STATE OF SOUTH DAKOTA
Richard Kneip, Governor

DEPARTMENT OF NATURAL RESOURCE DEVELOPMENT
Vern W. Butler, Secretary

GEOLOGICAL SURVEY
Duncan J. McGregor, State Geologist

Special Report 57

GROUND-WATER INVESTIGATION FOR THE CITY OF WEBSTER, SOUTH DAKOTA

by

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Vermillion, South Dakota
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INTRODUCTION

Present Investigation

This report contains the results of a special investigation conducted by the South Dakota Geological Survey from July 12 to July 31, 1971, in and around the city of Webster, Day County, South Dakota. It is the 57th in a continuing series of investigations to assist the cities in South Dakota in locating their future water supplies.

Webster has six wells, but the main producing wells are wells 4, 5, and 6. Except for well 3 which is producing water from an aquifer 80 feet deep, the remaining wells are drilled into a glacial outwash approximately 200 feet below the land surface within the city limits.

Included in the survey of the Webster area were: (1) the geologic mapping of the area, (2) the drilling of 5 auger and 14 rotary test holes, (3) a well inventory, (4) the collection and analyses of 17 water samples, and (5) conducting two pump tests in the area.

As a result of the survey more data on the thickness, areal extent, and hydraulic properties of the two aquifers from which the city obtains water were found. The available information indicates that the aquifer at a depth of 200 feet could sustain additional wells with a proper spacing between the wells. The quality of the water is expected to be comparable to the water from the present city wells.

The cooperation of the residents of Webster, especially the city officials and employees of the water treatment plant, was greatly appreciated. The pump tests were conducted with the assistance of Darrell Leap, geologist-hydrologist in charge of the Day County ground-water study. The project was financed by the South Dakota Geological Survey, Oahe Conservancy Sub-District, and the city of Webster.

Location and Extent of Area

The city of Webster is located in northeast South Dakota in Day County which is in the Coteau des Prairies division of the Central Lowland Physiographic Province (fig. 1). The Webster study area is approximately 9 square miles in area, measuring 3 miles north-south and 3 miles east-west.

GENERAL GEOLOGY

Surficial Deposits

The surficial deposits of the Webster area are the results of glaciation late in the Pleistocene Epoch of geologic time. Glacial deposits are collectively called drift and can be divided into till and outwash deposits. Till consists of unsorted material that ranges from boulder to clay size and was deposited directly by the ice.

Outwash is a more homogeneous material, consisting primarily of sand and gravel with minor amounts of silt and clay which was deposited by meltwater issuing from a glacier. Figure 2 is a generalized geologic map of the Webster area.

Subsurface Bedrock

No bedrock is exposed in the study area, but data obtained from the well logs in the area reveal that Cretaceous stratified sedimentary rocks underlie approximately 470 feet of glacial drift. These deposits in descending order are the Pierre Shale, Niobrara Marl, Carlile Shale, Greenhorn Limestone, Graneros Shale, and the Dakota Formation.

Pierre Shale consists of approximately 200 feet of light- to dark-gray shale. Beneath the Pierre Shale is approximately 125 feet of the Niobrara Marl.

Carlile Shale underlies the Niobrara Marl and consists of gray to black shale interbedded with silt and sand. Data from the Webster area indicate that as much as 80 feet of the Carlile Shale is the Codell Sandstone Member. The total thickness of the Carlile Shale is approximately 300 feet.

Greenhorn Limestone is composed of approximately 30 feet of hard, light-colored limestone and underlain by 250 feet of dark-gray Graneros Shale.

The Dakota Formation is a sequence of alternating sand, sandstone, and shale beds approximately 200 feet thick. Beneath the Dakota Formation at a depth of approximately 1,070 feet lies the Precambrian rocks (probably granite).

OCCURRENCE OF GROUND WATER

Principles of Occurrence

Ground water is defined as water contained in the voids or openings within rocks or sediments below the water table. Practically all open spaces in the rocks that lie below the water table are filled with water; this is called the zone of saturation. The water table is the upper surface of the zone of saturation and is under atmospheric pressure. Rocks (including the soil) that lie above the water table are in the zone of aeration because only some of the open spaces in this zone are filled with water; the remaining portion contains air. This water is either held by molecular attraction, or is moving downward toward the zone of saturation. Water within the ground above the saturated zone moves downward under the influence

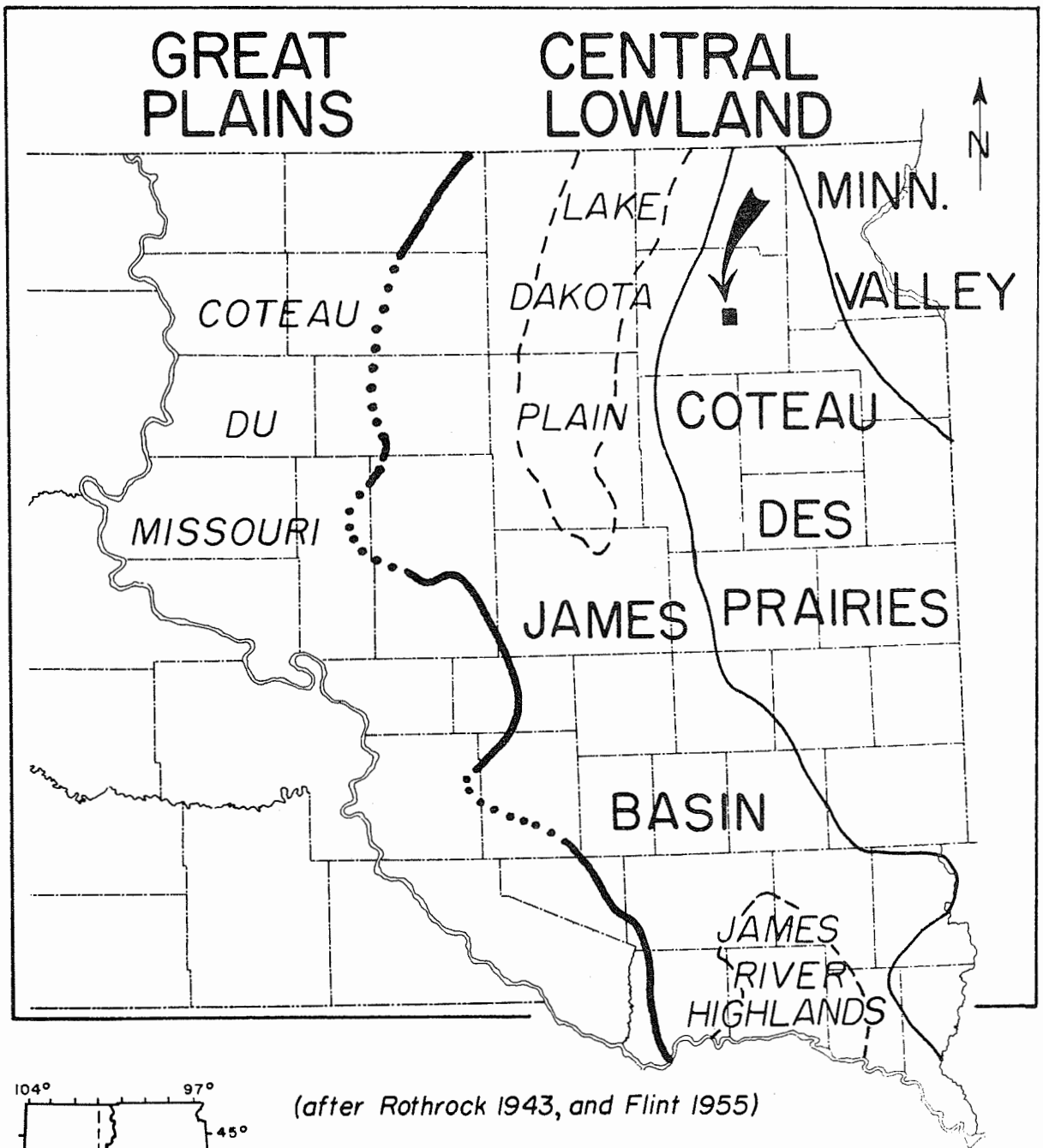
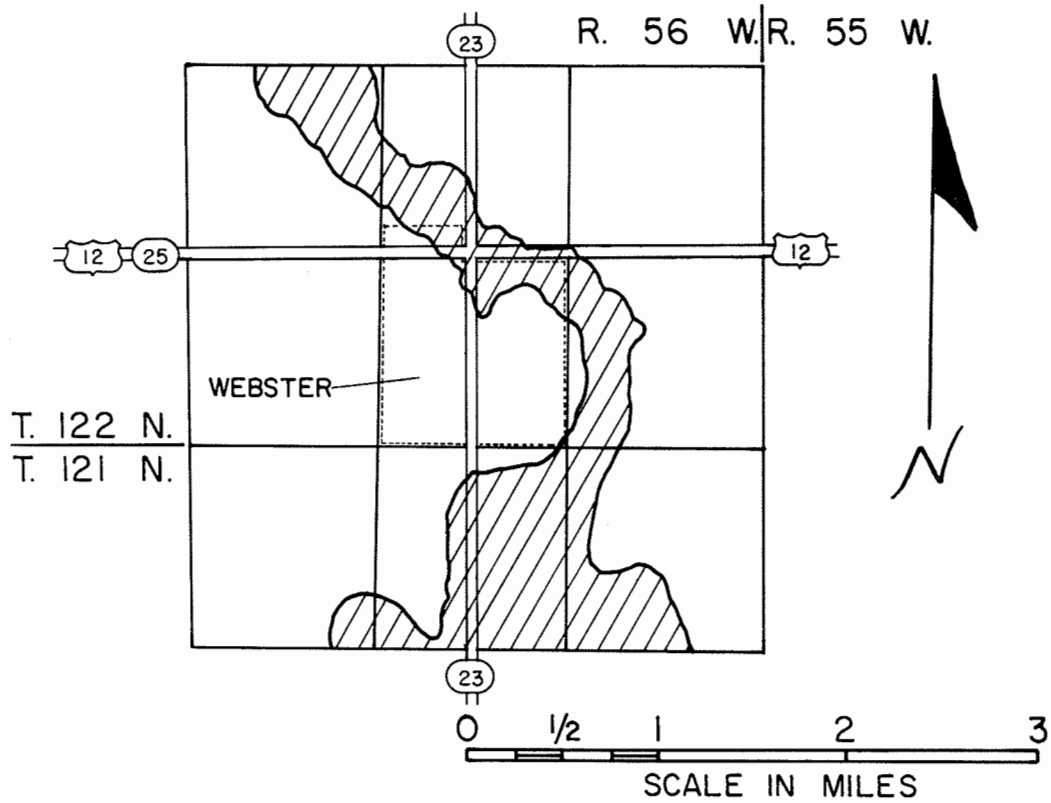


Figure 1. Map of eastern South Dakota showing the major physiographic divisions and location of the Webster area.



