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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
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TEST DRILLING AT SOLDIER CREEK, ROSEBUD INDIAN RESERVATION, TODD COUNTY, SOUTH DAKOTA

Open-File Report 75-355

Prepared in cooperation with the
Division of Indian Health
Public Health Service
Department of Health, Education, and Welfare

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by

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TEST DRILLING AT SOLDIER CREEK, ROSEBUD INDIAN RESERVATION, TODD COUNTY, SOUTH DAKOTA

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ABSTRACT

Thirty-six test holes were augered by the U.S. Geological Survey in the vicinity of Soldier Creek, Rosebud Indian Reservation, Todd County, South Dakota. Wells producing more than 5 gallons per minute (0.32 litre per second) from the Tertiary deposits are rare. However, as much as 20 feet (6.1 metres) of permeable alluvial deposits were penetrated in several test holes. One test well was pumped for . hours at a rate of 10 gallons per minute (0.63 litre per second).

INTRODUCTION

Purpose and scope of the investigation

Thirty-six test holes were augered by the U.S. Geological Survey in the vicinity of the village of Soldier Creek, Rosebud Indian Reservation, Todd County, South Dakota (figure 1) during

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Figure 1 belongs near here.

June 1972 and May 1973. The augering was done at the request of the Division of Indian Health, U.S. Public Health Service, as part of their program to provide towns on Indian Reservations with adequate amounts of water for domestic and sanitation use. Field work for the investigation consisted of an examination of the surface geology, augering test holes, examining auger cuttings, and collecting a water sample for chemical analysis.

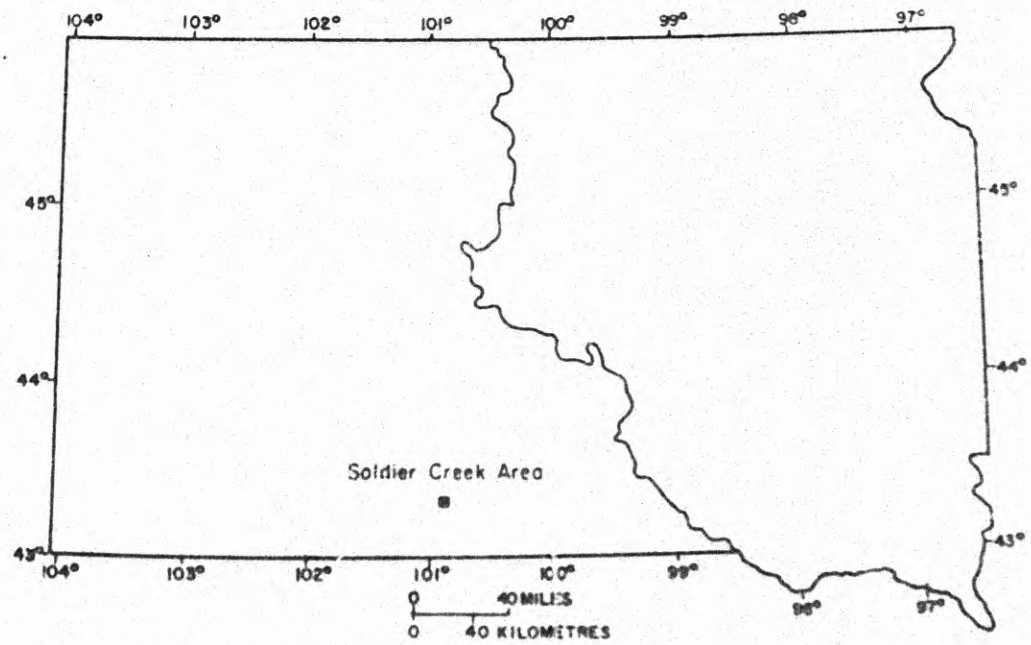

Figure 1.-- Map of South Dakota showing location of Soldier Creek Area

Metric conversion factors

For use of those readers who may prefer to use metric units rather than English units, the conversion factors for the terms used in this report are listed below:

Multiply English unit	By	To obtain metric unit
inches (in)	$2.540 \times 10^{+1}$	millimetres (mm)
feet (ft)	0.3048	metres (m)
gallons per minute (gal/min)	6.309×10^{-2}	litres per second (l/s)
cubic feet per second (ft^3/s)	2.832×10^{-2}	cubic metres per second (m^3/s)
acres	0.4047	hectares (ha)

Water supply

Most of the ground water used on the reservation is from springs and wells completed in water-table aquifers in Tertiary and Quaternary deposits. Some water is also obtained from wells drilled into artesian aquifers in Paleozoic and Mesozoic formations. Several of the larger towns have municipal water systems which obtain water from Tertiary deposits. The community of Soldier Creek is supplied by water from an infiltration gallery.

