GEOPHYSICAL AND LITHOLOGIC LOGS FOR 1979
DRILLING IN WILLIAMS COUNTY, NORTH DAKOTA

By

John M. Spencer

Open-File Report 80-646
1980

This report has not been edited for conformity with U.S. Geological Survey editorial standards or stratigraphic nomenclature.
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Figure 1. Drill-hole location map----------------------------- 2

List of abbreviations:
  bl - blue
  brn - brown
  cbncs - carbonaceous
  clayst - claystone
  cps - counts per second
  dk - dark
  gn - green
  gy - gray
  ironst - ironstone
  limest - limestone
  lt - light
  sandst - sandstone
  siltst - siltstone
  T.C. - time constant
  T.D. - total depth
  unconsol - unconsolidated
  yel - yellow
GEOPHYSICAL AND LITHOLOGIC LOGS FOR 1979 COAL DRILLING IN WILLIAMS COUNTY, NORTH DAKOTA

By John M. Spencer

INTRODUCTION AND ACKNOWLEDGMENTS

Under U.S. Geological Survey contract no. 14-08-0001-17427, Crandall Drilling Company drilled 56 test holes in Williams County, North Dakota. These holes were drilled to complete the drilling project in northern Williams County. Previous drilling in the project was reported by Cook and Spencer (1979). The hole locations are shown in figure 1. The purpose of the drilling was to obtain information on thickness and extent of coals in the area.

U.S. Geological Survey personnel collected drill cuttings for lithologic control. These cuttings were used in conjunction with the geophysical logs to determine the lithologic logs presented in this report. The lithologic logs have been generalized to 10-foot intervals. The strip logs presented are based on the lithologic logs and are not interpretations of the geophysical logs, with the exceptions of the tops and bottoms of lignite beds. All measurements are in feet, to convert to meters, multiply by 0.3048.

Field work was done by John M. Spencer, assisted by Leslie L. Tomac.

REFERENCE

**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO. 5**

**SHEET 1 OF 2**

**AREA**
Williams County

**QUAD NAME**
Epping

**DATE STARTED**
6/17/79

**DATE COMP.**
6/17/79

**COUNTY**
Williams

**STATE**
North Dakota

**LOCATION:** SEC. 21 T. 156 N., R. 98 W., FOOTAGE LOC. 15

**FOOTAGE**
112

**GROUND ELEV**
2351 ft

**TOTAL DEPTH**
460 ft

**SIZE AND BIT TYPE:**
5-inch drag

**DRILLING AGENCY:**
Crandall Drilling

**DRILL TYPE:**
CORING

**DEPTH TO WATER**
109 ft

**FOOTAGE LOG.**

**LITHOLOGY RECORDED BY**
Spencer

**GEOPHYSICAL LOGS RECORDED BY**
Nelson

**REMARKS:**

**LITHOLOGY**

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<th>FEET</th>
<th>METERS</th>
</tr>
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<tr>
<td>1000</td>
<td>300</td>
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</tbody>
</table>

- Logging speed: 20 ft/min
- Density range: 200 cps
- Density T.C.: 2 sec
- Gamma range: 50 cps
- SP sensitivity: 20 mv
- Gamma T.C.: 2 sec
- Resistance sensitivity: 20 ohms

**Lithology:**

- Sand, silt, unconsol
- Gravel, unconsol
- Coarse sand, unconsol
- No samples
- Lignite, 234-239
REMARKS:

LITHOLOGY

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
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<tbody>
<tr>
<td>lignite, 414-418</td>
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<tr>
<td>lignite, 449-451.5</td>
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Logging speed: 20 ft/min
Logged depth: 455
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
Gamma range: 50 cps
Gamma TC: 2 sec

Resistace sensitivity: 20 ohms

DEPTH

FEET

METERS

350  -110
400  -120
450  -130
500  -140
550  -150
600  -160
650  -170
700  -180
750  -190
800  -200
850  -210
900  -220
AREA: Williams County
QUAD NAME: Epping
DATE STARTED: 6/18/79
DATE COMP: 6/18/79
COUNTY: Williams
STATE: North Dakota
LOCATION: SEC. 1 T.156 N., R. 99 W., FOOTAGE LOC.
15 FNL
10 FEL
GROUND ELEV 2272 ft
FOOTAGE TOTAL DEPTH 400 ft
SIZE AND BIT TYPE: 5-inch drag
DRILLING AGENCY: Crandall Drilling
DRILL TYPE: ----
DEPT WATER 9 ft
LITHOLOGY RECORDED BY Spencer
GEOPHYSICAL LOGS RECORDED BY Nelson
REMARKS:
Logging speed 20 ft/min
Logged depth 399 Density range 200 cps
Gamma range 50 cps
Gamma TC 2 sec
SP sensitivity 20 mv
Resistance sensitivity 20 ohms
DEPTH RECORDED:
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350

LITHOLOGY:
sand, gravel, unconsol
oxidized sand, silt, unconsol
till:
oxidized silt, unconsol
siltst, gy; lignite, 66-67
clayst, gy, silt; lignite, 80.5-84, 85.5-90
sandst, gy, fine-grained
siltst, gy
clayst, brn; lignite, 156-158
sandst, gy, very fine grained
siltst, lt-gy, clayey
siltst, cbns
siltst, gy, clayey
lignite, 244-247
siltst, gy, sandy
siltst, gy, clayey
lignite, 349.5-353.5
REMARKS:

LITHOLOGY

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<th>FEET</th>
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Logging speed: 20 ft/min
Logged depth: 399
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

lignite, 359.5-360.5
siltst, gn-gy, sandy
sandst, gy
LOCATION: SEC. 20 T.156 N., R.99 W.  FOOTAGE LOC. 95

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORDED BY Spencer

REMARKS: Power line nearby

sand, silt, gravel, unconsol

till:
sand, very coarse, oxidized clay, unconsol

gravel; sand, unconsol
clayst, gy, silty

siltst, dk-gy

siltst, dk-gy, clayey

siltst, lt-gy; limestone 194-195.5

sandst, gy, fine-grained

clayst, lt-gy; lignite, 216.5-217.5, 228-231.5

siltst, gy; lignite, 268-270

siltst, cbncs

siltst, dk-gy; lignite, 344-351
REMARKS:

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<td></td>
<td>Gamma range: 50 cps</td>
<td>330</td>
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<td>siltst, dk-gy; lignite, 359-360</td>
<td>Density range: 200 cps</td>
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<td>Gamma TC: 2 sec</td>
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<td>sandst, gy</td>
<td>Density TC: 2 sec</td>
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<td>SP sensitivity: 20 mv</td>
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<td>Resistance sensitivity: 20 ohms</td>
<td>280</td>
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</table>
UNITED STATES GEOLOGICAL SURVEY

HOLE NO W 9
SHEET 1 OF 2

AREA: Williams County
QUAD NAME: Spring Brook

DATE STARTED: 6/17/79
DATE COMP.: 6/17/79
COUNTY: Williams
STATE: North Dakota

LOCATION: SEC. 27 T.156 N., R. 99 W., FOOTAGE LOC. 25
FOOTAGE: 83
GROUND ELEV: 2211 ft

SIZE AND BIT TYPE: 5-inch drag
DRILL TYPE: ---

DRILLING AGENCY: Crandall Drilling

LITHOLOGY:
- sand, silt, clay, gravel, oxidized, unconsol
- till:
  - sand, oxidized, unconsol
- siltst, gn-gy; lignite, 47-49
- clayst, gy
- siltst, gy, sandy
- siltst, dk-gy
- siltst, lt-gy; lignite, 145-148.5
- siltst, gy; lignite, 180.5-183
- sandst, gy
- lignite, 278.5-285.5
- siltst, dk-gy, clayey
- lignite, 315-320.5
- siltst, dk-gy
- siltst, gn-gy

Lithology Log:
- Logging speed: 20 ft/min
- Density range: 200 cps
- Logged depth: 400 ft
- Density TC: 2 sec
- Gamma range: 50 cps
- SP sensitivity: 20 mv
- Gamma TC: 2 sec
- Resistance sensitivity: 20 ohms

Depth:
- 0 ft
- 10 ft
- 20 ft
- 30 ft
- 40 ft
- 50 ft
- 60 ft
- 70 ft
- 80 ft
- 90 ft
- 100 ft
- 150 ft
- 200 ft
- 250 ft
- 300 ft
- 350 ft

Remarks:

Geophysical Logs recorded by Nelson

Logging speed: 20 ft/min
Density range: 200 cps
Logged depth: 400 ft
Density TC: 2 sec
Gamma range: 50 cps
Gamma TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms
**REMARKS:**

<table>
<thead>
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<th>LITHOLOGY</th>
<th>LOGGING LOG</th>
<th>DEPTH</th>
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<td>sandst, gy, silty</td>
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<td>Density T.C.: 2 sec</td>
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<td>Gamma range: 50 cps</td>
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<td>Gamma TC: 2 sec</td>
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<td>Resistance sensitivity: 20 ohms</td>
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Logging speed: 20 ft/min  
Density range: 200 cps  
Logged depth: 400  
Density T.C.: 2 sec  
Gamma range: 50 cps  
SP sensitivity: 20 mv  
Gamma TC: 2 sec  
Resistance sensitivity: 20 ohms
**LITHOLOGY**

- Till: silt, yel-brn, sandy, unconsol
- Gravel, clay, brn, silty, unconsol
- Clay, silty, gy, unconsol
- Pea gravel, unconsol
- Clayst, gy; lignite, 68.5-70
- Siltst, clayst, gy
- Sandst, gy
- Lignite, 171-175
- Siltst, clayst, gy
- Siltst, olive-gy
- Siltst, lt-gy
- Siltst, dk-gy; limest 240-242
- Clayst, lt-gy
- Siltst, gy, sandy
- Siltst, brn; lignite, 336.5-338
- Siltst, dk-gy
**Remarks:**

<table>
<thead>
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<th>Strip Log</th>
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<td>Siltst, dk-gy</td>
<td>![Strip Log Diagram]</td>
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- **Logging speed:** 20 ft/min
- **Logged depth:** 380
- **Density range:** 200 cps
- **Density T.C.:** 2 sec
- **Gamma range:** 50 cps
- **Gamma T.C.:** 2 sec
- **SP sensitivity:** 20 mv
- **Resistance sensitivity:** 20 ohms

**Depth:**

<table>
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<th>Depth (Feet)</th>
<th>Depth (Meters)</th>
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<td>1500</td>
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**Diagram:**

- GR
- Density
- Resistance
- JD

**Units:**

- FEET
- METERS
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO w 11**

**SHEET 1 OF 2**

<table>
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<th>Williams County</th>
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<tbody>
<tr>
<td>QUAD NAME</td>
<td>Bonetraill SW</td>
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<td>DATE STARTED</td>
<td>7/10/79</td>
</tr>
<tr>
<td>DATE COMP.</td>
<td>7/10/79</td>
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<tr>
<td>COUNTY</td>
<td>Williams</td>
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<tr>
<td>STATE</td>
<td>North Dakota</td>
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**LOCATION:** SEC. 2 T.156 N., R. 103 W., FOOTAGE LOC.

<table>
<thead>
<tr>
<th>SIZE AND BIT TYPE:</th>
<th>5-inch drag</th>
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<tr>
<td>DRILLING AGENCY</td>
<td>Crandall Drilling</td>
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<tr>
<td>DRILL TYPE:</td>
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**LITHOLOGY RECORDED BY** Spencer

**GEOPHYSICAL LOGS RECORDED BY** Nelson

**REMARKS:**

Logging speed: 20 ft/min
Logged depth: 600 ft
Density range: 200 cps
Density T.C.: 2 sec
Gamma range: 50 cps
Gamma T.C.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

**LITHOLOGY**

- sand, yel-brn, clayey, gravel, unconsol
- sand, yel-brn, clayey, unconsol
- till:
  - sand, silt, clay, yel-brn, unconsol
  - siltst, yel-brn, clayey
  - clayst, yel-brn
  - siltst, cbncs; lignite, 94.5-99
- siltst, dk-gy, clayey; lignite, 107-109, 128-131.5, 141-142.5
- siltst, dk-gy, coarse; lignite, 178.5-183
- sandst, gy, fine
- siltst, dk-gy, clayey; lignite, 231.5-239, 288-290, 311.5-313.5
- sandst, lt-gy, very fine
**REMARKS:**

<table>
<thead>
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<th>LITHOLOGY</th>
<th>DEPTH</th>
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<tbody>
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<td>Logging speed: 20 ft/min</td>
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<td>Density range: 200 cps</td>
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<td>Logged depth: 600</td>
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<td>Density T.C.: 2 sec</td>
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<td>Gamma range: 50 cps</td>
<td>140</td>
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<td>SP sensitivity: 20 mv</td>
<td>150</td>
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<td>Gamma T.C.: 2 sec</td>
<td>160</td>
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<td>Resistance sensitivity: 20 ohms</td>
<td>170</td>
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</table>

- **Lignite, 382-387, 389-401**
- **Clayst, dk-gy**
- **Siltst, dk-gy; lignite, 439.5-443, 445.5-449**
- **Siltst, clayst, lt-gy**
- **Siltst, dk-gy; lignite, 541-544.5**
- **Sandst, gy, fine**
- **Siltst, lt-gy, clayey; lignite, 576-579**
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO. W 12**