EXPLANATION

PLEISTOCENE

Sand and gravel

Clay

QUATERNARY

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Figure 2. Generalized geologic map of the Webster area.

of gravity, whereas in the saturated zone, it moves in a direction determined by the hydraulic gradient.

Contrary to popular belief, ground water does not occur in "veins" that crisscross the land at random. Instead it can be shown that water is found nearly everywhere beneath the surface, but at varying depths.

Nearly all ground water is derived from precipitation in the form of rain, snow, or ice. This water either evaporates, percolates directly downward to the water table and becomes ground water, or drains off as surface water. Surface water either evaporates, escapes to the ocean by streams, or percolates downward into the rocks.

Recharge is the addition of water to an aquifer (a deposit having structures that permit appreciable water to move through it under ordinary field conditions). Recharge to an aquifer is accomplished in four general ways: (1) by downward percolation of precipitation from the ground surface, (2) by downward percolation from surface bodies of water, (3) by lateral movement of ground water into the area, and (4) by artificial recharge, which takes place from excess irrigation, seepage from canals, and water purposely applied to augment ground-water supplies.

Discharge of ground water from an aquifer is accomplished in four ways: (1) by evaporation and transpiration by plants, (2) by seepage upward or laterally into surface bodies of water, (3) by lateral movement of ground water out of the area, and (4) by pumping from wells, which constitutes the major artificial discharge of ground water.

The porosity of a rock or soil is a measure of the contained open pore spaces, and is expressed as the percentage of void spaces to the total volume of the rock. Porosity of a sedimentary deposit depends chiefly on (1) the shape and arrangement of its constituent particles, (2) the degree of sorting of its particles, (3) the cementation and compaction to which it has been subjected since its deposition, (4) the removal of mineral matter through solution by percolating waters, and (5) the fracturing of the rocks, resulting in joints and other openings. Thus, the size of the material has little or no effect on porosity if all other factors are equal.

The permeability of a rock is its capacity for transmitting a fluid. Water will pass through a material with interconnected pores, but will not pass through material with unconnected pores, even if the latter material has a higher porosity. Therefore, permeability and porosity are not synonymous terms.

Ground Water in Glacial Deposits

It was stated earlier that glacial deposits are divided into till and outwash. Till does not yield water readily because of its highly unsorted nature and the predominance of silt and clay. Locally there may occur some lenses of sand and gravel within the till which provide an adequate supply of water for a farm well, but till as a unit cannot function as a source of water for municipalities. Outwash, usually a highly permeable deposit, may constitute an aquifer if it is extensive and located below the water table.

City well 3 is drilled to a depth of 83 feet. The results of the test holes in this location (fig. 3 and app. A, test holes 12, 13, and 14) indicate that the thickness of this aquifer is approximately 25 feet.

The remaining city wells are drilled to a depth of approximately 200 feet. Test holes from the area (fig. 4 and app. A, test holes 15 and 16) indicate that the thickness of this outwash is approximately 40 feet at the vicinity of city well 6. The data also indicate that this aquifer is more extensive than the aquifer at a depth of 80 feet. Test hole 3 shows that the drilling was halted due to very coarse gravel.

There is also an outwash layer at a depth of approximately 420 feet which was penetrated by some of the deep holes.

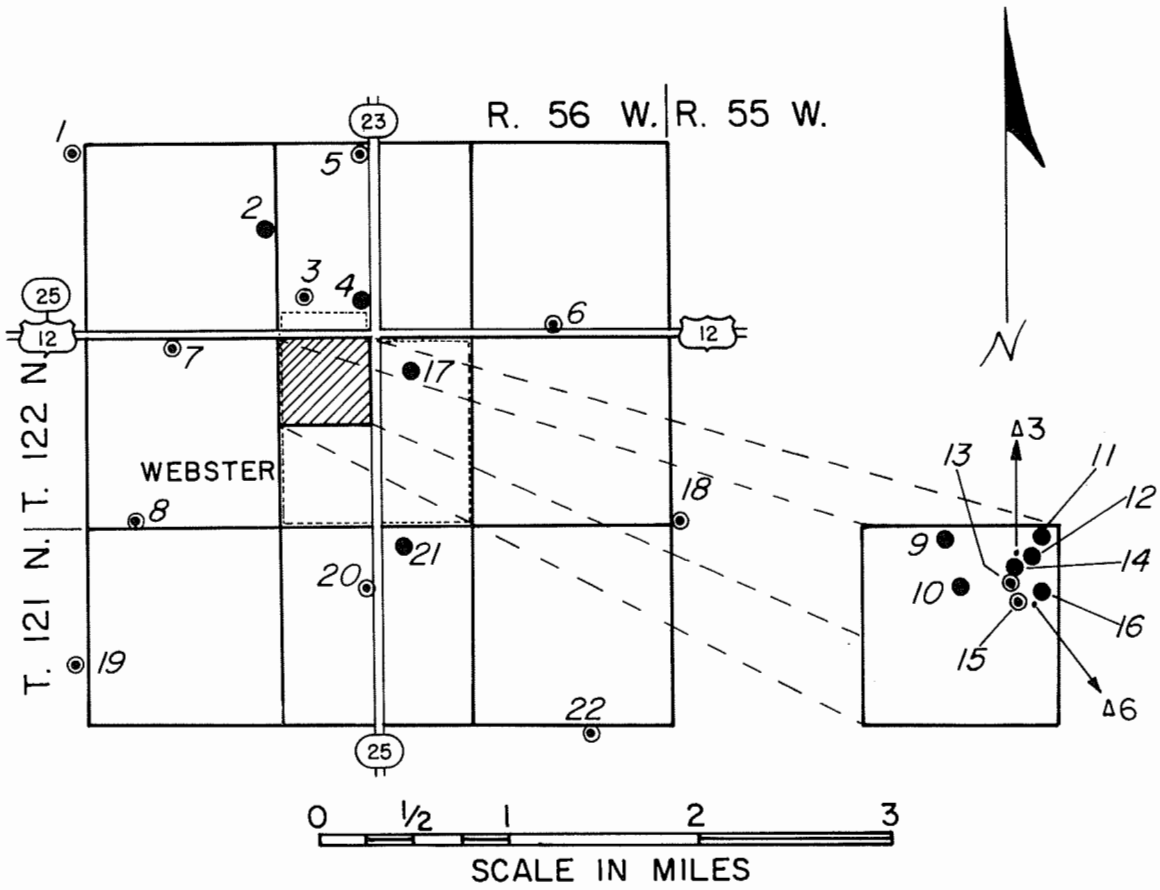
Ground Water in Bedrock

A deep test hole which was drilled next to the water plant indicates that the Codell Sandstone Member is present; this deposit is not expected to produce a large quantity of water because of very fine particle size and silt content. The next significant aquifer is the Dakota Formation. The transmissibility (permeability times thickness) of this formation is expected to be much less than the outwash aquifer.

Quality of Ground Water

Ground water always contains dissolved chemicals. Contained chemicals are derived from (1) the atmosphere as water vapor condenses and falls, (2) the soil and underlying deposits as the water moves downward to the water table, and (3) the rocks below the water table. In general, the more chemical substances that a water contains, the poorer its quality.

Table 1 shows the chemical quality of water samples collected in the Webster area (for map location, see fig. 5). All samples are from wells yielding water from glacial deposits. Samples W-3, W-5, W-6, W-9, W-15, and W-17 were collected from sand and gravel lenses or outwash deposits less than 50 feet deep. Except for sample W-15 all samples in this group have higher sulfate and total solids than the recommended limits set by the South Dakota Department of Health. Also, samples W-3, W-6, W-15, and W-17 have higher manganese than the