Water impounded in numerous man-made stock ponds is an important source of water for livestock. Smaller streams in the area flow intermittently, however, the Little White River at Soldier Creek has an average discharge of 112 ft^3/s (3.172 m^3/s) and a minimum daily discharge of 10 ft^3/s (0.28 m^3/s) (U.S. Geological Survey, 1973).

Previous Investigations

The geology and the occurrence of ground water on the Rosebud Indian Reservation were described by Ellis and Adolphson (1971). A 15-minute geologic quadrangle map (Sevon, 1960) of the area with a short text on the geology and ground water has been published by the South Dakota Geological Survey.

Station-numbering system

A recently adopted station-numbering system of the U.S. Geological Survey is based on the grid system of latitude and longitude. The number consists of 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude. The next seven digits denote degrees, minutes, and seconds of longitude. The last two digits are sequential numbers for stations within a 1-second grid. The system provides the geographic location of the station and a unique number for each station. However, in order to compare data in this report with data from previous studies in the area, the test holes are also numbered according to a system based on their location in the public-land classification of the U.S. Bureau of Land Management or Federal land-survey numbering system. Figure 2 illustrates this system of numbering. In

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addition, the test holes were assigned a field number in the order in which they were drilled in 1972 or 1973.

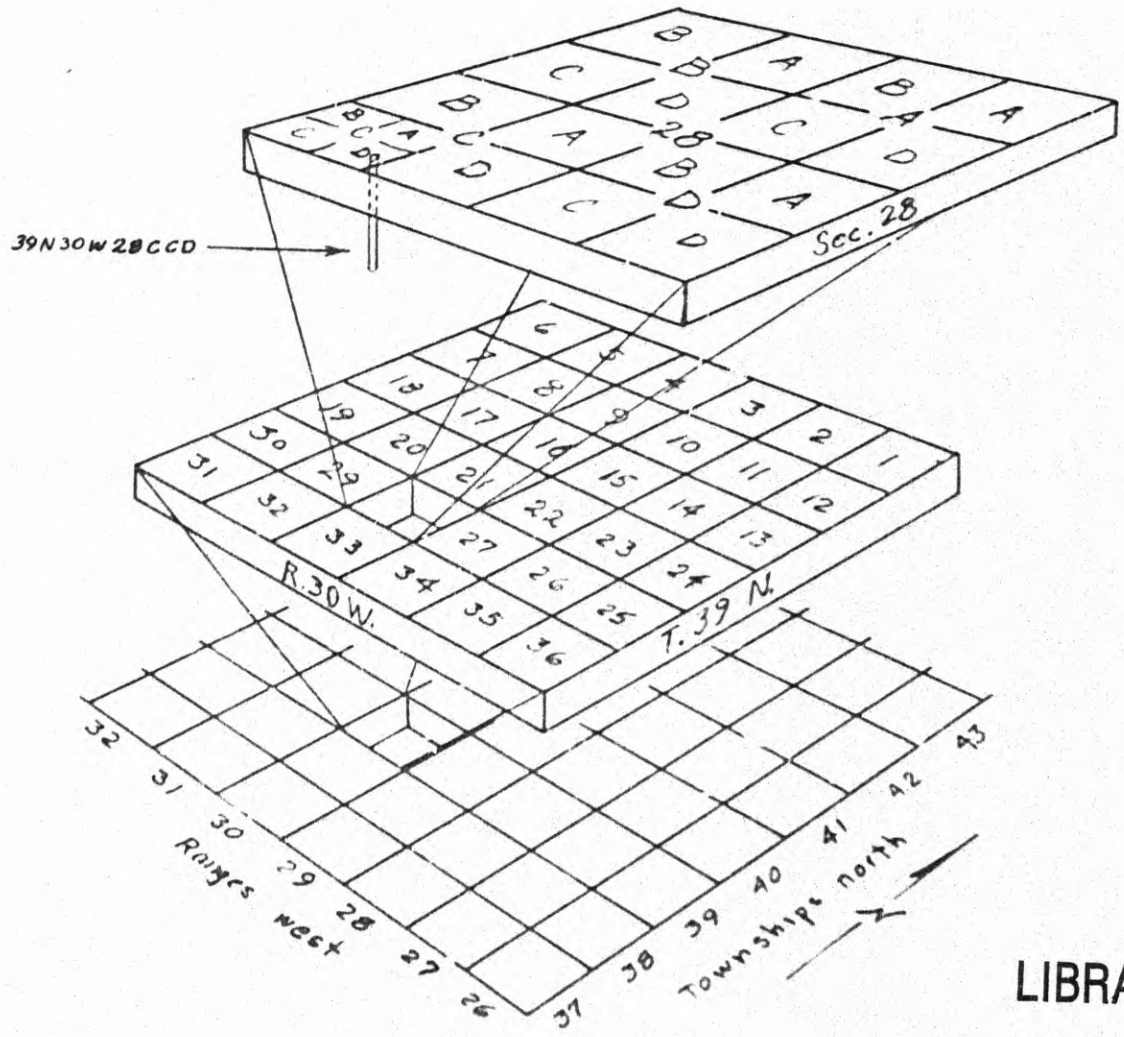

Figure 2.--Well-numbering system.

Each well or test hole referred to in this report has been assigned a number based on its location according to the Federal land-survey system used in South Dakota. The number consists of the township followed by "N", range followed by "W", and section number followed by three capital letters that indicate respectively the quarter section, quarter-quarter section, and quarter-quarter-quarter section in which the well is located. A serial number is added to distinguish between wells in the same 10-acre (4-ha) tract.

TEST AUGERING

Nine test holes were augered in the vicinity of the village of Soldier Creek in 1972 during a preliminary study of the area (table 1). This test augering was confined to

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Table 1 belongs near here.

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alluvium along Little White River (figure 3). In 1973,

