

STATE OF SOUTH DAKOTA  
Richard Kneip, Governor

DEPARTMENT OF NATURAL RESOURCE DEVELOPMENT  
Vern W. Butler, Secretary

GEOLOGICAL SURVEY  
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Open-File Report No. 15-UR

GROUND-WATER STUDY FOR THE  
CITY OF GREGORY

by

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GROUND-WATER STUDY FOR THE CITY OF GREGORY

UR 73

This report contains the results of a special ground-water investigation conducted by the South Dakota Geological Survey east of the City of Gregory in Gregory County, South Dakota. The project was financed by the South Dakota Geological Survey, the West River Conservancy Sub-District, and the City of Gregory.

Field work was conducted from April 22 to June 17, 1977, and involved: (1) a review of the geology of the area as mapped by the South Dakota Geological Survey (R. E. Stevenson, 1956-57), (2) a review of Special Report 49 (A. Barari, 1969), (3) the drilling of 29 rotary holes and 34 auger holes (see app. A), and (4) the collection and analysis of 10 water samples. Results of the chemical analysis of the water samples can be found in table 1 and figure 1 shows the recommended areas. The location of test holes and water samples are plotted on figure 2 and figure 3 shows the thickness of saturated sand.

At present the City obtains its water supply from 13 wells within the City limits and 7 wells in the southwest 1/4 of sec. 16, T. 97 N., R. 72 W. Combined production from these wells is 300 gallons per minute (personal communication, Robert Smutny). The present investigation was undertaken to locate a source of ground water to augment the present water supply.

Quality of the water in the study area is good, as evidenced by the relatively low value for total dissolved solids, however, the nitrate level varies. Samples W-1, W-5, and W-7 exceed the recommended limits of 10 ppm (table 1) as set by the U.S. Department of Health.

Based on grain size, clay content, areal extent, and thickness of saturated sand, three areas have been outlined for further testing by the City of Gregory. These recommended areas are labeled A, B, and C on figure 1 in accordance with their relative potential as a source for future water supplies. Another potential area was found in the southwest 1/4 of sec. 23, T. 97 N., R. 72 W. It was not recommended because of the presently high nitrate levels as shown by the chemical analysis of Samples W-1 and W-5 (table 1).

The necessity for additional test holes in the recommended areas is apparent from the rapid change in sand thickness. In addition, farming activities in the recommended areas prevented any additional drilling during the survey.

Before additional testing is undertaken, the City should hire a consulting engineer licensed in South Dakota. The engineer would plan and coordinate any additional testing. On the basis of the engineer's recommendation a commercial well drilling company should be engaged to drill additional test holes. This would allow locating the best site within areas A, B, or C for the installation of a test well. The test well would be used to determine quality of the water, yield, drawdown, and recovery data. Water samples should be collected and analyzed specifically for nitrate content. Based on the results of the pump test, an adequate distance between the future wells can be determined. The pump test should be conducted by a hydrologist or a qualified engineer and run for a minimum of 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 South Dakota Environmental Protection Agency to determine the biological and chemical suitability of the water.

The report was written by Carl Cripe and Assad Barari, September 1977.

TABLE 1. - Chemical analysis of water from the Gregory area

Sample	Parts per million										Total Solids	
	Calcium	Sodium	Magnesium	Chloride	Sulfate	Iron	Manganese	Nitrogen	Fluoride	pH		Hardness CaCO <sub>3</sub>
A	--	--	50	250	500 <sup>1</sup>	0.3	0.005 <sup>1</sup>	10.0	0.9 <sup>2</sup> 1.7 <sup>2</sup>	--	---	1000 <sup>1</sup>
W 1	70	30	30	35	<25	<0.1	<0.05	37	--	--	298	640
W 2	35	33	28	<5	<25	<0.1	<0.05	5	--	--	202	430
W 3	40	23	15	<11	<25	<0.1	<0.05	2.2	--	--	161	340
W 4	40	28	15	<22	<25	<0.1	<0.05	4.2	--	--	161	430
W 5	35	41	23	<13	<25	<0.1	<0.05	17.5	--	--	181	516
W 6	40	18	10	<2	<25	<0.1	<0.05	7	--	--	140	340
W 7	65	33	22	17	<25	<0.1	<0.05	18	--	--	252	530
W 8	30	10	13	<2	<25	<0.1	<0.05	2.6	--	--	128	260
W 9	34	10	12	<5	<25	<0.1	<0.05	3.5	--	--	134	360
W10	29	18	18	<5	<25	<0.1	<0.05	5.8	--	--	146	400

