GEOPHYSICAL AND LITHOLOGIC LOGS FOR 1979 COAL DRILLING,
THREE RIVER AREA, STARK, BILLINGS, AND DUNN COUNTIES, NORTH DAKOTA

By
Michael L. Menge

Open-File Report 80-860

This report has not been edited for conformity with Geological Survey editorial standards or stratigraphic nomenclature.
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<td>3</td>
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</table>

## ILLUSTRATION

<table>
<thead>
<tr>
<th>Illustration</th>
<th>Page</th>
</tr>
</thead>
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<td>Figure 1. Drill-hole location map</td>
<td>2</td>
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</tbody>
</table>

## Abbreviations

- blk - black
- brn - brown
- calc - calcareous
- cbncs - carbonaceous
- clayst - claystone
- consol - consolidated
- cps - counts per second
- dk - dark
- grn - green
- gy - gray
- lt - light
- med - medium
- mod - moderate, moderately
- MV - millivolts
- sandst - sandstone
- sec - second
- siltst - siltstone
- sli - slightly
- TD - total depth
- T.C. - time constant
- unconsol - unconsolidated
GEOPHYSICAL AND LITHOLOGIC LOGS FOR 1979 COAL DRILLING,
THREE RIVER AREA, STARK, BILLINGS, AND DUNN COUNTIES, NORTH DAKOTA

By Michael L. Menge

INTRODUCTION AND ACKNOWLEDGMENTS

During July and August 1979 the U.S. Geological Survey personnel supervised the drilling of 151 test holes, for a total of 68,236 ft (including three reruns), in Stark, Billings, and Dunn Counties, N. Dak. The hole locations are shown on figure 1. Drilling and geophysical logging for each of these holes was completed by Gregory Drilling Company under contract 14-08-0001-17881.

The purpose of the drilling was to determine the extent and quality of the coal contained within several Known Recoverable Coal Resource Areas (KRCRA) and to provide data for classifying additional lands in the public domain.

U.S. Geological Survey personnel collected and described the drill cuttings that were used for lithologic control on this project. These cuttings were used in conjunction with the geophysical logs to plot the lithologic logs in this report. The lithologic logs do not (except for coal beds) show each separate stratigraphic unit in each test hole; they show only the major rock type that occurs in a given interval. All measurements are in feet; to convert to meters, multiply by 0.3048.

Fieldwork for this project was done by Michael Menge, assisted by Arthur Banet, Jr., Susan Cook, John Spencer, Mark Hudson, Scott Christensen, and Leslie Tomac.
Figure I.—Drill-hole location map, Three River area, Stark, Billings, and Dunn Counties, N. Dak.
### Lithology

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Lithology Description</th>
</tr>
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<tbody>
<tr>
<td>0-165</td>
<td>Soil, sand, silt, clay, unconsol</td>
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<tr>
<td>165-180</td>
<td>Clayst, dk-gy, silty</td>
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<tr>
<td>180-190</td>
<td>Siltst, lt-gy</td>
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<tr>
<td>190-200</td>
<td>Lignite (70.5-74)</td>
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<tr>
<td>200-215</td>
<td>Clayst, med-gy, silty</td>
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<tr>
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<tr>
<td>250-260</td>
<td>Sandst, med-brn, calc, well-consol, med-grained</td>
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<td>260-270</td>
<td>Clayst, med-gy, mod silty</td>
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<td>270-280</td>
<td>Lignite (123-124)</td>
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<td>300-310</td>
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<td>310-320</td>
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<tr>
<td>320-330</td>
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<tr>
<td>330-340</td>
<td>Clayst, dk-gy to blk, very chnca</td>
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<tr>
<td>340-350</td>
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<td>370-380</td>
<td>Lignite (319-327.5)</td>
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<tr>
<td>380-390</td>
<td>Clayst, med-gy, mod silty</td>
</tr>
</tbody>
</table>

### Geophysical Logs

- **Logging speed**: 20 ft/min
- **Density range**: 3 cps
- **Logged depth**: 340 ft
- **Density TC**: 1 sec
- **Gamma range**: 15 cps
- **SP sensitivity**: 100 mv
- **Gamma TC**: 3 sec
- **Resistance sensitivity**: 12.5 ohms