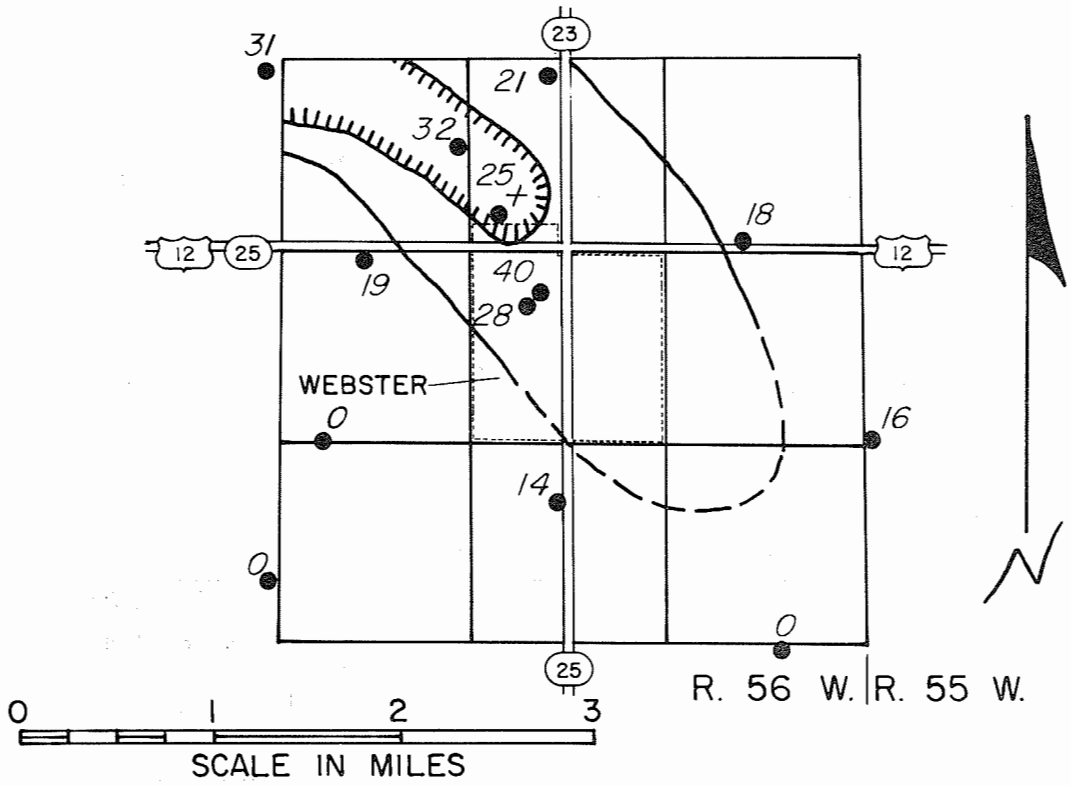
EXPLANATION

●7 Rotary test hole
●4 Auger test hole
Numbers refer to test holes in Appendix A.

Δ3 Location of city well, numbers refer to the city well numbers.

by Assad Barari, 1971 drafted by Rich Markus

Figure 3. Map showing location of rotary and auger test holes in the Webster area.



EXPLANATION

Area which contains more than 20 feet of sand and gravel (dashed in the area of limited data.

Recommended area for future well development.

25 + Test hole, number indicates thickness of sand and gravel (+ indicates that full thickness of outwash was not penetrated.)

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Figure 4. Map showing thickness of the outwash deposits at a depth of approximately 200 feet.

Table 1. Chemical Analyses of Water Samples from the Webster Area.

Sample	Depth of Well	Parts Per Million											
		Calcium	Sodium	Magnesium	Chlorides	Sulfate	Iron	Manganese	Nitrate Nitrogen	Fluoride	pH	Hardness $CaCO_3$	Total Solids
A	------	------	------	------	250	500[1]	0.3	0.05	10.0	0.9-1.7[2]	-----	------	1000[1]
W- 1	240	210		92	6	1200	0.00	0.90	0.27			900	1590
W- 2	210	265		35	0.6	1100	0.06	0.90	0.2		8.0	805	1252
W- 3	37	140		120	20.0	1075	0.00	1.52	0.1		8.1	830	1500
W- 4	200	110		120	60.0	500	0.00	0.25	6.1		8.2	770	1092
W- 5	30	210		55	3.0	665	0.16	0.00	0.38			750	1415
W- 6	45	230		90	12.0	775	0.12	0.68	1.80			935	1685
W- 7	188	210		55	8.0	1200	0.10	0.85	0.20			750	1435
W- 8	190	340			11.0	390	0.00	0.00	0.10			710	1125
W- 9	33	415		224	90.0	2275	0.00	0.00	25.0			1950	3830
W-10	210	160		70	35.0	925	0.00	0.68	0.17			685	1235
W-11	80	185		154	135.0	800	0.00	0.00	26.0			1090	1970
W-12	83	235		64	9.4	650	0.13	0.72	1.38		7.4	847	1385
W-13	187	204	123	73	18.0	796	0.80	0.80	0.0	0.5	7.2	830?	1425
W-14	200?	195		60	8.0	590	0.08	0.0	0.28			720	1120
W-15	23	70		75	40.0	185	0.00	0.09	4.2		8.4	490	658
W-16	190	120		105	12.0	925	0.00	3.22	3.0		8.4	725	1226
W-17	11	195		70		875	0.06	0.80	1.00			775	2570
W-18	200	105		9	8.0	200	0.00	0.00	0.44			300	810

A. Drinking water standards, U.S. Public Health Service (1962).

Sample W-13 was analyzed by the South Dakota Department of Health. (South Dakota Department of Health, 1971).

All other samples were analyzed by the South Dakota Geological Survey.

[1] Modified for South Dakota by the Department of Health (written communication, Water Sanitation Section, September 24, 1968).

[2] 1.2 is optimum for South Dakota.

Location of Water Samples
(For map location, see fig. 5)

W- 1 SE¼SE¼NW¼ sec. 27, T. 122 N., R. 56 W., C. Weber, 165 feet to water

W- 2 SE¼SW¼SW¼ sec. 27, T. 122 N., R. 56 W., Krause, ? feet to water

W- 3 SW¼SE¼NE¼NE¼ sec. 27, T. 122 N., R. 56 W., A. M. Bierschbach, 15 feet to water

W- 4 SW¼SE¼NE¼NE¼ sec. 27, T. 122 N., R. 56 W., A. M. Bierschbach, 150 feet to water

W- 5 SW¼SE¼NE¼NW¼ sec. 26, T. 122 N., R. 56 W., M. Likness, 20 feet to water

W- 6 SW¼SE¼NE¼NW¼ sec. 26, T. 122 N., R. 56 W., M. Likness, 25 feet to water

W- 7 SE¼SW¼SW¼NE¼ sec. 26, T. 122 N., R. 56 W., N. Grode, 175 feet to water

W- 8 SW¼SW¼NW¼NE¼ sec. 26, T. 122 N., R. 56 W., R. Schumacher, ? feet to water

W- 9 NW¼NW¼SW¼SW¼ sec. 25, T. 122 N., R. 56 W., R. Jones, ? feet to water

W-10 NW¼NW¼SE¼SW¼ sec. 25, T. 122 N., R. 56 W., J. A. Peterson, 200 feet to water

W-11 SW¼NE¼SE¼NW¼ sec. 34, T. 122 N., R. 56 W., E. Christenson, 80 feet to water

W-12 NE¼NE¼NW¼ sec. 35, T. 122 N., R. 56 W., city of Webster well 3, 35 feet to water

W-13 SE¼NE¼NW¼ sec. 35, T. 122 N., R. 56 W., city of Webster well 6, 114 feet to water

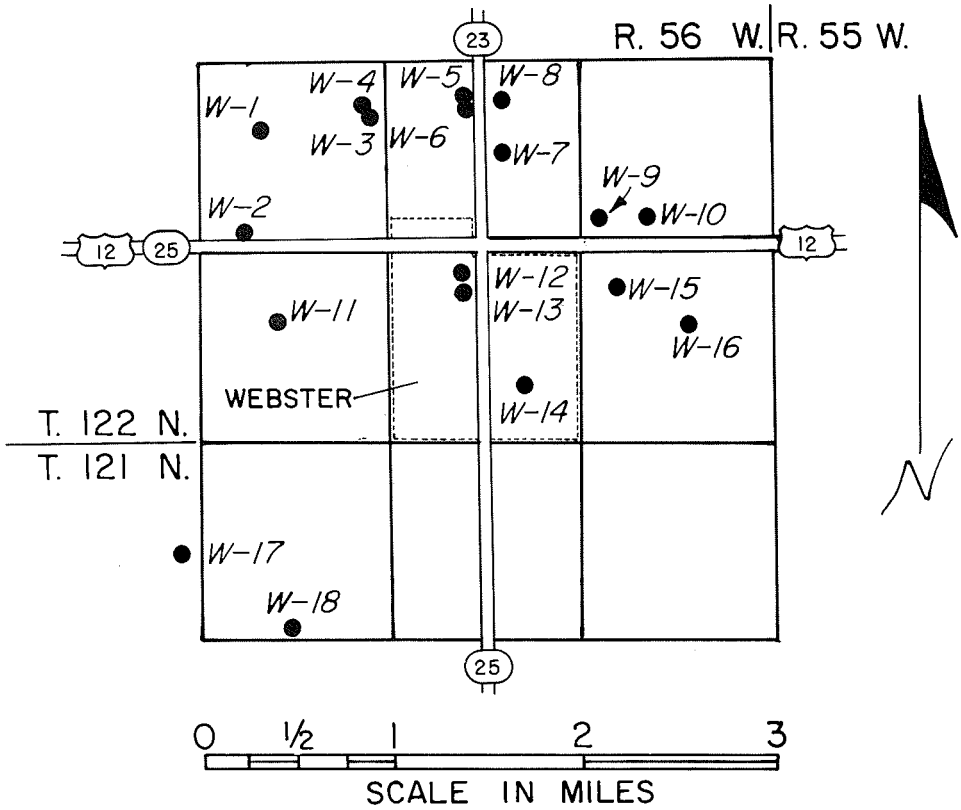
W-14 SE¼NW¼SE¼ sec. 35, T. 122 N., R. 56 W., Northwestern Public Service well, 175? feet to water

W-15 SE¼NW¼NW¼NW¼ sec. 36, T. 122 N., R. 56 W., H. Stephens, 7 feet to water

W-16 SW¼NW¼SW¼NE¼ sec. 36, T. 122 N., R. 56 W., R. Anderson, 126 feet to water

W-17 SE¼NE¼NE¼ sec. 4, T. 121 N., R. 56 W., B. Lambert, 5 feet to water

W-18 SE¼SE¼SE¼SW¼ sec. 3, T. 121 N., R. 56 W., D. Wattier, ? feet to water



EXPLANATION

W-12 Location of water samples (numbers refer to water samples in Table 1.)