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22 test holes were augered in alluvium of Little White River, four in alluvium of Soldier Creek, and one in the bedrock (figure 4). The test holes penetrated clay, silt, sand and

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Figure 4 belongs near here.

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gravel (table 2). The alluvium has a maximum thickness of

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22 ft (6.7 m), an average thickness of about 10 ft (3.0 m), and a saturated thickness of 5 to 10 ft (1.5 to 3.0 m).

Table 1.--Logs of test holes augered during June 1972.

For each test hole, the first series of numbers and letters is the well location based on the Federal land-survey system; the number in parentheses is the sequential well number; the last series of numbers is the station number based on latitude and longitude coordinates. Depth is in feet below land surface.

TODD COUNTY

39N30W28CBD1 (1) 431918100530101

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium	16	17
Clay, pink, silty (White River Group)	10	27

Depth to water, 15 ft below land surface

39N30W28CBD2 (2) 431918100530102

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium	17	18
Clay, pink, silty (White River Group)	3	21

Depth to water, 8.2 ft below land surface

Table 1.--Continued

39N30W28CBD3 (3) 431918100530103

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium	9	10
Sand, fine to medium, silty	5	15
Clay, pink; pebbles	2	17
Clay, pink (White River Group)	2	19

Depth to water, 10.9 ft below land surface

39N30W28CBD4 (4) 431918100530104

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium	7	8
Clay, brown, sandy	9	17
Clay, pink (White River Group)	3	20

Depth to water, 15 ft below land surface

39N30W28CBD5 (5) 431918100530105

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium	9	10
Sand, fine to medium, silty	10	20
Clay, pink (White River Group)	4	24

Depth to water, 11.5 ft below land surface

Table 1.--Continued

39N30W28CBD6 (6) 431918100530106

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium	10	11
Sand, fine to medium, silty	10	21
Clay, pink (White River Group)	1	22

Depth to water, 10.5 ft below land surface

39N30W28CBD7 (7) 431918100530107

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium, silty	7	8
Clay, pink (White River Group)	2	10

Dry hole

39N30W33BCA1 (8) 431846100530001

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium	14	15
Sand, medium, silty, and coarse gravel	5	20
Clay, light gray (White River Group)	2	22