**SHEET 1 OF 2**

**AREA**
Williams County

**QUAD NAME**
Bull Butte

**DATE STARTED**
7/9/79

**DATE COMP.**
7/9/79

**COUNTY**
Williams

**STATE**
North Dakota

**LOCATION:** SEC. 2 T.156 N., R. 104 W., FOOTAGE LOC. 35

**FOOTAGE:**
- FEL: 265
- TOTAL: 600 ft

**GROUND ELEV:** 2388 ft

**SIZE AND BIT TYPE:** 5-inch drag

**DRILLING AGENCY:** Crandall Drilling

**DRILL TYPE:** ----

**DEPTH TO WATER:** 23 ft

**LITHOLOGY RECORDED BY:** Spencer

**GEOPHYSICAL LOGS RECORDED BY:** Nelson

**REMARKS:**

**Logging speed:** 20 ft/min

**Logged depth:** 599 ft

**Density range:** 200 cps

**Density TC:** 2 sec

**Gamma range:** 50 cps

**Gamma TC:** 2 sec

**SP sensitivity:** 20 mv

**Resistance sensitivity:** 20 ohms

---

**LITHOLOGY**

- sand, silt, yel-brn, unconsol
- till
  - silt, clay, yel-brn, gravel, unconsol
- siltst, gy
- sandst, gy, very fine; lignite, 93-99.5
- siltst, dk-gy, clayey
- siltst, bl-gy, coarse
- clayst, dk-gy, silty
- sandst, gy, fine; lignite, 151.5-153
- siltst, dk-gy; gn fine sandst; lignite, 174-175.5
- siltst, dk-gy
  - limest 192-194
- sandst, gy
  - lignite, 234-239
- siltst, gy-brn
  - lignite, 247-257.5
- siltst, gy; limest, 275-278;
  - lignite, 285-287.5
- siltst, lt-gy
**REMARKS:**

<table>
<thead>
<tr>
<th>Lithology</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
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<td>clayst, lt-gy</td>
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<td>sandst, gy, fine</td>
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<td>sandst, gy</td>
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<td>clayst, white; lignite, 557.5-559</td>
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<td>sandst, gy</td>
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Logging speed: 20 ft/min
Logged depth: 599 ft
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms
LOCATION: SEC. 26 T.157 N., R. 98 W., FOOTAGE LOC.

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORDED BY Spencer

REMARKS:

Logging speed: 20 ft/min
Logged depth: 479 ft
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 200 mV

LITHOLOGY

till: sand, silt, gravel, oxidized, unconsol
siltst, gy, clayey; lignite, 29-30
clayst, bl-gy; lignite, 31.5-35
siltst, gy
sandst, gy, very fine; lignite, 64-66, 67.7-70.5

siltst, gy, clayey; lignite, 113.5-115.5
124-127, 133.5-135.5

siltst, gn-gy, clayey; lignite, 153-156.5, 159-163
siltst, dk-gy
sandst, gy

siltst, gy, clayey

siltst, brn-gy; gy clayst;
  lignite, 230-232.5, 239.5-242

siltst, gy

siltst, lt gn-gy
siltst, lt-gy; clayst
siltst, cbncs; lignite, 315-318
sandst, gy
siltst, gy

DEPTH
REMARKS:

Logging speed 20 ft/min
Logged depth 479
Gamma range 50 cps
Gamma TC 2 sec
Density range 200 cps
Density T.C. 2 sec
SP sensitivity 20 mv
Resistance sensitivity 20 ohms

LITHOLOGY

sandst, gy, fine

siltst, gy; lignite, 451-453
### Remarks:

- **Lithology**
  - Lignite, 360-363; dk-gy, silty clayst
  - Sandst, gy
  - Siltst, gy; Lignite, 426-428.5
  - Sandst, gy

### Log Strip Log

<table>
<thead>
<tr>
<th>Depth</th>
<th>Logging speed</th>
<th>Density range</th>
<th>Density TC</th>
<th>Gamma range</th>
<th>SP sensitivity</th>
<th>Resistance sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>20 ft/min</td>
<td>200 cps</td>
<td>2 sec</td>
<td>50 cps</td>
<td>20 mv</td>
<td>20 ohms</td>
</tr>
<tr>
<td>400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Depth Table

<table>
<thead>
<tr>
<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>110</td>
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<tr>
<td>400</td>
<td>120</td>
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<tr>
<td>450</td>
<td>130</td>
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<td>500</td>
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<td>550</td>
<td>150</td>
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<td>600</td>
<td>160</td>
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<tr>
<td>650</td>
<td>170</td>
</tr>
<tr>
<td>700</td>
<td>180</td>
</tr>
<tr>
<td>750</td>
<td>190</td>
</tr>
</tbody>
</table>
**LITHOLOGY**

- **till:** sand, gravel, unconsol
- **sandst, oxidized**
- **no sample**
- **siltst, lt brn-gy, clayey**
- **sandst, coarse**
- **no sample**
- **siltst, clayey; lignite, 181-183.5, 185.5-187.5**
- **siltst, lt brn-gy**
- **lignite, 219.5-222.5**
- **clayst, gy, siltty**
- **no sample**
- **siltst, gy**
- **clayst, gy; lignite, 303.5-309**
- **siltst, gy; clayst**

**REMARKS:**

- Logging speed: 20 ft/min
- Density range: 200 cps
- Logged depth: 399 ft
- Density TC: 2 sec
- Gamma range: 50 cps
- SP sensitivity: 20 mv
- Gamma TC: 2 sec
- Resistance sensitivity: 20 ohms

---

**LOCATION:** Sec. 21, T.157 N., R. 99 W., Footage Loc. 2620

**DATE STARTED:** 6/19/79

**DATE COMP.:** 6/19/79

**COUNTY:** Williams

**STATE:** North Dakota

**LOCATION:** SEC. 21 T.157 N., R. 99 W., FOOTAGE LOC. 2620

**SIZE AND BIT TYPE:** 5-inch drag

**FOOTAGE:** 2620 ft

**GROUND ELEV:** 2214 ft

**DEPTH TO WATER:** 4 ft

**DRILLING AGENCY:** Crandall Drilling

**DRILL TYPE:** ROTARY 400 TCORENC

**TOTAL DEPTH:** 400 ft

**REMARKS:**

- Lithology recorded by Spencer
- Geophysical logs recorded by Nelson
## Remarks:

**Lithology**

- Siltst, gn-gy
- Sandst, clayst, lignite, 373-377.5
- Siltst, gy, sandy

<table>
<thead>
<tr>
<th>Strip Log</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logging speed: 20 ft/min</td>
<td>Density range: 200 cps</td>
</tr>
<tr>
<td>Logged depth: 399</td>
<td>Density TC: 2 sec</td>
</tr>
<tr>
<td>Gamma range: 50 cps</td>
<td>SP sensitivity: 20 mv</td>
</tr>
<tr>
<td>Gamma TC: 2 sec</td>
<td>Resistance sensitivity: 20 ohms</td>
</tr>
</tbody>
</table>

### Depth

- **Feet**: 350-750
- **Meters**: 107-228
UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 61

SHEET 1 OF 2

AREA: Williams County
QUAD NAME: Springbrook

DATE STARTED: 6/18/79
DATE COMP.: 6/18/79
COUNTY: Williams
STATE: North Dakota

LOCATION: SEC. 35, T.157 N., R.99 W., FOOTAGE LOC.

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

DRILL TYPE: ~

DEPT TO WATER: 110 ft

LITHOLOGY RECORDED BY: Spencer
GEOPHYSICAL LOGS RECORDED BY: Nelson

DATE: 6/18/79
COUNTY: Williams
STATE: North Dakota
GROUND ELEV: 2253 ft
TOTAL DEPTH: 420 ft

REMARKS:

LITHOLOGY

Logging speed: 20 ft/min
Logged depth: 414 ft
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

silt, oxidized, sandy, unconsol

till:

sand, unconsol
gravel
no sample
sand, coarse, unconsol
gravel, coarse

no sample

lignite, 175.5-177, 196.5-199, 202-203

lignite, 233.5-235

lignite, 275-276.5

lignite, 298-302
REMARKS:

LITHOLOGY

Logging speed: 20 ft/min
Logged depth: 414 ft
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

Lignite, 363-368.5 ft
AREA: Williams County
QUAD NAME: Twin Lakes

DATE STARTED: 6/23/79
DATE COMP.: 6/23/79
COUNTY: Williams
STATE: North Dakota

LOCATION: SEC. 2 T.157 N., R. 100 W., FOOTAGE LOC. 15
FOOTAGE: FNL 115 FEL 2206 ft
GROUND LEVEL: 2206 ft

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling
DRILL TYPE: ----- DEPTH TO WATER: 40 ft

LITHOLOGY RECORDED BY: Spencer
GEOPHYSICAL LOGS RECORDED BY: Nelson

REMARKS:

LITHOLOGY:

- sand, silt, gravel, unconsol
- sand, coarse, silt, unconsol
- silt, sandy, unconsol
- till:
  - silt, gy, unconsol
  - sand, gy, very fine, unconsol
  - sand, coarse, unconsol
  - gravel, coarse
  - gravel, fine, coarse sand, unconsol
  - sand, coarse, unconsol
  - gravel, fine
- sandst, siltst, gy; lignite, 244.5-246.5
- siltst, gy; lignite, 260.5-262.5
- clayst, gy; cbncs siltst
- clayst, gy; siltst; lignite, 316-318, 323-326.5
- sandst, gy, fine
**Remarks:**

**Lithology**

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>499</td>
<td>Sand, medium, calcareous</td>
</tr>
<tr>
<td>419.5-423.5</td>
<td>Lignite</td>
</tr>
<tr>
<td>350-400</td>
<td>Silt, gy, clayst</td>
</tr>
</tbody>
</table>

**Logging Details**

- **Logging speed:** 20 ft/min
- **Logged depth:** 499 ft
- **Gamma range:** 50 cps
- **Gamma TC:** 2 sec
- **Density range:** 200 cps
- **Density TC:** 2 sec
- **SP sensitivity:** 20 mv
- **Resistance sensitivity:** 20 ohms
LITHOLOGY

silt, oxidized, unconsol
till:
sand, coarse, unconsol
gravel
siltst
no sample, lignite, 64.5-68
siltst, gy
sandst, gy
siltst, gy; lignite, 125.5-129
clayst, dk-gy; lignite, 150.5-152
siltst, dk gn-gy
sandst, gy
siltst, cbncs
no sample
siltst, gy; clayst
lignite, 230-234; siltst, brn
sandst, gy, fine
siltst, gy
siltst, dk-gn, clayey; lignite, 286-292
siltst, brn-gy
clayst, lt-gy
siltst, lt-gy, sandy
siltst, gn-gy, sandy
siltst, dk-gy
siltst, clayst, lt-gy; lignite, 347.5-350
REMARKS:

LITHOLOGY

siltst, dk-gy

no sample

Logging speed: 20 ft/min
Logged depth: 390
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density T.C.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms
UNITED STATES GEOLOGICAL SURVEY

AREA Williams County
QUAD NAME Twin Lakes

DATE STARTED 6/28/79
DATE COMP. 6/28/79
COUNTY Williams
STATE North Dakota

LOCATION: SEC. 23 T.157 N., R.100 W., FOOTAGE LOC.

FOOTAGE

TOTAL DEPTH 400 ft

GROUND ELEV 2051 ft

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

DRILL TYPE: -----

DEPTH TO WATER 8 ft

GROUND ELEV

FOOTAGE

COUNTY Williams

STATE North Dakota

LOCATION: SEC. 23 T.157 N., R.100 W., FOOTAGE LOC.

FOOTAGE

TOTAL DEPTH 400 ft

GROUND ELEV 2051 ft

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

DRILL TYPE: -----

DEPTH TO WATER 8 ft

GROUND ELEV

FOOTAGE

COUNTY Williams

STATE North Dakota

LOCATION: SEC. 23 T.157 N., R.100 W., FOOTAGE LOC.

FOOTAGE

TOTAL DEPTH 400 ft

GROUND ELEV 2051 ft

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

DRILL TYPE: -----
**LITHOLOGY**

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<th>LOGGING DATA</th>
<th>DEPTH</th>
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<td>Logging speed: 20 ft/min</td>
<td>350 FT</td>
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<tr>
<td>Logged depth: 400</td>
<td>400 FT</td>
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<tr>
<td>Gamma range: 50 cps</td>
<td>450 FT</td>
</tr>
<tr>
<td>Gamma TC: 2 sec</td>
<td>500 FT</td>
</tr>
<tr>
<td>Density range: 200 cps</td>
<td>550 FT</td>
</tr>
<tr>
<td>Density TC: 2 sec</td>
<td>600 FT</td>
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<tr>
<td>SP sensitivity: 20 mv</td>
<td>650 FT</td>
</tr>
<tr>
<td>Resistance sensitivity: 20 ohms</td>
<td>700 FT</td>
</tr>
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</table>

**REMARKS:**

- Siltst., gn
- Siltst., lt-gy, clayey
UNITED STATES GEOLOGICAL SURVEY

LOCATION: SEC. 30 T.157 N., R. 100 W., FOOTAGE LOC.

