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IMPACT OF COMMUNITY WATER SYSTEMS IN SMALL TOWNS

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IMPACT OF COMMUNITY WATER SYSTEMS IN SMALL TOWNS

The primary purpose of this study was to describe the impact the addition of a community water system to a small town would have upon that town and the surrounding communities. The benefits of the system were recognized by the residents and some of the first round impacts were measured. Benefits observed were increases in the number of water using appliances, increases in property values, improved fire protection and sanitary conditions. Several factors need to be considered when planning future water systems as to the calculation of future needs of the system. Changes which can be expected in population and business activity, changes in the number of water using appliances, and other factors all need to be considered when planning for the successful installation and operation of a community water system. Ample quantities of water are available in Illinois, but intelligent planning for increasing needs, careful management of water supply, and improved waste disposal are essential. Rural people are showing increased concern and are taking action to maintain an abundant supply of clear, safe water for the future.

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INTRODUCTION

Our natural resources, including air, soil, and water are basic to all life on this planet. Domestic water supplies are essential to the health, social, and economic well-being of people. In rural America, the frequently discussed subject of water supply involves many complicated and vital facets. Community water systems may not only improve health conditions but can also be self-supporting, encourage community and industrial development, and be extremely valuable in contributing other benefits to the community such as fire protection and sewage systems.

In the United States, thousands of small rural communities lack adequate and safe supplies of water. It has been the objective of the United States Department of Agriculture, acting through the Farmers Home Administration, to help alleviate this problem by making loans available and providing engineering and other technical assistance to aid these communities in developing safe and adequate water supplies. In the five year period, 1964-68, the FHA has financed more than 2,000 successful rural water systems in the United States with more than a fifth of these being in Illinois. The FHA approaches each of these water supply problems with the philosophy that a solution does exist, and it is only necessary to find the proper solution for each particular problem.

Objectives

The basic objective of this study was to collect and develop information to show the impact of a community water system on the community. Data were developed to show the extent this type of investment had on the social and economic development of towns and farmers in the area surrounding a town where a system has become operational.

Research Procedure

To the community water systems of Illinois that were financed by the FHA, mail questionnaires were sent to obtain primary data regarding the system. Then, from these water systems, three were selected for further investigation. From each of these three: Herrick, Strasburg, and Liberty Ledford, a random sample of seventeen intown residents was selected and personally interviewed. Furthermore, all known farmers who buy and haul water to their farm from the water outlet provided by the system were also personally interviewed to determine the impact of water on their farming operation.

More specifically, the method of quantifying benefits of a water system was:

1. From systems financed by the Farmers Home Administration data was collected concerning:

    a. Population

    b. Changes in the rate of building before and after the completion of the water system.

c. New businesses and enlargements since the addition of the new water system.

d. Changes in employment and tax base.

e. Source of water, storage, and filtration capacities as well as the rates charged.

f. Number of full-time and part-time farmers served directly by the line, number of systems providing a water buying outlet, and costs of the outlet.

2. From the consumers within the city limits, a random survey of fifty one consumers from three different systems was interviewed to develop information concerning:

a. Adequacy and value of the system.

b. Changes they have made or expect to make in their daily living habits, such as the addition of bathrooms or other water using appliances.

c. Trend in water usage per meter over time.

d. An estimate of a growth pattern for water use.

e. Personal ideas as to the other benefits which the water system has brought to the town and the surrounding community.

f. Characteristics of head of household, such as age, occupation, and income.

g. Collect data as to the total amount of water consumed by each household.

3. From a group of farmers served directly by the line and from those who buy and haul water from the water buying

outlet, develop additional information concerning:

a. Water systems before and after the completion of the system.

b. Changes in livestock numbers.

c. Number of farmers who haul water and costs involved.

d. Present and future changes in farming operations resulting from the addition of the water system.

Multiple regression techniques were used in an effort to explain variation in water usage of individuals served by the line and by those who hauled water. Average monthly water consumption of those served by the line was hypothesized to be a function of: age of the head of the household, number of members in the household, number of water using appliances, and income of the family. Besides these variables, the number of ponds and wells on the farm, distance from farm to water outlet, and total number of livestock owned were hypothesized to influence gallons of water hauled.

