GROUND-WATER STUDY FOR THE CITY OF MURDO

by

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GROUND-WATER STUDY FOR THE CITY OF MURDO

This report contains the results of a special ground-water investigation conducted by the South Dakota Geological Survey along the White River floodplain in Jones County, South Dakota. Field work was conducted from June 16 to June 23, 1977. The investigation involved: (1) a review of the unpublished Little White River study (A. Baran, 1970); (2) the drilling of 22 auger test holes; and (3) the collection and analysis of 12 water samples.

The project was financed by the South Dakota Geological Survey, the West River Conservancy Sub-District, and the city of Murdo. The cooperation of the residents in and around Murdo was appreciated.

Alluvial deposits along the White River (fig. 1) consist of fine to medium sand and fine to coarse gravel with clay. The thickness of these deposits vary from less than 1 foot (test hole 16, app. A) to 25 feet (test hole 6, app. A). For location of test holes, see figure 2.

The most promising area, considering the thickness, grain size, and the areal extent of sand and gravel is outlined in figure 2.

Table 1 shows the chemical analysis of water samples collected from the area of study in 1977. Except for samples W12, W9, and W12, all water samples in table 1 were collected from the alluvium along the White River. The total solids in the water samples from the alluvium vary from 288 to 1030 parts per million. The total solids in the vicinity of the recommended area (fig. 2) vary from 268 to 420 parts per million. Overall the water in the area outlined in figure 2 is of good quality.

Another source of water in the area was located along the Little White River during the 1969 study (see fig. 3). The Little White River has deposited alluvial sediments in the valley which vary from less than 1 foot to 21 feet thick (test hole 5, app. B). These sediments consist of sand ranging in size from fine to coarse and in some locations clay and sand are mixed together. The thickest alluvial deposit is at the junction of the Little White River and the White River. These deposits are mostly coarse to very coarse sand and approximately 16 feet of these deposits are water saturated. Twenty-three feet of alluvium ranging in size from medium sand to gravel was penetrated in test hole 3 (app. B). The water saturated thickness of the material was 16 feet in this hole.

Table 2 shows the chemical analysis of water samples and figure 3 shows the location of samples. The total solids in samples W2 and W3 in the area outlined in figure 3 varies from 418 to 268 parts per million.

Sources of water in the alluvial deposits in these valleys are from local precipitation and from the streams that are hydraulically connected with the aquifers. The water in the White River has higher dissolved chemicals than the Little White River (see W52 and W512, table 1). Extensive ground-water pumping would induce water from these surface streams into the alluvial deposits. Consequently, water from the White River probably will deteriorate the quality of water in the area outlined in figure 2. In addition, the high silt content of the White River is much higher than the Little White River. The high silt content of the White River could reduce the permeability of the aquifer outlined in figure 2 and consequently, could reduce the production of the wells. For this reason the area outlined in figure 3 is preferred over the area outlined in figure 2.

If the city of Murdo should decide to develop a well field in one or both of the recommended areas, a pump test should be conducted before the construction of a permanent well field in order to determine the quantity and quality of water, the optimum pumping rate, and the well spacing. An engineering firm licensed in South Dakota should be consulted with regard to the pump tests. The South Dakota Geological Survey is available to supervise such a pump test. The city should also consult the Division of Water Rights, Department of Natural Resource Development, to obtain water rights and the Environmental Protection Agency to determine the biological and chemical suitability of the water.
Figure 1. Generalized geologic map of the White River study area and the Little White River area. (modified from A. F. Agnew, 1957)
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<th>Sample</th>
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1 Modified for South Dakota by the Department of Health (written communication, Water Sanitation Section, September 24, 1988).

2 The 1.2 is optimum for South Dakota.

Source: WA, existing well in alluvium; TA, test hole in alluvium; R, River; LR, Little White River; WP, existing well in Pierre Shale

Samples were analyzed by the South Dakota Geological Survey.
Location of water samples from the Murdo area
(for map location, see fig. 2)

WS 1  Sec. 4, T. 4 S., R. 29 E., W. Sanderson.

WS 2  Sec. 8, T. 4 S., R. 29 E., White River sample.