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORDED BY Spencer

REMARKS:

logging speed: .20 ft/min

Logged depth: 300
Gamma range: 50 cps
Gamma TC: 2 sec

Density range: 200 cps
Density T.C.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

sand, silt, clay, oxidized, unconsol

clayst, dk-gy, clcyst

clayst, brn-gy

sand, silt, gravel, unconsol

siltst, dk-gy

siltst, brn-gy

siltst, brn-gy

siltst, olive-gy

clayst, gy; lignite, 146.5-147, 149.5-151.5

siltst, dk-gy

siltst, yel-brn

siltst, yel-gy; lignite, 195-197

siltst, lt-gy, clayey

sandst, lt-gy, very fine

siltst, lt-gy
**UNITED STATES GEOLOGICAL SURVEY**

<table>
<thead>
<tr>
<th>AREA</th>
<th>Williams County</th>
<th>QUAD NAME</th>
<th>Blacktail Lake</th>
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<th>DATE STARTED</th>
<th>DATE COMP.</th>
<th>COUNTY</th>
<th>STATE</th>
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<tbody>
<tr>
<td>7/2/79</td>
<td>7/2/79</td>
<td>Williams</td>
<td>North Dakota</td>
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<thead>
<tr>
<th>LOCATION: SEC.</th>
<th>T.</th>
<th>R.</th>
<th>FOOTAGE LOC.</th>
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<tr>
<td>9</td>
<td>157</td>
<td>101</td>
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<table>
<thead>
<tr>
<th>SIZE AND BIT TYPE:</th>
<th>5-inch drag</th>
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<table>
<thead>
<tr>
<th>DRILLING AGENCY:</th>
<th>Crandall Drilling</th>
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<table>
<thead>
<tr>
<th>DRILL TYPE:</th>
<th>DEPTH TO WATER</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>48 ft</td>
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<table>
<thead>
<tr>
<th>FOOTAGE LOG.</th>
<th>DEPTH</th>
</tr>
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<tbody>
<tr>
<td>1234 ft</td>
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</table>

<table>
<thead>
<tr>
<th>SIZE AND BIT TYPE:</th>
<th>S-inch drag</th>
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</table>

<table>
<thead>
<tr>
<th>DRILLING AGENCY:</th>
<th>Crandall Drilling</th>
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<table>
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<tr>
<th>DRILL TYPE:</th>
<th>DEPTH TO WATER</th>
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<tbody>
<tr>
<td></td>
<td>48 ft</td>
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**LITHOLOGY**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
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</thead>
<tbody>
<tr>
<td>till: sand, silt, oxidized, unconsol gravel</td>
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<tr>
<td>siltst, olive-gy</td>
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<tr>
<td>siltst, dk-gy, bl; lignite, 51.5-53</td>
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<tr>
<td>clayst, gy</td>
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</tr>
<tr>
<td>siltst, gy</td>
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<tr>
<td>lignite, 112-115; clayst, gy</td>
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<tr>
<td>siltst, dk-gy</td>
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</tr>
<tr>
<td>sandst, gy, fine</td>
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<tr>
<td>siltst, dk-gy, lignite, 170.5-173.5</td>
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<td>sandst, gy, fine; lignite, 201-202</td>
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<tr>
<td>siltst, gy, coarse; lignite, 234-240.5</td>
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<tr>
<td>clayst, cbncs</td>
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</tr>
<tr>
<td>siltst, dk-gy</td>
<td></td>
</tr>
<tr>
<td>sandst, gy, fine</td>
<td></td>
</tr>
<tr>
<td>lignite, 323-324.5</td>
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</tr>
<tr>
<td>siltst, gy</td>
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</tr>
</tbody>
</table>

**REMARKS:**

- Logging speed: 20 ft/min
- Density range: 200 cps
- Logged depth: 460 ft
- Density T.C.: 2 sec
- Gamma range: 50 cps
- SP sensitivity: 20 mv
- Gamma T.C.: 2 sec
- Resistance sensitivity: 20 ohms

**DEPTH**

- 0-10
- 10-20
- 20-30
- 30-40
- 40-50
- 50-60
- 60-70
- 70-80
- 80-90
- 90-100
- 100-110
- 110-120
- 120-130
- 130-140
- 140-150
- 150-160
- 160-170
- 170-180
- 180-190
- 190-200
- 200-210
- 210-220
- 220-230
- 230-240
- 240-250
- 250-260
- 260-270
- 270-280
- 280-290
- 290-300
- 300-310
- 310-320
- 320-330
- 330-340
- 340-350
### Remarks:

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Strip Log</th>
<th>Depth (Feet)</th>
<th>Depth (Meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandst, gy</td>
<td></td>
<td>350-360</td>
<td>105-110</td>
</tr>
<tr>
<td>Clayst, brn-gy</td>
<td></td>
<td>360-400</td>
<td>110-120</td>
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<tr>
<td>Siltst, lt-gn</td>
<td></td>
<td>400-450</td>
<td>120-130</td>
</tr>
<tr>
<td>Siltst, gy; clayst</td>
<td></td>
<td>450-500</td>
<td>130-150</td>
</tr>
</tbody>
</table>

Logging speed: 20 ft/min
Logged depth: 460
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
SP sensitivity: 20 mV
Resistance sensitivity: 20 ohms
UNITED STATES GEOLOGICAL SURVEY

HOLE NO w 27
SHEET 1 OF 2

AREA: Williams County

QUAD NAME: Bonetraill

DATE STARTED: 7/11/79
DATE COMP.: 7/11/79
COUNTY: Williams
STATE: North Dakota

LOCATION: SEC. 17 T.157 N. R.101 W. FOOTAGE LOC.:

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

DRILL TYPE:

LITHOLOGY RECORDED BY: Tomac
GEOPHYSICAL LOGS RECORDED BY: Nelson

REMARKS:

LITHOLOGY

- clayst, siltst, gy-brn
- clayst, gn-gy; lignite, 35-40, 43.5-46
- sandst, gy
- siltst, gy; lignite, 74-77
- siltst, clayst, gy; lignite, 90.5-92, 114-119
- siltst, brn-gy, gn; clayst
- sandst, gy
- siltst, clayst, gy; lignite, 166-171, 188-189.5
- siltst, clayst, gn-gy
- sandst, gy, very fine
- siltst, clayst, gy; lignite, 245.5-247, 249.5-258.5
- siltst, clayst, brn-gy
- sandst, gy; lignite, 293-295.5, 299-300
- no sample
- siltst, clayst, gy
- lignite, 336-339
- sandst, siltst, gy-brn
**Remarks:**

- **Lithology:** siltst, clayst, lt-gy

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>350-</td>
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<tr>
<td>400-</td>
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<td>450-</td>
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<td>550-</td>
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</tr>
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<td>600-</td>
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<td>650-</td>
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</tr>
<tr>
<td>700-</td>
<td></td>
</tr>
<tr>
<td>750-</td>
<td></td>
</tr>
</tbody>
</table>

- **Logging speed:** 20 ft/min
- **Logged depth:** 400 ft
- **Density range:** 200 cps
- **Density T.C.:** 2 sec
- **Gamma range:** 50 cps
- **Gamma T.C.:** 2 sec
- **SP sensitivity:** 20 mv
- **Resistance sensitivity:** 20 ohms
**LITHOLOGY**

**Logging speed**: 20 ft/min  
**Density range**: 200 cps  
**Logged depth**: 500 ft  
**Density T.C.**: 2 sec  
**Gamma range**: 50 cps  
**Gamma T.C.**: 2 sec  
**SP sensitivity**: 20 mv  
**Resistance sensitivity**: 20 ohms

- **till**: silt, yel-brn, sandy, unconsol  
- **sand, gravel, unconsol**  
- **siltst, gy-brn, sandy**  
- **siltst, yel-gy**  
- **siltst, gy, clayey**  
- **siltst, cbnscs; brn silty clayst; lignite, 90-93, 94-95, 99.5-102; gn clayst**  
- **siltst, gy**  
- **sandst, gy, fine**  
- **lignite, 160.5-163.5; dk-gy siltstone clayst, gn, silty**  
- **sandst, dk-gy**  
- **clayst, siltst, dk-gy**  
- **sandst, gy**  
- **clayst, dk-gy, lt-brn; lignite, 253-260.5**  
- **clayst, dk-gy; gn siltst**  
- **siltst, dk-gy, clayey; limestone**  
- **sandst, lt-gy**  
- **clayst, dk-gy, siltst; lignite, 326.5-334.5, 340.5-342**
**REMARKS:**

**LITHOLOGY**

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
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<tbody>
<tr>
<td>350-1</td>
<td>sandst, gy, fine</td>
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<tr>
<td>400-2</td>
<td>siltst, dk-gy, clayey</td>
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<tr>
<td>450-3</td>
<td>siltst, gy, clayey; gy fine sandst; lignite, 393.5-395.5, 402-406.5, 414.5-419</td>
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<td>500-4</td>
<td>clayst, dk-gy, lt-brn; lignite, 438.5-441</td>
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<tr>
<td>550-5</td>
<td>siltst, lt-gy; lignite, 471-476.5</td>
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<td>600-6</td>
<td>sandst, gy, fine</td>
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<tr>
<td>650-7</td>
<td>clayst, lt-gy, silty</td>
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**Logistics:**
- Logging speed: 20 ft/min
- Logged depth: 500
- Gamma range: 90 cps
- Gamma TC: 2 sec
- Density range: 200 cps
- Density TC: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms
LITHOLOGY

- siltst, yel-brn, sandy
- clayst, yel-brn, silty
- siltst, brn; lignite, 20-21.5
- no sample
- siltst, clayst, yel-brn
- sandst, yel-brn; ironst
- sandst, brn
- sandst, gy; lignite, 117-122
- siltst, gy, clayey
- siltst, dk-gy
- sandst, dk-gy, fine
- siltst, dk-gy; lignite, 189.5-196.5, 201-203
- siltst, lt-gy; lignite, 240.5-243, 254-258
- clayst, dk-gy, brn; lignite, 268.5-272
- siltst, dk-gy; clayst
- sandst, calcareous
- siltst, clayst, lt-gy
## Remarks:

**Lithology**

- Siltst, sandst, lt-gy

### Log Strip

- Logging speed: 20 ft/min
- Logged depth: 380
- Gamma range: 50 cps
- Gamma TC: 2 sec
- Density range: 200 cps
- Density TC: 2 sec
- SP sensitivity: 20 mv
- Gamma TC: 2 sec
- Resistance sensitivity: 20 ohms

### Depth

<table>
<thead>
<tr>
<th>Feet</th>
<th>Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>110</td>
</tr>
<tr>
<td>400</td>
<td>120</td>
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<tr>
<td>450</td>
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<td>150</td>
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<td>600</td>
<td>160</td>
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<tr>
<td>650</td>
<td>170</td>
</tr>
<tr>
<td>700</td>
<td>180</td>
</tr>
<tr>
<td>750</td>
<td>200</td>
</tr>
</tbody>
</table>
**LITHOLOGY**

- **Logging speed:** 20 ft/min
- **Logged depth:** 605 ft
- **Density range:** 200 cps
- **Gamma range:** 50 cps
- **Gamma TC:** 2 sec
- **SP sensitivity:** 20 mv
- **Resistance sensitivity:** 20 ohms

**REMARKS:**

- **Logging speed:** 20 ft/min
- **Density range:** 200 cps
- **Gamma range:** 50 cps
- **Gamma TC:** 2 sec
- **SP sensitivity:** 20 mv
- **Resistance sensitivity:** 20 ohms

**LITHOLOGY RECORDED BY:** Spencer

**GEOPHYSICAL LOGS RECORDED BY:** Nelson

**LOCATION:**
- **Sec:** 4
- **T:** 157 N
- **R:** 102 W
- **Footage Loc:** 2595 ft
- **Total Footage:** 620 ft
- **Rotary:** 620 ft
- **Coring:** ft
- **Ground Elev:** 2411 ft
- **Final Elev:** 565 ft
- **Depth to Water:** 5 ft

**DATE STARTED:** 7/11/79

**DATE COMPLETED:** 7/11/79

**COUNTY:** Williams

**STATE:** North Dakota
### Lithology

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>350-356.5</td>
<td>lignite, clayst, gy, silty</td>
</tr>
<tr>
<td>358.5-368.5</td>
<td>siltst, dk-gy, clayey</td>
</tr>
<tr>
<td>410-418</td>
<td>lignite, clayst, gy, silty</td>
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<tr>
<td>497.5-500</td>
<td>siltst, clayst, lt-gy; lignite, clayst, gy</td>
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<tr>
<td>500-550</td>
<td>siltst, lt-gy, clayey</td>
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<tr>
<td>550-600</td>
<td>clayst, gy</td>
</tr>
<tr>
<td>600-650</td>
<td>sandst, gy, very fine</td>
</tr>
</tbody>
</table>

---

**Remarks:**

- Logging speed: 20 ft/min
- Logged depth: 605 ft
- Gamma range: 50 cps
- Gamma TC: 2 sec
- Density range: 200 cps
- Density TC: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 2 ohms
LITHOLOGY