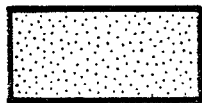
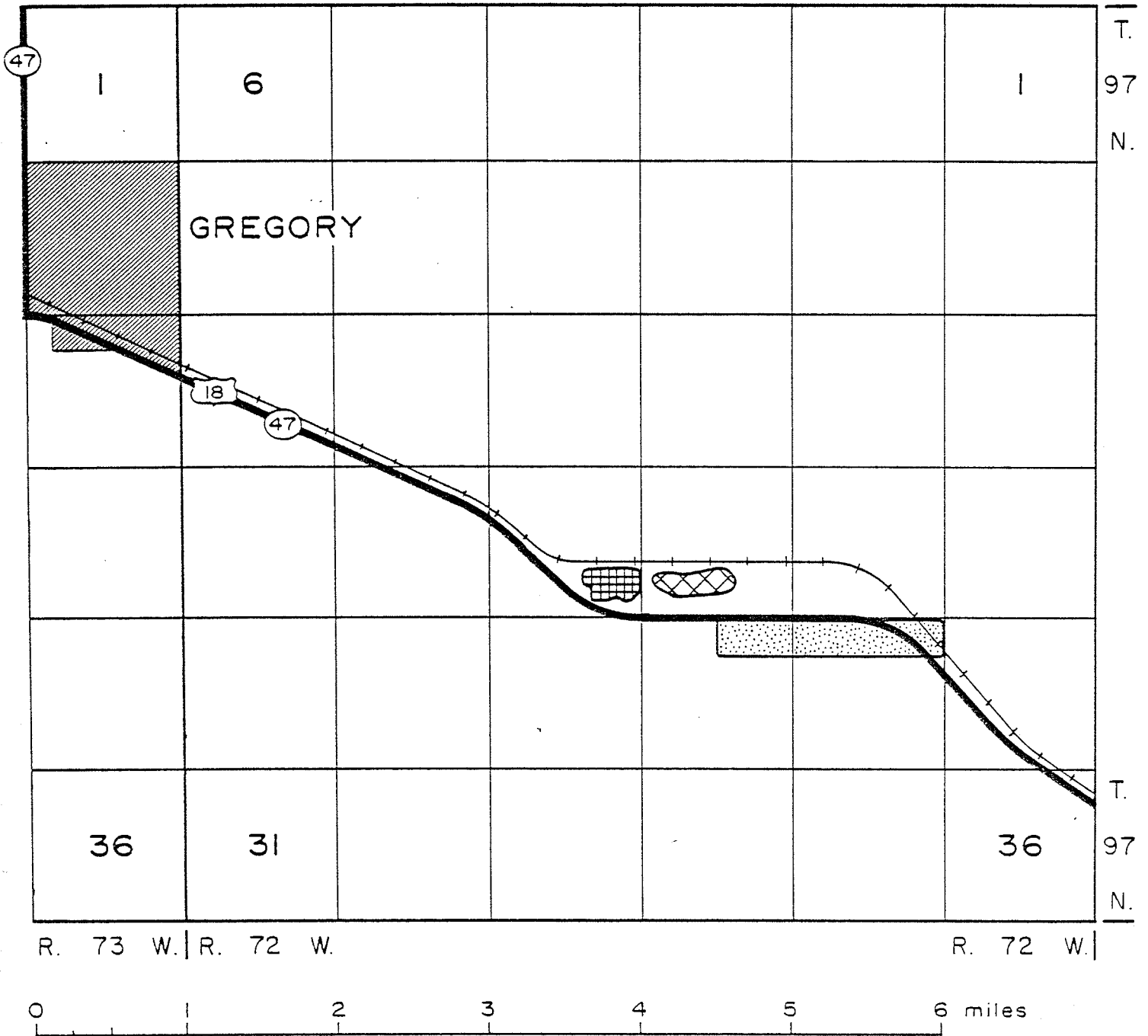
A - Drinking water standards, U.S. Public Health Service (1962).