WS 3  Sec. 4, T. 4 S., R. 29 E., W. Sanderson, well system in dugout.

WS 4  Sec. 4, T. 4 S., R. 29 E., W. Sanderson.

WS 5  Sec. 8, T. 4 S., R. 29 E., Road Side Park well.

WS 6  Sec. 34, T. 3 S., R. 29 E., D. Height, test hole 19.

WS 7  Sec. 33, T. 3 S., R. 29 E., P. Thomas, old well.

WS 8  Sec. 33, T. 3 S., R. 29 E., Ardith Eggleston.

WS 9  Sec. 7, T. 4 S., R. 29 E., P. Thomas.

WS10A Sec. 4, T. 4 S., R. 29 E., W. Sanderson, well system in dugout.

WS10B Sec. 4, T. 4 S., R. 29 E., W. Sanderson, well system in dugout.

WS10C Sec. 4, T. 4 S., R. 29 E., W. Sanderson, well system in dugout.

WS10D Sec. 4, T. 4 S., R. 29 E., W. Sanderson, well system in dugout.

WS11 Sec. 4, T. 4 S., R. 29 E., W. Sanderson, stock well.

WS12 Sec. 9, T. 43 N., R. 28 W., Little White River.
Figure 3. Data map of the Little White River study area.

by C. Orga
and A. Barracl,
1977

Test hole

Well D
Existing well water sample

W2 and 2 G
Test hole water sample

W9 A
River water sample

Recommended area
<table>
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<th>Sample</th>
<th>Source</th>
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<th>Calcium</th>
<th>Magnesium</th>
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</table>
Location of water samples
(for map location, see fig. 2)

W 1. SW\SW\SW\W sec. 8, T. 4 S., R. 29 E., Road Side Park well.

W 2. NW\NW\NW\NE sec. 9, T. 43 N., R. 28 W., test hole. Water was collected from depth of 14 feet.

W 3. SE\NE sec. 9, T. 43 N., R. 28 W., water from Little White River.

W 4. SE\NW\SW\NW\NE sec. 15, T. 43 N., R. 28 W., test hole 9.

W 5. SE\SW\SW\SW\NW\NE sec. 15, T. 43 N., R. 28 W., test hole 10.

W 6. SE\SW\SW\SW\NW\NE sec. 5, T. 42 N., R. 28 W., Larry Hutchinson well.

W 7. SE\ENE\SW\W sec. 24, T. 42 N., R. 29 W., Knife well, 47 feet deep.

W 8. SW\SW\SW\SW\SW sec. 23, T. 42 N., R. 29 W., Joseph Larvix well, 48 feet deep.

W 9. SW\SW\SW\NW\NW sec. 23, T. 42 N., R. 29 W., Little White River water.

W10. NE\NE\NW\NW\NW sec. 34, T. 42 N., R. 29 W., White River City well no. 2

W11. SE\NE\SE\SW\SW sec. 34, T. 42 N., R. 29 W., White River City well no. 1.
APPENDIX A

Log of test holes in the White River area
(For location, see fig. 2)

NOTE: Elevations for the test holes are taken from U.S. Geological Survey 7 1/2 minute, 10 feet contour interval map and should not be considered as an exact elevation of the test hole location.

Test Hole 1
Location: SW\(\frac{1}{4}\)SE\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1776 feet
0-4 Silt, medium tan; dry
4-7 Silt, clayey (7); moist
7-11 Sand, dark brown, very fine to fine, clayey, moist
11-13 Sand, medium to coarse, saturated
13-24 Sand, coarse, rounded, some elongated pebbles
24-33 Shale, gray

Test Hole 2
Location: NW\(\frac{1}{4}\)SE\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1772 feet
0-4 Silt, light tan; clayey; dry
4-8 Sand, medium to coarse, pebbly (grading to a medium sand)
8-23 Sand, coarse, some pebbles; clean
23-24 Sand, coarse, elongated pebbles, some gravel
24-28 Shale

Test Hole 3
Location: SE\(\frac{1}{4}\)SE\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1775 feet
0-3 Silt, light tan
3-7 Sand, light brown, medium, rounded
7-14 Sand, gray-brown, fine to very fine, clayey
14-21 Sand, medium to coarse, rounded
21-24 Sand, medium to coarse, pebbly
24-30 Shale