- sand, silt, yel-gy, unconsol
- silt, lt yel-gy, clay, unconsol
- silt, yel-brn, sandy, unconsol
- silt, gy-brn, unconsol
- sand, olive-gy silt, unconsol
- gravel
- siltst, dk-gy
- siltst, dk-gy, yel-gy
- clayst, gy
- siltst, yel
- siltst, dk-gy, clayey
- sandst, yel, very fine
- siltst, yel
- sandst, gy; dk-gy clayey silt; lignite, 223.5-229
- siltst, gy; white clayst
- siltst, dk-gy, clayey; lignite, 293.5-295, 303.5-307.5
- siltst, dk-gn
- siltst, gy, clayey

Logging speed: 20 ft/min
Logged depth: 500 ft
Density range: 200 cps
Gamma range: 50 cps
Gamma TC: 2 sec
Density TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms
REMARKS:

Logging speed: 20 ft/min
Logged depth: 500
Density range: 200 cps
SP sensitivity: 20 mv
Gamma range: 50 cps
Gamma TC: 2 sec
Resistance sensitivity: 20 ohms

LITHOLOGY

<table>
<thead>
<tr>
<th>DEPTH (FEET)</th>
<th>DEPTH (METERS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>350-110</td>
<td></td>
</tr>
<tr>
<td>400-120</td>
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<td>450-130</td>
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<td>500-140</td>
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<td>550-150</td>
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<td>600-160</td>
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<td>650-170</td>
<td></td>
</tr>
<tr>
<td>700-180</td>
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</tr>
<tr>
<td>750-190</td>
<td></td>
</tr>
</tbody>
</table>

siltst, dk-gy; dk-gy clayst; lignite, 375.5-379, 380-390
clayst, dk-gy, silty
siltst, gy, clayey; lignite, 417.5-421, 432-437
sandst, gy, fine
siltst, lt-gy, clayey
UNITED STATES GEOLOGICAL SURVEY

HOLE NO W 33
SHEET 1 OF 2

AREA: Williams County
QUAD NAME: West Bonetraill

DATE STARTED: 7/9/79
DATE COMP.: 7/9/79
COUNTY: Williams
STATE: North Dakota

LOCATION: SEC. 2 T.157 N., R.103 W., FOOTAGE LOC. 33

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORDED BY: Spencer

GEOPHYSICAL LOGS RECORDED BY: Nelson

REMARKS:

LITHOLOGY

Logging speed: 20 ft/min
Density range: 200 cps
Logged depth: 500 ft
Density T.C.: 2 sec
Gamma range: 50 cps
SP sensitivity: 20 mv
Gamma TC.: 2 sec
Resistance sensitivity: 20 ohms

Depth to water: 9 ft

FOOTAGE

TOTAL DEPTH: 500 ft

TILL:
- sand, yel-brn, gravel, unconsol
- gravel

TILL:
- silt, gy, clayey, unconsol
- sand, very coarse, unconsol

SILTST, dk-gy, clayey

SILTST, yel-gy, clayey

SILTST, gy, clayst

SILTST, dk-gn, clayey

SILTST, clayst, bl-gy

SANDST, gy, very fine

CLAYST, dk-gy, sily

SILTST, gy, clayey; lignite, 194-197, 199-210.5

SILTST, brn-gy, clayey

SILTST, brn-gy, clayey

LIGNITE, 240.5-247

SILTST, brn-gy

SILTST, lt-gy

SILTST, yel-gy, clayey

CLAYST, lt-gy, sily; lignite, 335-339
REMARKS:

LITHOLOGY

clayst, gy; lignite, 354-357
siltst, lt-gy
siltst, brn, cbncs
siltst, dk-gy
siltst, lt-gy
siltst, lt-gy, clayey
sandst, gy, fine
clayst, gy; lignite, 484.5-488.5
**Lithology**

- **Sand, silt, fine gravel, gy-brn, unconsol**
- **Till:**
  - Sand, silt, gravel, yel-brn, unconsol
  - Gravel
  - Siltst, gy-brn, sandy
  - Siltst, dk-gy, sandy
  - Siltst, clayst, dk-gy
  - Siltst, dk-gy, clayey
  - Sandst, gy, coarse; gn siltst; lignite, 196-197.5
  - Siltst, dk-gy
  - Clayst, gy, silty
  - Siltst, dk-gy, clayey
  - Clayst, gn
  - Clayst, gy, silty; lignite, 269-275, 279.5-289
- Siltst, gy
- Sandst, dk-gn, very fine
- Sandst, gy, fine
- Lignite, 339-344.5, 346-347.5
### Lithology

<table>
<thead>
<tr>
<th>Depth</th>
<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>700</td>
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<td></td>
</tr>
<tr>
<td>750</td>
<td>190</td>
<td></td>
</tr>
</tbody>
</table>

- siltst, clayst, gy
- clayst, white
- siltst, lt-gy
- siltst, bl-gy
- siltst, gy; lignite, 447-449.5
- sandst, lt-gy
- siltst, lt-gy, clayey; lignite, 474-476
- sandst, gy; brn siltst

### Logging Details
- Logging speed: 20 ft/min
- Logged depth: 500 ft
- Gamma range: 50 cps
- Density range: 200 cps
- Gamma TC: 2 sec
- Density TC: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms
UNITED STATES GEOLOGICAL SURVEY

HOLE NO W 35
SHEET 1 OF 2

AREA: Williams County
QUAD NAME: West Bonetraill
DATE STARTED: 7/10/79
DATE COMP.: 7/10/79
COUNTY: Williams
STATE: North Dakota

LOCATION: SEC. 25 T.157 N., R.103 W., FOOTAGE LOC.: 8
GROUND ELEV: 2241 ft

SIZE AND BIT TYPE: 5-inch drag
DRILLING AGENCY: Crandall Drilling
LITHOLOGY RECORDED BY: Spencer

DRILL TYPE: ROTARY 600
DEPTH TO WATER: 51 ft
GEOPHYSICAL LOGS RECORDED BY: Nelson

FOOTAGE LOG:

- FSL 82
- FEL 82
- TOTAL DEPTH 600 ft

LOCATION: SEC. 25 T.157 N., R.103 W., FOOTAGE LOC.

Remarks:

Logging speed: 20 ft/min
Density range: 200 cps
Density TC: 2 sec
Gamma range: 50 cps
Gamma TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

Lithology:

- Till: sand, silt, yel-brn; gravel, unconsol
- Siltst, yel-brn; sandst
- Siltst, clayst, yel-brn
- Clayst, yel-gy; orange siltst
- Siltst, yel-brn
- Clayst, brn; lignite, 112.5-115
- Clayst, olive-gy, silty
- Siltst, clayst, gy
- Clayst, dk-gy, lignite, 154-158.5
- Siltst, clayst, gy
- Siltst, gy
- Siltst, dk-gy, clayey; lignite, 215.5-223
- Sandst, gy, fine
- Siltst, gn, coarse
- Clayst, gn
- Clayst, gy, silty
- Sandst, gy, fine
- Siltst, dk-gy, silty
- Siltst, gy
- Siltst, gy, clayey
REMARKS:

LITHOLOGY

Logging speed: 20 ft/min
Logged depth: 599 ft
Density range: 200 cps
Gamma range: 50 cps
Gamma TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

DEPTH

sandst, gy, very fine

siltst, gy; lignite, 385-390.5, 394-405, 418-421.5

siltst, dk-gy; lignite, 427-428, 429-430

siltst, lt-gy, clayey

siltst, lt-gy, cbncs

siltst, gy; lignite, 540.5-544.5, 555.5-558

siltst, gy, clayey
**AREA:** Williams County  
**QUAD NAME:** Tom Berg Lake

**DATE STARTED:** 6/15/79  
**DATE COMP.:** 6/15/79  
**COUNTY:** Williams  
**STATE:** North Dakota

**LOCATION:** SEC. 14  
**T. 158 N., R. 97 W., FOOTAGE LOC.:** 95  
**GND ELEV:** 2353 ft

**SIZE AND BIT TYPE:** 5-inch drag  
**FOOTAGE:** TOTAL DEPTH 400 ft  
**DEPTH TO WATER:** 3 ft

**DRILLING AGENCY:** Crandall Drilling  
**DRILL TYPE:** -----  
**LITHOLOGY RECORDED BY:** Spencer  
**GEOPHYSICAL LOGS RECORDED BY:** Nelson

**REMARKS:**

**LITHOLOGY**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>silt, sand, clay, oxidized, unconsol</td>
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<tr>
<td></td>
<td>gravel, fine</td>
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<td>sandst, oxidized</td>
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<td>siltst, gy, sandy</td>
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<tr>
<td></td>
<td>sandst, oxidized, fine</td>
</tr>
<tr>
<td></td>
<td>siltst, dk-gy, cbnsc</td>
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<tr>
<td></td>
<td>siltst, olive-gy</td>
</tr>
<tr>
<td></td>
<td>siltst, yel-gy</td>
</tr>
<tr>
<td></td>
<td>siltst, gy</td>
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<td>siltst, gy, clayey; lignite, 162-165, 168.5-171.5</td>
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<td>sandst, gy, very fine; lignite, 202-204.5</td>
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<td>siltst, dk-gy; clayst; lignite, 222-224.5</td>
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<td>sandst, gy-gn</td>
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<td>siltst, clayst, gy; lignite, 301.5-306</td>
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<td>sandst, gy</td>
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<th>Lithology</th>
<th>Strip Log</th>
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<tbody>
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<tr>
<td>siltst, lt-gy, clayey</td>
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</tr>
<tr>
<td>sandst, bl-gy</td>
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</tbody>
</table>

### Logging Information:
- Logging speed: 20 ft/min
- Logged depth: 400 ft
- Gamma range: 50 cps
- Gamma TC: 2 sec
- Density range: 200 cps
- Density TC: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms
UNITED STATES GEOLOGICAL SURVEY

HOLE NO w 42
SHEET 1 OF 2

AREA
Williams County

QUAD NAME
Tom Berg Lake

DATE STARTED
6/16/79

DATE COMP.
6/16/79

COUNTY
Williams

STATE
North Dakota

LOCATION: SEC. 21
T. 158 N., R. 97 W., FOOTAGE LOC.

FOOTAGE
35

FNL
50

FWL

GROUND ELEV
2278 ft

TOTAL
400 ft

DEPTH TO
WATER
3 ft

SIZE AND BIT TYPE:
5-inch drag

DRILLING AGENCY:
Crandall Drilling

DRILL TYPE:

LITHOLOGY RECORDED BY
Spencer

GEOPHYSICAL LOGS RECORDED BY
Nelson

REMARKS:

LITHOLOGY

Logging speed: 20 ft/min
Logged depth: 400
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density T.C: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

sand, silt, gravel, yel-brn, unconsol
till:
silt, brn-gy, unconsol
siltst, brn; clayst
clayst, brn, silty
siltst, brn-gy, clayey
siltst, gn-gy, clayey
siltst, clayst, gy
siltst, gy; limest
siltst, gy
sandst, gy
gravel, very fine
siltst; lignite, 212.5-214.5
clayst, gy-brn; lignite, 232.5-234.5
clayst, gn
clayst, gy, silty
siltst, gy, clayey
clayst, gy, cbncs; lignite, 322.5-327.5
siltst, gy
**REMARKS:**

**LITHOLOGY**

- siltst, gy, clayey
- siltst, lt-gy

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>siltst, gy, clayey</td>
<td>siltst, lt-gy</td>
<td>Feet</td>
</tr>
</tbody>
</table>

- Logging speed: 20 ft/min
- Logged depth: 400
- Gamma range: 50 cps
- Gamma T.C: 2 sec
- Density range: 200 cps
- Density T.C: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms

- N.G. rpm: 200
- N.G. depth: 400
- Density range: 200
- Density T.C: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms
<table>
<thead>
<tr>
<th>Lithology</th>
<th>Depth</th>
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<tbody>
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<td>sand, oxidized, clayey, unconsol</td>
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<td>clay, gy, silty, unconsol</td>
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<td>silt, gy-brn, unconsol</td>
<td>40-60</td>
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<td>silt, gy, clayey, unconsol</td>
<td>60-80</td>
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<td>till: silt, dk-gy, clay, unconsol</td>
<td>80-100</td>
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<td>silt, yel-gy, unconsol</td>
<td>120-140</td>
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<tr>
<td>silt, olive-gy, unconsol</td>
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<td>sand, coarse, unconsol</td>
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<td>clayst, gy; limest</td>
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<td>clayst, lt-gy, silty</td>
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<td>siltst, gn-gy, clayey; lignite, 348-349.5</td>
<td>380-400</td>
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</table>

Logging speed: 20 ft/min
Logged depth: 440 ft
Density range: 200 cps
Density TC: 2 sec
Gamma range: 50 cps
Gamma TC: 2 sec
SP sensitivity: 20 mV
Resistance sensitivity: 20 ohms
**REMARKS:**

**LITHOLOGY**

<table>
<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
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<tbody>
<tr>
<td>Logging speed 20 ft/min</td>
<td>350</td>
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<tr>
<td>Logged depth 440</td>
<td>400</td>
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<tr>
<td>Gamma range 50 cps</td>
<td>450</td>
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<tr>
<td>Gamma TC 2 sec</td>
<td>500</td>
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<tr>
<td>Density range 200 cps</td>
<td>550</td>
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<tr>
<td>Density TC 2 sec</td>
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<tr>
<td>SP sensitivity 20 mv</td>
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<tr>
<td>Resistance sensitivity 20 ohms</td>
<td>700</td>
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</tbody>
</table>

