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Rural Water Supplies in South Dakota : Custer County

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Rural Water Supplies in South Dakota

USTER County

January, 1940
Special Extension Circular
Number 47

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Brookings, S. D.

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RURAL WATER SUPPLIES
IN
SOUTH DAKOTA
CUSTER COUNTY

BY
WALTER V. SEARIGHT
AND
ELMER E. MELEEN

**THIS BOOK DOES
NOT CIRCULATE**

PREPARED BY THE WORK PROJECTS ADMINISTRATION
AS A REPORT ON THE WELL SURVEY CONDUCTED
AS WORK PROJECTS ADMINISTRATION OFFICIAL PROJ-
ECT 665-74-3-126; SPONSORED BY THE EXTENSION
SERVICE AND THE EXPERIMENT STATION SOUTH DAK-
OTA STATE COLLEGE, IN COOPERATION WITH THE
STATE GEOLOGICAL SURVEY.

JANUARY 1940

FOREWORD

This study was first proposed as a project of the Mineral Resources Committee of the State Planning Board under the direction of the State Geological survey and undertaken as a Work Projects Administration project sponsored by the State Planning Board, and was continued under the Planning Board until that body was abolished July 1, 1939 by the State Legislature. At that time sponsorship was transferred to the South Dakota Agricultural Experiment Station and the State College Extension Service, South Dakota State College. Field work was begun October 1, 1938 and was practically completed by February 15, 1939. Workers were assigned in the several counties under the supervision and direction of the County Agricultural Agents and Field Supervisors who were employed by the Work Projects Administration. Questionnaires were mailed out from the offices of the County Agents and were checked and tabulated in these offices. The material was then forwarded to the central office for final tabulation and analysis under the direction of Elmer E. Meleen and Walter V. Searight.

Particular credit should be given to the individual County Agricultural Agents in the various counties of the state who arranged the contacts with the individuals from whom these data were collected, furnished a large portion of the necessary supplies for field work, and directed the workers engaged in collecting field data. Without this assistance in gathering basic data, this study could not have been conducted. The value of the report is therefore in direct proportion to the accuracy and adequacy of these basic data.

INTRODUCTION

PURPOSE

This report on rural water supplies of South Dakota has been prepared to present data recently made available on the types and the sources of water supply, exclusive of stream, lake and dam waters. The information presented is of importance to evaluate present supplies. It should also prove useful as a basis for further development of supplies where they are needed or become necessary. Further, it is hoped that the facts presented may prove of value in any program of water conservation.

SOURCES OF INFORMATION

Questionnaires were sent to all, or essentially all of the farmers of the state, asking for complete data on farm wells and supplementary supplies, with the exception of the supplies above noted. A most gratifying number returned questionnaires, actually 60.1% average for the entire state. The coverage is probably more than 60.1% since it is likely that many unanswered inquiries were those to farmers who were without wells, the type of supply emphasized in the questionnaires. The data thus obtained were supplemented with information contained in the files of the State Geological Survey, the office of the State Engineer, and reports of the United States Geological Survey. This supplementary information, together with that contained in questionnaires was used in making the well location maps included in this report.

PROCEDURE

All data from the questionnaires were tabulated and analyzed statistically by counties, which were made the areal units of study. Within the county,

Acknowledgments - The authors wish especially to acknowledge and commend the conscientious assistance of Mr. E. L. Woodburn, Supervisor, for careful and painstaking supervision of statistical work. The authors also desire to express appreciation for the constant interest and support of this project by Mr. Bob Butts, Director of Research and Records Projects, South Dakota Work Projects Administration.

supplies were allocated as to kind on county maps. Since shallow waters are the most important source of rural supply in South Dakota, wells 200 feet deep and less were plotted on county maps from which maps indicating depths of wells by 50 foot intervals were made. Springs, shown on the well location map, and cisterns were also tabulated as important supplementary supplies, although the latter do not appear on maps or in the tables in this report.

PRESENTATION OF DATA

For convenience and utility, this report has been divided into sections, each covering one county, and each county section bound separately. Each county report contains the following material wherever possible.

1. Well Location Map: This map shows the location of all wells and springs within the county, so far as information is now available. These have been plotted in such a manner that artesian and shallow wells can be differentiated readily by the reader. Artesian wells, where they occur, are divided into flowing and pumped. Artesian wells showing decreased flow and those reported as controlled are also indicated by symbols. Shallow wells are differentiated as adequate and inadequate, and dry holes as of 1938 are located. Wells from other sources of information other than questionnaires collected by this survey are shown in blue.

2. Shallow Well Map: This map shows, as accurately as possible, in 50 foot intervals, the depths at which shallow supplies are commonly obtained. Where shallow wells are abundant, as indicated by the well location map, the map is as accurate as the information on which it is based, but where such wells are sparsely distributed errors are likely to occur. In many places reports of shallow wells are absent, in which case the area has been left blank.