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Figure 5. Map showing location of water samples collected in the Webster area.

recommended limits. The remaining analyzed chemicals are within the limits set by the South Dakota Department of Health.

Samples W-11 and W-12 are from wells yielding water from an outwash at a depth of 80 feet. Sample W-12 was collected from city well 3. Both samples have higher sulfate and total solids, and sample W-12 has higher manganese than the recommended limits.

Samples W-1, W-2, W-4, W-7, W-8, W-10, W-13, W-14, W-16, and W-18 were collected from the outwash deposits at a depth of approximately 200 feet. Sample W-13 was collected and analyzed in 1969 by the South Dakota Department of Health. Except for sample W-18 all samples in this group have generally higher sulfate and total solids than the recommended limits. Also, samples W-1, W-2, W-4, W-7, W-10, W-13, and W-16 have higher manganese than the limits set by the South Dakota Department of Health. Sample W-13 has higher iron and less fluoride than the recommended limits. All other analyzed chemicals in this group are within the limits set by the South Dakota Department of Health. Table 2 shows the significance of some physical and chemical properties of drinking water.

CONCLUSIONS AND RECOMMENDATIONS

It was stated earlier that there are three glacial aquifers in the study area:

A shallow outwash deposit was penetrated by city well 3 which is drilled to a depth of 83 feet. The thickness of this aquifer is approximately 25 feet, but the extent of this deposit is limited.

An outwash deposit 200 feet deep was penetrated by all of the city wells, except city well 3. The results of the test holes in the area indicate that the thickness of this aquifer in the vicinity of city well 6 is approximately 40 feet. The drilling of test hole 3, which is northwest of the city (fig. 3), was halted after penetrating 25 feet of very coarse gravel. The drilling was stopped due to caving of the gravel, in spite of the fact that a large quantity of bentonite was used. The chemical quality of the water from this location is expected to be comparable to the present city well water.

A deep glacial aquifer was encountered at a depth of approximately 420 feet. Three of the five test holes (test holes 1, 5, and 8) which were drilled to the bottom of the glacial drift indicate that this aquifer is approximately 16 feet thick. More data are necessary to define the water quality, extent, and hydraulic properties of the aquifer.

The Dakota Formation is the next major aquifer in the area which is located at a depth of approximately 1,500 feet. The Dakota Formation is thicker than the outwash deposit at the depth of 200 feet, but available data indicate that the transmissibility (permeability times thickness) is much less than the glacial aquifer.

If the city should decide to drill another well(s) in the 200-foot level glacial outwash, it is recommended that the city hire an engineering firm licensed in South Dakota to coordinate the drilling and piping of the water to the city. It is recommended that the well be drilled in the northwest part of town (preferably in the vicinity of test hole 3). A short pump test (approximately 24 hours) should be conducted in this area before the completion of the well. The South Dakota Geological Survey will provide technical assistance and supervise the conducting of the pump test. Recommendation of future well spacing will be based on the results of the pump test.

If the city should decide to test the potential of the deep outwash aquifer or the Dakota Formation, the same procedure recommended for the 200-foot deep aquifer should be followed, with the exception that the pump test should be conducted for at least 72 hours.

Before a permanent well is drilled, the city officials should contact the Division of Water Rights, Department of Natural Resource Development, to obtain water rights and a permit to drill a municipal well and the Environmental Protection Agency to determine the biological and chemical suitability of the water.

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Jorgensen, D. G., 1966, Ground-water supply for the city of Lake Norden: S. Dak. Geol. Survey Special Report 34, 27 p., 6 figs.

Rothrock, E. P., 1943, A geology of South Dakota, Part I: The Surface: S. Dak. Geol. Survey Bull. 13, 88 p.

South Dakota Department of Health, 1971, S. Dak. Public Water Supply Data, 47 p.

U.S. Public Health Service, 1962, Drinking water standards: U.S. Public Health Service 956, 61 p.

Table 2.--Significance of some chemical and physical properties of drinking water.

Chemical Constituents	Significance	Recommended Limits (ppm)[1]
Calcium (Ca) and Magnesium (Mg)	Cause most of the carbonate hardness and scale-forming properties of water by combining with carbonate and bicarbonate present in the water. Seldom can be tasted except in extreme concentrations.	Ca—None Mg—None
Sodium (Na)	Large amounts in combination with chloride will give water a salty taste. Large amounts will limit water for irrigation and industrial use.	None
Chloride (Cl)	Large amounts in combination with sodium give water a salty taste. Large quantities will also increase corrosiveness of water.	250
Sulfate (SO_4)	Large amounts of sulfate in combination with other ions give a bitter taste to water and may act as a laxative to those not used to drinking it. Sulfates of calcium and magnesium will form hard scale. U. S. Public Health Service recommends 250 ppm maximum concentration.	500[2]
Iron (Fe) and Manganese (Mn)	In excess will stain fabrics, utensils, and fixtures and produce objectionable coloration in the water. Both constituents in excess are particularly objectionable.	Fe—0.3 Mn—0.05
Nitrate Nitrogen (N)	In excess may be injurious when used in infant feeding. The U. S. Public Health Service regards 45 ppm as the safe limit of nitrate (NO_3) or 10 ppm nitrate nitrogen (N).	10
Fluoride (F)	Reduces incidence of tooth decay when optimum fluoride content is present in water consumed by children during period of tooth calcification. Excessive fluoride in water may cause mottling of enamel.	0.9-1.7[3]
pH	A measure of the hydrogen ion concentration; pH of 7.0 indicates a neutral solution, pH values lower than 7.0 indicate acidity, pH values higher than 7.0 indicate alkalinity. Alkalinity tends to aid encrustation and acidity tends to aid corrosion.	None
Hardness	Hardness equivalent to carbonate and bicarbonate is called carbonate hardness. Hardness in excess of this amount is noncarbonate hardness. Hardness in water consumes soap and forms soap curd. Will also cause scale in boilers, water heaters, and pipes. Water containing 0-60 ppm hardness considered soft; 61-120 ppm moderately hard; 121-180 ppm hard, and more than 180 ppm very hard. Good drinking water can be very hard.	None
Total Solids	Total of all dissolved constituents. U. S. Public Health Department recommends 500 ppm maximum concentration. Water containing more than 1000 ppm dissolved solids may have a noticeable taste; it may also be unsuitable for irrigation and certain industrial uses.	1000[2]

Modified from Jorgensen (1966).
[1] (ppm) parts per million.
[2] Modified for South Dakota by the South Dakota Department of Health (written communication, Water Sanitation Section, September 24, 1968).
[3] 1.2 is optimum for South Dakota.

APPENDIX A

Logs of Test Holes in the Webster Area
(For map location, see fig. 3)

Test Hole 1 (Rotary Test Hole)
Location: NE¼NE¼NE¼NE¼ sec. 28, T. 122 N., R. 56 W.
Surface Elevation: 1836.80 feet
Depth to water: not measured

0- 1	Soil
1- 3	Clay, yellowish-brown, pebbly
3- 7	Sand and gravel
7- 21	Clay, yellowish-brown
21-158	Clay, gray, pebbly
158-161	Sand and gravel
161-178	Clay, gray
178-179	Rock
179-211	Clay, pebbly
211-241	Sand (very coarse) and gravel
241-416	Clay, dark-gray, sandy
416-435	Gravel, medium to coarse
435-444	Clay, gray, sandy, (till)
444-470	Clay, dark-gray, (shale)

* * * *

Test Hole 2 (Observation Well)
Location: SE¼SE¼SE¼NE¼ sec. 27, T. 122 N., R. 56 W.
Top of Observation Well: 1833.87 feet
Depth to water: 134 feet

0- 10	Sand and gravel
10-100	Clay, gray, sandy
100-103	Sand and gravel
103-168	Clay, gray, pebbly
168-200	Gravel
200-202	Clay, gray
202-205	Gravel
205-217	Clay, gray, pebbly

* * * *

Test Hole 3 (Rotary Test Hole)
Location: NE¼NE¼SW¼SW¼ sec. 26, T. 122 N., R. 56 W.
Surface Elevation: 1828.40 feet
Depth to water: not measured

0- 4	Soil, black
4- 8	Gravel
8- 96	Clay, gray, pebbly
96-107	Sand and gravel, some clay layers
107-160	Clay, gray, sandy
160-185	Gravel, very coarse (caving and binding pipe, after adding 20 bags of bentonite, abandoned the hole)

* * * *

Test Hole 4 (Auger Test Hole)
Location: SE¼NE¼SE¼SW¼ sec. 26, T. 122 N., R. 56 W.
Surface Elevation: not measured
Depth to Water: 8? feet

0 - 1	Soil
1 - 11	Clay, brown, pebbly
11 - 14	Clay, gray, sandy
14 - 21	Sand and gravel
21 - 27	Clay, gray, pebbly
27 - 31	Sand and gravel
31 - 37	Clay, gray, sandy
37 - 50?	Sand, very fine, not much clay
50?- 70?	Clay, gray, very pebbly
70?- 85	Sand and gravel, gray
85 - 92	Clay, pebbly

* * * *

Test Hole 5 (Rotary Test Hole)
Location: NE¼NE¼NE¼NW¼ sec. 26, T. 122 N., R. 56 W.
Surface Elevation: 1831.83 feet
Depth to water: not measured

0- 16	Clay, yellowish-brown, pebbly
16- 78	Clay, gray, pebbly
78-159	Clay, gray, gravelly

Test Hole 5 -- continued.