<sup>1</sup>Modified for South Dakota by the Department of Health (written communication, Water Sanitation Section, September 24, 1968).

<sup>2</sup>1.2 is optimum for South Dakota.

Location of Water Samples  
(for map location, see fig. 2)

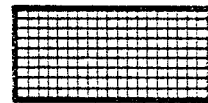
- W 1. SW SW SE SW sec. 23, T. 97 N., R. 72 W., Gus Callender stock well.
- W 2. NE NE NE NE sec. 27, T. 97 N., R. 72 W., Elmer Horn well.
- W 3. NW NW NW NW sec. 26, T. 97 N., R. 72 W., Clark Horn hydrant.
- W 4. NE NE NW NW sec. 26, T. 97 N., R. 72 W., Elmer Horn stock well.
- W 5. SE SE SE NE sec. 27, T. 97 N., R. 72 W., Elmer/Henry Horn stock well inside steel building.
- W 6. SE SE SE SW sec. 27, T. 97 N., R. 72 W., Elmer/Henry Horn stock well.
- W 7. NE SE SE SE sec. 22, T. 97 N., R. 72 W., Henry Horn hydrant near house.
- W 8. SE SE SE SE sec. 27, T. 97 N., R. 72 W., Water Rights observation well.
- W 9. SW SW SW SW sec. 22, T. 97 N., R. 72 W., Helen Hutchinson household well.
- W10. Sec. 21, T. 97 N., R. 72 W., Joe Kerwin well.