3. Table of Pumped Wells, from 0 to 200 feet (inclusive) in depth: This table shows minimum, maximum and average depths of wells within the county, as reported in the questionnaires. Tabulations are by townships. The general character of the water, hard, medium, and soft, as reported by farm-

ers, and the number of wells suitable or unsuitable for drinking are shown in this table. Further, the adequacy of supply, as indicated on the questionnaires, and use for irrigation are shown here.

4. Table of Wells greater in depth than 200 feet: Minimum, maximum, and average depths are indicated. Character, reported as hard, medium or soft is tabulated. Adequacy and use for irrigation are shown as in the preceding table.

5. Table of flowing wells: Minimum, maximum, and average depths are shown together with general character and use for irrigation. The volume of flow as reported, and the number of flowing wells reported as equipped with control valves is also included in this table.

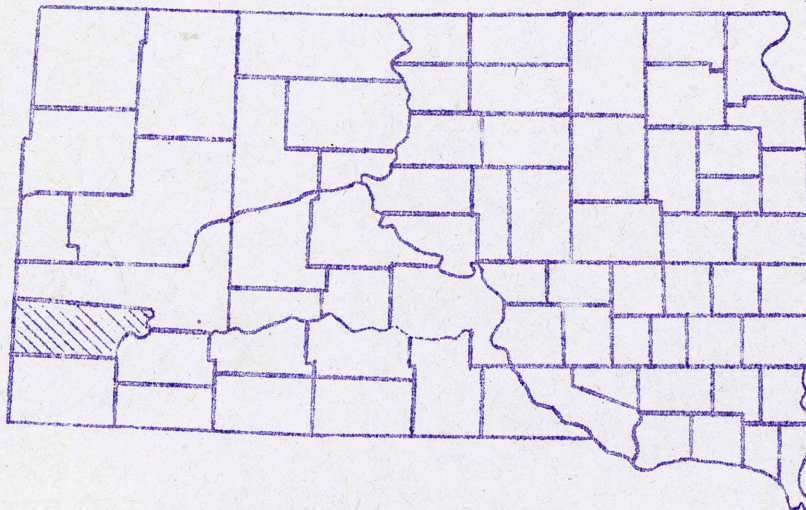
SUMMARY OF STATE SUPPLIES

In the entire state, a total of 48,479 wells were reported in response to questionnaires, returned by 60.1% of the recipients. If those who did not respond have a number of wells in proportion to those who reported, there are approximately 80,000 wells in South Dakota. There are possibly many less than this number since several counties with large numbers of wells returned over 75% of the questionnaires and since many farmers without wells did not reply because they were not requested to do so in the formal questionnaire. Of the wells reported, 16.2% are artesian, including both pumped and flowing wells. Shallow wells are 83.8% of the wells reported. Wells from shallow sources are thus obviously by far the most important means for obtaining water in rural South Dakota.

Important supplementary supplies are cisterns and springs. Roughly, there is more than one cistern to each 40 wells. Many springs are reported, however, in counties with very few wells, so that in some localities they are of considerable importance.

CUSTER COUNTY

Custer county is in the southwestern part of South Dakota. It is bounded on the north by Pennington county, on the east by Washington and Pennington counties, on the south by Fall River county, and on the west by the State of Wyoming.



