____%
Wells	_____%	_____%
Cisterns for collecting rain water	_____%	_____%
Dams or ponds	_____%	_____%
Natural waterways	_____%	_____%
Rural water system	NONE %	_____%
Other _____	_____%	_____%
Total	100%	100%

5b. Since joining the rural water system have you discontinued use of any dams or ponds for watering livestock? (65)

_____ No

_____ Yes, discontinued use completely

_____ Yes, discontinued use in winter

5c. If Yes, please estimate the approximate size of each dam or pond you no longer use. (c3)

Dam or Pond	Surface Acres	Depth at Deepest Point
#1	_____ acres	_____ feet
#2	_____ acres	_____ feet
#3	_____ acres	_____ feet
#4	_____ acres	_____ feet

(5-28)

CHANGES IN RESIDENCES

6. What is the best description of your residence? (29)
   ______ Home in a town
   ______ Country home not on a farm
   ______ Full time farmer's home
   ______ Part time farmer's home
   ______ Retirement farm residency
   ______ Other (specify) ______________________

7. In what year was your home built? __________ (year) (30-33)

8. How long have you lived in your present home? __________ years (34-35)

9. Was your decision to move into your present home (or to continue living there) influenced by the establishment of the rural water district? (36)
   ______ Yes
   ______ Maybe
   ______ No

10. Has the market value of your home changed since 1970? (37)
   ______ Don't know since it is part of farmstead
   ______ No change
   ______ Increased
   ______ Decreased

   → 10a. If it increased or decreased in its market value, what is the approximate percentage change in value? ______ percent (38-40)

11. Approximately how much have you spent on all improvements on your home (remodeling, additions, but not including water appliances) since 1970? ________ dollars (41-45)

12. Did you own a vacant homestead in 1970? (46)
   ______ Yes → 12a. Have you made any improvements on these vacant homesteads since 1970? ______ Yes ______ No (47)
   ______ No
   12b. How much did this add to their value? ________ dollars (48-52)

13. In your area, how much has the value of acreages for residential use changed since 1970? ________ dollars/acre (53-56)

14. What percentage of this change has been a result of the rural water system? ________ percent (57-59)

15. Please check the household water appliances that you have acquired since 1970: (Do not include replacements)
   ______ Automatic dishwasher (60)
   ______ Kitchen garbage disposal (61)
   ______ Automatic clothes washer (62)
   ______ Automatic dryer (63)
   ______ Water softener (64)
   ______ Water conditioning equipment (65)
   ______ Water heaters (66)
   ______ Other (please list) ______________________ (67)

16. Do any members of your family work in occupations other than farming or ranching? (68)

_____ No
_____ Yes

If Yes, what is their total weekly mileage to and from work? _____ miles (69-71)

17. In a typical year, what percent of your family's income comes from farming or ranching? _____ percent (72-74)

IF YOU MAKE ANY INCOME FROM FARMING, PLEASE ANSWER QUESTIONS 18. TO 24b. IF NOT, PLEASE GO TO QUESTION 25.

IMPACTS ON AGRICULTURE

18. Approximately what is the largest number of livestock you had on your place at any one time in 1970 and 1975? (c4)

	1970	1975
A. Dairy cows	_____	_____
B. Beef cows	_____	_____
C. Cattle on feed	_____	_____
D. Other cattle	_____	_____
E. Sows	_____	_____
F. Other hogs	_____	_____
G. Sheep	_____	_____
H. Poultry	_____	_____
I. Other _____	_____	_____

(5-72)

19. Has the rural water system had any effects on the types or numbers of livestock you keep or your management practices? (73)

_____ No _____ Yes (please describe these changes)

(74-75)

20. Have you had fewer livestock health problems since being on the water system? _____ No _____ Yes (please describe) (76)

(77-78)

21. How many total acres of your farm operation were used for each of the following categories in 1970 and 1975? (c5)

	1970	1975
Cropland	_____ acres	_____ acres
Improved pasture	_____ acres	_____ acres
Native pasture	_____ acres	_____ acres
Hayland	_____ acres	_____ acres
Other _____	_____ acres	_____ acres
Total	_____ acres	_____ acres

(5-41)

22. Have you sold any agricultural land since 1970? (42)

_____ No
_____ Yes

If Yes, how many acres were used by the new owner for:

Agricultural uses	_____ acres
Residential acreages	_____ acres
Commercial or industrial uses	_____ acres
Other _____	_____ acres

(43-54)

23. What was the market value for the entire farm (including both owned and leased land, farm buildings, and homes) in 1970 and 1975?
   1970 market value ______________dollars (55-60)
   1975 market value ______________dollars (61-66)

24. In your area, what effect has the rural system had on land values?
   _____ No effect
   _____ Decreased (67)
   _____ Increased

   24a. What percent of the land in your unit has been affected in value because of the water district?
   __________ percent (68-70)

   24b. What percent of the change in land values has been a result of the public water system?
   __________ percent (71-73)

GENERAL INFORMATION NEEDED FOR STATISTICAL COMPARISONS

EVERYONE SHOULD ANSWER THE FOLLOWING QUESTIONS.

25. What township (or territory) do you live in? ______________ (74-75)

26. How far do you live from Sioux Falls? ______________ miles (76-78)

27. How far do you live from the nearest town? ______________ miles (c6)

28. How many persons reside in your home? ______________ (5-7)

29. How many of your children will be enrolled in public school next year and in 5 years? (8-15)

	Next year	In 5 years
Grades 1-8	________	________
Grades 9-12	________	________

30. What is the age of the head of the household? ______________ year (16-17)

31. What is your family's average annual income? (Include wages, salaries and net farm or business income) (18)
   _____ $ 0 to 3,999
   _____ 4,000 to 7,999
   _____ 8,000 to 11,999
   _____ 12,000 to 15,999
   _____ 16,000 and over

32. In your own words, what beneficial effects from the rural water system have you observed? (19-25)

33. In your own words, what problems concerning rural water systems have you observed? (26-31)