---

**Remarks**: Logging speed and density range are specified. Gamma and SP sensitivity are recorded. Resistance sensitivity is noted.
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 2
SHEET 1 OF 2

AREA: Three River
QUAD NAME: North Killdeer Mountain

DATE STARTED: 8-13-79
DATE COMP: 8-13-79
COUNTY: Dunn
STATE: North Dakota

LOCATION: SEC. 29 T 148 N., R. 96 W., FOOTAGE LOC.
FOOTAGE: 2490 ft
GROUND ELEV: 1945 ft

SIZE AND BIT TYPE: 4-3/4 inch drag
FOOTAGE: ROTARY 440 ft
TOTAL DEPTH: 440 ft
DEPTH TO FLUID LEVEL: 1 ft

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: M. Hudson
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:
Logging speeds: 20 ft/min
Density range: 3 cps
Logged depth: 440 ft
Density TC: 1 sec
Gamma range: 15 cps
SP sensitivity: 100 mV
Gamma TC: 3 sec
Resistance sensitivity: 12.5 ohm

LITHOLOGY

- soil, lt-brn, sand, silt, unconsol
- clayst, med-gy, very silty
- siltst, med-gy; high clay content
- clayst, med-gy, mod silty
- siltst, lt-gy; high clay content
- sandst, med-gy, calc, well-consol, med-grained
- sandst, med-gy, fine-grained: lignite (114.5-115.5)
- siltst, med-gy: lignite (138.5-140)
- alternate layers of clayst, med-gy, and siltst, med-gy: lignite (159-163)
- siltst, lt-gy; high clay content
- sandst, med-gy, fine-grained: lignite (212-217)
- clast, med-gy: lignite (218-219)
- sandst, med-gy, fine-grained
- siltst, med-gy
- sandst, med-brn, calc, well-consol, med-grained
- siltst, med-gy: lignite (308-309)
- clayst, lt-gy, very silty
- siltst, med-gy
**REMARKS:**

<table>
<thead>
<tr>
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<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
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**LITHOLOGY**

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<td>210</td>
<td>-210</td>
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<tr>
<td>900</td>
<td>220</td>
<td>-220</td>
</tr>
</tbody>
</table>

- **Siltst, med-gy**
- **Clayst, blk, very cbnccs lignite (365-369)**
- **Clayst, med-gy, mod silty lignite (391.5-393)**
- **Sandst, med-gy, calc, well-consol, fine-grained lignite (420-424)**
- **Clayst, dk-gy lignite (435-436.5)**

**LOG**

- **Logging speed:** 20 ft/min
- **Density range:** 3 cps
- **Logged depth:** 440 ft
- **Density TC:** 1 sec
- **Gamma range:** 15 cps
- **SP sensitivity:** 100 mv
- **Gamma TC:** 3 sec
- **Resistance sensitivity:** 12.5 ohms

**TD**

- 440
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 3  
SHEET 1 OF 2

AREA: Three River
QUAD NAME: Lone Butte SE

DATE STARTED: 8-10-79  
DATE COMP: 8-10-79  
COUNTY: Dunn  
STATE: North Dakota

LOCATION: SEC. 10  
T147 N., R. 97 W., FOOTAGE LOC.

FOOTAGE LOC.

SIZE AND BIT TYPE:  4-3/4 inch drag

FOOTAGE

DRILLING AGENCY: Gregory Drilling Company

DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: M. Hudson

GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

Logging speed: 20 ft/min  
Density range: 3 cps  
Gamma range: 15 cps  
Gamma TC: 3 sec  
SP sensitivity: 100 mv  
Resistance sensitivity: 12.5 ohms