Depth to water, 10 ft below land surface

Table 1.--Continued

39N30W33BCA2 (9) 431846100530002

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium	6	7
Clay, brown, sandy	13	20
Clay, pink (White River Group)	2	22

Depth to water, 10 ft below land surface

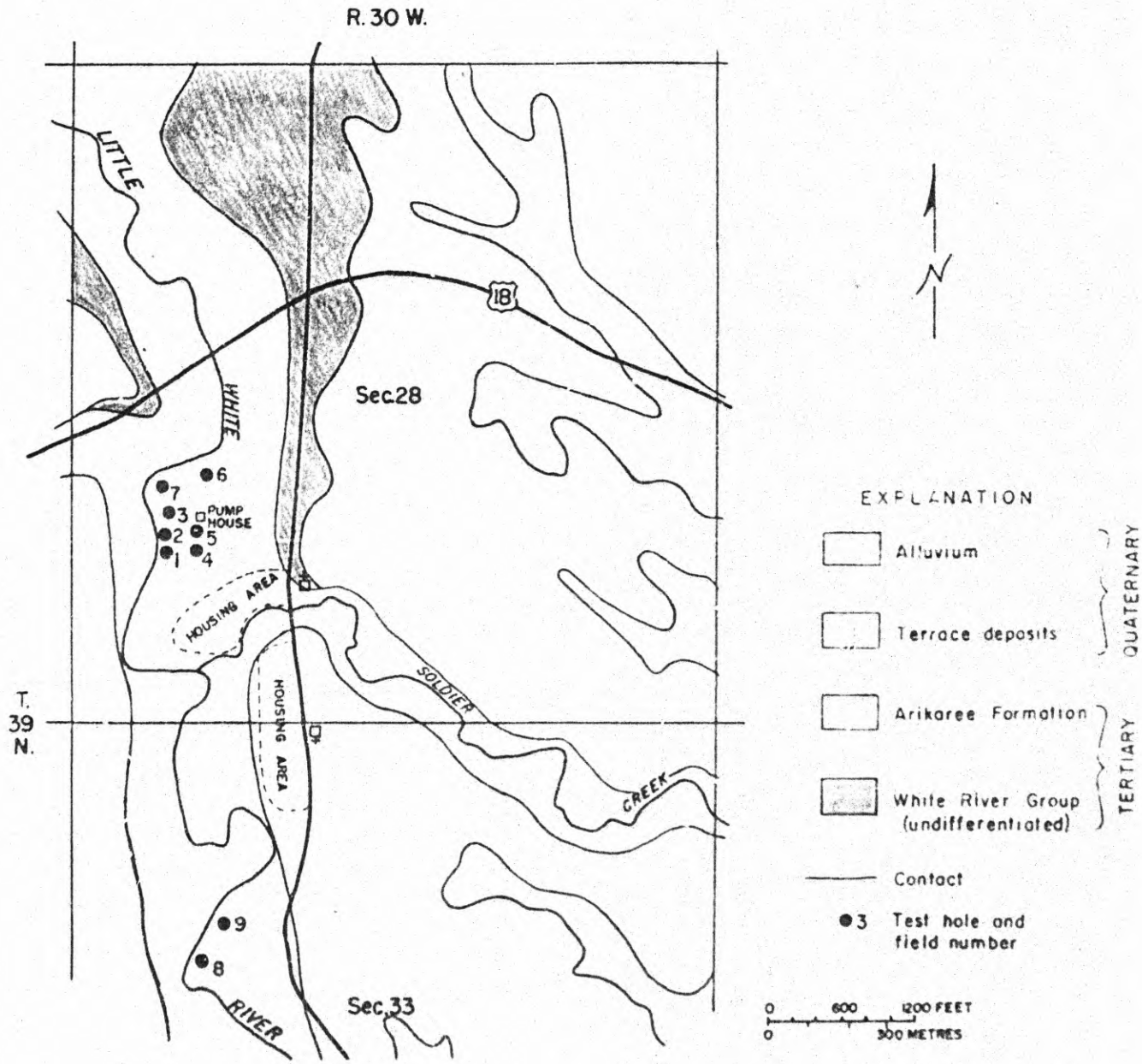

Figure 3.-- Locations of test holes augered during 1972 in the Soldier Creek area.