159-171	Sand and gravel
171-180	Sand and gravel (with a clay layer at 172 feet
180-202	Clay, yellowish-brown, sandy
202-210	Sand, very coarse, some gravel
210-274	Clay, dark-gray, sandy
274-361	Clay, pebbly, some thin gravel layers
361-374	Sand, gravel layers and clay layers
374-452	Clay, dark-gray, pebbly, (till)
452-470	Clay, bluish-black, compact, (shale)

* * * *

Test Hole 6 (Rotary Test Hole)
Location: SW¼SE¼SE¼SW¼ sec. 25, T. 122 N., R. 56 W.
Surface Elevation: 1822.46 feet
Depth to water: not measured

0- 17	Clay, yellowish-brown, pebbly
17- 18	Gravel
18-142	Clay, gray, pebbly, some thin gravel layers
142-150	Gravel
150-172	Clay, yellowish-brown
172-190	Gravel
190-200	Clay, gray, pebbly

* * * *

Test Hole 7
Location: NE¼NE¼NE¼NW¼ sec. 34, T. 122 N., R. 56 W.
Surface Elevation: 1846.15 feet
Depth to water: not measured

0- 1	Soil
1- 18	Clay, yellowish-brown
18- 23	Clay, grayish-brown, pebbly
23- 43	Clay, gray, pebbly
43- 45	Sand and gravel
45- 70	Clay, gray, pebbly
70- 83	Sand and gravel
83-162	Clay, gray, pebbly

Test Hole 7 -- continued.

162-167	Sand and gravel
167-190	Clay, dark-gray, pebbly
190-209	Sand and gravel
209-230	Clay, yellowish-brown, (till)

* * * *

Test Hole 8
Location: SE¼SW¼SW¼ sec. 34, T. 122 N., R. 56 W.
Surface Elevation: 1828.23 feet
Depth to water: not measured

0- 5	Sand and gravel
5- 17	Clay, yellowish-brown
17-120	Rocks
120-185	Clay, gray, pebbly
185-235	Clay, yellow, pebbly
235-290	Clay, gray, pebbly
290-300	Clay, sandy
300-393	Clay, gray, pebbly
393-400	Gravel, coarse
400-410	Gravel, some clay layers
410-455	Clay, bluish-black, compact, (shale)

* * * *

Test Hole 9 (Auger Test Hole)
Location: NE¼NE¼NW¼NW¼ sec. 35, T. 122 N., R. 56 W.
Surface Elevation: not measured
Depth to water: 27? feet

0 - 2	Soil, dark-brown, sandy
2 - 13	Clay, yellowish-brown
13 - 48	Clay, gray, pebbly
48 - 63	Sand, very fine, gray
63 - 79?	Sand and gravel, gray
79?- 91	Clay, gray, pebbly

* * * *

Test Hole 10 (Auger Test Hole)
Location: NW¼SW¼NE¼NW¼ sec. 35, T. 122 N., R. 56 W.
Surface Elevation: not measured
Depth to water: 2? feet

0- 2	Soil
2- 6	Clay, dark-gray, pebbly
6- 18	Clay, brown
18- 41	Clay, gray, pebbly
41- 49	Sand, gray
49- 99	Clay, gray, pebbly

* * * *

Test Hole 11 (Auger Test Hole)
Location: NE¼NE¼NE¼NW¼ sec. 35, T. 122 N., R. 56 W.
Surface Elevation: not measured
Depth to water: 4 feet

0 - 2	Soil
2 - 5	Clay, brown, sandy
5 - 11	Sand, brown, coarse
11 - 14	Clay, brown, pebbly
14 - 41?	Clay, gray, pebbly
41?- 60	Sand, gray, very fine
60 - 76	Sand and gravel, gray
76 - 84	Clay, gray, very pebbly

* * * *

Test Hole 12 (Observation Well)
Location: SW¼NE¼NE¼NW¼ sec. 35, T. 122 N., R. 56 W.
Top of Observation Well: 1816.98 feet
Depth to water: 34 feet

0- 2	Soil, brown, sandy
2- 14	Clay, brown, sandy
14- 34	Clay, gray, pebbly
34- 44	Clay, sandy
44- 59	Sand, gray, very fine
59- 81	Sand and gravel, some small clay layers
81- 84	Clay, gray, pebbly, (till)

* * * *

Test Hole 13 (Observation Well)
Location: SW¼NE¼NE¼NW¼ sec. 35, T. 122 N., R. 56 W.
Top of Observation Well: 1819? feet
Depth to water: 35 feet

0- 2	Soil, black
2- 16	Clay, brown, pebbly
16- 31	Clay, gray, sandy
31- 51	Sand, gray, very fine
51- 62	Clay, sandy
62- 87	Sand and gravel, gray, thin clay layers at 69 feet
87- 91	Clay, gray, pebbly

* * * *

Test Hole 14 (Observation Well)
Location: SE¼NW¼NE¼NW¼ sec. 35, T. 122 N., R. 56 W.
Top of Observation Well: 1819.74 feet
Depth to water: 33 feet

0- 15	Clay, yellow, pebbly
15- 42	Clay, gray
42- 67	Sand, gray, some clay layers
67- 90	Gravel
90- 95	Clay, gray

* * * *

Test Hole 15 (Observation Well)
Location: NE¼SE¼NE¼NW¼ sec. 35, T. 122 N., R. 56 W.
Top of Observation Well: 1814.60 feet
Depth to water: 116.5 feet

0- 1	Sand
1- 16	Clay, yellowish-brown, pebbly
16- 33	Clay, gray, pebbly
33- 37	Sand and gravel
37- 94	Clay, gray
94-110	Sand and gravel, coarse
110-115	Clay, gray
115-122	Sand and gravel, some clay layers
122-150	Clay, gray
150-153	Gravel
153-158	Clay, gray

Test Hole 15 -- continued.

158-160	Gravel
160-168	Clay, gray
168-180	Gravel
180-182	Clay, gray, gravelly
182-196	Gravel
196-220	Clay, gray, gravelly, boulders at 200 feet

* * * *

Test Hole 16 (Observation Well)
Location: NE¼SE¼NE¼NW¼ sec. 35, T. 122 N., R. 56 W.
Top of Observation Well: 1819.16 feet
Depth to water: 118 feet

0- 9	Clay, gravelly
9- 18	Clay, yellowish-brown, pebbly
18- 99	Clay, gray, pebbly
99-117	Clay, gray, sandy
117-118	Gravel
118-122	Clay, gray, pebbly
122-126	Gravel
126-144	Clay, gray, some gravel
144-189	Gravel, some clay layers
189-200	Clay, gray, gravelly, (till)

* * * *

Test Hole 17 (Auger Test Hole)
Location: SE¼SE¼NW¼NE¼ sec. 35, T. 122 N., R. 56 W.
Surface Elevation: not measured
Depth to water: 9 feet

0- 6	Clay, brown, sandy
6- 37	Clay, gray
37- 57	Clay, grayish-brown, pebbly
57- 79	Clay, gray, pebbly

* * * *

Test Hole 18 (Rotary Test Hole)
Location: SW¼SW¼SW¼SW¼ sec. 31, T. 122 N., R. 55 W.
Surface Elevation: 1867.47 feet
Depth to water: not measured

0- 12	Clay, reddish-brown, pebbly
12- 18	Clay, yellowish-brown
18-141	Clay, gray, pebbly
141-144	Boulder
144-170	Clay, gray, pebbly
170-220	Clay, gravelly
220-223	Gravel
223-229	Clay, gray, pebbly
229-245	Gravel
245-456	Clay, gray, gravelly
456-461	Sand, coarse
461-490	Clay, gray, sandy
490-515	Clay, bluish-black, compact, (shale)

* * * *

Test Hole 19 (Rotary Test Hole)
Location: NE¼SE¼NE¼SE¼ sec. 4, T. 121 N., R. 56 W.
Surface Elevation: 1841.24 feet
Depth to water: not measured

0- 5	Clay, yellowish-brown
5- 22	Sand and gravel
22- 25	Clay, grayish-brown, pebbly
25-141	Clay, gray, pebbly
141-143	Sand and gravel
143-174	Clay, gray, pebbly
174-235	Clay, yellowish-brown
235-290	Clay, gray
290-360	Clay, yellowish-brown
360-435	Clay, gray, some thin clay layers
435-442	Clay, gray, pebbly, (till)
442-470	Clay, dark-gray, compact, (shale)

* * * *

Test Hole 20 (Rotary Test Hole)
Location: NE¼NE¼SE¼NW¼ sec. 2, T. 121 N., R. 56 W.
Surface Elevation: 1827.67 feet
Depth to water: not measured

0- 18	Gravel
18-104	Clay, gray, pebbly
104-112	Gravel
112-140	Clay and sand layers
140-154	Clay, gray, gravelly
154-168	Gravel
168-171	Clay, gray
171-176	Gravel
176-187	Clay, gray, gravelly
187-189	Boulder
189-245	Clay, gray, pebbly, lot of brown clay samples

* * * *

Test Hole 21 (Auger Test Hole)
Location: SW¼NE¼NW¼NE¼ sec. 2, T. 121 N., R. 56 W.
Surface Elevation: not measured
Depth to water: 9 feet

0- 2	Soil
2- 3	Clay, yellowish-brown, pebbly
3- 17	Sand and gravel, not much clay
17- 74	Clay, gray, very pebbly, (till)

* * * *

Test Hole 22 (Rotary Test Hole)
Location: NE¼NW¼NE¼NW¼ sec. 12, T. 121 N., R. 56 W.
Surface Elevation: 1824.41 feet
Depth to water: not measured

0- 30	Clay, yellowish-brown, pebbly
30-165	Clay, gray, pebbly
165-185	Clay, yellow, pebbly
185-191	Clay, gray, pebbly
191-212	Clay, gravelly
212-230	Clay, yellowish-brown
230-271	Clay, gray
271-290	Clay, dark-gray

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APPENDIX B

Well Records in the Webster Area

Use: D, domestic; S, stock

Source of all water is from glacial sand lenses or outwash deposits.