**DEPTH**

siltst, gy

---

**DEPTH**

350-400-450-500-550-600-650-700-750

---

**DEPTH**

110-120-130-140-150-160-170-180-190-200-210-220

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**DEPTH**

750
UNITED STATES GEOLOGICAL SURVEY

AREA: Williams County

DATE STARTED: 6/16/79

DATE COMP.: 6/16/79

LOCATION: SEC. 34, T. 158 N., R. 98 W., FOOTAGE LOC. 20

FOOTAGE TOTAL: 400 ft

LITHOLOGY

silt, oxidized, unconsol
till:
sand, oxidized, unconsol
silt, gravel, unconsol
silt, oxidized, unconsol
siltst, gy; lignite, 55.5-63

sandst, gy; gn siltst
sandst, gy; cbncs clayst
clayst, bl-gy
clayst, gy, silty
siltst, gy; clayst; lignite 118-121.5, 131-134.5

siltst, gy
sandst

siltst, clayst, lt-gy
clayst, gn-gy, silty
siltst, lt-gy
siltst, lt gn-gy, clayst
sandst; white clayst
sandst, gy
siltst, gn-gy, clayey
siltst, gy
siltst, gy, clayey; lignite, 313-316, 320-321
siltst, brn, cbncs
siltst, gy

Logging speed: 20 ft/min
Logged depth: 400 ft
Density range: 200 cps
Density T.C.: 2 sec
Gamma range: 50 cps
Gamma T.C.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

REMARKS:

LITHOLOGY RECORDED BY Spencer
GEOPHYSICAL LOGS RECORDED BY Nelson
### Remarks:

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Strip Log</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lignite, 357-358.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandstone, gy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Logging speed:** 20 ft/min
- **Logged depth:** 400 ft
- **Density range:** 200 cps
- **Density TC:** 2 sec
- **Gamma range:** 50 cps
- **Gamma TC:** 2 sec
- **SP sensitivity:** 20 mv
- **Resistance sensitivity:** 20 ohms
UNITED STATES GEOLOGICAL SURVEY

AREA: Williams County
QUAD NAME: Alamo

DATE STARTED: 6/21/79
DATE COMP.: 6/21/79
COUNTY: Williams
STATE: North Dakota

LOCATION: SEC. 4 T. 158 N, R. 99 W, FOOTAGE LOC. 65

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORDED BY: Spencer

REMARKS:

Logging speed: 20 ft/min
Logged depth: 340
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 2 ohms

LITHOLOGY:
sand, silt, oxidized, unconsol
silt, clay, coarse sand, gravel, unconsol
silt, gy, sandy, unconsol
till
silt, yel-gy, clayey; sand, unconsol
silt, yel-gy; gy clay, unconsol
sand, coarse; silt
gravel, fine
siltst, dk gn-gy; lignite, 165-166.5
siltst, cbncs; gy clayst; lignite, 185.5-187.5
siltst, lt-gy, clayey
siltst, gy; lt-gy clayst
siltst, dk-gy
sandst, gy, clayey
no sample
**Lithology**

- sand, silt, yel-brn, unconsol
  - till:
    - gravel, fine
- siltst, gy-brn, sandy
- clayst, gy, silty
- siltst, dk gn-gy, sandy
- siltst, dk-gy, clayey
- clayst, gy, silty
- siltst, dk-gy
- clayst, lt-brn
- clayst, gy-brn
- no sample
- siltst, clayst, gy
- siltst, gy, coarse
- sandst, dk-gy, clayey
- no sample
- siltst, brn-gy
- siltst, gy, clayey
- siltst, gy; limest
- siltst, gy
- siltst, gy, sandy
- sandst, gy, clayey
- sandst, gy, clayey
- sandst, gy, clayey

---

**Log Data**

- Logging speed: 20 ft/min
- Logged depth: 440 ft
- Density range: 200 cps
- Gamma range: 50 cps
- Gamma TC: 2 sec
- Density TC: 2 sec
- Resistance sensitivity: 20 ohms
- SP sensitivity: 20 mv
### Lithology

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Strip Log</th>
<th>Depth</th>
<th>Feet</th>
<th>Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silt, gy, clayey; lignite, 403-404.5</td>
<td>411-414</td>
<td>350</td>
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</tr>
<tr>
<td>Silt, gy</td>
<td></td>
<td>400</td>
<td>120</td>
<td></td>
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<td></td>
<td></td>
<td>750</td>
<td>220</td>
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</table>

### Remarks:

- Logging speed: 20 ft/min
- Logged depth: 440 ft
- Density range: 200 cps
- Density TC: 2 sec
- Gamma range: 50 cps
- Gamma TC: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms
**LITHOLOGY**

<table>
<thead>
<tr>
<th>Depth Range</th>
<th>Lithology Notes</th>
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<tbody>
<tr>
<td>0-30 ft</td>
<td>sand, gravel, unconsol</td>
</tr>
<tr>
<td>30-32 ft</td>
<td>sand, silt, oxidized, unconsol</td>
</tr>
<tr>
<td>32-33 ft</td>
<td>sand, gy silt, gravel, unconsol</td>
</tr>
<tr>
<td>33-72 ft</td>
<td>till: gravel, coarse sand, unconsol</td>
</tr>
<tr>
<td>72-74 ft</td>
<td>gravel, fine, well-sorted</td>
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<tr>
<td>74-100 ft</td>
<td>sand, coarse, unconsol</td>
</tr>
<tr>
<td>100-300 ft</td>
<td>sand, very coarse, unconsol</td>
</tr>
<tr>
<td>300-302 ft</td>
<td>gravel, fine</td>
</tr>
<tr>
<td>302-350 ft</td>
<td>gravel, medium</td>
</tr>
<tr>
<td>350-352 ft</td>
<td>gravel, coarse</td>
</tr>
<tr>
<td>352-379 ft</td>
<td>siltst, clayst, lt-gy; lignite, 191.5-193.5</td>
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<tr>
<td>379-381 ft</td>
<td>siltst, dk-gy</td>
</tr>
<tr>
<td>381-393 ft</td>
<td>sandst, very fine</td>
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<tr>
<td>393-400 ft</td>
<td>siltst</td>
</tr>
<tr>
<td>400-416 ft</td>
<td>sandst, gy, very fine</td>
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<tr>
<td>416-500 ft</td>
<td>sandst, very fine; clayst; lignite, 294.5-300</td>
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<tr>
<td>Lithology</td>
<td>Strip Log</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Silt, oxidized, sandy, unconsol</td>
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</tr>
<tr>
<td>Till: gravel, sand, unconsol</td>
<td></td>
</tr>
<tr>
<td>Sand, gy; clay, unconsol</td>
<td></td>
</tr>
<tr>
<td>Sand, coarse, unconsol</td>
<td></td>
</tr>
<tr>
<td>No samples</td>
<td></td>
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<tr>
<td>Lignite, 216.5-221.5</td>
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<tr>
<td>Lignite, 341-346.5</td>
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## Remarks:

**Lithology**

<table>
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<tr>
<th>Strip Log</th>
<th>Depth</th>
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<tbody>
<tr>
<td></td>
<td>350</td>
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<tr>
<td></td>
<td>400</td>
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<td>700</td>
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<td></td>
<td>750</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Logging speed</th>
<th>20 ft/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logged depth</td>
<td>400</td>
</tr>
<tr>
<td>Gamma range</td>
<td>50 cps</td>
</tr>
<tr>
<td>Gamma TC</td>
<td>2 sec</td>
</tr>
<tr>
<td>Density range</td>
<td>200 cps</td>
</tr>
<tr>
<td>Density T.C.</td>
<td>2 sec</td>
</tr>
<tr>
<td>SP sensitivity</td>
<td>20 mv</td>
</tr>
<tr>
<td>Resistance sensitivity</td>
<td>20 ohms</td>
</tr>
</tbody>
</table>

---

*Note: The diagram at the bottom of the page contains a visual representation of depth and other data points.*
LITHOLOGY

silt, clay, yel-brn, gravel, unconsol
till:
silt, clay, unconsol
sand, very coarse, very fine gravel
siltst, clayst, yel-brn
siltst, clayst, dk-gy
no sample
clayst, gy, sandy; cbncs clayey silt;
lignite, 110-111, 122-128
siltst, gn-gy
siltst, lt-gy; clayst
siltst, dk-gy
siltst, clayst, gy
sandst, gy, very fine
siltst, gy
siltst, dk-gy, lt brn-gy
siltst, clayst, gy;
lignite, 270-272.5, 279.5-281
siltst, gy, coarse
siltst, lt-gy, cbncs
siltst, lt-gy
sandst, gy, very fine
siltst, lt-gy, clay zones
REMARKS:

LITHOLOGY

siltst, lt-gy, clay zones

Logging speed: 20 ft/min
Logged depth: 360
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms
UNITED STATES GEOLOGICAL SURVEY

AREA: Williams County
QUAD NAME: Zahl

DATE STARTED: 7/3/79
DATE COMP.: 7/3/79
COUNTY: Williams
STATE: North Dakota

LOCATION: SEC. 11 T. 158 N, R. 101 W., FOOTAGE LOC.

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORDED BY: Spencer

REMARKS:

LITHOLOGY:

- till: sand, yel-brn, coarse, unconsol
- sand, yel-brn, silty, unconsol
- sand, coarse, gravel, unconsol
- siltst, yel-gy, clayey; lignite, 44.5-45.5
- clayst, gy-brn
- siltst, gy, clayey
- siltst, dk gy-gy
- siltst, clayst, gy; lignite, 95.5-99
- siltst, cbnsc, lt-gy
- siltst, lt-gy, sandy
- clayst, gy
- siltst, clayst, lt-gy
- sandst, gy, fine
- siltst, dk-gy, clayey; lignite, 184-186, 183-184, 202-203
- siltst, yel-gy
- siltst, lt-gy, cbncs; lignite, 235.5-237, 245.5-247
- siltst, gy
- sandst, gy, fine
- sandst, gy, medium; some cemented zones
**Lithology**

<table>
<thead>
<tr>
<th>Depth (FT)</th>
<th>Depths (MT)</th>
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</thead>
<tbody>
<tr>
<td>350</td>
<td>110</td>
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<tr>
<td>400</td>
<td>120</td>
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<td>650</td>
<td>170</td>
</tr>
<tr>
<td>700</td>
<td>180</td>
</tr>
<tr>
<td>750</td>
<td>190</td>
</tr>
</tbody>
</table>

- Sand, gy, medium; some cemented zones

**Logging Details**

- Logging speed: 20 ft/min
- Logged depth: 360
- Density range: 200 cps
- Density T.C.: 2 sec
- Gamma range: 50 cps
- Gamma T.C.: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms

**Remark:**

- Sand, gy, medium; some cemented zones
**Lithology**

<table>
<thead>
<tr>
<th>Lithology Description</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>sandstone, yellow-brown, coarse</td>
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</tr>
<tr>
<td>siltstone, yellow-gray, dark-gray</td>
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</tr>
<tr>
<td>siltstone, gray, clayey, cbnscs</td>
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<tr>
<td>siltstone, dark-gray, clayey</td>
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<tr>
<td>claystone, gray, brown; lignite, 125-133</td>
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<tr>
<td>siltstone, dark-gray, clayey</td>
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<tr>
<td>siltstone, gray, fine sandstone</td>
<td></td>
</tr>
<tr>
<td>sandstone, gray, medium</td>
<td></td>
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<tr>
<td>sandstone, coarse</td>
<td></td>
</tr>
<tr>
<td>claystone, light-gray; lignite, 216.5-223.5</td>
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<tr>
<td>siltstone, claystone, light-gray</td>
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</tr>
<tr>
<td>siltstone, cbnscs</td>
<td></td>
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<tr>
<td>siltstone, dark-gray</td>
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<tr>
<td>siltstone, light-gray, cbnscs; lignite, 289-291.5</td>
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<tr>
<td>siltstone, claystone, gray</td>
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<tr>
<td>siltstone, light-gray</td>
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<tr>
<td>sandstone, very fine</td>
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<tr>
<td>siltstone, claystone, gray</td>
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</tbody>
</table>

**Logging speed:** 2 ft/min

**Logged depth:** 400 ft

**Density range:** 200 cps

**Density T.C.:** 2 sec

**Gamma range:** 50 cps

**Gamma T.C.:** 2 sec

**SP sensitivity:** 20 mv

**Resistance sensitivity:** 20 ohms
**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>siltst, lt-gy; lignite, 377-380, 397-399</td>
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Logging speed: 2 ft/min  
Logged depth: 400  
Gamma range: 50 cps  
Gamma TC: 2 sec  
Density range: 200 cps  
Density T.C.: 2 sec  
SP sensitivity: 20 mv  
Resistance sensitivity: 20 ohms
UNITED STATES GEOLOGICAL SURVEY

AREA: Williams County

QUAD NAME: Blacktail Lake

DATE STARTED: 7/2/79

DATE COMP.: 7/2/79

COUNTY: Williams

STATE: North Dakota

LOCATION: SEC. 23 T.158 N., R. 101 W., FOOTAGE LOC. 2230

FOOTAGE: 400 ft

GROUND ELEV: 2158 ft

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORDED BY: Spencer

GEOPHYSICAL LOGS RECORDED BY: Nelson

REMARKS:

LITHOLOGY:

till: sand, oxidized, gravel, unconsol

clayst, brn; yel-brn siltst

siltst, yel-gy

sandst, gy, medium

sandst, brn, medium

siltst, brn; gy clayst; lignite, 147.5-153

siltst, clayst, gy

sandst, lt-gy, fine

siltst, dk-gy; white clay

siltst, lt-gy

siltst, lt-gy, cbncs; lt-brn clayst; lignite, 229.5-233

sandst, gy; lt-gy siltst

siltst, lt-gy

limest; lt-gy siltst

siltst, lt; gn-gy, clayey

siltst, lt-gy

siltst, gy-gn; gy clayst

siltst, dk-gy, cbncs; lignite, 309-311

siltst, dk-gy

sandst, gy, fine

siltst, gy, clayey
### Remarks:

**Lithology**

- silt, gy, clayey

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Strip Log</th>
<th>Depth</th>
</tr>
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<tbody>
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<td>700-</td>
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<td>750-</td>
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</tbody>
</table>

- Logging speed: 20 ft/min
- Logged depth: 400
- Density range: 200 cps
- Density T.C.: 2 sec
- Gamma range: 50 cps
- Gamma T.C.: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms
**LITHOLOGY**

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<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
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<tr>
<td>0</td>
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<td>3</td>
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<td>gravel</td>
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<td>5-7</td>
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<td>7-11</td>
<td>siltst, yel-brn, cbncs</td>
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<td>11-14</td>
<td>siltst, dk-gy, clayey, lignite, 71.5-73</td>
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<td>14-16</td>
<td>clayst, siltst, lt-gy</td>
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<td>16-20</td>
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<td>20-22</td>
<td>siltst, clayst, gy</td>
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<td>22-26</td>
<td>siltst, gn-gy; cbncs; lignite, 119-122</td>
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<td>siltst, gy, clayey</td>
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<td>29-34</td>
<td>sandst, gy, medium</td>
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<td>34-36</td>
<td>clayst, gy; lignite, 192-196.5</td>
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<td>46-50</td>
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<td>50-56</td>
<td>lignite, 259-260.5, 273.5-282.5</td>
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<td>sandst, lt-gy, very fine</td>
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### Remarks:

#### Lithology

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
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<td>siltst, clayst, lt-gy</td>
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<td>siltst, lt-gy; limestone</td>
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</tr>
<tr>
<td>siltst, lt-gy; clay zones</td>
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</tr>
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</table>
UNITED STATES GEOLOGICAL SURVEY

HOLE NO W 54
SHEET 1 OF 2

AREA Williams County
QUAD NAME Hanks

DATE STARTED 7/4/79
DATE COMP. 7/4/79
COUNTY Williams
STATE North Dakota

LOCATION: SEC. 1 T.158 N., R. 102 W., FOOTAGE LOC.
325 ft
FOOTAGE 325 ft
TOTAL DEPTH 460 ft

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORDED BY Spencer

DATE STARTED 7/4/79
DATE COMP. 7/4/79
COUNTY Williams
STATE North Dakota

LOCATION: SEC. 1 T.158 N., R. 102 W., FOOTAGE LOC.
325 ft
FOOTAGE 325 ft
TOTAL DEPTH 460 ft

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORDED BY Spencer

REMIX: 5-inch drag

LITHOLOGY:
sand, gravel, unconsol.
sand, unconsol
silt, olive-gy, unconsol
silt, sand, yel-brn, unconsol
till:
silt, olive-gy, sandy; gravel, unconsol
silt, olive-gy, unconsol
sand, silty, olive-gy, unconsol
silt, clay, olive-gy, unconsol
siltst, gy, coarse; sandst
sandst, gy, clayey
sandst, gy; lignite, 196-203
siltst, clayst, gy
siltst, gn; lignite, 252-254
siltst, gy, cbncs
siltst, gn, brn-gy, clayey
siltst, gy, coarse; lignite, 290-291.5
siltst, lt-gy, clayey
siltst, brn-gy
siltst, lt-gy, clayey
siltst, dk-gy, cbncs

REMIX: 5-inch drag

LITHOLOGY:
sand, gravel, unconsol.
sand, unconsol
silt, olive-gy, unconsol
silt, sand, yel-brn, unconsol
till:
silt, olive-gy, sandy; gravel, unconsol
silt, olive-gy, unconsol
silt, olive-gy, unconsol
sand, silty, olive-gy, unconsol
silt, clay, olive-gy, unconsol
siltst, gy, coarse; sandst
sandst, gy, clayey
sandst, gy; lignite, 196-203
siltst, clayst, gy
siltst, gn; lignite, 252-254
siltst, gy, cbncs
siltst, gn, brn-gy, clayey
siltst, gy, coarse; lignite, 290-291.5
siltst, lt-gy, clayey
siltst, brn-gy
siltst, lt-gy, clayey
siltst, dk-gy, cbncs

REMIX: 5-inch drag

LITHOLOGY:
sand, gravel, unconsol.
sand, unconsol
silt, olive-gy, unconsol
silt, sand, yel-brn, unconsol
till:
silt, olive-gy, sandy; gravel, unconsol
silt, olive-gy, unconsol
silt, olive-gy, unconsol
sand, silty, olive-gy, unconsol
silt, clay, olive-gy, unconsol
siltst, gy, coarse; sandst
sandst, gy, clayey
sandst, gy; lignite, 196-203
siltst, clayst, gy
siltst, gn; lignite, 252-254
siltst, gy, cbncs
siltst, gn, brn-gy, clayey
siltst, gy, coarse; lignite, 290-291.5
siltst, lt-gy, clayey
siltst, brn-gy
siltst, lt-gy, clayey
siltst, dk-gy, cbncs
**REMARKS:**

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<th>Lithology</th>
<th>Strip Log</th>
<th>Depth</th>
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<tbody>
<tr>
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<td>siltst, gn</td>
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<tr>
<td>siltst, clayst, dk-gy</td>
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<td>clayst, gn</td>
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<tr>
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<tr>
<td>sandst, gy, calcareous; lignite, 459-460</td>
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Logging speed: 20 ft/min  
Logged depth: 460  
Density range: 200 cps  
Density TC: 2 sec  
Gamma range: 50 cps  
Gamma TC: 2 sec  
SP sensitivity: 20 mv  
Resistance sensitivity: 20 ohms
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO. W 55**
**SHEET 1 OF 2**

**AREA:** Williams County  
**QUAD NAME:** Bonetraill

**DATE STARTED:** 7/7/79  
**DATE COMP.:** 7/7/79  
**COUNTY:** Williams  
**STATE:** North Dakota

**LOCATION:** SEC. 22 T.158 N., R. 102 W., FOOTAGE LOC.  
**FOOTAGE:** 105  
**FWL:** 35  
**GROUND ELEV.:** 2402 ft

**SIZE AND BIT TYPE:** 5-inch drag  
**FOOTAGE LOG:** ROTARY 600  
**CORING:** ---  
**TOTAL DEPTH:** 600 ft

**DRILLING AGENCY:** Crandall Drilling  
**DRILL TYPE:** ---  
**DEPTH TO WATER:** 9 ft

**LITHOLOGY RECORDED BY:** Spencer  
**GEOPHYSICAL LOGS RECORDED BY:** Nelson

**REMARKS:**

**LOGGING SPEED:** 20 ft/min  
**LOGGED DEPTH:** 600  
**GAMMA RANGE:** 50 cps  
**GAMMA TC.:** 2 sec  
**DENSITY RANGE:** 200 cps  
**DENSITY TC.:** 2 sec  
**SP SENSITIVITY:** 20 mv  
**RESISTANCE SENSITIVITY:** 20 ohms

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<th>FEET</th>
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<td>105.73</td>
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</table>

**LITHOLOGY**

- sand, silt, yel-brn, unconsol
- sand, silt, clay, yel, unconsol
- till: sand, silt, yel-brn; gravel, unconsol
- sand, silt, gy-brn, unconsol
- siltst, clayst, dk-gy
- siltst, dk-gy, cbncs; lignite,107-111, 113-114.5
- siltst, gy, clayey
- siltst, clayst, gy
- siltst, cbncs; lignite,161.5-163
- siltst, dk-gy, cbncs
- siltst, clayst, gy
- siltst, dk-gu
- siltst, clayst, dk-gy
- siltst, gy
- sandst, gy, fine
- siltst, dk-gy, cbncs; lignite,238.5-242.5
- sandst, gy, clayst
- sandst, gy, very fine
- siltst, clayst, dk-gy
- siltst, olive-gy, gn, cbncs; lignite,313.5-315, 318-326.5
- sandst, gy, fine
- sandst, medium
### Remarks:

**Lithology**

<table>
<thead>
<tr>
<th>Logging speed</th>
<th>20 ft/min</th>
<th>Density range</th>
<th>200 cps</th>
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<tr>
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<td>600</td>
<td>Density T.C.</td>
<td>2 sec</td>
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<tr>
<td>Gamma range</td>
<td>50 cps</td>
<td>SP sensitivity</td>
<td>20 mv</td>
</tr>
<tr>
<td>Gamma TC</td>
<td>2 sec</td>
<td>Resistance sensitivity</td>
<td>20 ohms</td>
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</table>

**Log:**

- **350-1**

**Lithology:**

- siltst, dk gy; lignite, 368-376.5
- siltst, lt-gy; white clayst
- siltst, dk-gy, clayey
- siltst, lt-gy, cbncs
- siltst, lt-gn, clayey
- siltst, gy, brn-gy; lt-gn clayst
- siltst, dk-gy; lignite, 453.5-455
- siltst, lt-gy, clayey
- sandst, gy, medium; lignite, 480.5-482
- clayst, gy, white; limestone
- sandst, brn, fine

- siltst, lt-gy; lignite, 597-600

**Depth:**

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<th>Feet</th>
<th>Meters</th>
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<td>700</td>
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<tr>
<td>300</td>
<td>120</td>
</tr>
<tr>
<td>250</td>
<td>110</td>
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</table>
**LITHOLOGY**

- till: sand, silt, gravel, unconsolidated
- siltst, dk-gy; sandst
- siltst, dk-gy; clayst
- siltst, gy; very fine sandst
- siltst, gy, cbncs
- siltst, dk-gy, cbncs; lignite, 81.5-92.5
- siltst, dk-gy, clayey
- sandst, gy, clayey
- siltst, cbncs; lignite, 122.5-130.5
- siltst, lt-gy, clayey
- siltst, dk-gy; limest
- siltst, gy, clayey
- clayst, gy; lignite, 204.5-208
- sandst, gy, fine
- sandst, gy, medium
- siltst, dk-gy; lignite, 233-234, 237-238.5
- siltst, lt-gy, clayey
- siltst, gy
- clayst, lt-gy, silty
- clayst, lt-gy; lignite, 290.5-291.5
- siltst, sandst, dk-gy
- sandst, dk-gy, very fine
**REMARKS:**

**LITHOLOGY**

<table>
<thead>
<tr>
<th>Depth</th>
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<td>350-110</td>
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<td>400-120</td>
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<td>450-130</td>
<td>silt st, dk-gy, cbncs</td>
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<td>500-140</td>
<td>silt st, lt-gy</td>
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<tr>
<td>550-150</td>
<td>silt st, lt-gy, clayey</td>
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<td>600-160</td>
<td>silt st, lt-gy, cbncs</td>
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<tr>
<td>650-170</td>
<td>silt st, dk-gy</td>
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<td>700-180</td>
<td>silt st, lt-gy, clayey</td>
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<tr>
<td>750-190</td>
<td>silt st, dk-gy; lignite, 453-460</td>
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</table>
**UNITED STATES GEOLOGICAL SURVEY**

**AREA**
Williams County

**QUAD NAME**
Brush Mountain

**DATE STARTED**
7/8/79

**DATE COMP.**
7/8/79

**COUNTY**
Williams

**STATE**
North Dakota

**LOCATION: SEC.**
32 T. 158 N., R. 103 W., FOOTAGE LOC.: 100

**COUNT**
3

**GROUND ELEV.**
2278 ft

**SIZE AND BIT TYPE:**
5-inch drag

**FOOTAGE**
ROTARY 500

**CORING**
---

**TOTAL DEPTH**
500 ft

**DRILLING AGENCY:**
Crandall Drilling

**DRILL TYPE:**
---

**DEPTH TO WATER**
13 ft

**LITHOLOGY RECORDED BY**
Spencer

**GEOPHYSICAL LOGS RECORDED BY**
Nelson

**REMARKS:**

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Depth</th>
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<tbody>
<tr>
<td>silt, sand, gravel, yel-brn, unconsol</td>
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<tr>
<td>till: silt, gravel, dk-gy, unconsol</td>
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<tr>
<td>silt, sand, gravel, yel-brn, unconsol</td>
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<tr>
<td>siltst, dk-gy, clayey</td>
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<td>siltst, dk-gy, coarse</td>
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<td>lignite, 90.5-101</td>
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<td>sandst, gy, fine</td>
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<td>sandst, gy, clayey</td>
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<td>sandst, gy, medium; lignite, 145-152</td>
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<td>siltst, lt-gy; lignite, 201.5-202.5</td>
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<td>siltst, clayst, gy; lignite, 230.5-233</td>
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**Logging speed:** 20 ft/min

**Logged depth:** 500

**Gamma range:** 50 cps

**Gamma TC:** 2 sec

**Density range:** 200 cps

**Density T.C.:** 2 sec

**SP sensitivity:** 20 mv

**Resistance sensitivity:** 20 ohms
REMARKS:

Logging speed: 20 ft/min
Logged depth: 500
Gamma range: 50 cps
Gamma TC.: 2 sec
SP sensitivity: 20 mv
Resistivity sensitivity: 20 ohms

LITHOLOGY

siltst., lt-gy
siltst., lt gr-gy
siltst., clayst., gy; lignite, 406-410

siltst., gy, clayey
LOCATION: SEC. 7 T.159 N., R. 96 W., FOOTAGE LOC.