AREA A



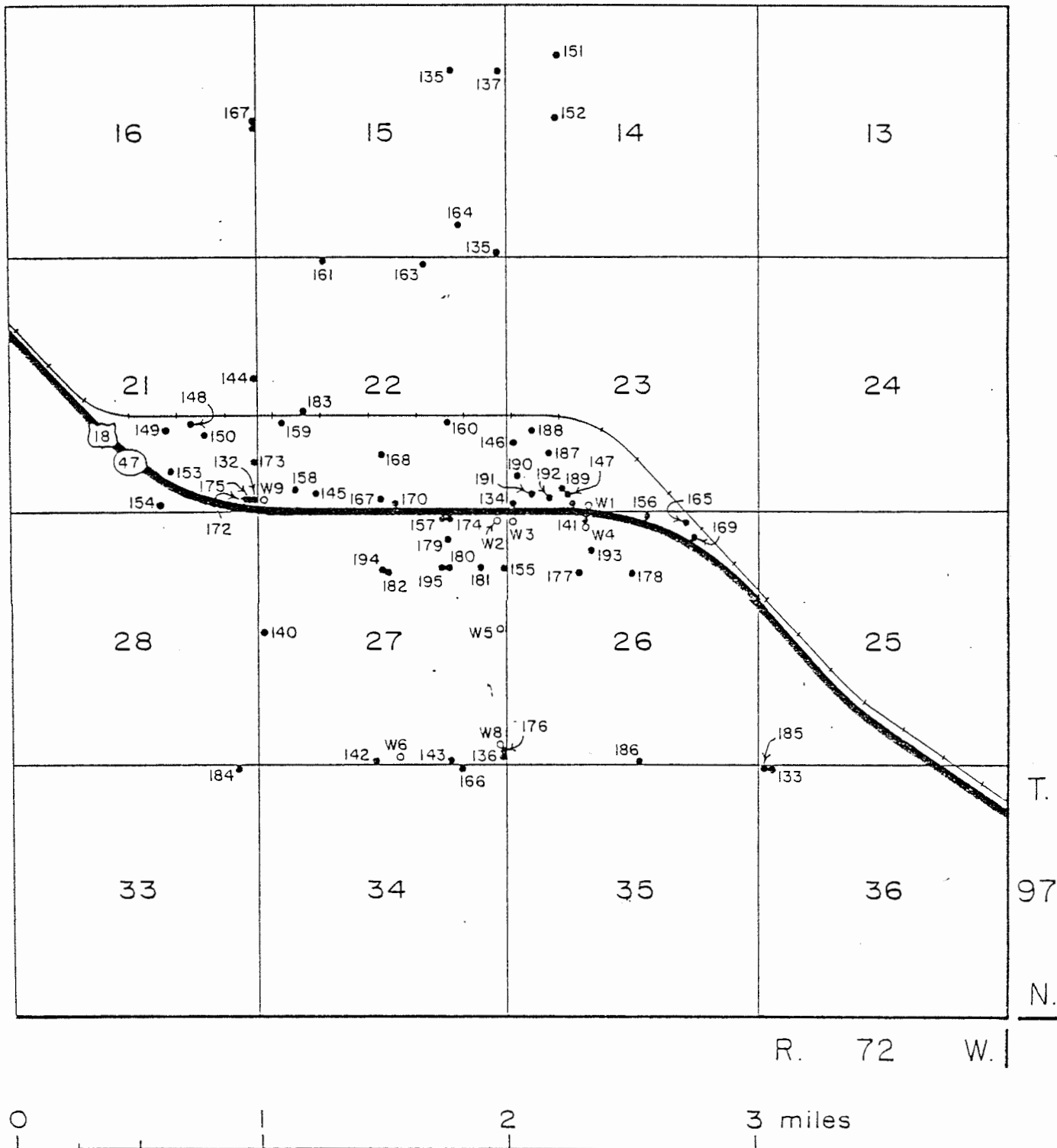
AREA B



AREA C

Figure 1. Map showing location of recommended areas for additional water supplies at Gregory.