Test Hole 4
Location: NE\(\frac{1}{4}\)SW\(\frac{1}{4}\)NW\(\frac{1}{4}\)SE\(\frac{1}{4}\) sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1775 feet
0-3 Silt, light tan
3-7 Sand, fine to medium, rounded
7-10 Sand, gray, medium; moist
10-18 Sand, medium to coarse, pebbly
18-22 Sand, coarse, pebbles
22-25 Shale

Test Hole 5
Location: NW\(\frac{1}{4}\)SE\(\frac{1}{4}\)NW\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1777 feet
0-3 Silt, light tan
3-6 Sand, brown, medium to fine clayey
6-16 Sand, medium to fine, rounded
16-20 Sand, dark gray, medium, very fine
20-27 Sand, dark gray, coarse, silty
27-35 Shale

Test Hole 6
Location: SW\(\frac{1}{4}\)NW\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 1, T. 4 S., R. 29 E.
Surface elevation: 1772 feet
0-6 Sand, yellow-brown, fine, medium to fine, rounded
6-20 Sand, light brown, medium, rounded, clean
20-23 Sand, gray, medium to fine, thin
23-25 Sand, dark gray, very fine, clayey
25-30 Shale, soft, some sand and pebbles
30-35 Shale

Test Hole 7
Location: NE\(\frac{1}{4}\)NW\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1775 feet
0-4 Silt, medium tan; dry
4-10 Silt, light-brown, clayey; moist
10-17 Sand, fine to medium; saturated
17-20.5 Sand, medium to coarse, rounded
20.5-24 Some small pebbles
24-28 Sand, coarse to very coarse, pebbles
28-30 Sand, very coarse, pebbles

Test Hole 8
Location: NE\(\frac{1}{4}\)NW\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1775 feet
0-3 Silt, medium tan; dry
3-10 Silt, light-brown, clayey
10-13 Clay, medium-brown, sandy, soft
13-21 Sandy, fine to medium, rounded, brown
21-22 Clay
22-24 Sand, coarse, rounded, clayey; some pebbles to 8 cm
24-28 Sand, coarse, pebbles
28-30 Shale

Test Hole 9
Location: NW\(\frac{1}{4}\)SE\(\frac{1}{4}\)NW\(\frac{1}{4}\)SW\(\frac{1}{4}\) sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1775 feet
0-4 Silt, medium tan; dry
4-8 Sand, fine to medium, clayey
8-15 Sand, brown, medium
15-22 Sand, coarse, pebbles, gritty
Test Hole 9 - continued.

22-24 Sand, coarse, pebbly, clean
24-30 Shale

Test Hole 10
Location: NW1/4 SE1/4 NW1/4 sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1775 feet

0.3 Silt, light-brown; dry
3-9 Sand, brown, fine to medium, clayey; moist
9-15 Sand, gray-brown, medium to coarse, clayey
15-21 Sand, coarse, well-rounded; clean
21-23 Sand, coarse, some flat, smooth pebbles
23-27 Shale

Test Hole 11
Location: NW1/4 NW1/4 SE1/4 sec. B, T. 4 S., R. 29 E.
Surface elevation: 1775 feet

0-4 Sand, fine, silty
4-7 Sand, light-brown, medium to coarse, clean
7-14 Sand, light-brown, medium to coarse, silty
14-15 5 Gravel, coarse
15-20 5-20 Shale, hard

Test Hole 12
Location: NE1/4 SW1/4 SW1/4 sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1775 feet

0 5 Silt, light-brown
5 9 Silt, light-brown; mottled
9-22 Sand, light-brown to light-gray, fine to coarse, silty
22-25 Shale, hard

Test Hole 13
Location: NW1/4 SW1/4 SW1/4 sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1772 feet

0-13 Sand, fine; dry
13-20 Sand, light-brown, medium to coarse; saturated
20-27 Shale, dark-gray, hard

Test Hole 14
Location: NW1/4 SE1/4 NW1/4 sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1775 feet

0-8 Sand, light-brown, fine; dry
9-11 Sand, fine to medium; moist
11-15 Sand, light-brown, fine to coarse

Test Hole 14 - continued.