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
McCarlson, A.	SE¼SW¼ sec. 13, T. 123 N., R. 57 W.	67		S
Yost, G.	NW¼ sec. 16, T. 123 N., R. 57 W.	375	40	D,S
Saarheim, M.	NW¼NE¼NW¼ sec. 17, T. 123 N., R. 57 W.	270	180	D,S
Loken, P.	NE¼NE¼SE¼ sec. 17, T. 123 N., R. 57 W.	350		D,S
Raap, O.	NE¼SE¼NE¼ sec. 20, T. 123 N., R. 57 W.	325	200	D,S
Raap, O.	SE¼NE¼ sec. 20, T. 123 N., R. 57 W.	315	170	D,S
Tvinnereim, E.	NE¼NE¼SE¼ sec. 25, T. 123 N., R. 57 W.	80	15	S
Anderson, R.	SW¼ sec. 28, T. 123 N., R. 57 W.	220	60	D,S
Raap, D.	NW¼NW¼ sec. 32, T. 123 N., R. 57 W.	350	200	D,S
Anderson, R.	NW¼ sec. 33, T. 123 N., R. 57 W.	220		D,S
Anderson, H.	SW¼SW¼SE¼ sec. 34, T. 123 N., R. 57 W.	230	100	D,S
Anderson, H.	SW¼SW¼SE¼ sec. 34, T. 123 N., R. 57 W.	74	30	D,S
Waddle, E.	SE¼SE¼SW¼ sec. 14, T. 123 N., R. 56 W.	27	18	D,S
Hendrickson, R.	NW¼NW¼NW¼ sec. 15, T. 123 N., R. 56 W.	230	90	D,S
Hendrickson, R.	SW¼NW¼NW¼ sec. 15, T. 123 N., R. 56 W.	236	90	D,S
Larson, F.	SE¼NE¼NE¼ sec. 17, T. 123 N., R. 56 W.	100	74	D,S
Spiering, R. W.	SE¼ sec. 17, T. 123 N., R. 56 W.	87	65	D,S

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Berglund, E.	SE¼NE¼NE¼ sec. 23, T. 123 N., R. 56 W.	440	350	D,S
Glosimodt, G.	NW¼NW¼SE¼ sec. 25, T. 123 N., R. 56 W.	400	100	D,S
Ewalt, E.	SW¼SW¼SW¼ sec. 25, T. 123 N., R. 56 W.	240	100	D,S
Davidson, E.	SW¼NW¼NE¼ sec. 30, T. 123 N., R. 56 W.	293		D,S
Williams, A.	SW¼SW¼SW¼ sec. 35, T. 123 N., R. 56 W.	260		D,S
Gaikowski, J.	NE¼ sec. 36, T. 123 N., R. 56 W.	265	100	D,S
Ewalt, J.	NE¼SW¼SW¼ sec. 15, T. 123 N., R. 55 W.	190		D,S
Helwig, J.	NE¼NW¼NW¼ sec. 18, T. 123 N., R. 55 W.	250		D,S
Hagen, J.	SW¼ sec. 19, T. 123 N., R. 55 W.	400	150	D,S
Kampa, A.	SW¼ sec. 19, T. 123 N., R. 55 W.	64	4	D,S
Danielson, M.	SE¼NW¼ sec. 20, T. 123 N., R. 55 W.	50	26	S
Danielson, M.	SW¼SW¼SE¼ sec. 20, T. 123 N., R. 55 W.	50	30	D,S
Lesnar, J.	NE¼SW¼NE¼ sec. 22, T. 123 N., R. 55 W.	336	36	D,S
Wika, S.	SW¼SW¼NE¼ sec. 27, T. 123 N., R. 55 W.	35	29	D,S
Gonsoir, S.	SW¼SW¼NE¼ sec. 29, T. 123 N., R. 55 W.	131	24	D,S
Hagen, G.	NW¼NW¼SW¼ sec. 29, T. 123 N., R. 55 W.	70	35	D,S
Breske	SW¼SW¼SE¼ sec. 30, T. 123 N., R. 55 W.	90	40	
Gaikowski, P.	SW¼SE¼ sec. 30, T. 123 N., R. 55 W.	400	100	D,S
Wika, L.	NW¼ sec. 30, T. 123 N., R. 55 W.	47	18	D,S
Rumpca	NW¼ sec. 31, T. 123 N., R. 55 W.	70	30	D,S
Breske	SW¼SW¼NE¼ sec. 31, T. 123 N., R. 55 W.	80	29	

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Pratt, M.	SW¼SW¼SE¼ sec. 1, T. 122 N., R. 57 W.	250		
Johnson, L.	SW¼SW¼SW¼ sec. 2, T. 122 N., R. 57 W.	256	55	D,S
Nolte, H.	SE¼SE¼SE¼ sec. 2, T. 122 N., R. 57 W.	60	35	S
Bakken, T.	SE¼SE¼NW¼ sec. 4, T. 122 N., R. 57 W.	320	120	D,S
Kambestad, O.	SE¼SW¼SE¼ sec. 10, T. 122 N., R. 57 W.	60	20	S
Johnson, W.	NW¼NE¼NE¼ sec. 10, T. 122 N., R. 57 W.	60	20	S
Johnson, C.	NE¼NW¼ sec. 11, T. 122 N., R. 57 W.	65	52	S
Nolte, H.	NE¼NE¼NE¼ sec. 11, T. 122 N., R. 57 W.	300		D,S
Holmquist, A.	SW¼SE¼SE¼ sec. 22, T. 122 N., R. 57 W.	58	15	S
Johnson, D.	NW¼NE¼NE¼ sec. 23, T. 122 N., R. 57 W.	14	2	D,S
Carlson, A.	SE¼NW¼NE¼ sec. 24, T. 122 N., R. 57 W.	300	190	S
Carlson, J.	SE¼SE¼SW¼ sec. 26, T. 122 N., R. 57 W.	60	20	D,S
Golden	NW¼NW¼NE¼ sec. 26, T. 122 N., R. 57 W.	30	20	S
Gustafson, C.	SW¼NW¼NW¼ sec. 29, T. 122 N., R. 57 W.	60	20	D,S
Bury, L.	SW¼SE¼SE¼ sec. 32, T. 122 N., R. 57 W.	32	18	D,S
Plepp, E.	NE¼SE¼NE¼ sec. 32, T. 122 N., R. 57 W.	36	15	D,S
Bury, L.	SW¼SE¼SE¼ sec. 32, T. 122 N., R. 57 W.	35	15	D,S
Carlson, C.	SE¼SE¼SE¼SE¼ sec. 33, T. 122 N., R. 57 W.	225		D,S
Gaikowski, D.	SE¼SE¼NE¼ sec. 1, T. 122 N., R. 56 W.	80	25	D,S
Sichmeller, T.	NE¼NE¼NW¼ sec. 1, T. 122 N., R. 56 W.	65	55	D,S
Rumpca, P.	NE¼SE¼SE¼ sec. 2, T. 122 N., R. 56 W.	350		D,S

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Waddle, L.	SW¼SW¼SE¼ sec. 3, T. 122 N., R. 56 W.	250		D,S
Amundson, J.	SW¼SE¼SW¼ sec. 3, T. 122 N., R. 56 W.	280		D,S
Hanson, H.	SW¼SE¼SW¼ sec. 4, T. 122 N., R. 56 W.	200	180	D,S
Moir, W. W.	NE¼SE¼NE¼ sec. 4, T. 122 N., R. 56 W.			D
Amundson, K.	SE¼SE¼SW¼ sec. 6, T. 122 N., R. 56 W.	50	35	
Meuen, R.	NW¼NW¼SE¼ sec. 9, T. 122 N., R. 56 W.	84	42	D,S
Hanson, J.	SW¼NW¼NW¼ sec. 9, T. 122 N., R. 56 W.	78	65	
Phillips, A.	NE¼NE¼NE¼ sec. 10, T. 122 N., R. 56 W.	240	180	S
Koenig, J.	SE¼NE¼ sec. 11, T. 122 N., R. 56 W.	40		D,S
Grebner, P.	SW¼SE¼ sec. 11, T. 122 N., R. 56 W.	44		
Nelson, L.	NW¼NW¼NW¼ sec. 11, T. 122 N., R. 56 W.	80	58	S
Sichmeller, J.	SW¼SW¼NW¼ sec. 12, T. 122 N., R. 56 W.	60	30	D,S
Kanago, W.	SE¼SE¼SE¼ sec. 12, T. 122 N., R. 56 W.	64	32	D,S
Zenk, F.	SE¼SE¼SE¼ sec. 15, T. 122 N., R. 56 W.	350		D,S
Zenk, F.	SE¼SE¼SE¼ sec. 15, T. 122 N., R. 56 W.	244		D,S
McCarlson, S.	SW¼SW¼NW¼ sec. 15, T. 122 N., R. 56 W.	200	150	D,S
Christensen, A.	SW¼SE¼NW¼ sec. 16, T. 122 N., R. 56 W.	106	30	D,S
Lindquist, C.	NE¼SE¼NW¼ sec. 21, T. 122 N., R. 56 W.	75	30	D,S
Horst, A.	NE¼SE¼NE¼ sec. 22, T. 122 N., R. 56 W.	220	150	D,S
Jones, R.	NW¼NW¼SW¼SW¼ sec. 25, T. 122 N., R. 56 W.	33		S
Peterson, J. A.	NW¼NW¼SE¼SW¼ sec. 25, T. 122 N., R. 56 W.	210	200	D,S