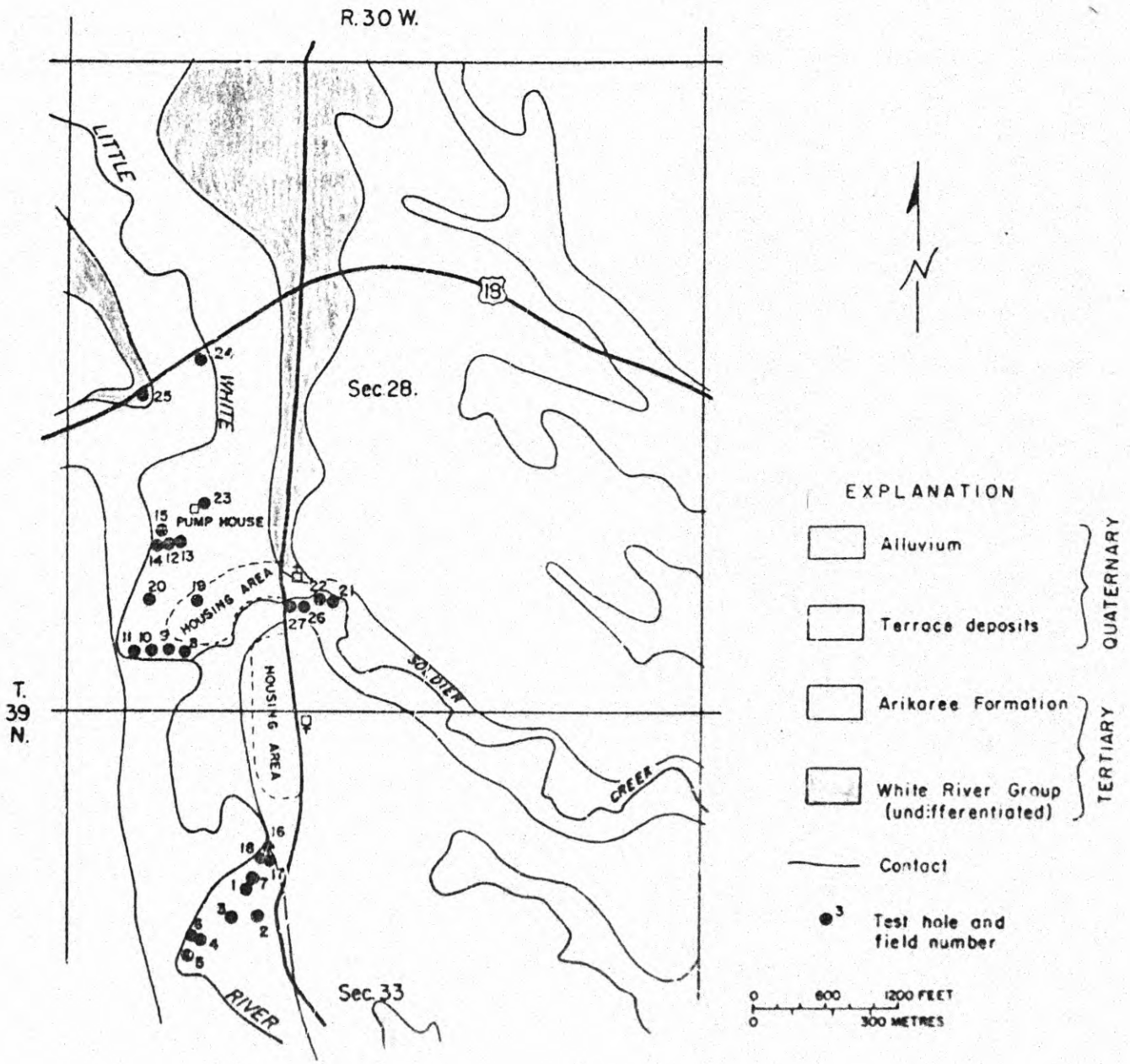

Figure 4.-- Locations of test holes augered during 1973 in the Soldier Creek area.

Table 2.--Logs of test holes augered during May 1973.

For each test hole, the first series of numbers and letters is the well location based on the Federal land-survey system; the number in parentheses is the sequential well number; the last series of numbers is the station number based on latitude and longitude coordinates. Depth is in feet below land surface.