DEPT

FEET

METERS

soil, lt-brn, sand, silt, unconsol

sandst, med-brn, fine-grained

clayst, med-gy, very silty

sandst, med-brn, fine-grained

clayst, med-gy, very silty

sandst, med-brn

lignite (173.5-182)

clayst, med-gy, mod silty

lignite (199-202)

lignite (204-206.5)

lignite (209-212)

clayst, lt-gy, very silty

clayst, dk-brn to blk, very cbncs

clayst, med-gy, mod silty

lignite (296-297)

lignite (298.5-301)

clayst, dk-gy to dk-brn, cbncs, mod silty

clayst, med-gy, mod silty

lignite (328-329.5)
**REMARKS:**

<table>
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<tr>
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<th>STRIP LOG</th>
<th>DEPTH</th>
<th>FEET</th>
<th>METERS</th>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>siltst, med-gy; high clay</td>
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<td>content</td>
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<td>110</td>
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<td>lignite (415.5-417)</td>
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<tr>
<td>clayst, dk-gy, very silty</td>
<td></td>
<td>130</td>
<td></td>
<td></td>
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</table>

Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 440 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mv  
Gamma TC: 3 sec  
Resistance sensitivity: 12.5 ohms  
TD 440
### Remarks
- Hole abandoned at 60 ft due to complete loss of circulation
- No geophysical log run on this hole

### Lithology

<table>
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<th>Soil Type</th>
<th>Description</th>
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<tr>
<td>sandst, med-brn, fine-grained</td>
<td></td>
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</tbody>
</table>
LITHOLOGY

- soil, lt-brn, sand, silt, unconsol
- sandst, med-brn, fine-grained
- clayst, med-brn, very silty
- sandst, med-brn, fine-grained
- lignite (94-96)
- sandst, med-brn, fine-grained
- clayst, med-gy
  - lignite (116.5-118)
  - lignite (121-122)
- siltst, med-gy; high clay content
  - lignite (138.5-140.5)
  - lignite (160-163.5)
- clayst, dk-brn, cbncs
  - lignite (171.5-173.5)
  - lignite (175-176.5)
- siltst, med-gy; high clay content
- clayst, med-gy, very silty
  - lignite (201.5-204)
- siltst, med-gy; high clay content
  - lignite (230.5-233)
- siltst, lt-gy
- sandst, med-gy, fine-grained
- clayst, dk-gy, very silty
- siltst, lt-gy
- sandst, med-gy, fine-grained
- lignite (301-308)
- lignite (317.5-322)
- sandst, med-gy, fine-grained
- clayst, med-gy, very silty
### REMARKS:

The logging data and geophysical logs are as follows:

<table>
<thead>
<tr>
<th>Lithology</th>
<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay, med-gy, very silty</td>
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<td>110</td>
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<td>Sand, med-gy, fine-grained</td>
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<td>Silt, dk-gy</td>
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<td>Lignite (369-370)</td>
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<tr>
<td>Sand, med-gy, fine-grained</td>
<td>150</td>
<td>60</td>
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</tbody>
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- **Logging speed:** 20 ft/min
- **Density range:** 3 cps
- **Density TC:** 1 sec
- **Gamma range:** 15 cps
- **SP sensitivity:** 100 mv
- **Gamma TC:** 3 sec
- **Resistance sensitivity:** 12 ohms

**Diagram:**
- No geophysical log available for this interval due to caving.

**TD:** 460
## LITHOLOGY

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</tr>
<tr>
<td>2950-3000</td>
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<tr>
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<tr>
<td>3100-3150</td>
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**Logging speed**: 20 ft/min  
**Density range**: 3  
**Density TC**: 1 sec  
**Gamma range**: 15 cps  
**Gamma T.C**: 3 sec  
**SP sensitivity**: 100  
**Resistance sensitivity**: 12.5 ohms
# Remarks:

**Lithology**

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<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>clayst, med-gy, silt sily</td>
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<tr>
<td>siltst, med-gy; high clay content</td>
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<table>
<thead>
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<td>Resistance sensitivity</td>
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**Depth**