Map of South Dakota showing location of Custer county

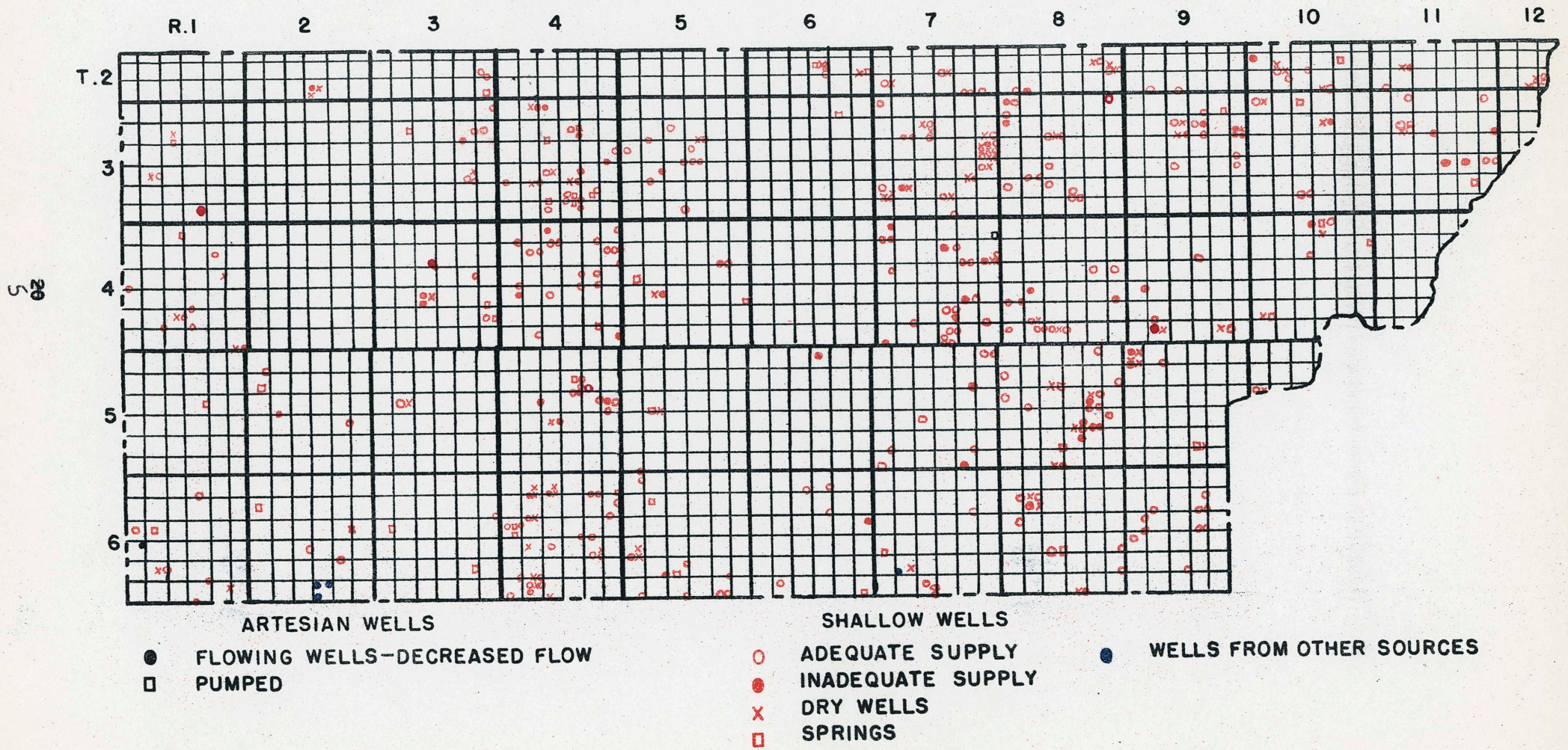
Custer county is mainly devoted to agriculture with 555,072 (55.1 per cent) of its total 1,006,720 acres in farms. There are 645 farm units of approximately 860 acres in each. Hay, wheat, potatoes, corn, oats, and barley are the important field crops, being produced in the order named. Livestock is also important; cattle, horses and mules, sheep and lambs, and hogs are valued highest.*

Farm units devoted to livestock and dairy cattle require generally distributed sources of water supplies. The supplies required are not great, but adequate and suitable supplies of underground water at low cost are necessary to operate farms of these sizes and organization profitably. The well location map of Custer county indicates that, in general, such supplies are available and are widely distributed.

On the well location map of Custer county, all flowing and all deep pumped wells obtaining water from artesian sources under pressure are shown in black

*South Dakota Agricultural Statistics, Annual Report, 1937.

LOCATION OF ARTESIAN AND SHALLOW WELLS IN CUSTER COUNTY



as artesian wells. All other wells are shown in red and are called shallow wells regardless of depth. On all other maps and in the tables and text of this report, the term shallow wells applies to those wells of 200 feet or less in depth, and those greater than 200 feet deep are treated as deep wells including artesian wells unless otherwise stated.

Questionnaires were sent to 647 farmers and land owners of Custer county, of whom 298 responded with information on 308 wells, 50 springs, and 38 cisterns throughout the county. These data represent a 46 per cent coverage of well supplies in Custer county.

DEPTH AND DISTRIBUTION

Rural water supplies of Custer county are obtained from shallow pumped, deep flowing, and deep pumped wells, which are widely distributed over the county.

Shallow wells: Approximately 99 per cent of the wells reported from Custer county were shallow pumped wells. Of the 304 shallow wells reported, 87.1 per cent were from 0 to 50 feet in depth; 8.4 per cent between 50 and 100 feet deep; 2.1 per cent from 100 to 150 feet; and 2.4 per cent from 150 to 200 feet deep. Thus, approximately 95 per cent of all shallow wells reported are less than 100 feet in depth. Whenever possible the shallow supplies are used because of the increased cost of construction of deeper wells, and because in many cases, deeper waters are not available. In the northern tier of townships all wells reported were less than 50 feet in depth with the exception of wells in T.2S., R.7E., and T.2S., R.8E., in which wells were more than 50 feet deep but less than 100 feet in depth. In general, over the county, shallow wells were rather widely distributed throughout the various depth ranges from 0 to 200 feet.