TODD COUNTY

39N30W28BCD (24) 4319331005301

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium, pebbles	8	9
Clay, red, sandy (White River Group)	6	15
Siltstone	5	20

39N30W28CBB (25) 4319251005311

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Clay, red, sandy; limestone chips (White River Group)	79	80
Claystone, siltstone	20	100

Table 2.--Continued

39N30W28CBD8 (23) 431918100530108

Material penetrated	Thickness (ft)	Depth (ft)
Soil, sandy	1	1
Sand, fine to medium	4	5
Sand, medium; pebbles	10	15
Sand, fine, silty	7	22
Clay, red, sandy (White River Group)	18	40
Claystone	20	60

Depth to water, 14 ft below land surface

39N30W28CBD9 (12) 431918100530109

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Soil, fine to medium	5	6
Clay (White River Group)	14	20

39N30W28CBD10 (13) 431918100530110

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	6	7
Gravel, coarse; pebbles	9	16
Clay (White River Group)	4	20

Depth to water, 10.5 ft below land surface

Test pumped 4 gpm (gallons per minute) 0.25 l/s (litre per second)

Table 2.--Continued

39N30W28CBD11 (14) 431918100530111

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	8	9
Clay, red, sandy (White River Group)	11	20

39N30W28CBD12 (15) 431918100530112

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	5	6
Gravel, fine to coarse; pebbles	11	17
Clay (White River Group)	3	20

39N30W28CCA1 (19) 431912100530101

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium, and coarse gravel	8	9
Clay, red (White River Group)	11	20

Table 2.--Continued

39N30W28CCA2 (20) 431912100530102

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium, and coarse gravel	5	6
Clay (White River Group)	14	20

39N30W28CCC (11) 4319051005311

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	5	6
Clay (White River Group)	14	20

39N30W28CCD1 (8) 431905100530101

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	5	6
Sand, medium to coarse; pebbles	11	17
Clay (White River Group)	3	20

Depth to water, 5 ft below land surface

Table 2.--Continued

39N30W28CCD2 (9) 431905100530102

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	4	5
Gravel, medium to coarse; pebbles	13	18
Clay, red, sandy (White River Group)	2	20

39N30W28CCD3 (10) 431905100530103

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	5	6
Gravel, coarse	2	8
Clay (White River Group)	12	20

39N30W28CDA1 (21) 431912100524401

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to coarse, silty	8	9
Clay, red (White River Group)	11	20

Depth to water, 11.3 ft below land surface

Table 2.--Continued

39N30W28CDA2 (22) 431912100524402

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Gravel, fine to coarse; pebbles	12	13
Clay, red, sandy; pebbles (White River Group)	24	37
Claystone, siltstone	3	40

39N30W28CDB1 (26) 43191210052301

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	9	10
Gravel, coarse; pebbles	8	18
Sand, medium	2	20
Clay, red, sandy; limestone chips (White River Group)	15	35
Claystone	5	40

Depth to water, 10.6 ft below land surface

Test pumped at 10 gpm (0.63 l/s)

Water temperature 56°F (13°C)

Table 2.--Continued

39N30W28CDB2 (27) 431912100525302

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to coarse	6	7
Gravel, coarse	15	22
Clay, red, sandy; pebbles (White River Group)	11	33
Claystone	7	40

Depth to water, 8.64 ft below land surface

39N30W33BAC1 (16) 431853100525201

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	4	5
Gravel, coarse; pebbles	8	13
Clay, red (White River Group)	7	20

39N30W33BAC2 (17) 431853100525202

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	5	6
Gravel, coarse; pebbles	8	14
Clay (White River Group)	6	20

Depth to water, 5.5 ft below land surface

Table 2.--Continued

39N30W33BAC3 (18) 431853100525203

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine to medium	4	5
Gravel, coarse; pebbles	12	17
Clay (White River Group)	13	30

39N30W33BCA3 (4) 431846100530003

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine	4	5
Sand, medium to coarse	7	12
Sand, coarse, and fine gravel	5	17

Depth to water, 9 ft below land surface

39N30W33BCA4 (5) 431846100530004

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, medium to coarse; pebbles	5	6
Sand, coarse; pebbles	8	14
Sand, fine to medium	2	16
Clay (White River Group)	4	20

Depth to water, 9.5 ft below land surface

Table 2.--Continued

39N30W33BCA5 (6) 431846100530005

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, medium to coarse	4	5
Sand, coarse, and fine gravel; pebbles	7	12
Sand, fine to medium, and fine to medium gravel	5	17
Clay (White River Group)	3	20