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Grode, N.	SE¼SW¼SW¼NE¼ sec. 26, T. 122 N., R. 56 W.	188	178	D,S
Schumacher, R.	SW¼SW¼NW¼NE¼ sec. 26, T. 122 N., R. 56 W.	190		D,S
Likness, M.	SW¼SE¼NE¼NW¼ sec. 26, T. 122 N., R. 56 W.	30	20	D,S
Likness, M.	SW¼SE¼NE¼NW¼ sec. 26, T. 122 N., R. 56 W.	45	25	D,S
Weber, C.	SE¼SE¼NW¼ sec. 27, T. 122 N., R. 56 W.	240	165	D,S
Bierschbach, A. M.	NE¼SE¼NE¼ sec. 27, T. 122 N., R. 56 W.	200	180	S
Bierschbach, A. M.	NE¼SE¼NE¼ sec. 27, T. 122 N., R. 56 W.	35	7	D
Krause	SE¼SW¼SW¼ sec. 27, T. 122 N., R. 56 W.	210		
Sauer, W.	NW¼NE¼NW¼ sec. 32, T. 122 N., R. 56 W.	85	35	D,S
Christensen, E.	SW¼NE¼SE¼NW¼ sec. 34, T. 122 N., R. 56 W.	80	30	D,S
Northwestern Public Ser.	SE¼NW¼SE¼ sec. 35, T. 122 N., R. 56 W.	108		S
Larsen, A.	NW¼SW¼SW¼NE¼ sec. 36 T. 122 N., R. 56 W.	24		
Anderson, R.	SW¼NW¼SW¼NE¼ sec. 36, T. 122 N., R. 56 W.	190	126	D
Stephens, H.	SE¼NW¼NW¼NW¼ sec. 36, T. 122 N., R. 56 W.	22	7	D,S
Breske, T.	SE¼SE¼NE¼ sec. 6, T. 122 N., R. 55 W.	400	100	D,S
Breske, A.	SW¼SW¼NW¼ sec. 6, T. 122 N., R. 55 W.	68	55	D,S
Ninke, B.	SE¼SW¼SE¼ sec. 20, T. 122 N., R. 55 W.	300		D,S
Ninke, B.	SE¼SW¼SE¼ sec. 20, T. 122 N., R. 55 W.			D,S
Zenk, G.	SW¼SW¼NW¼ sec. 23, T. 122 N., R. 55 W.	49	11	D,S
Fisher, G.	NE¼SW¼SW¼SW¼ sec. 25, T. 122 N., R. 55 W.	40		D,S
Gollnick, E.	SW¼NE¼SE¼SE¼ sec. 26, T. 122 N., R. 55 W.	50		D,S

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Anderson, E.	SW¼SW¼SW¼ sec. 26, T. 122 N., R. 55 W.	12		D,S
Gollnick, E.	SW¼NE¼SE¼SE¼ sec. 26, T. 122 N., R. 55 W.	35		D,S
Gaikowski, S.	NE¼NE¼SW¼SE¼ sec. 27, T. 122 N., R. 55 W.	44		D,S
Peschke, D.	NW¼NE¼SE¼SW¼ sec. 28, T. 122 N., R. 55 W.	30		D,S
Ninke, P.	SE¼NE¼SE¼ sec. 29, T. 122 N., R. 55 W.			D,S
Hubsch, W.	SW¼SE¼NE¼ sec. 29, T. 122 N., R. 55 W.	270		D,S
Jorgenson, O.	NE¼ sec. 30, T. 122 N., R. 55 W.	260	6	D,S
McFarland, D.	NE¼SE¼SE¼SW¼ sec. 30, T. 122 N., R. 55 W.	55		D,S
Breske, R.	SE¼NW¼NE¼SE¼ sec. 30, T. 122 N., R. 55 W.	265	65	D,S
Ninke, W.	NW¼SE¼NE¼NW¼ sec. 33, T. 122 N., R. 55 W.	190		D,S
Hubsch, H.	SW¼NW¼SE¼SW¼ sec. 33, T. 122 N., R. 55 W.	45	18	D,S
Johnson, A.	SE¼SE¼NE¼ sec. 34, T. 122 N., R. 55 W.	55	20	D,S
Ninke, E. C.	SE¼SE¼SE¼ sec. 34, T. 122 N., R. 55 W.	304		D,S
Schmidt, H.	NE¼SW¼SE¼SW¼ sec. 35, T. 122 N., R. 55 W.	300		D,S
Jorgenson, I.	SW¼SW¼SW¼ sec. 8, T. 122 N., R. 54 W.	48	36	D,S
Tesch, R.	SE¼SE¼NE¼ sec. 18, T. 122 N., R. 54 W.	150	1	D,S
Tesch, R.	SE¼SE¼NE¼ sec. 18, T. 122 N., R. 54 W.		37	D,S
Kohlhoff, E.	SE¼NW¼SE¼ sec. 20, T. 122 N., R. 54 W.	30	15	D,S
Dembowski, J.	SE¼SE¼SE¼SE¼ sec. 30, T. 122 N., R. 54 W.	90		D,S
Dembowski, J.	SE¼SE¼SE¼SE¼ sec. 30, T. 122 N., R. 54 W.	190		D,S
Long, G.	NW¼NE¼NE¼SE¼ sec. 31, T. 122 N., R. 54 W.	155	50	D,S

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Kasten, K.	NE¼SW¼NW¼ sec. 17, T. 121 N., R. 57 W.			D,S
Petrich, E.	SW¼SE¼SE¼ sec. 20, T. 121 N., R. 57 W.	376		D,S
Petrich, E.	SW¼SE¼SE¼ sec. 20, T. 121 N., R. 57 W.	80		S
Coyne, F.	SE¼SE¼SE¼ sec. 21, T. 121 N., R. 57 W.	272		D,S
Coyne, F.	SE¼SE¼SE¼ sec. 21, T. 121 N., R. 57 W.	110		D,S
Whitmyre, R.	NW¼NW¼SE¼ sec. 24, T. 121 N., R. 57 W.	335	150	D,S
Whitmyre, J.	NE¼NW¼SW¼ sec. 24, T. 121 N., R. 57 W.	275		D,S
Hanson, O.	NE¼NW¼NE¼SE¼ sec. 26, T. 121 N., R. 57 W.	270	100	D,S
Parks, K.	NE¼NW¼NE¼ sec. 27, T. 121 N., R. 57 W.	260		D,S
Parks, R.	SW¼NW¼NE¼ sec. 34, T. 121 N., R. 57 W.	20	3	D,S
Parks, R.	SW¼NW¼NE¼ sec. 34, T. 121 N., R. 57 W.	50		S
Parks, R.	SW¼NW¼NE¼ sec. 34, T. 121 N., R. 57 W.	40		S
Parks, H.	SE¼NW¼NW¼ sec. 34, T. 121 N., R. 57 W.	240		D,S
Parks, O. R.	SW¼NW¼NE¼ sec. 34, T. 121 N., R. 57 W.	350		D,S
Knispel, N.	SW¼SE¼NE¼NW¼ sec. 2, T. 121 N., R. 56 W.	36		D,S
Severson, H.	NW¼NE¼NE¼ sec. 2, T. 121 N., R. 56 W.	21	12	D,S
Knispel, N.	SW¼SE¼NE¼NW¼ sec. 2, T. 121 N., R. 56 W.	41	33	D,S
Naessig, L.	SE¼NW¼ sec. 2, T. 121 N., R. 56 W.	160	60	S
Wattier, D.	SE¼SE¼SE¼SW¼ sec. 3, T. 121 N., R. 56 W.	200		S
Lambert, B.	SE¼SE¼NE¼ sec. 4, T. 121 N., R. 56 W.	11	5	D
Koenig, B.	NE¼SW¼NE¼NW¼ sec. 5, T. 121 N., R. 56 W.	420	155	D,S

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Klein, N.	NW¼NW¼ sec. 5, T. 121 N., R. 56 W.	55	35	D,S
Klein, N.	SW¼NW¼NW¼ sec. 5, T. 121 N., R. 56 W.	55		D,S
Fleischaker, F.	NE¼SW¼NW¼SE¼ sec. 6, T. 121 N., R. 56 W.	18		D,S
Reiprich, H.	NE¼NE¼NW¼ sec. 7, T. 121 N., R. 56 W.	208		D,S
Reiprich, A.	SE¼SE¼SW¼ sec. 7, T. 121 N., R. 56 W.	60	30	D,S
Mathiason, H.	NE¼NW¼NW¼ sec. 9, T. 121 N., R. 56 W.	180		S
Murschel, R.	SE¼NE¼NE¼ sec. 10, T. 121 N., R. 56 W.			D,S
Koenig, J.	NE¼NW¼NW¼SE¼ sec. 11, T. 121 N., R. 56 W.	40		D,S
Buhler, M.	SW¼SE¼NE¼NW¼ sec. 11, T. 121 N., R. 56 W.	26	22	D
Buhler, M.	SW¼SE¼NE¼NW¼ sec. 11, T. 121 N., R. 56 W.	28	25	S
Hommel, G. E.	NE¼NE¼NE¼ sec. 11, T. 121 N., R. 56 W.	13	2	D,S
Gaikowski, L.	SW¼SE¼NE¼SW¼ sec. 12, T. 121 N., R. 56 W.	37	25	D,S
Raeder, G.	NW¼SW¼SW¼SW¼ sec. 12, T. 121 N., R. 56 W.	27		D,S
Lambert, B.	SE¼NE¼NE¼ sec. 17, T. 121 N., R. 56 W.	47	27	S
Valentine, A.	SW¼SE¼SE¼ sec. 19, T. 121 N., R. 56 W.	32		D,S
Fleischaker, J.	NE¼NW¼NE¼ sec. 23, T. 121 N., R. 56 W.	20		D
Waller, E.	NE¼SE¼NW¼ sec. 23, T. 121 N., R. 56 W.	18	3	D,S
Fleischaker, J.	NE¼NW¼NE¼ sec. 23, T. 121 N., R. 56 W.	20	12	D,S
Kaiser, B. J.	SE¼SE¼NE¼ sec. 24, T. 121 N., R. 56 W.	32		D,S
Lutz, S. R.	NE¼NE¼NE¼ sec. 24, T. 121 N., R. 56 W.	50	36	D,S
Kaiser, B. J.	SE¼SE¼NE¼ sec. 24, T. 121 N., R. 56 W.	24		D