DATE STARTED 6/14/79
DATE COMP. 6/14/79
COUNTY Williams
STATE North Dakota

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling
DRILL TYPE: ---

LITHOLOGY RECORDED BY Spencer
GEOPHYSICAL LOGS RECORDED BY Nelson

REMARKS:

Logging speed: 20 ft/min
Logged depth: 438 ft
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

LITHOLOGY:
- sand, silt, clay, gravel, oxidized, unconsol
- till
- siltst, gy
- sandst, gy
- siltst, gy, sandy
- clayst, dk brn-gy
- siltst, dk-gy
- clayst, brn; gy siltst
- siltst, gy; sandst
- clayst, lt-brn, cbncs; lignite, 150-153
- siltst, brn; gy sandst
- siltst, gy, sandy
- siltst, gy; limest
- siltst, sy, sandy; clayst; cbncs
  siltst; lignite, 198-200, 203.5-205, 217.5-218.5
- siltst, clayst, gy
- siltst, lt-gy
- siltst, gy; limest
- siltst, gy; lignite, 273-278
- siltst, cbncs
- sandst, gy
- siltst, gy
- siltst, cbncs, lt-brn; gn silty clayst
- sandst, gy
### Remarks:

**Lithology**

- Lignite, 390-399
- Sandstone, gy

**Strip Log**

- Logging speed: 20 ft/min
- Logged depth: 438
- Gamma range: 50 cps
- Gamma TC: 2 sec

**Depth**

- Log density range: 200 cps
- Density TC: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms

**Diagram**

- Graph of density, SP, and resistance curves over depth.
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<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
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<tbody>
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<td>Resistance sensitivity: 20 ohms</td>
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</table>
## Lithology

- **Till:** silt, gravel, oxidized, unconsolidated
- **Siltstone:**
  - clay, gy
  - dk olive-gy
  - gy, white clay
  - gy, sandy; limestone
  - dk-gy
  - lt gy-brn
  - gy, cbncs
  - gy, silty
  - gy, sandy; lime
  - gy, clayey
  - gy, sandy; sand
  - silt, brn; lignite, 214-218
  - sand, gy
  - silt, cbncs, gy; lignite, 246-247.5, 266-268
  - silt, clayey
  - silt, dk-gy, cbncs
  - gy; fine sand
  - gy, fine
  - silt, gy, sandy
  - silt, cbncs; gy-brn clay
**REMARKS:**

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<td>siltst, dk-gy, clayey</td>
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Logging speed: 20 ft/min
Logged depth: 520
Density range: 200 cps
Density TC: 2 sec
Gamma range: 50 cps
Gamma TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO. W 65**

**SHEET 1 OF 2**

**AREA** Williams County

**QUAD NAME** Bright Water Lake

**DATE STARTED** 6/20/79

**DATE COMP.** 6/20/79

**COUNTY** Williams

**STATE** North Dakota

**LOCATION:** Sec. 6, T. 159 N., R. 98 W., FOOTAGE LOC.

**SIZE AND BIT TYPE:** 5-inch drag

**FOOTAGE:**
- Rotary: 400 ft
- Coring: ---
- Total: 400 ft

**DEPTH TO WATER:** 30 ft

**DRILLING AGENCY:** Crandall Drilling

**DRILL TYPE:** ---

**LITHOLOGY RECORDED BY:** Spencer

**GEOPHYSICAL LOGS RECORDED BY:** Nelson

**REMARKS:**

<table>
<thead>
<tr>
<th>DEPTH (FEET)</th>
<th>Lithology Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 ft/min</td>
<td>Sand, silt, gravel, oxidized, unconsol</td>
</tr>
<tr>
<td>20-200 ft/min</td>
<td>Silt, olive-gy; gy clay, unconsol</td>
</tr>
<tr>
<td>200-400 ft/min</td>
<td>Till: silt, dk-gy, unconsol</td>
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<tr>
<td>400-600 ft/min</td>
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<tr>
<td>600-800 ft/min</td>
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<tr>
<td>800-1000 ft/min</td>
<td>Sand, coarse; fine gravel, unconsol</td>
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<tr>
<td>1000-1200 ft/min</td>
<td>Siltst, dk-gy</td>
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<tr>
<td>1200-1400 ft/min</td>
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<td>1400-1600 ft/min</td>
<td>Clayst, gy, silty; lignite, 234.5-248</td>
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<td>1600-1800 ft/min</td>
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<td>2400-2600 ft/min</td>
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<tr>
<td>2600-2800 ft/min</td>
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<tr>
<td>2800-3000 ft/min</td>
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**Logging speed:** 20 ft/min

**Density range:** 200 cps

**Density TC:** 2 sec

**Gamma range:** 50 cps

**Gamma TC:** 2 sec

**SP sensitivity:** 20 mv

**Resistance sensitivity:** 20 ohms
REMARKS:

LITHOLOGY

Log logging speed: 20 ft/min
Logged depth: 400
Density range: 200 cps
Density TC: 2 sec
Gamma range: 50 cps
Gamma TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

sandst, gy
clayst, gy; lignite, 381.5-387
sandst, fine; gy siltst
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO W 66**

**SHEET 1 OF 2**

<table>
<thead>
<tr>
<th>AREA</th>
<th>Williams County</th>
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<tbody>
<tr>
<td>QUAD NAME</td>
<td>Corinth</td>
</tr>
<tr>
<td>DATE STARTED</td>
<td>6/20/79</td>
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<tr>
<td>DATE COMP.</td>
<td>6/20/79</td>
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<td>COUNTY</td>
<td>Williams</td>
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<td>STATE</td>
<td>North Dakota</td>
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<tr>
<td>LOCATION: SEC.</td>
<td>T. 159 N, R. 98 W, FOOTAGE LOC.</td>
</tr>
<tr>
<td>SIZE AND BIT TYPE:</td>
<td>5-inch drag</td>
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<tr>
<td>DRILLING AGENCY:</td>
<td>Crandall Drilling</td>
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<tr>
<td>DRILL TYPE:</td>
<td>-----</td>
</tr>
<tr>
<td>LITHOLOGY RECORDED BY</td>
<td>Spencer</td>
</tr>
<tr>
<td>GEOPHYSICAL LOGS RECORDED BY</td>
<td>Nelson</td>
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</tbody>
</table>

**REMARKS:**

| Logging speed | 20 ft/min |
| Density range | 200 cps |
| Gamma range  | 50 cps |
| Gamma TC     | 2 sec |
| SP sensitivity | 20 mv |
| Resistance sensitivity | 20 ohms |

**LITHOLOGY**

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<tr>
<th>Depth</th>
<th>Lithology</th>
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<tbody>
<tr>
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<tr>
<td></td>
<td>till: silt, gy-brn, sandy, unconsol</td>
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<tr>
<td></td>
<td>sand, gravel, brn clay, unconsol</td>
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<td>5</td>
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<td>15</td>
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REMARKS:

LITHOLOGY

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<tr>
<th>STRIP LOC</th>
<th>DEPTH</th>
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<td>650</td>
<td>170</td>
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<tr>
<td>700</td>
<td>180</td>
</tr>
<tr>
<td>750</td>
<td>190</td>
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</tbody>
</table>

- siltst, gy
- sandst, gy, very fine
- siltst, gy; gn clayst
- siltst, gy; lignite, 392.5-406
- siltst, yel-gy; gy clayst
- siltst, gy

Logging speed: 20 ft/min
Logged depth: 440
Density range: 200 cps
Density T.C.: 2 sec
Gamma range: 50 cps
Gamma TC.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms
**UNITED STATES GEOLOGICAL SURVEY**

**AREA** Williams County  
**QUAD NAME** Bright Water Lake

**DATE STARTED** 6/21/79  
**DATE COMP.** 6/21/79  
**COUNTY** Williams  
**STATE** North Dakota

**LOCATION:** SEC. 3  
**T. 159 N, R. 99 W., FOOTAGE LOC.** 70 ft  
**ELEV.** 25 ft  
**GROUND ELEV.** 2177 ft

**SIZE AND BIT TYPE:** 5-inch drag  
**ROTARY** 380 ft  
**TOTAL FOOTAGE** 380 ft  
**DEPTH TO WATER** 16 ft

**DRILLING AGENCY:** Crandall Drilling  
**DRILL TYPE:** ---

**LITHOLOGY**

- silt, yel-brn, sandy, unconsol
- silt, coarse sand, yel-brn, unconsol
- silt, gravel, yel-brn, unconsol
- silt, olive-gy, sandy, unconsol
- silt, clay, brn, unconsol
- silt, clay, gy, unconsol
- silt, dk-gy, sandy, unconsol
- clay, sandy silt, gy, unconsol
- sand, very coarse, unconsol

**Till:**
- sand, silt, dk-gy, unconsol
- sand, very coarse; fine gravel
- sand, very coarse, unconsol
- silt, gy, coarse; sand, unconsol
- gravel, fine, unconsol
- silt, sand, clay, gravel, unconsol
- sand, coarse; gravel, unconsol
- siltst, clayst, brn
- sandst, clayey
- siltst, sandy

**Logging speed:** 20 ft/min  
**Logged depth:** 380 ft  
**Density range:** 200 cps  
**Density, T.C.:** 2 sec  
**Gamma range:** 50 cps  
**Gamma T.C.:** 2 sec  
**SP sensitivity:** 20 mv  
**Resistance sensitivity:** 20 ohms
### Remarks:

No sample

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<th>Lithology</th>
<th>Strip Log</th>
<th>Depth</th>
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<td></td>
<td>Logged depth: 380</td>
<td>Density TC: 2 sec</td>
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<tr>
<td></td>
<td>Gamma range: 50 cps</td>
<td>SP sensitivity: 20 mv</td>
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<tr>
<td></td>
<td>Gamma TC: 2 sec</td>
<td>Resistance sensitivity: 20 ohms</td>
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</tbody>
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### Diagram Details:

- **Density:**
  - Density values are indicated for various depths.
- **Gamma:**
  - Gamma values are also indicated for different depths.
- **SP Sensitivity:**
  - Sensitivity values are marked for specific depths.
- **Resistance Sensitivity:**
  - Resistance sensitivity values are noted for certain depths.

### Depth Measurements:

- **FEET**:
  - Depth measurements are marked in feet from 350 to 750.
- **METERS**:
  - Corresponding depth measurements are noted in meters simultaneously.
**Lithology**

- Sand, silt, gravel, brown, unconsol
- Sand, very coarse; gravel, unconsol
- Gravel, coarse
- Sand, coarse, unconsol
- Clayey silt, gy
- Silt, dk-gy, sandy
- Silt, gy
- Silt, dk-gy, cbncs; lt-gy clayey
- Silt, lt-gy, clayey
- Silt, clayey, gy; limestone
- Sand, gy, fine
- Silt, clayey, gy, cbncs
- Silt, clayey, gy
- Silt, clayey, lt-gy
- Silt, dk-gy, cbncs; lignite, 258-262.5
- Clayey silt, lt-gy, silty
- Silt, cbncs; lignite, 286-288.5
- Silt, dk-gy
- Silt, clayey, gy
- Silt, gy, gn
- Sand, gy, very fine
- Silt, gy; clayey
- Lignite, 342.5-355; gy silt
REMARKS:

<table>
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<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
<th>FEET</th>
<th>METERS</th>
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</thead>
<tbody>
<tr>
<td>lignite, 342.5-355; gy siltst</td>
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<td>350-</td>
<td>-110</td>
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</table>

Logging speed: 20 ft/min
Logged depth: 360
Density range: 200 cps
Density T.C.: 2 sec
Gamma range: 50 cps
Gamma T.C.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms
UNITED STATES GEOLOGICAL SURVEY

AREA Williams County
QUAD NAME Appam

DATE STARTED 6/21/79
COUNTY Williams
DATE COMP. 6/21/79
STATE North Dakota

LOCATION: SEC. 12 T.159 N., R.100 W., FOOTAGE LOC.