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**TD**

420
UNITED STATES GEOLOGICAL SURVEY

AREA Three River QUAD NAME North Killdeer Mountain
DATE STARTED 8-10-79 DATE COMP 8-10-79 COUNTY Dunn STATE North Dakota
LOCATION: SEC. 19 T. 147 N., R. 96 W., FOOTAGE LOC. 2435 ft
GROUND ELEV. 2518 ft
SIZE AND BIT TYPE: 4-3/4 inch drag
FOOTAGE ROTARY 680 ft CORING ---
TOTAL DEPTH 680 ft
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
DEPTH TO FLUID LEVEL 4 ft
LITHOLOGY RECORDED BY L. Tomac
GEOPHYSICAL LOGS RECORDED BY J. Walz
REMARKS:

LITHOLOGY

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<tr>
<td>sandst, lt-gy, fine-grained</td>
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<td>clayst, lt-gy to lt-grn, very silty</td>
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<td>siltst, med-gy; high clay content</td>
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<td>Lignite (308-311)</td>
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### LITHOLOGY

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</table>

**Remarks:**

- Logging speed: 20 ft/min
- Logged depth: 680 ft
- Density range: 3 cps
- Density T.C.: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mV
- Gamma T.C.: 3 sec
- Resistance sensitivity: 12.5 ohms
LOCATION: SEC. 28, T.147 N., R. 96 W., FOOTAGE LOC.

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company

LITHOLOGY RECORDED BY: L. Tomac

REMARKS:

LITHOLOGY

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<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
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<td>350</td>
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</table>

- soil, lt-brn, sand, silt, clay, unconsol
- clayst, med-brn, very silty
- sandst, med-brn, fine-grained
- clayst, dk-gy, sli silty
- clayst, med-gy, mod silty
- siltst, med-gy
- clayst, med-gy, mod silty
- clayst, dk-gy
- clayst, dk-gy, mod silty
- sandst, lt-gy, calc, fine-grained, well-consol
- clayst, med-gy, mod silty
- clayst, dk-gy, sli silty
- siltst, med-gy; high clay content
- clayst, dk-gy, sli silty
- lignite (245.5-249)
- sandst, med-gy
- clayst, med-gy, very silty
- siltst, med-gy
- sandst, lt-gy, fine-grained, calc
REMARKS:

**LITHOLOGY**

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**Logging speed:** 20 ft/min
**Density range:** 3 cps
**Logged depth:** 689 ft
**Density TC:** 1 sec
**Gamma range:** 15 cps
**Gamma TC:** 3 sec
**SP sensitivity:** 100 mv
**Resistance sensitivity:** 12.5 ohms
Hole No. 8A

Location: SEC. 34 T.147 N., R. 95 W., FOOTAGE LOC.

Size and Bit Type: 4-3/4 inch drag

Drilling Agency: Gregory Drilling Company

Lithology Recorded By: S. Christensen

Remarks: Hole abandoned at 80 ft due to complete loss of circulation
No geophysical log run on this hole

Lithology:
- soil, lt-brn, sand, unconsol
- clayst, med-brn, very silty
- sandst, med-brn, fine-grained
- no return, probably sandst
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 8B
SHEET 1 OF 2

AREA Three River
QUAD NAME Lost Bridge

DATE STARTED 8-13-79
DATE COMP 8-13-79
COUNTY Dunn
STATE North Dakota

LOCATION: SEC. 34 T. 147 N., R. 95 W., FOOTAGE LOC.

FOOTAGE

TOTAL FOOTAGE

GROUND ELEV

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company

DRILL TYPE: Rotary

DEPTH TO FLUID LEVEL 5 ft

LITHOLOGY RECORDED BY S. Christensen

GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

soil, lt-brn, silt, clay, unconsol
clayst, med-brn, very silty
lignite (14-15)
clayst, med-brn, very silty
sandst, med-brn, fine-grained
clayst, med-gy, mod silty
siltst, med-gy
sandst, med-gy, fine-grained
clayst, dk-brn to blk, cbncs
siltst, dk-gy; high clay content
clayst, dk-brn
lignite (205.5-215.5)
clayst, dk-gy, sli silty
lignite (219.5-220.5)
clayst, dk-brn
lignite (235-237.5)
sandst, med-gy, fine-grained
clayst, dk-brn
lignite (264-265.5)
siltst, med-gy; high clay content
lignite (297.5-304.5)
lignite (305.5-307)
clayst, med-gy, very silty
clayst, dk-gy
lignite (329-333)