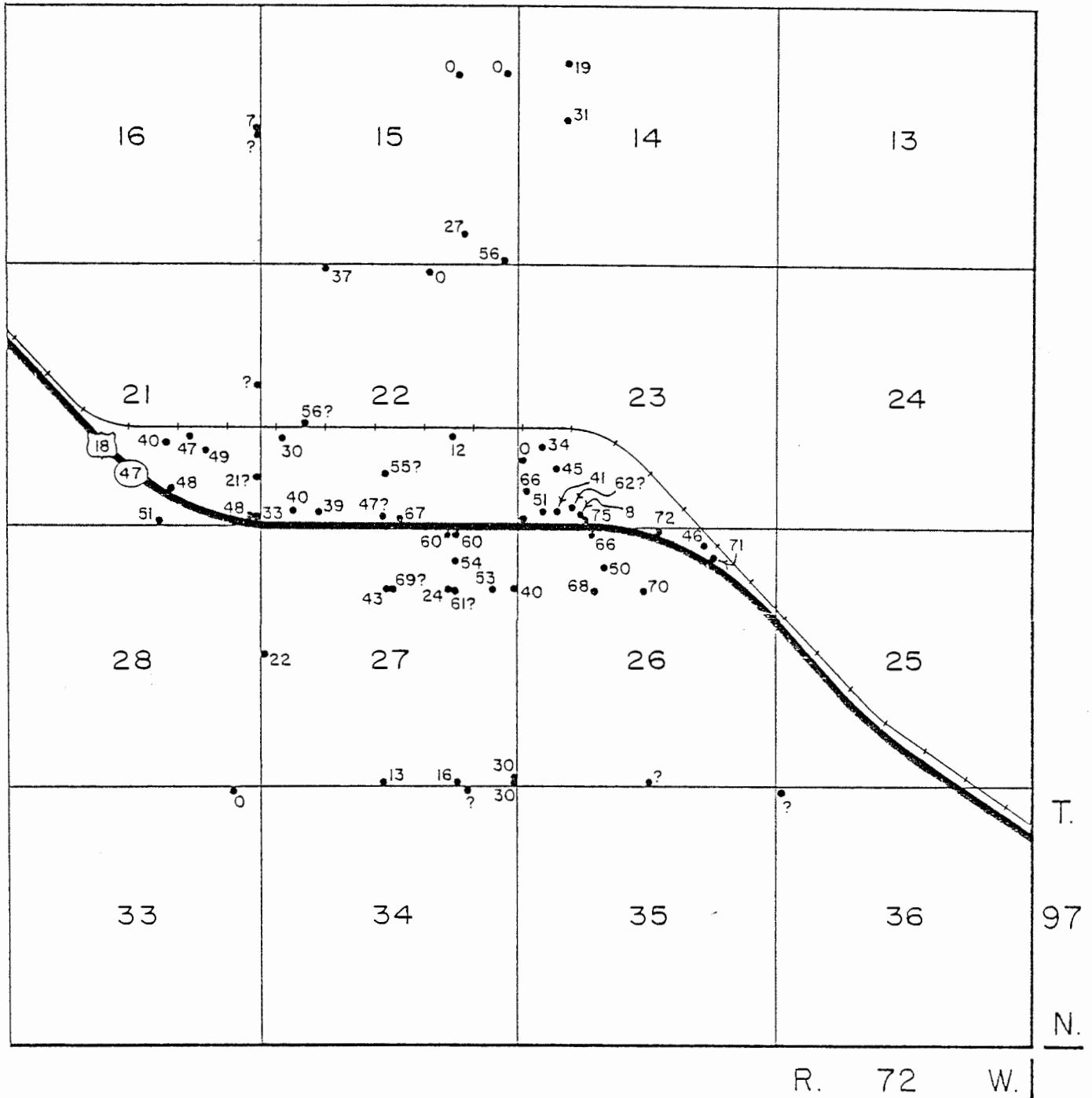




184 • Test hole - number refers to test holes listed in Appendix A.

w5° Water sample - number refers to sample number in Table I.

Figure 2. Data map showing the location of test holes and water samples in the Gregory area.



56. Test hole - number indicates thickness of saturated sand, in feet.

Figure 3. Map showing approximate thickness of saturated sand in the Gregory area.

APPENDIX A

Logs of test holes drilled in the Gregory area

Log descriptions 1-131 can be found in "Ground-Water Investigations for the City of Gregory" (Special Report 49, Barari, 1969).















## SOUTH DAKOTA GEOLOGICAL SURVEY

Location S1/2S1/2NE1/4NE1/4 Section: 15 T. 27 N. X R. 72 X W.  
 Well: \_\_\_\_\_ Test Hole: GY-133 Land Owner: Matucha  
 County: Gregory Date: 4/26/77 Elevation: 2100 (~~X~~ X, T)  
 E-Log: \_\_\_\_\_ Samples: \_\_\_\_\_ Drilling Company: S.D.G.S.  
 Source of Data: Carl Cripe - Rotary

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	5	Clay, sandy, fine, silty, dry	0- 5
	6	Clay, sandy, fine, dark brown, dry	5- 11
	7	Sand, fine, yellow-brown, dry	11- 13
	7	Sand, fine, clayey, brown, dry	13- 25
	16	Sand, fine, greenish-tan, some clay	25- 41
	4	Sand, fine, brown, clayey, drills hard	41- 45
	31	Sand, fine grained, some pebbles, interbedded layers of sandstone, clay, fine sand and silt, greenish-tan	45- 76
	9	Clay, silty, soft, greenish-tan	76- 85
	5	Clay, silty, soft, greenish-tan, with ash white coloring	85- 90
	12	Sand, fine, clayey, silty, brown	90-102
	3	Silt, light tan to orange-brown, limonitic concre- tions, compact	102-110
	5	Shale, ?olive brown, clay	110-115
		T.D. = 115 feet	













































