The following townships reported all wells to be shallow:

Twp.	Rge.	Total Wells	Twp.	Rge.	Total Wells
2S.	2E.	1	4S.	9E.	5
2	3	2	4	10	3
2	6	2	5	2	2
2	7	5	5	3	1
2	8	5	5	4	11
2	9	2	5	5	1
2	10	5	5	6	1
2	11	2	5	7	8
2	12	3	5	8	16
3	1	2	5	9	3
3	3	6	5	10	1
3	4	17	6	1	5
3	5	11	6	2	2
3	8	14	6	3	1
3	9	12	6	4	20
3	10	4	6	5	7
3	11	10	6	6	5
4	1	7	6	7	4
4	3	5	6	8	8
4	4	21	6	9	10
4	5	3			
4	8	12			

No shallow flowing wells were reported from Custer county.

Deep wells: Approximately 1.3 per cent of the well supplies of Custer county were obtained from deep wells (pumped and flowing). Of four deep wells reported, three were deep pumped and one was a deep flowing well. These wells ranged in depth from 230 feet to 700 feet (see table 2) and were reported in the following townships:

T.3S., R.7E. T.4S., R.7E. T.6S., R.1E.*

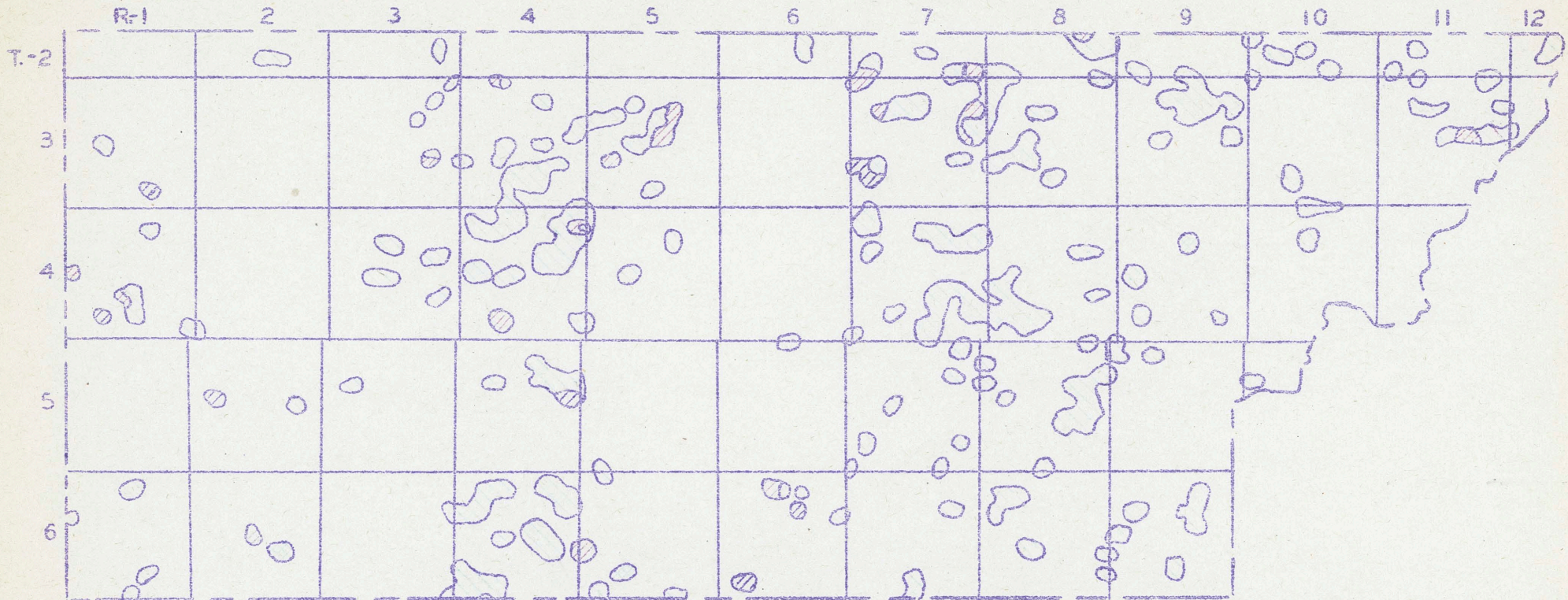
*Denotes location of the deep flowing well.

CHARACTER OF WELL WATERS

In order to determine character of water in the county, users were asked to indicate whether they considered supplies to be hard, moderately hard, or soft. Although chemical analyses are not commonly available to farmers, usage is a fairly satisfactory criterion of quality until adequate laboratory analyses are available.

In general, well supplies of Custer county produce hard or moderately hard water. Of all the shallow wells reported, 26.1 per cent produced hard water, 48.2 per cent moderately hard, and 25.7 per cent soft. Thus, approximately 74

CUSTER COUNTY



SHALLOW WELLS (0-200 FT.)
DEPTHS AT WHICH SUPPLIES ARE COMMONLY OBTAINED

□ 0-50 FT.

▨ 50-100 FT.

□ 100-150 FT.

▩ 150-200 FT.