Logging speed 20 ft/min
Logged depth 559 ft
Gamma range 15 cps
Gamma TC 3 sec
Density range 3 cps
Density TC 1 sec
SP sensitivity 100 mv
Resistance sensitivity 5 ohms

DEPTH

FEET

METERS
**LITHOLOGY**

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- **Claystone, med-gy, mod silty**
- **Claystone, med-gy, very silty**
- **Lignite (414-415)**
- **Claystone, lt-gy, mod silty**
- **Lignite (466-467)**
- **Lignite (468-480)**
- **Claystone, dk-brown, all silty**
- **Siltstone, lt-gy; high clay content**
- **Lignite (515.5-517.5)**
- **Claystone, dk-gy, all silty**
- **Lignite (533-534)**
- **Claystone, dk-gy, very silty**
- **Claystone, med-gy, mod silty**

**REMARKS:**

- Logging speed: 20 ft/min
- Logged depth: 559 ft
- Density range: 3 cps
- Density T.C.: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mV
- Gamma T.C.: 3 sec
- Resistance sensitivity: 5 ohms

**TD:** 560
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 9**

**SHEET 1 OF 2**

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<th>ELEV 2490 ft</th>
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**REMARKS:**

**LITHOLOGY**

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**Lignite**

- (102-105)
- (125-126.5)
- (137-139)
- (147.5-149)
- (159-163)
- (179-183)
- (193-197)
- (203-207)
- (213-217)
- (223-227)
- (233-237)
- (243-247)
- (253-257)
- (263-267)
- (273-277)
- (283-287)
- (293-297)
- (303-307)
- (313-317)
- (323-327)
- (333-337)
- (343-347)
- (353-357)
- (363-367)
- (373-377)
- (383-387)
- (393-397)
- (403-407)
- (413-417)
- (423-427)
- (433-437)
- (443-447)
- (453-457)
- (463-467)
REMARKS:

LITHOLOGY

clayst, med-gy, mod silty
lignite (362.5-363.5)
siltst, med-gy
sandst, med-gy, fine-grained
lignite (374.5-376)
clayst, med-gy, sli silty
lignite (430-431)
siltst, dk-gy; high clay content
clayst, lt-grn, very silty

Logging speed 20 ft/min  Density range 3 cps
Logged depth 440 ft  Density T.C. 1 sec
Gamma range 15 cps  SP sensitivity 100 mv
Gamma T.C. 3 sec  Resistance sensitivity 12.5 ohms

TD 440

DEPTH

FEET

METERS

350

110

360

120

370

130

380

140

390

150

400

160

410

170

420

180

430

190

440

200

450

210

460

220

470

230

480

240

490

250

500

260

510

270

520

280

530

290

540

300

550

310

560

320

570

330

580

340

590

350

600

360

610

370

620

380

630

390

640

400

650

410

660

420

670

430

680

440

690

450

700

460

710

470

720

480

730

490

740

500

750
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 10
SHEET 1 OF 2

AREA Three River

QUAD NAME Killdeer Mountains

DATE STARTED 8-9-79
DATE COMP. 8-9-79
COUNTY Dunn
STATE North Dakota

LOCATION: SEC. 26 T.146 N., R. 97 W., FOOTAGE LOC. 1175 ft FNL 168 ft FEL
FOOTAGE 565 ft CORING ---
GROUND ELEV 2642 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

DEPTH TO FLUID LEVEL 12 ft

LITHOLOGY RECORDED BY M. Hudson
GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

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<td>lignite (533-538.5)</td>
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**REMARKS:**

Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 564 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mv  
Gamma TC: 3 sec  
Resistance sensitivity: 5 ohms
UNITED STATES GEOLOGICAL SURVEY

AREA: Three River
QUAD NAME: Pete's Creek

DATE STARTED: 8-4-79
DATE COMP: 8-4-79
COUNTY: Dunn
STATE: North Dakota

LOCATION SEC: 28 T.146 N., R.97 W., FOOTAGE LOC: 2415 ft FSL 1790 ft FWL
GROUND ELEV: 2545 ft
TOTAL DEPTH: 400 ft
DEPTH TO FLUID LEVEL: 56 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: L. Tomac
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