15-19 Gravel, gray, medium, rounded, silty
19-25 Shale, gray, reworked

Test Hole 15
Location: SW1/4 NE1/4 SW1/4 sec. 4, T. 4 S., R. 29 E.
Surface elevation: 1775 feet

0 5 Silt, light-brown
5 8 Silt, very fine sand; moist
8-19 Sand, light-brown to light-gray, medium to coarse
19-26 Shale, reworked, gray, hard

Test Hole 16
Location: SE1/4 NE1/4 NE1/4 sec. 32, T. 3 S., R. 29 E.
Surface elevation: 1798 feet

0-12 Silt, light-brown; dry
12-19 Silt, light-brown, clayey, shaley; saturated
19-25 Shale, dark-gray, hard

Test Hole 17
Location: SE1/4 NE1/4 SE1/4 sec. 32, T. 3 S., R. 29 E.
Surface elevation: 1795 feet

0 2 Clay, medium-brown; dry
2-12 Clay, brown to gray; dry
12-24 Clay, shaley; dry
24-29 Sand, brown, fine, clayey; dry
29-31 Sand, light-brown, medium; saturated
31-35 Shale, soft

Test Hole 18
Location: NE1/4 SE1/4 NE1/4 sec. 32, T. 3 S., R. 29 E.
Surface elevation: 1785 feet

0-11 Shale, weathered
11-17 Silt, light to dark-brown, clayey; moist
17-29 Silt, light-brown, clayey and slightly sandy, fine; moist
29-35 Shale, hard

Test Hole 19
Location: SW1/4 SW1/4 NE1/4 sec. 34, T. 3 S., R. 29 E.
Surface elevation: 1765 feet

0-10 Sand, light-brown, fine
10-21 Sand, medium to coarse
21-32 Shale

- 10 -
Test Hole 20
Location: NW\%SW\%NW\%SW\% sec. 33, T. 3 S., R. 29 E.
Surface elevation: 1770 feet
0-2 Topsoil
2-6 Sand, light-brown, very fine; dry
6-12 Silt, light-brown, clayey
12-20 Sand, dark-gray, coarse, shaley, clayey; saturated at 12 feet
20-27 Shale, dark-gray, hard

* * *

Test Hole 21
Location: SE\%SE\%SW\%SW\% sec. 8, T. 4 C., R. 29 E.
Surface elevation: 1762 feet
0-5 Sand, light-brown, fine; dry
5-10 Sand, light-brown to fine, medium
10-16 Sand, light-brown to light-gray, medium to coarse, silt
16-21 Gravel, coarse, silt and cobbles
21-27 Shale, dark-gray, hard

* * *

Test Hole 22
Location: NW\%SW\%NW\%SW\% sec. 8, T. 4 S., R. 29 E.
Surface elevation: 1782 feet
0-8 Sand, fine; dry
8-18 Sand, light-brown, very coarse to gravel, medium, silt; saturated
18-27 Shale, dark gray, hard

* * *

Test Hole 23
Location: SW\%SW\%NE\%SW\% sec. 8, T. 4 S., R. 29 E.
Surface elevation: 1782 feet
0-6 Sand, light-brown, fine, silty; dry
6-14 Sand as above; moist
14-21 Sand, coarse to very coarse, silty, shaley, some fine gravel
21-26 Shale, gray, hard

* * *
### APPENDIX B

*Logs of test holes in the little White River area (For location, see Fig. 3)*

**NOTE:** Elevations for the test holes are taken from U.S. Geological Survey 7½ minute, 10 feet contour interval map and should not be considered as an exact elevation of the test hole location.