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per cent of all shallow wells in Custer county produced hard or moderately hard water. The hard water wells were widely distributed over the county and occurred at the various depths. Soft water shallow wells are few in number and are scattered over the county. Twenty nine townships reported 67 soft water wells, most of which were in the north central part of the county.

The four deep wells, both pumped and flowing, produce moderately hard water.

Well supplies in Custer county were, in general, suitable for drinking purposes. Of the 308 wells reported, only 21 were unsuitable for drinking. All of the unsuitable wells were shallow and are scattered at random over the county. There are many reasons for unsuitability. Water from some wells is unsatisfactory for drinking because of surface contamination but most of the unsuitable water contains disagreeable or unpleasant chemical ingredients. Injurious ingredients may also occur in some cases but these must be determined by analyses.

ADEQUACY OF WELL WATERS

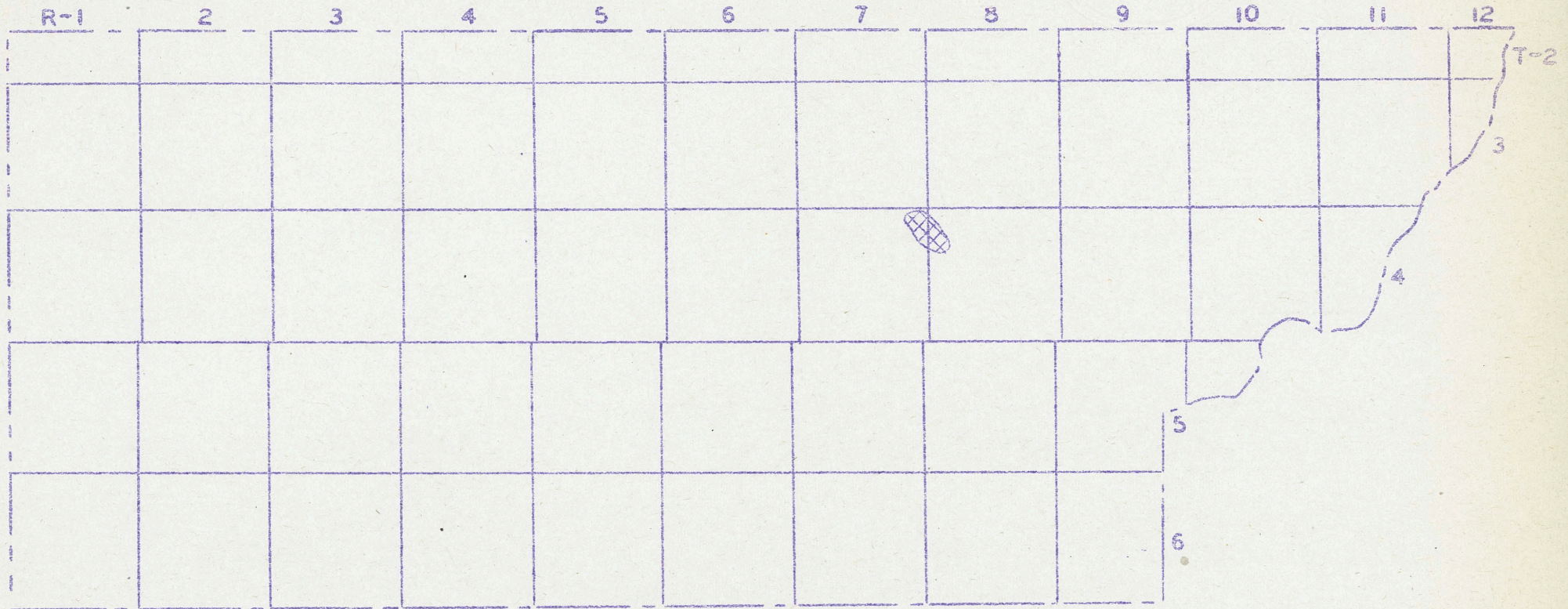
Supplies were mostly reported adequate for present needs in Custer county. Needs vary, however, and changes in land use, modification of farm management, or dry cycles in this and surrounding land areas affect both the source and the demand for supplies.

Of the 308 wells reported in the county, only 75 were inadequate for current needs and all of these were shallow. All deep wells were reported adequate. The rate of flow of the deep flowing well was not reported.

IRRIGATION

Thirty-eight shallow wells were used for the irrigation of garden plots ranging in size from $1/8$ to one acre, a total of $13 \frac{3}{8}$ acres. Two deep pumped wells were used to irrigate $1/4$ acre.