ANALYSIS

Characteristics and Benefits of Water Systems

The eighteen water systems contacted were distributed over the entire state of Illinois. This distribution indicates that the need for community water systems is widely distributed. Seventy one per cent of the systems provided a water buying outlet where customers located outside the system could buy and haul water. This arrangement benefits those people who could

not be served directly because of costs. Furthermore, an average of 10.8 farmers per system were served directly by the water line. However, there was considerable variation between systems as to number served.

The number of new housing starts after the installation of the system was found to be almost double the number of starts before the water system. Business activity was also reported to have increased since the addition of the water system. The number of jobs also increased as the result of these new businesses. It was concluded that new business activity is an important factor in contributing to the economic development of a community.

Changes in population of the towns were also obtained. Only one of the towns had a population decrease. Of those reporting increases, the increase was about eight per cent. The increases in population were also reflected in the sale of new water taps to both new residents and those people of the community who did not buy a water tap during construction of the water system.

Few people experienced a reduction in fire insurance rates for various reasons. Many towns lack the necessary firm fighting equipment, and most fire insurance companies require a six inch main capacity for supplying large volumes of water which many of these systems do not have.

Since system technologies were different and the systems were geographically dispersed, the costs of construction and the various capacities of the water systems differed. The total costs of the system ranged from a low of $66,000 to a high of $266,000. An average cost of $115,692 represents a sizeable outlay of cash by the people of these small communities. The majority of these loans were completely financed by FHA with repayment set up over a forty year period.

The capacities of these water systems varied considerably, even when calculated on a per capita basis. Capacities varied from a low of 13,000 gallons to a high of 250,000 gallons per day, with the average being approximately 86,000 gallons per day. On a per capita basis, the range was from 46 to 1,379 gallons per day.

The purification facilities of the systems are also an important facility which could place a ceiling on the amount of water consumed. Some towns had excess capacity. The filtration capacity ranged from 86 to 343 gallons per capita per day with the average being 205 gallons.

Variation in Water Consumption Among Households

The towns of Herrick, Strasburg, and Liberty Ledford were selected in which personal interviews were made. The communities selected had two basic types of organization. The systems of Herrick and Strasburg were small towns as such and the water was piped from the well located in the country

into the town and distributed within the community. However the only rural families served by the line were those living along the line as it passed from the well to the town. The third water system, Liberty Ledford, was not a small town but was an organized water district including the two small communities of Liberty and Ledford. Many more of the rural people were served in this case.

As hypothesized, the number of water using appliances that each household possesses has increased since the addition of the water system. However, some of these increases may have occurred without the addition of the system. Others expected to add them in the future as money and time became available. Of the town's people interviewed, 82.4 per cent presently have bathrooms as compared to 74.5 per cent before the water system. Another 11.8 per cent expect to add them. Hot water heaters were owned by about 92 per cent after, as compared to 78.4 per cent before the water system. There are another six per cent who expect to obtain one. The possession of an automatic washer increased from 27 per cent to 35 per cent after the addition of the water system with six per cent expecting to add one in the future. Dishwashers and humidifiers were also included in the study but not enough families owned one to make the numbers meaningful.

Similar results were also obtained from the farmers living outside these systems who were contacted. Bathrooms were possessed by 95.2 per cent of the farmers while 85.7

per cent had one before the system. However, greater increases were found in farmers owning hot water heaters. Only 73.8 per cent possessed one before the system, but 95.2 per cent have one now. There was also a 10 per cent increase in automatic washing machines. Furthermore, 9.5 per cent of these farmers expected to add a water using appliance in the future.

With the addition of the new water system, many of the old private sources of water were abandoned. Before the system, 16 per cent of the families interviewed living in town had encountered pollution in their old water sources. Moreover, only half of the families had had their water tested for purity which indicates there could have been undetected pollution problems. However, one of the families indicated that they had sickness in their family as the result of drinking polluted water.