#### Test Hole 1
**Location:** SE½SE½NW½SE½ sec. 4, T. 43 N., R. 28 W.
**Surface elevation:** 1785 feet
**Depth to water:** 10 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-12</td>
<td>Clay, yellowish-brown</td>
</tr>
<tr>
<td>12-20</td>
<td>Clay and gravel</td>
</tr>
<tr>
<td>20-25</td>
<td>Gravel</td>
</tr>
<tr>
<td>25-28</td>
<td>Shale, dark-gray</td>
</tr>
</tbody>
</table>

#### Test Hole 2
**Location:** NW½NW½NW½NW½ sec. 9, T. 43 N., R. 28 W.
**Surface elevation:** 1782 feet
**Depth to water:** 6 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-4</td>
<td>Sand, light-brown, medium</td>
</tr>
<tr>
<td>4-20</td>
<td>Sand, coarse to very coarse</td>
</tr>
<tr>
<td>20-28</td>
<td>Sand and gravel</td>
</tr>
<tr>
<td>26-28</td>
<td>Clay</td>
</tr>
</tbody>
</table>

#### Test Hole 3
**Location:** SW½SE½NW½NW½ sec. 9, T. 43 N., R. 28 W.
**Surface elevation:** 1782 feet
**Depth to water:** 7 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-7</td>
<td>Sand, medium</td>
</tr>
<tr>
<td>7-14</td>
<td>Sand, medium to coarse</td>
</tr>
<tr>
<td>14-23</td>
<td>Sand and gravel</td>
</tr>
<tr>
<td>23-24</td>
<td>Shale, gray</td>
</tr>
</tbody>
</table>

#### Test Hole 4
**Location:** NE½NE½SE½NW½ sec. 9, T. 43 N., R. 28 W.
**Surface elevation:** 1763 feet
**Depth to water:** 7 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Clay</td>
</tr>
<tr>
<td>4-8</td>
<td>Sand, gray, medium fine</td>
</tr>
<tr>
<td>8-18</td>
<td>Sand, medium</td>
</tr>
<tr>
<td>18-21</td>
<td>Sand, coarse, some pebbles</td>
</tr>
<tr>
<td>21-25</td>
<td>Shale, gray</td>
</tr>
</tbody>
</table>

#### Test Hole 5
**Location:** SE½SE½NW½NW½ sec. 9, T. 43 N., R. 28 W.
**Surface elevation:** 1791 feet
**Depth to water:** 6 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-8</td>
<td>Sand, light-brown, grading to gray, coarse, well-sorted</td>
</tr>
<tr>
<td>8-18</td>
<td>Sand, coarse</td>
</tr>
<tr>
<td>18-21</td>
<td>Sand, coarse to very coarse, some clay</td>
</tr>
<tr>
<td>21-26</td>
<td>Clay, gray</td>
</tr>
</tbody>
</table>

#### Test Hole 6
**Location:** SE½SE½NW½NW½ sec. 9, T. 43 N., R. 28 W.
**Surface elevation:** 1799 feet
**Depth to water:** 6 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-5</td>
<td>Sand, medium</td>
</tr>
<tr>
<td>5-18</td>
<td>Sand, gray, medium, some clay</td>
</tr>
<tr>
<td>18-23</td>
<td>Shale</td>
</tr>
</tbody>
</table>

#### Test Hole 7
**Location:** NW½NW½NW½NW½ sec. 15, T. 43 N., R. 28 W.
**Surface elevation:** 1794 feet
**Depth to water:** 4 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Topsoil</td>
</tr>
<tr>
<td>2-4</td>
<td>Sand, fine, silt</td>
</tr>
<tr>
<td>4-9</td>
<td>Sand, brown, medium to coarse</td>
</tr>
<tr>
<td>9-27</td>
<td>Clay, dark-gray (shale)</td>
</tr>
</tbody>
</table>

#### Test Hole 8
**Location:** SW½NW½NW½NW½ sec. 15, T. 43 N., R. 28 W.
**Surface elevation:** 1794 feet
**Depth to water:** 4 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Topsoil</td>
</tr>
<tr>
<td>2-4</td>
<td>Sand, brown, fine to medium</td>
</tr>
<tr>
<td>4-12</td>
<td>Sand, brown changing to gray, medium</td>
</tr>
<tr>
<td>12-18</td>
<td>Clay, dark-gray (shale)</td>
</tr>
</tbody>
</table>

#### Test Hole 9
**Location:** NW½NW½NW½NW½ sec. 15, T. 43 N., R. 28 W.
**Surface elevation:** 1795 feet
**Depth to water:** 4 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Topsoil</td>
</tr>
<tr>
<td>2-7</td>
<td>Sand, fine, some clay</td>
</tr>
<tr>
<td>7-15</td>
<td>Sand, gray, medium to coarse</td>
</tr>
<tr>
<td>15-23</td>
<td>Clay, gray</td>
</tr>
</tbody>
</table>