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Lutz, S. R.	NE¼NE¼NE¼ sec. 24, T. 121 N., R. 56 W.	52	35	D,S
Bente, F.	NE¼SW¼SW¼NW¼ sec. 25, T. 121 N., R. 56 W.	180	150	D,S
Bullert, O.	SE¼SE¼NE¼ sec. 25, T. 121 N., R. 56 W.	50	40	D,S
Ninke, W.	NW¼NE¼NE¼ sec. 27, T. 121 N., R. 56 W.	165		D,S
Reetz, M.	SE¼NE¼NE¼ sec. 28, T. 121 N., R. 56 W.	160		D,S
Grode, H.	SE¼NE¼ sec. 28, T. 121 N., R. 56 W.	180		D,S
Czmowski, H.	NE¼SE¼NE¼ sec. 29, T. 121 N., R. 56 W.	250		D,S
Grosek, F.	NE¼SW¼ sec. 30, T. 121 N., R. 56 W.			S
Grosek, F.	NW¼NE¼SE¼ sec. 31, T. 121 N., R. 56 W.	11		D,S
Grosek, F.	NW¼NE¼SE¼ sec. 31, T. 121 N., R. 56 W.	31	15	D,S
Grosek, F.	NW¼NE¼SE¼ sec. 31, T. 121 N., R. 56 W.	291		D,S
Grosek, F.	NW¼NE¼SE¼ sec. 31, T. 121 N., R. 56 W.	71	15	S
Hoberg, L.	SW¼SW¼SW¼ sec. 33, T. 121 N., R. 56 W.	425		D,S
Naessig, L.	SE¼SE¼SE¼SW¼ sec. 36, T. 121 N., R. 56 W.	155	60	D,S
Kotzea, D.	NE¼SW¼SW¼SE¼ sec. 1, T. 121 N., R. 55 W.	65	50	D,S
Ludtke, E.	SE¼SW¼SW¼ sec. 2, T. 121 N., R. 55 W.	190		D
Ludtke, E.	SE¼SW¼SW¼ sec. 2, T. 121 N., R. 55 W.	50	15	D,S
Keucker, E.	NE¼NW¼ sec. 2, T. 121 N., R. 55 W.	400		D,S
Hubsch, W.	SW¼SE¼SE¼ sec. 4, T. 121 N., R. 55 W.	35	20	D,S
Jeske, E.	NW¼SE¼NW¼SW¼ sec. 5, T. 121 N., R. 55 W.	48	42	D,S
Olson, T.	SE¼NW¼NW¼NW¼ sec. 6, T. 121 N., R. 55 W.	180		

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Hayhurst Bros.	SE¼SE¼SW¼ sec. 6, T. 121 N., R. 55 W.	280		D,S
Pies	NW¼NW¼NW¼ sec. 7, T. 121 N., R. 55 W.	500	280	D,S
Jeske, M.	NE¼NW¼SW¼SE¼ sec. 8, T. 121 N., R. 55 W.	48	45	D,S
Washenberger, L.	NE¼NW¼SW¼SW¼ sec. 8, T. 121 N., R. 55 W.	43		D,S
Prieb, D.	NW¼NW¼SE¼ sec. 9, T. 121 N., R. 55 W.	32		D,S
Prieb, D.	NW¼NW¼NE¼ sec. 9, T. 121 N., R. 55 W.	42	15	D,S
Prieb, D.	NW¼NW¼NE¼ sec. 9, T. 121 N., R. 55 W.	36	12	D,S
Ludtke, E.	SW¼NW¼NE¼ sec. 11, T. 121 N., R. 55 W.	200		D,S
Carr, D.	SE¼NW¼NW¼NW¼ sec. 11, T. 121 N., R. 55 W.	210	12	D,S
Rumpca, A.	NW¼SW¼ sec. 12, T. 121 N., R. 55 W.	34	24	D,S
Raeder, H.	SE¼NW¼NW¼SE¼ sec. 17, T. 121 N., R. 55 W.	48	36	D,S
Raeder, C.	NW¼NW¼NE¼ sec. 18, T. 121 N., R. 55 W.	26	18	D,S
Lutz, L.	SW¼SW¼NW¼ sec. 19, T. 121 N., R. 55 W.	50	36	D,S
Kwasniewski, I.	SW¼SE¼NE¼NE¼ sec. 20, T. 121 N., R. 55 W.	32	22	D,S
Gregerson, R.	NW¼NW¼NE¼SE¼ sec. 20, T. 121 N., R. 55 W.	55	20	D,S
Monzel, J.	SW¼NW¼NE¼ sec. 22, T. 121 N., R. 55 W.	30		S
Gregerson, K.	NE¼SW¼SW¼SE¼ sec. 27, T. 121 N., R. 55 W.	50	17	D,S
Gregerson, T.	NW¼NW¼NE¼ sec. 28, T. 121 N., R. 55 W.	269	100	D,S
Wagner, D.	SW¼SW¼NW¼ sec. 28, T. 121 N., R. 55 W.	30	22	D,S
Kuecker Bros.	NE¼SW¼SE¼SW¼ sec. 28, T. 121 N., R. 55 W.	40	30	D,S
Kuecker Bros.	NE¼SW¼SE¼SW¼ sec. 28, T. 121 N., R. 55 W.	80	60	D,S

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Gregerson, T.	NW¼NW¼NE¼ sec. 28, T. 121 N., R. 55 W.	24	18	D
Gelhaus, H.	SE¼SE¼SE¼SE¼ sec. 29, T. 121 N., R. 55 W.	45	37	S
Bullert, D.	NW¼NW¼SW¼ sec. 30, T. 121 N., R. 55 W.	165	50	D,S
Dulitz, F.	SE¼SE¼NE¼ sec. 31, T. 121 N., R. 55 W.	55	40	D,S
Schmidt, M.	NE¼NW¼NW¼ sec. 31, T. 121 N., R. 55 W.	418	210	D,S
Bierschbach Bros.	NW¼NE¼NW¼NW¼ sec. 35, T. 121 N., R. 55 W.	60	20	D,S
Thompson, P.	NW¼NE¼SE¼NE¼ sec. 5, T. 121 N., R. 54 W.	40		S
Jorgenson, O.	NW¼NE¼NE¼SE¼ sec. 7, T. 121 N., R. 54 W.	45	30	D,S
Jones, C.	NE¼NW¼NW¼ sec. 7, T. 121 N., R. 54 W.	187	27	D,S
Gaikowski, R.	NE¼NE¼NW¼SW¼ sec. 9, T. 121 N., R. 54 W.	16		S
Gaikowski, R.	NE¼NE¼NW¼SW¼ sec. 9, T. 121 N., R. 54 W.	6		D
Jorgenson, M.	NE¼NW¼NW¼SW¼ sec. 9, T. 121 N., R. 54 W.	21	6	D,S
Zubke, D.	NW¼SW¼SW¼ sec. 18, T. 121 N., R. 54 W.	24	12	D,S
Zubke, D.	NW¼SW¼SW¼ sec. 18, T. 121 N., R. 54 W.	21	12	D,S
Kotza, J.	NW¼SW¼ sec. 19, T. 121 N., R. 54 W.	120		S
Leimkuhl, W.	NW¼NW¼NW¼ sec. 19, T. 121 N., R. 54 W.	108		D,S
Kotza, J.	NW¼SW¼ sec. 19, T. 121 N., R. 54 W.	12	7	D,S
Espeland, M.	SW¼SE¼SE¼ sec. 4, T. 120 N., R. 57 W.	350		D,S
Buchele, B.	NW¼NW¼SW¼ sec. 5, T. 120 N., R. 57 W.	318		D,S
Schiley, M.	NW¼NW¼SW¼ sec. 10, T. 120 N., R. 57 W.	385	376	D,S
Gebur, A.	SW¼NW¼SE¼ sec. 11, T. 120 N., R. 57 W.	10	6	D,S

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Use
Kwasniewski, R.	NE¼NW¼NE¼SE¼ sec. 3, T. 120 N., R. 56 W.	180		D,S
Hanson, D.	SE¼NE¼SE¼ sec. 1, T. 120 N., R. 55 W.	115		D
Bisgard, B.	NE¼SW¼NW¼SW¼ sec. 1, T. 120 N., R. 55 W.	55	20	D,S
Bisgard, E.	SE¼NE¼ sec. 1, T. 120 N., R. 55 W.	176	20	D,S
Dulitz, E.	SE¼SE¼SE¼SW¼ sec. 4, T. 120 N., R. 55 W.	140		D
Kestner, R.	SE¼NE¼SE¼NW¼ sec. 5, T. 120 N., R. 55 W.	190		D,S
Bloom, F.	NW¼NE¼SE¼ sec. 7, T. 120 N., R. 55 W.	125		S
Hinye, H.	NW¼NE¼NE¼ sec. 8, T. 120 N., R. 55 W.	185		D
Hanson, M.	NW¼SW¼ sec. 8, T. 120 N., R. 55 W.	170		S
Lesner, H.	NW¼NE¼ sec. 9, T. 120 N., R. 55 W.	25		S
Jorgenson, A.	SW¼SE¼SE¼NE¼ sec. 5, T. 120 N., R. 54 W.	32	21	D,S
Ost, J.	NW¼NW¼NW¼NE¼ sec. 6, T. 120 N., R. 54 W.	60		D,S
Bisgard, H.	NW¼SW¼NW¼NW¼ sec. 9, T. 120 N., R. 54 W.	140	20	D,S