Of the farmer interviewed from these three systems, 54.8 per cent had had their water tested for purity but only 4.8 per cent found pollution problems. An identical percentage (4.8), reported sickness in their family as a result of bad water.

The families experiencing pollution problems had a variety of problems. The most dominant type was that of surface contamination from poorly constructed well casings and tops, and in several cases, no tops or lids at all. Iron content, oil leakage, odor, and sewage were the other types

of problems encountered. It was found that a particular pollution problem would only be present in one town or part of town with another type completely concentrated somewhere else. This might indicate that if a particular underground stream becomes polluted, all people using this source of water are confronted with water problems regardless of whether they realize it or not.

Individual opinions as to changes in property values and fire insurance rates were collected. Of the people living in town, 90 per cent felt that property values had increased, four per cent felt they remained the same, and six per cent said they did not know if their property values had changed. Of those stating increases in property values, the average increase was 27 per cent with a range from 5 per cent to 100 per cent.

In the rural areas, 61 per cent of the farmers felt that the water line had increased their property values. Some of these individuals felt that the water line had increased their property value as much as 50 per cent. However, these increases were of a decreasing nature, in that as the distance from the water line increased, the amount of increase in property value decreased.

Personal opinion regarding fire insurance rates varied. Approximately 20 per cent of the residents related they did not know if fire insurance rates had changed. Of those remaining, 74 per cent felt that their fire insurance rates were about

the same now as they were before the addition of the water system. Only about six per cent said that their fire insurance was cheaper since the addition of the water system.

With increases in property values and undecided opinion on fire insurance rates, respondents were asked to list any other benefits of the water system. Benefits cited by the town residents in order of their importance are: (1) increased building in the community, (2) the addition of a fire department to the community, (3) the addition of laundry facilities, (4) availability of more jobs, (5) the addition of a dependable water source, (6) lack of pump problems, (7) the addition of car washes, and (8) elimination of water hauling. All such factors and improvements benefitted the community and were so recognized by the residents of the community.

Additional benefits most frequently mentioned by the farmers interviewed were that the water system had made available a better quality of water. Other benefits, in the frequency they were mentioned were: (1) no hauling by those served by the line and shorter hauls by others not directly served, (2) convenience of having plenty of available water "at your door," or a short distance away, (3) protection against shortages during extremely dry periods, (4) watering of garden and lawn, (5) no pump problems where served directly, (6) being able to have a bathroom, (7) improved sanitary conditions, and (8) laundry and better fire protection.

One of the important areas of interest in this study was discovering what impact the water system had on farmers hauling water. In 1966, the year before the completion of the system, all farmers interviewed in Liberty Ledford were hauling water or having water hauled to their farm. However, in 1966 after completion of the system, farmers were served by the line, thus the hauling of water was eliminated. This is not only a great economic benefit to the farmer, but also reduces one of the great risks and uncertainties of his farming operation.

Granting that some farmers are still faced with the awesome task of hauling water, the costs incurred and time required to do so have been substantially reduced by the addition of the water system. The farmer no longer has to haul from a distant community, but has plenty of good water within a few miles of his farm in towns that have provided a water buying outlet. It was found that farmers were paying approximately $5.50 per 1,000 gallons of water delivered to their farm. This was considerably higher than the calculated cost of $3.70 per 1,000 gallons incurred by farmers hauling it themselves.

When water is hauled to the farm, it has found that it is used for a great variety of purposes. The largest percentage of it is deposited in wells and cisterns to be pumped out for future uses. However, a large percentage is also used directly by livestock and in spraying operations. Further-

more, it was found that a great many of the farmer's hauling water were doing so because of poor quality, not lack of quantity. Although these farmers felt there was no pollution problem in their own water supply and in many cases they were still using it for livestock, there were other problems such as hardness, color, odor, etc. Because of the quality of the water made available by the system, they used this water for household purposes and their farm source for all other purposes.