#### Test Hole 10
**Location:** SE½SE½NW½NW½ sec. 15, T. 43 N., R. 28 W.
**Surface elevation:** 1798 feet
**Depth to water:** 6 feet

<table>
<thead>
<tr>
<th>Depth</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>Topsoil</td>
</tr>
<tr>
<td>1-7</td>
<td>Sand, some clay</td>
</tr>
<tr>
<td>7-15</td>
<td>Sand, medium to coarse, well-sorted</td>
</tr>
<tr>
<td>15-17</td>
<td>Clay, gray</td>
</tr>
</tbody>
</table>
Test Hole 11
Location: SW\%NE\%NW\%SE\% sec. 15, T. 43 N., R. 28 W.
Surface elevation: 1802 feet
Depth to water: 6 feet

0 - 1 Topsoil
1 - 5 Sand, brown, medium to coarse
5-17 Sand, gray, some pebbles
17-18 Shale

Test Hole 12
Location: SW\%NW\%SE\%NE\% sec. 15, T. 43 N., R. 28 W.
Surface elevation: 1805 feet
Depth to water: 7 feet

0 - 1 Topsoil
1 - 4 Sand, brown, fine
4 - 8 Sand, medium
8 - 17% Sand, medium, some clay
17½-23 Clay, dark-gray (shale)

Test Hole 13
Location: SE\%SE\%NW\%NE\% sec. 22, T. 43 N., R. 28 W.
Surface elevation: 1813 feet
Depth to water: 8 feet

0 - 1 Topsoil
1 - 7 Sand, brown, fine
7 - 8 Sand, medium
8 - 10% Clay, gray, soft drilling
10½-21 Shale

Test Hole 14
Location: NE\%SE\%NW\%NE\% sec. 22, T. 43 N., R. 28 W.
Surface elevation: 1814 feet
Depth to water: 7 feet

0 - 1 Topsoil
1 - 4 Sand, brown, fine
4 - 6 Sand, medium, some clay
6-12 Sand, medium to coarse
12-15 Sand, some clay
15-18 Clay, gray (shale)

Test Hole 15
Location: SE\%NE\%NW\%NW\% sec. 27, T. 43 N., R. 28 W.
Surface elevation: 1822 feet
Depth to water: 5 feet

0 - 1 Topsoil
1 - 4 Sand, fine, some clay
4-13 Sand, medium to coarse
13-18 Clay, dark gray

Test Hole 16
Location: SW\%NW\%SE\%NE\% sec. 28, T. 43 N., R. 28 W.
Surface elevation: 1823 feet
Depth to water: 8 feet

0 - 1 Topsoil
1 - 5 Sand, fine
5 - 8 Sand, medium
8-12 Sand, coarse
12-13 Clay, gray
13-19 Sand and gravel
19-21 Shale

Test Hole 17
Location: SW\%SE\%SW\%NW\% sec. 5, T. 42 N., R. 28 W.
Surface elevation: 1802 feet
Depth to water: 3 feet

0 - 2 Sand, brown, medium
2 - 5 Sand, coarse
5 - 9 Sand, gray, some pebbles
9-12 Shale

Test Hole 18
Location: NE\%SW\%SE\%SW\% sec. 5, T. 42 N., R. 28 W.
Surface elevation: 1875 feet
Depth to water: dry hole

0 - 1 Topsoil
1 - 4 Clay, brown
4 - 8 Shale, gray

Test Hole 19
Location: SE\%SE\%SW\%NW\% sec. 24, T. 42 N., R. 29 W.
Surface elevation: not measured
Depth to water: 7 feet

0 - 9 Sand, tan, medium to coarse
9-11 Shale, gray

Test Hole 20
Location: NE\%NE\%SW\%SW\% sec. 34, T. 42 N., R. 29 W.
Surface elevation: not measured
Depth to water: 9 feet

0 - 5 Clay and sand (built up area)
5-20 Sand, coarse
20-23 Shale, gray