- soil, med-brn, sand, silt, unconsol
- siltst, med-brn
- sandst, med-brn, fine-grained
  lignite (56-61.5)
- siltst, med-brn; high clay content
- clayst, dk-gy, mod silty
  lignite (112.5-113.5)
- clayst, med-gy, very silty
- sandst, med-gy, fine-grained
  lignite (194-195.5)
- clayst, med-brn, very silty
- clayst, dk-gy, cbnecs
  lignite (215-218.5)  lignite (221-225)
- clayst, med-gy, mod silty
- clayst, lt-gy, very silty
- sandst, med-gy, fine-grained
- clayst, med-gy, mod silty
- sandst, dk-gy, fine-grained
- clayst, dk-gy
  lignite (289-294)
- siltst, med-gy
  lignite (301.5-303)
- clayst, dk-brn, cbnecs
  lignite (333-335)
- clayst, med-gy, mod silty
  lignite (338-341)
LITHOLOGY

clay, med-gy, mod silty  lignite (357-362)
clay, dk-gy, chnks  lignite (363.5-366)
clay, med-gy, very silty  lignite (368.5-371.5)
siltst, med-gy

Logging speed  20 ft/min  Density range  3 cps
Logged depth  399 ft  Density TC  1 sec
Gamma range  15 cps  SP sensitivity  100 mv
Gamma TC  3 sec  Resistance sensitivity  5 ohms

DEPTH

FEET

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

METERS

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
UNITED STATES GEOLOGICAL SURVEY

AREA Three River
QUAD NAME Oakdale
DATE STARTED 8-9-79
DATE COMP 8-9-79
COUNTY Dunn
STATE North Dakota
LOCATION: SEC. 8 T.146 N., R. 95 W., FOOTAGE LOC. 120 ft FSL 10 ft FWL
GROUND ELEV 2378 ft

SIZE AND BIT TYPE: 4-3/4 inch drag
ROTARY 480 ft CORING ---
TOTAL DEPTH 480 ft

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
DEPTH TO FLUID LEVEL 4 ft

LITHOLOGY RECORDED BY L. Tomac
GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

soil, lt-brn, sand, silt, unconsol
sandst, med-brn, fine-grained
clayst, med-gy, very silty
clayst, med-gy, mod silty
lignite (80-81)
lignite (84-87)
lignite (88-89)
clayst, dk-gy, sli silty
lignite (202-208)
lignite (210-211)
lignite (236-238)
siltst, dk-gy
lignite (279.5-282.5)
clayst, dk-gy
lignite (291-301.5)
clayst, dk-gy, sli silty
lignite (314-316)
clayst, dk-brn
lignite (320-325)
clayst, med-gy, sli silty
sandst, med-gy, med-grained

FOOTAGE TOTAL

ROTARY 480 ft CORING ---

LOGGING LOG

Logging speed 20 ft/min Density range: 3 cps
Logged depth 479 ft Density TO 1 sec
Gamma range 15 cps SP sensitivity 100 mv
Gamma TC 3 sec Resistance sensitivity 5 ohms

DEPTH

FEET METERS
### Remarks:

#### Lithology

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<th>Density range</th>
<th>Density TC</th>
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<th>Gamma TC</th>
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<th>Resistance sensitivity</th>
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<td>3 sec</td>
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#### DEPTH

- **Feet**: 350, 400, 450, 500, 550, 600, 650, 700, 750
- **Meters**: 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

**TD 480**
### Lithology

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**Remarks:**

- LITHOLOGY RECORDED BY L. Tomac
- GEOPHYSICAL LOGS RECORDED BY J. Wald
**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>clayst, med-gy, silt silty</td>
<td></td>
</tr>
<tr>
<td>siltst, med-gy</td>
<td></td>
</tr>
<tr>
<td>clayst, dk-gy, very silty</td>
<td></td>
</tr>
<tr>
<td>siltst, med-gy</td>
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</table>