COUNTY Williams
STATE North Dakota

FOOTAGE 500 ft
ELEV 2195 ft
TOTAL DEPTH 500 ft

DRILLING AGENCY: Crandall Drilling

SIZE AND BIT TYPE: 5-inch drag

DRILL TYPE: ------

LITHOLOGY RECORDED BY Spencer

REMARKS:
Logging speed 20 ft/min
Density range 200 cps
Density T.C. 2 sec
Gamma range 50 cps
Gamma T.C. 2 sec
SP sensitivity 20 mw
Resistance sensitivity 20 ohms

LITHOLOGY

sand, gravel, yel-brn, unconsol
sand, yel-brn, unconsol
silt, dk-gy, unconsol
till:
sand, coarse; gravel, unconsol
sand, unconsol
clayst, silty
siltst, dk-gy
siltst, olive-gy, clayey
clayst, siltst, yel-gy
clayst, siltst, olive-gy
clayst, brn-gy
siltst, clayst, dk-gy
sandst, very fine; clayst
siltst, clayst
sandst, very fine
clayst, gy, silty
sandst

DEPTH

0-0
0-10
0-20
0-30
0-40
0-50
0-60
0-70
0-80
0-90
0-100
0-110
0-120
0-130
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0-280
0-290
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0-310
0-320
0-330
0-340
0-350

FEET

METERS
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<tbody>
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<td>siltst, gy, clayey</td>
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<tr>
<td>sandst, siltst, gy; cbnsc siltst</td>
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<td>Gamma range: 50 cps</td>
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<tr>
<td>Gamma TC: 2 sec</td>
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<table>
<thead>
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<tbody>
<tr>
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Density range: 200 cps
Density TC: 2 sec
Gamma range: 50 cps
Gamma TC: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

Logging speed: 20 ft/min
Logged depth: 496
Gamma range: 50 cps
Gamma TC: 2 sec
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REMKS:

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<table>
<thead>
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<tbody>
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<td>METERS</td>
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<th>Logging speed: 20 ft/min</th>
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<tr>
<td>Logged depth: 440</td>
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<td>Gamma T.C.: 2 sec</td>
<td>Resistance sensitivity 20 ohms</td>
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**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO W 72**

**SHEET 1 OF 2**

**AREA**
Williams County

**QUAD NAME**
Zahl

**DATE STARTED**
7/5/79

**DATE COMP.**
7/5/79

**COUNTY**
Williams

**STATE**
North Dakota

**LOCATION**:
SEC. 9 T159 N., R. 101 W., FOOTAGE LOC.

**FOOTAGE**

**ELEV.**
42

**DEPT.**
43

**GROUND**
2161 ft

**TOTAL DEPT.**
400 ft

**DEPTH TO WATER**
25 ft

**SIZE AND BIT TYPE**
5-inch drag

**DRILLING AGENCY**
Crandall Drilling

**DRILL TYPE**

**LITHOLOGY RECORDED BY**
Spencer

**GEOPHYSICAL LOGS RECORDED BY**
Nelson

**REMARKS**

**LITHOLOGY**

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<th>Depth</th>
<th>Description</th>
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**Logging speed**: 20 ft/min

**Density range**: 200 cps

**Gamma range**: 50 cps

**Gamma T.C.**: 2 sec

**Density T.C.**: 2 sec

**SP sensitivity**: 20 mv

**Resistance sensitivity**: 20 ohms
REMARKS:

LITHOLOGY

siltstone, gy, sandy, cbnscs
siltstone, dk-gy, gn, clayey
siltstone, white clayst
siltstone, lt-gy, sandy
siltstone, gy, clayey

Logging speed: 20 ft/min
Logged depth: 400
Gamma range: 50 cps
Gamma T.C.: 2 sec
Density range: 200 cps
Density T.C.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

DEPTH

FEET  METERS

350  110
400  120
450  130
500  140
550  150
600  160
650  170
700  180
750  190
800  200
850  210
900  220
950  230
1000  240
1050  250
1100  260
1150  270
1200  280
1250  290
1300  300
1350  310
1400  320
1450  330
1500  340
1550  350
1600  360
1650  370
1700  380
1750  390
1800  400
1850  410
1900  420
1950  430
2000  440
2050  450
2100  460
2150  470
2200  480
2250  490
2300  500
2350  510
2400  520
2450  530
2500  540
2550  550
2600  560
2650  570
2700  580
2750  590
2800  600
2850  610
2900  620
2950  630
3000  640
3050  650
3100  660
3150  670
3200  680
3250  690
3300  700
3350  710
3400  720
3450  730
3500  740
3550  750
3600  760
3650  770
3700  780
3750  790
3800  800
3850  810
3900  820
3950  830
4000  840
4050  850
4100  860
4150  870
4200  880
4250  890
4300  900
4350  910
4400  920
4450  930
4500  940
4550  950
4600  960
4650  970
4700  980
4750  990
4800  1000
**LITHOLOGY**

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Logging speed: 20 ft/min  
Logged depth: 400  
Density range: 200 cps  
Density TC: 2 sec  
Gamma range: 50 cps  
Gamma TC: 2 sec  
SP sensitivity: 20 mv  
Resistance sensitivity: 2 ohms  

**LITHOLOGY:**

- silt, sand, yel-brn, gravel, unconsol
- till:
  - silt, sand, clay, yel-brn, unconsol
  - siltst, yel-brn, gy, sandy
  - siltst, yel-gy; lt-brn clayst
  - siltst, gy; cbncs clayst
  - siltst, gy, lt-yel
  - siltst, gy, clayey
  - siltst, cbncs; lignite, 133-133.5, 143-144
  - sandst, very fine
  - siltst, gy; cbncs
  - siltst, fine sandst, gy
  - siltst, clayst, gy
  - siltst, clayst, lt-gy
  - siltst, lt-gy; brn clayst-
  - siltst, dk-gy, clayst
  - sandst, gy, fine

**Remarks:**

Logging speed: 20 ft/min  
Logged depth: 400  
Density range: 200 cps  
Density TC: 2 sec  
Gamma range: 50 cps  
Gamma TC: 2 sec  
SP sensitivity: 20 mv  
Resistance sensitivity: 2 ohms
REMARKS:

LITHOLOGY

sandst, gy, fine

Logging speed: 20 ft/min
Logged depth: 400
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density T.C.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms
LOCATION: SEC. 21  T. 159 N.  R.  102 W.  FOOTAGE LOC.  2610  FNL  41  FEL  GROUND ELEV  2300 ft

SIZE AND BIT TYPE:  5-inch drag  ROTARY  500  CORING  ----  TOTAL DEPTH  500 ft

DRILLING AGENCY:  Crandall Drilling  DRILL TYPE:  ----  DEPTH TO WATER  20 ft

LITHOLOGY RECORDED BY:  Spencer  GEOPHYSICAL LOGS RECORDED BY:  Nelson

REMARKS:

Logging speed: 20 ft/min
Logged depth: 500
Gamma range: 50 cps
Gamma TC: 2 sec
Density range: 200 cps
Density T.C.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

LITHOLOGY

silt, sand, fine gravel, yel-brn, unconsol
siltst, clayst, yel-brn
siltst, sandst, brn-gy
clayst, brn; lignite, 110-112
siltst, dk-gy; clayst
clayst, dk-gy; cbncs siltst
siltst, clayst, lt-gy
lignite, 149.5-157
siltst, clayst, gy
siltst, dk-gy; limest; white clayst
siltst, clayst, lt-gy
siltst, lt-gy-gn; clayst
siltst, dk-gy
siltst, gy, sandy
sandst, gy, fine
siltst, clayst, lt-gy; limest
siltst, gy, sandy
clayst, siltst, lt-gy
siltst, brn
sandst, gy, fine
LITHOLOGY

REMARKS:

Logging speed: 20 ft/min
Logged depth: 500 ft
Density range: 200 cps
Density T.C.: 2 sec
Gamma range: 50 cps
Gamma T.C.: 2 sec
SP sensitivity: 20 mv
Resistance sensitivity: 20 ohms

DEPTH

siltst, gy; brn clayst
siltst, clayst, lt-gy
clayst, siltst, dk-gy
sandst, gy, fine
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO W 75**

**SHEET 1 OF 2**

**AREA** Williams County  
**QUAD NAME** Grenora

**DATE STARTED** 7/6/79  
**DATE COMP.** 7/6/79  
**COUNTY** Williams  
**STATE** North Dakota

**LOCATION:** SEC. 10  
T. 159 N, R. 103 W., FOOTAGE LOC.

**FOOTAGE:** 255 FNL  
**XRF:** 3 FWL  
**GROUND ELLEV:** 2057 ft

**SIZE AND BIT TYPE:** 5-inch drag  
**FOOTAGE:** 400 ft

**DRILL TYPE:** ---  
**DEPTH TO WATER** 5 ft

**DRILLING AGENCY:** Crandall Drilling

**LIHOTOLOGY:**

- sand, very coarse; gravel, unconsol
- silt, yel, brn, unconsol
- silt, clay, brn, unconsol
- silt, dk olive-gy, sandy, unconsol
- silt, clay, dk-gy, unconsol
- silt, sand, dk-gy, unconsol
- gravel, medium
till:
- silt, dk-gy, sandy, unconsol
- clay, dk-gy, silty, unconsol
- gravel, fine
- silt, gy, cbncs, unconsol
- silt, gy; fine gravel, unconsol
- silt, dk-gy, sandy, unconsol
- silt, dk-gy, unconsol
- sand, dk-gy, coarse, unconsol
- gravel, medium to coarse
- siltst, clayst, gy; lignite, 271.5–289
- sandst, coarse
- clayst, lt-gy
- siltst, dk-gy; lignite, 314–317.5
- siltst, clayst, gy; lignite, 327.5–329
- siltst, clayst, yel-gy, brn; lignite, 336–337

**REMARKS:**

- Logging speed: 20 ft/min
- Logged depth: 398 ft
- Gamma range: 50 cps
- Gamma TC: 2 sec
- Density range: 200 cps
- Density T.C.: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms

**DEPTH TO:** 0 ft

**FOOTAGE:** 400 ft

**GROUND ELLEV:** 2057 ft
**LITHOLOGY**

- siltst, clayst, lt-gy
- clayst, dk-gy; cbncs siltst
- no sample
- siltst, clayst, gy; limest

**LOGGING**

- Logging speed: 20 ft/min
- Logged depth: 398 ft
- Gamma range: 50 cps
- Gamma T.C.: 2 sec
- Density range: 200 cps
- Density T.C.: 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms

**DEEP**

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<td>180</td>
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<tr>
<td>750</td>
<td>200</td>
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**REMARKS:**

- siltst, clayst, lt-gy
- clayst, dk-gy; cbncs siltst
- no sample
- siltst, clayst, gy; limest
### Lithology

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<td>siltst, dk-gy; lignite, 347.5-350.5</td>
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Logging speed: 20 ft/min  
Density range: 200 cps  
Gamma range: 50 cps  
Gamma TC: 2 sec  
SP sensitivity: 20 mv  
Resistance sensitivity: 20 ohms
**REMARKS:**

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<td>Gamma T.C.: 2 sec</td>
<td>Resistance sensitivity: 20 ohms</td>
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**Diagram:**

[Diagram showing GR, Density, and TSP data at various depths.]
UNITED STATES GEOLOGICAL SURVEY

AREA: Williams County
QUAD NAME: Brush Lake

DATE STARTED: 7/8/79
DATE COMP.: 7/8/79
COUNTY: Williams
STATE: North Dakota

LOCATION: SEC. 33 T.159 N., R. 103 W., FOOTAGE LOC.

SIZE AND BIT TYPE: 5-inch drag

DRILLING AGENCY: Crandall Drilling

LITHOLOGY RECORD: Spencer
GEOPHYSICAL LOGS RECORD: Nelson

REMARKS:
Logging speed: 20 ft/min
Density range: 200 cps
Logged depth: 400 ft
Density T.C.: 2 sec
Gamma range: 50 cps
SP sensitivity: 20 mv
Gamma T.C.: 2 sec
Resistance sensitivity: 20 ohms

LITHOLOGY:
silt, yel, unconsol
silt, sand, brn, unconsol
silt, sand, gy, unconsol
silt, very coarse sand, unconsol
silt, sand, gravel, unconsol
till:
silt, dk-gy, clayey, unconsol

gravel, fine
sandst, dk-gy, silty; coarse sandst
sandst, dk-gy, silty; clayst
siltst, dk-gy, sandy; clayst
sandst, brn, calcareous
no sample
sandst, brn, medium

clayst, brn; lignite, 241.5-247
siltst, lt-gy
siltst, yel-gy, lt-gy
siltst, dk-gy
siltst, yel-gy
clayst, gy; cbncs siltst
clayst, siltst, gy
siltst, gy; brn clayst
siltst, gy

DRILL TYPE:
DEPTH TO WATER: .19 ft
TOTAL DEPTH: 400 ft
GROUND ELEV: 2122 ft
FOOTAGE: 155 ft
FOOTAGE LOG:
FRWL
115

LITHOLOGY

Logging speed: 20 ft/min
Density range: 200 cps
Logged depth: 400 ft
Density T.C.: 2 sec
Gamma range: 50 cps
SP sensitivity: 20 mv
Gamma T.C.: 2 sec
Resistance sensitivity: 20 ohms
**LITHOLOGY**

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**STRIP LOG**

- Logging speed: 20 ft/min
- Logged depth: 400
- Gamma range: 50 cps
- Gamma T.C. 2 sec
- Density range: 200 cps
- Density T.C. 2 sec
- SP sensitivity: 20 mv
- Resistance sensitivity: 20 ohms

**DEPTH**

- FEET
- METERS

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**DIAGRAM**

- G.P.
- Density
- S.P.