Depth to water, 10 ft below land surface

39N30W33BDB1 (1) 431846100525201

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silt	2	2
Sand, fine to medium	5	7
Clay, sandy (White River Group)	13	20

39N30W33BDB2 (2) 431846100525202

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	2	2
Sand, fine to medium	7	9
Clay, sandy (White River Group)	11	20

Table 2.--Continued

39N30W33BDB3 (3) 431846100525203

Material penetrated	Thickness (ft)	Depth (ft)
Soil, silty	1	1
Sand, fine	4	5
Sand, medium to coarse; pebbles	7	12
Clay, sandy (White River Group)	8	20

39N30W33BDB4 (7) 431846100525204

Material penetrated	Thickness (ft)	Depth (ft)
Soil	1	1
Sand, fine to medium	4	5
Gravel, coarse, and medium sand; pebbles	5	10
Sand, medium to coarse, and coarse gravel	10	20
Clay, sandy (White River Group)	12	32

GEOLOGY AND GROUND WATER

The unconsolidated surficial deposits associated with the Little White River drainage consist of alluvium and colluvium. Underlying these are stream and lake deposits of Tertiary age which are exposed in and around the Soldier Creek village area. Wells producing more than 5 gal/min (0.32 l/s) from the Tertiary deposits are rare; however, 5 gal/min (0.32 l/s) wells producing water of satisfactory quality for domestic uses may be obtained in some areas.

The alluvium along Soldier Creek contains less silt and fine material and is coarser-grained than that along Little White River. The greatest amount of permeable alluvium penetrated by test augering was in test holes 26 and 27 (table 2). The water-bearing materials here consist of about 20 ft (6.1 m) of fine to medium sand and coarse gravel in the alluvium and 11 to 15 ft (3.4 to 4.6 m) of sandy clay and pebbles in the bedrock. The area around these two test holes is a possible site for future ground-water development. Test well 26 was pumped for 2 hours at 10 gal/min (0.63 l/s).

Recharge to the alluvium is from precipitation, infiltration from the streams, and movement of water into the alluvium from the adjacent bedrock. The water in the alluvium moves toward the river and downstream. It discharges to the river or leaves the area as underflow.

Precipitation, about two-thirds of which comes during the May through September growing season, averages about 18 in (460 mm) a year. Most of the precipitation during the growing season is returned to the atmosphere through the processes of evapotranspiration. The most significant recharge from precipitation probably occurs during periods of snowmelt and early spring rains.

The Little White River, one of the few streams in the area which has perennial flow, is the most important and dependable source of recharge to the alluvium. The adequacy and reliability of the alluvium as a source of supply would depend, in part, on the permeability of the river bed at a specific location.

Results of a chemical analysis of water from test well 26 are given in table 3.

Table 3 belongs near here.

Table 3.--Chemical quality of water from test well 26,

Soldier Creek, Todd County, South Dakota

(Results in milligrams per litre, except as indicated;
ug/l, micrograms per litre)

Date of collection May 31, 1973

Silica (SiO_2), dissolved	51	Nitrite (NO_2) + Nitrate (NO_3) dissolved as N	0.00
Aluminum (Al), dissolved, ug/l	0	Boron (B), dissolved, ug/l	70
Iron (Fe), dissolved, ug/l	9	Dissolved solids, residue at 180°C	358
Manganese (Mn), dissolved, ug/l	0	Hardness as $CaCO_3$ (Ca, Mg)	220
Calcium (Ca), dissolved	70	Noncarbonate hardness	0
Magnesium (Mg), dissolved	10	Percent sodium	23
Sodium (Na), dissolved	31	Sodium-adsorption ratio	.9
Potassium (K), dissolved	12	Specific conductance (micromhos/cm at 25°C)	550
Bicarbonate (HCO_3)	367	pH (units)	7.7
Carbonate (CO_3)	0	Temperature (°C)	13.0
Alkalinity as $CaCO_3$, total	301	Lithium (Li), dissolved, ug/l	20
Sulfate (SO_4), dissolved	9.6	Strontium (Sr), dissolved, ug/l	350
Chloride (Cl), dissolved	3.4		
Fluoride (F), dissolved	1.0		

REFERENCES

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