CUSTER COUNTY



ARTESIAN AREAS 1938



FLOWING WELLS



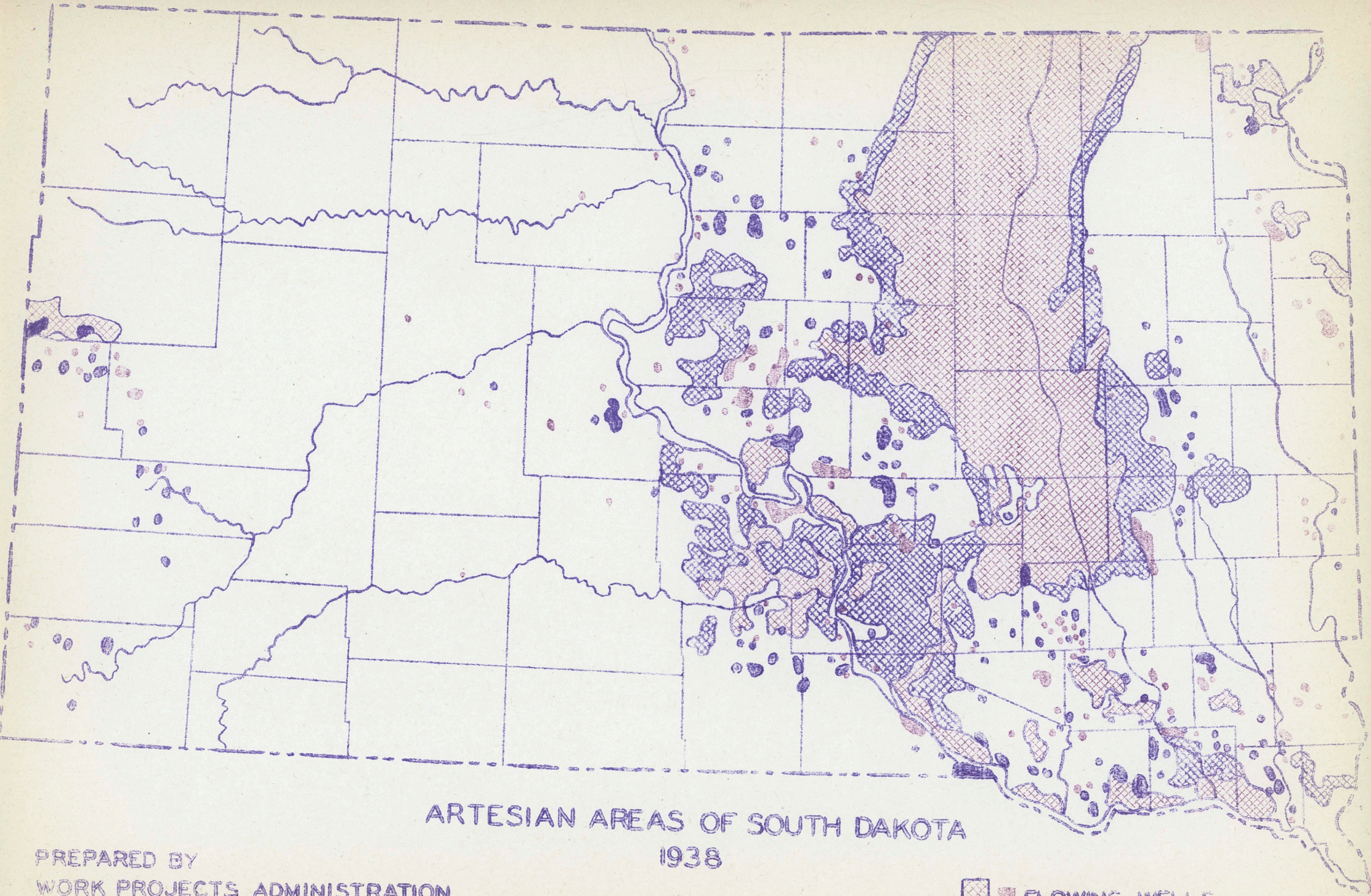
PUMPED WELLS



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ARTESIAN AREAS OF SOUTH DAKOTA

1938

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W.P. 3636

-   FLOWING WELLS
-   PUMPED ARTESIAN WELLS

SUPPLEMENTARY SUPPLIES

Springs are an important source of supplementary supplies in Custer county and 50 were reported. Most of the springs are in the western half of the county where they were used for watering of livestock and for domestic purposes where well supplies were inadequate or unsuitable. Forty eight of the springs are adequate for present needs, four reported hard water, eight moderately hard, and sixteen soft. Water from 36 springs was suitable for drinking purposes.

The following tabulation shows the location of these springs and the number reported from Custer county:

Twp.	Rge.	Number of Springs	Twp.	Rge.	Number of Springs
2S.	3E.	1	4S.	10E.	3
2	6	2	5	1	1
2	10	1	5	2	2
3	1	1	5	4	1
3	3	1	5	5	1
3	4	6	5	8	2
3	6	1	5	9	1
3	8	1	6	1	1
3	9	1	6	2	2
3	10	1	6	3	2
3	11	2	6	4	3
4	1	1	6	5	4
4	3	2	6	6	1
4	4	1	6	7	1
4	5	2	6	8	1

Cisterns are of considerable importance in Custer county as a source of supplementary supplies, with 38 (approximately one cistern to every eight wells) reported. These cisterns were used for laundry purposes where well supplies were unsuitable because of hard water, and were also used for drinking and cooking where regular supplies were inadequate or unsuitable. Farmers with shallow wells reported 32 cisterns, of which 17 were used for drinking and cooking and 27 for laundry. Users of springs reported five cisterns, most of which were used for laundry.