- **Lignite (374-380.5)**
- **Lignite (401.5-403.5)**

<table>
<thead>
<tr>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
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<tr>
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<tr>
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<td>650</td>
</tr>
<tr>
<td>700</td>
</tr>
<tr>
<td>750</td>
</tr>
</tbody>
</table>

- **Logging speed:** 20 ft/min
- **Logged depth:** 420 ft
- **Density range:** 3 cps
- **Density T.C.:** 1 sec
- **Gamma range:** 15 cps
- **Gamma T.C.:** 3 sec
- **SP sensitivity:** 100 mv
- **Resistance sensitivity:** 5 ohms
**LITHOLOGY**

<table>
<thead>
<tr>
<th>STRIP LOC</th>
<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>...</td>
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</tbody>
</table>

- **soil, lt-brn, sand, unconsol**
- **siltst, med-gy; high clay content**
- **sandst, med-gy, calc, med-grained**
- **siltst, med-gy**
- **lignite (121-128)**
- **clayst, dk-gy, mod silty**
- **siltst, med-gy**
- **sandst, med-gy, fine-grained**
- **clayst, dk-gy, cbncs**
- **lignite (185-190.5)**
- **lignite (194-197)**
- **siltst, med-gy**
- **clayst, dk-gy, very silty**
- **lignite (248-253)**
- **lignite (254-259)**
- **clayst, med-gy, mod silty**
- **sandst, med-gy, fine-grained**
- **clayst, lt-gy, mod silty**
- **siltst, med-gy**
- **clayst, med-brn, cbncs**
- **lignite (334.5-337)**
- **lignite (340.5-349.5)**
REMARKS:

LITHOLOGY

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<th>Depth</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>360-370</td>
<td>lignite (374-377)</td>
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<tr>
<td>370-380</td>
<td>clayst, med-gy, lignite (380.5-382)</td>
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<td>380-390</td>
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<tr>
<td>390-400</td>
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<td>400-410</td>
<td>siltst, med-gy</td>
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TD 440
### Lithology Log

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<th>Depth Range</th>
<th>Lithology Description</th>
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<tr>
<td>0-20 ft</td>
<td>Soil, med-brn, silt, clay, unconsol</td>
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<tr>
<td>20-200 ft</td>
<td>Clayst, med-brn, very silty</td>
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<tr>
<td>200-250 ft</td>
<td>Lignite (22.5-24)</td>
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<tr>
<td>250-300 ft</td>
<td>Clayst, med-gy, mod silty</td>
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<tr>
<td>300-350 ft</td>
<td>Lignite (52-59)</td>
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<tr>
<td>350-400 ft</td>
<td>Clayst, dk-gy, silty</td>
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<tr>
<td>400-450 ft</td>
<td>Siltst, med-gy</td>
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<tr>
<td>450-500 ft</td>
<td>Clayst, dk-brn</td>
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<tr>
<td>500-550 ft</td>
<td>Lignite (105.5-113.5)</td>
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<tr>
<td>550-600 ft</td>
<td>Clayst, med-gy, very silty</td>
</tr>
<tr>
<td>600-650 ft</td>
<td>Lignite (134-135)</td>
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<tr>
<td>650-700 ft</td>
<td>Clayst, med-gy, mod silty</td>
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<tr>
<td>700-750 ft</td>
<td>Clayst, dk-gy</td>
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<tr>
<td>750-800 ft</td>
<td>Clayst, dk-brn</td>
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<tr>
<td>800-850 ft</td>
<td>Lignite (168.5-174)</td>
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<td>850-900 ft</td>
<td>Lignite (179-180)</td>
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<td>900-950 ft</td>
<td>Clayst, med-gy, very silty</td>
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<tr>
<td>950-1000 ft</td>
<td>Sandst, med-gy, fine-grained</td>
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<tr>
<td>1000-1050 ft</td>
<td>Clayst, dk-gy</td>
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<td>1100-1150 ft</td>
<td>Clayst, dk-gy</td>
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<td>1150-1200 ft</td>
<td>Lignite (282-290)</td>
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<td>1200-1250 ft</td>
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<td>1250-1300 ft</td>
<td>Lignite (291-296)</td>
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<td>1300-1350 ft</td>
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<td>1350-1400 ft</td>
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**Remarks:**