It was hypothesized that water might be a limiting factor in farming operations, and with the addition of this resource, the size and scale of enterprises would be increased. The largest change farmers attributed to the presence of the water system was increased spraying of herbicides. Other farmers reported that they had added automatic waterers in their livestock program. Also, since the addition of the water system, the number of beef cattle owned by the 42 farmers interviewed from these three communities had increased 58.2 per cent. The number of swine per farmer increased 5.3 per cent with the greatest increases reported by farmers served directly by the water line. However, it was not possible to isolate the presence of water as the only factor leading to this increase, although there is little doubt it was very important. However approximately one-fourth of the farmers interviewed stated that they had made an improvement in their farming operation as a result of the water system.

Water utilization varied considerably among households, farmers, in-town residents, and farmers who hauled water. Such variation has policy implications, and an explanation of water usage would be of value for the purpose of planning future water systems. Multiple regression techniques were used in an effort to explain variation in water utilization among households. The following variables were thought to be correlated with average monthly water consumption of in-town residents: (1) the income of the head of the households, (2) the age of the head of the household, (3) the number and type of water using appliances within the household, and (4) the number of members in the household.

All variables were hypothesized to be positively correlated with average monthly water consumption except age. Age was hypothesized to be negatively correlated with water consumption. The predictive equation explained only 35 per cent of the total variation and the presence of a bathroom and age were the only variables which were statistically significant.

Besides the above variables, per cent of time the individual devotes to farming and total number of livestock were believed to be correlated with the average monthly consumption of farmers served by the line. This regression model explained a sugstantially larger portion of the total variation, 73.91 per cent. But with a limited number of observations only one variable, farmer's age, was statistically significant. However, the simple correlation coefficients between independent and dependent variables possessed the hypothesized signs.

The second objective of the regression analysis was to formulate an equation that would accurately predice the total number of gallons of water a farmer might haul during a given year. Two regression equations were formulated using the two years since the three systems completion dates as the source of data to test the model. The independent variables used in these two regression equations were: (1) per cent of time the individual devotes to farming, (2) number of usable ponds and wells on the farm, (3) number of members in the household, (4) distance to the water outlet, (5) taxable income, and (6) total number of livestock.

These equations explained 44.09 per cent and 72.13 per cent of the total variation in amount of water hauled for 1966 and 1967 respectively. However, few of the independent variables were statistically significant in explaining this variation. Nevertheless it is felt that the simple correlation coefficients and regression analysis did isolate important variables that should be further investigated in the future. More precisely, the following variables appear to be influencing water consumption: (1) age, (2) number of members in the household, (3) income, and (4) per cent of the time the individual is engaged in farming. These variables explained large portions of the total variation in all model formulations.

Future Research

This project was principally pilot in nature with the purpose of identifying and ascertaining costs and benefits of

FHA financed water systems. The relatively small scope of the study, three towns in Southern Illinois, limits application of the findings of this study to policy issues.

The researchers feel the scope of the study should be extended to a multi-state area. This would enable the relation of towns that have been in operation for a time period greater than one year. As a result, one could obtain a reading on the benefits other than the initial first round benefits. Likewise, one could standardize for other exogenous factors that have promoted economic growth.

Control groups of towns would be very beneficial in measuring the impact of water systems. The control groups should include towns with neither public water nor sewage facilities, communities which receive finance for water facilities, and communities which receive assistance for both water and sewage.

The researchers feel that water and sewage systems are complementary--the extent of this interaction, however, is not known.

SUMMARY

The primary purpose of this study was to describe the impact the addition of a community water system to a small town would have upon that town and the surrounding communities. The results would be beneficial to a great number of people, including the small communities themselves.

The benefits of the system were recognized by the residents and some of the first round impacts were measured. Benefits observed were increases in the number of water using appliances, increases in property values, improved fire protection and sanitary conditions.

Several factors need to be considered when planning future water systems as to the calculation of future needs of the system. Changes which can be expected in population and business activity, changes in the number of water using appliances, and other factors all need to be considered when planning for the successful installation and operation of a community water system.

In conclusion, ample quantities of water are available in Illinois, but intelligent planning for increasing needs, careful management of water supply, and improved waste disposal are essential. Rural people are showing increased concern and are taking action to maintain an abundant supply of clear, safe water for the future.