## SOUTH DAKOTA GEOLOGICAL SURVEY

Location SE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$  Section: 21 T. 97 N. ~~XX~~ R. 72 ~~XX~~ W.Well: \_\_\_\_\_ Test Hole: GY-173 Land Owner: \_\_\_\_\_County: Gregory Date: 6-3-77 Elevation: 2171 (~~XX~~, ~~XX~~ T)E-Log: \_\_\_\_\_ Samples: \_\_\_\_\_ Drilling Company: S.D.G.S.Source of Data: Driller - Greg Wallace (Rotary)

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	2	Topsoil, black	0- 2
	4	Sand, fine to medium, subangular, dirty	2- 6
	3	Clay, light-brown, slightly sandy, fine	6- 9
	25	Sand, medium, rounded, clean,	9- 34
	8	Sand, medium to fine, rounded, some interbedded light-	
		green silts	34- 42
	19	Silt, light-green, clayey. Some thin sand lenses,	
		fine and slightly cemented	42- 61
	11	Sand, fine, rounded, some thin, intermittent silt	
		lenses, light-green to light-brown, some cemented	
		sandstone lenses	61- 72
	11	Silt, light-green to light-brown, a cemented layer	
		of magnesia (76'-77'), very hard	72- 83
	17	Clay, light-brown, hard	83-100
		T.D. = 100 feet	
		Water level - 21 feet	































## SOUTH DAKOTA GEOLOGICAL SURVEY

Location SE 1/4 SW 1/4 SW 1/4 Section: 23 T. 97 N. S. R. 72 ~~W.~~ W.  
 Well: \_\_\_\_\_ Test Hole: GY-188 Land Owner: Gus Callender  
 County: Gregory Date: 6-9-77 Elevation: 2170 (XX, XX T)  
 E-Log: \_\_\_\_\_ Samples: \_\_\_\_\_ Drilling Company: S.D.G.S.  
 Source of Data: Driller - Greg Wallace (Rotary)

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	3	Topsoil, black	0- 3
	6	Silt, clayey, light to dark brown	3- 9
	23	Clay, light green to light brown, sandy, fine, rounded	9- 32
	13	Sand, (sandstone?), compact, fine, hard, light brown, clayey, bedded with light green silt	32- 45
	27	Silt, clay, light green, interbedded with some thin sandstone layers. Sandstone is compact and light brown, fine grained	45- 72
	34	Sand, compact, (sandstone?), fine, dark brown, subrounded to subangular	72-106
	7	Silt, light green to light gray-brown, very clayey	106-113
	23	Silt, to clay, light brown	113-136
	14	Shale, highly weathered, concretion, deep, red-brown at 147'	136-150
		T.D. = 150 feet	
		No water level - collapsed.	







## SOUTH DAKOTA GEOLOGICAL SURVEY

Location S1/4SE1/4S1/4SW1/4 Section: 23 T. 97 N. 8 R. 72 E. W.

Well: \_\_\_\_\_ Test Hole: GY-192 Land Owner: Bus Callender

County: Gregory Date: 5-15-77 Elevation: \_\_\_\_\_ (X, Y, T)

E-Log: \_\_\_\_\_ Samples: \_\_\_\_\_ Drilling Company: S.D.G.S.

Source of Data: Driller - Greg Wallace (Rotary)

Geologic Unit	Thickness	Lithologic Description	From - to Feet
	3	Topsoil, black	0- 3
	2	Silt, light to dark brown	3- 5
	4	Sand, medium to coarse, subrounded	5- 9
	13	Sand, fine, rounded	9- 22
	1	Sandstone layer cemented, dark green	22- 23
	3	Sand, fine, rounded	23- 26
	1	Silt, clayey, light green	26- 27
	4	Sand, fine, rounded	27- 31
	6	Sand, fine, cemented, like sandstone, brown	31- 37
	25	Sand, fine to medium, rounded	37- 62
	6	Sand, fine, cemented, sandstone	62- 68
	14	Sand, fine, rounded, interbedded sandstone and silt layers	68- 82
	12	Silt, light green, clayey, hard, some sand stringers, thin, fine	82- 94
	26	Silt, to clay, light green to light brown, gradates to brown	94-120
		T.D. = 120 feet	