CUSTER COUNTY

Table 1.

DATA ON PUMPED WELLS FROM 0 TO 200 FEET (INCL) IN DEPTH

LOCATION		Number of Wells	DEPTH OF WELLS			CHARACTER OF WATER					ADEQUACY OF SUPPLY			
Twp.	Rge.		Min.	Max.	Ave.	Hard	Med	Soft	Corrode Casing	Unsuitable for Drinking	Adequate	Inadequate	Number used for Irrigation	Approximate Acres Irrigated
2	2	1	30	30	30	-	1	-	-	-	-	1	-	-
2	3	2	12	22	17	-	2	-	-	-	2	-	1	-
2	6	2	30	30	30	-	1	1	-	-	1	1	-	-
2	7	5	8	69	35	1	2	2	-	-	5	-	1	1/4
2	8	5	20	85	35	1	2	1	-	-	4	1	-	-
2	9	2	6	25	15	-	2	-	-	-	2	-	-	-
2	10	5	12	35	21	2	2	1	1	1	4	1	2	3/8
2	11	2	18	30	24	-	1	1	-	-	1	1	1	1/8
2	12	3	8	20	14	3	-	-	1	-	3	-	-	-
3	1	2	28	190	109	1	-	-	-	-	1	1	-	-
3	3	6	11	96	30	1	2	3	-	2	5	1	1	1/8
3	4	17	9	55	22	3	4	5	-	1	12	5	2	5/8
3	5	11	10	88	41	-	5	4	-	1	10	1	1	1
3	7	15	10	200	62	5	6	3	3	-	10	5	1	1/8
3	8	14	11	128	32	3	5	4	1	1	12	2	-	-
3	9	12	7	50	21	2	6	1	-	1	7	5	-	-
3	10	4	5	33	20	2	1	1	-	-	3	1	-	-
3	11	10	8	55	26	2	1	6	-	1	6	4	2	1/4
4	1	7	12	180	62	2	4	-	2	1	6	1	-	-
4	3	5	10	20	15	-	4	-	-	-	2	3	-	-
4	4	21	6	126	34	1	11	5	-	-	18	3	1	1/8
4	5	3	12	22	18	-	-	2	-	1	1	2	-	-
4	7	24	10	40	23	3	10	2	-	-	16	8	2	1/4
4	8	12	8	32	23	4	6	2	-	1	9	3	4	1
4	9	5	20	134	47	2	1	2	2	-	3	2	1	1/8
4	10	3	12	20	14	1	1	1	-	-	2	1	-	-
5	2	2	36	160	98	1	1	-	-	-	1	1	1	-
5	3	1	22	22	22	-	1	-	-	-	1	-	-	-
5	4	11	6	175	40	-	7	2	1	-	7	4	-	-
5	5	1	15	15	15	1	-	-	-	-	1	-	-	-
5	6	1	30	30	30	-	1	-	-	-	-	1	-	-

CUSTER COUNTY (continued)

Table 1.

DATA ON PUMPED WELLS FROM 0 TO 200 FEET (INCL.) IN DEPTH

LOCATION		Number of Wells	DEPTH OF WELLS			CHARACTER OF WATER					ADEQUACY OF SUPPLY			
Twp.	Rge.		Min.	Max.	Ave.	Hard	Med	Soft	Corrode Casing	Unsuitable for Drinking	Adequate	Inade-quate	Number used for Irrigation	Approximate Acres Irrigated
5	7	8	15	30	20	3	4	1	1	1	6	2	2	5/8
5	8	16	11	35	23	5	6	1	1	1	11	5	-	-
5	9	3	30	35	33	2	1	-	1	-	1	2	-	-
5	10	1	17	17	17	1	-	-	-	-	1	-	-	-
6	1	5	8	32	17	5	-	-	-	3	4	1	1	5 1/8
6	2	2	90	102	96	1	-	1	-	-	2	-	-	-
6	3	1	14	14	14	-	-	1	-	-	1	-	-	-
6	4	20	10	30	18	1	16	3	1	-	18	2	2	1/4
6	5	7	7	132	66	1	4	2	1	1	6	1	3	1 1/4
6	6	5	30	200	100	2	1	1	1	1	4	1	3	1/8
6	7	4	16	20	18	4	-	-	-	1	4	-	-	-
6	8	8	12	42	28	2	1	3	1	2	6	2	3	1 1/4
6	9	10	3	39	25	-	3	5	-	-	10	-	3	3/8
Total		304				68	126	67	18	21	229	75	38	13 3/8

CUSTER COUNTY

Table 2.

DATA ON PUMPED WELLS OVER 200 FEET IN DEPTH

LOCATION		Number of Wells	DEPTH OF WELLS			CHARACTER OF WATER					ADEQUACY OF SUPPLY			
Twp.	Rge.		Min.	Max.	Ave.	Hard	Med.	Soft	Corroded Casing	Unsuitable for Drinking	Adequate	Inadequate	Number used for Irrigation	Approximate Acres Irrigated
3	7	2	230	251	240	-	2	-	-	-	2	-	1	1/8
4	7	1	-	-	480	-	1	-	-	-	1	-	1	1/8
Total		3				-	3	-	-	-	3	-	2	1/4

Note: No other wells over 200 feet in depth reported for Custer county.

Table 3.
DATA ON FLOWING WELLS

LOCATION		Number of Wells	DEPTH OF WELLS			CHARACTER OF WATER					ADEQUACY OF SUPPLY				
Twp.	Rge.		Min.	Max.	Ave.	Hard	Med.	Soft	Corroded Casing	Unsuitable for Drinking	Adequate	Inadequate	Number used for Irrigation	Approx. Acres Irrigated	Ave. Gallon Per Min.
6	1	1	-	-	700	-	1	-	1	-	1	-	-	-	-

NOTE: No other flowing wells reported for Custer County

CUSTER COUNTY - WELL NOTES

The following are pertinent remarks quoted from questionnaires returned by farmers and are included opinions of the water situation as expressed by the individual farmers and must be so applied.

- T.2S., R.2E.
Sec. 34 30 feet:
"I have tried to dig three different wells. In the first one there was no water. In the second I struck rock and couldn't go through. In the third I got a little water at 20 ft. We are now hauling water for the stock & house a distance of six miles."
- T.3S., R.1E.
Sec. 9 Spring:
"The water on this farm is obtained from a small spring just on the boundary line of our land. At the present time it is running about 50 gallons in 20 hrs., and the supply is gradually diminishing. It waters 5 head of stock & supplies house which uses it all."
- T.3S., R.4E.
Sec. 26 Spring:
"Water has been tested and was extra good, only fault that I can find is it will rust shut the best pipe you can buy. New 3/4 inch pipe will stay open about 2 years if you use a force pump on it about every month. If I get the money will try wood pipe so I can pipe to house."
- T.3S., R.8E.
Sec. 27 20 feet:
"Have two soft water springs that have never been known to go dry. There is also a dug well rock casing and hard water that I have heard is an awful good well but have never used it myself."
- T.3S., R.10E.
Sec. 6 23 feet:
"The well on this farm is 23 ft. deep, and has 12 ft. of water. The water looks cloudy and is hard. It has such a bad odor that the stock won't drink it."
- T.3S., R.10E.
Sec. 10 No depth given:
"I have two wells on my place and one is dry and has been for years, this well used to have an abundance of water. Irrigated about 4 acres of garden used for domestic purposes, and also for stock. The other well is new. Dug two years ago and has some water but hardly enough for domestic use, and is not very good quality."
- T.4S., R.3E.
Sec. 24 Spring:
"This spring runs the year around, good medium hard water at a temperature of 44° F. Too cold for irrigating."
- T.5S., R.4E.
Sec. 10 25 feet:
"We have a dug well by the house 4 ft. across & 25 ft. deep and has ten foot of water. Would water 75 to 100 head of stock. Ten foot on top is walled with lumber and is in very poor condition. The rest is blasted out of hard rock and does not need any wall. The water comes through large crevices in the rock."

- T.5S., R.4E.
Sec. 13 175 feet:
"Several attempts have been made to drill wells but rock too hard to drill through."
- T.5S., R.4E.
Sec. 14 40 feet:
"This well will not furnish more than one gallon per minute now but normally you can not pump it dry with a 3½ inch cylinder with a 6 inch stroke. Well is in slate rock."
- T.5S., R.9E.
Sec. 6 30 feet:
"I have dug three wells and all have gone dry."
- T.5S., R.9E.
Sec. 27 Spring:
"We live in a spring draw and also use Cheyenne River for stock. On upland we dug one well and hit shale at 40 feet with no water."
- T.6S., R.3E.
Sec. 1 Spring:
"The present water supply rises in the gravel of a dry creek. It is quite likely that it would be difficult to obtain a well because the limestone formation is of such a nature that one might lose the water trying to obtain sufficient reservoir. The loss would be due to crevices in the formation."
- T.6S., R.8E.
Sec. 25 35 feet:
"The trouble I have digging a well is quicksand. I don't seem to be able to get it deep enough."
- T.6S., R.9E.
Sec. 10 28 feet:
"We have started an open well for irrigation purposes is about 9 ft. to water. We are experiencing considerable difficulty with sand caving in."
- T.6S., R.9E.
Sec. 18 20 feet:
"There is very fine sand in the bottom and can't work anything into it that will hold. The sand runs in as fast as you clean it out. Have been unable to get any supply of water out of it."

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