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 505 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mV
- Gamma TC: 3 sec
- Resistance sensitivity: 12.5 ohms

---

### Drill Log

- Log: 
  - Depth: 20-350 ft
  - Lithology: Various formations including silt, clay, and lignite
  - Density and Gamma readings

---

**Drilling Details:**

- **Agency:** Gregory Drilling Company
- **Type:** Rotary
- **Total Depth:** 505 ft
- **Depth to Fluid Level:** 15 ft
- **Ground Elevation:** 2255 ft

---

**Geophysical Logs:**

- Recorded by J. Wald

---

**Area:** Three River

- **Quad Name:** Dunn Center NE
- **County:** Dunn
- **State:** North Dakota

---

**Logbook Information:**

- **Date Started:** 8-14-79
- **Date Completed:** 8-14-79

---

**Notes:**

- Lithology recorded by M. Hudson
- Geophysical logs recorded by J. Wald

---

**Unit:** United States Geological Survey

**Sheet:** 15 of 2

---

**Footage:**

- **Location:** Sec. 28 T.146 N., R. 93 W., Dunn Center NE, Dunn County, North Dakota
- **Footage Location:** 72 ft FSL, 1360 ft FWL
- **Footage:** 505 ft
- **Rotary:** 505 ft
- **Coring:** ---
- **Total Depth:** 505 ft
REMARKS:

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
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</thead>
<tbody>
<tr>
<td>clayst, med-gy, ali silty</td>
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<td>350</td>
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<td>clayst, lt-gy, very silty</td>
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<td>lignite (377.5-384)</td>
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<tr>
<td>siltst, med-gy; high clay content</td>
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<td>700</td>
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<tr>
<td>clayst, med-gy, mod silty</td>
<td></td>
<td>750</td>
</tr>
<tr>
<td>siltst, med-gy</td>
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<td></td>
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</tbody>
</table>

Logging speed 20 ft/min  Density range 3 cps  Logged depth 505 ft  Density TC 1 sec  Gamma range 15 cps  SP sensitivity 100 mV  Gamma TC 3 sec  Resistance sensitivity 125 ohms
AREA: Three River
QUAD NAME: Pete's Creek
DATE STARTED: 8-5-79
DATE COMP: 8-5-79
COUNTY: Dunn
STATE: North Dakota
LOCATION: SEC. 8 T. 145 N, R. 97 W, FOOTAGE LOC.
SIZE AND BIT TYPE: 4-3/4 inch drag
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
LITHOLOGY RECORDED BY: L. Tomac
LITHOLOGY:
- soil, lt-brn, sand, silt, clay, unconsol
- sandst, med-brn, fine-grained
- clayst, dk-brn, sli silty
- siltst, med-gy; high clay content
- clayst, dk-gy, mod silty
- siltst, med-gy
- clayst, dk-gy, mod silty
- sandst, lt-gy, fine-grained
- clayst, dk-gy, ali silty
- clayst, med-gy, very silty
- clayst, med-gy, ali silty
- clayst, med-gy, very silty
- lignite (207.5-209)
- lignite (226.5-231)
- lignite (232-236)
- lignite (207.5-210)
- lignite (314-315)
- lignite (323.5-328)
- clayst, med-gy, mod silty
- clayst, dk-gy, mod silty
- clayst, dk-gy, mod silty
- siltst, med-gy

GEOPHYSICAL LOGS RECORDED BY: J. Wald
Logging speed: 20 ft/min
Density range: 3 cps
Logged depth: 475 ft
Density TC: 1 sec
Gamma range: 15 cps
Gamma TC: 3 sec
SP sensitivity: 100 mV
Resistance sensitivity: 5 ohms
REMARKS:

LITHOLOGY

<table>
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<tr>
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<th>FEET</th>
<th>METERS</th>
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<tbody>
<tr>
<td>475</td>
<td>110</td>
<td>350</td>
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</tbody>
</table>

- clayst, dk-gy
- clayst, dk-brn
- clayst, med-gy, very silty
- clayst, med-gy, mod silty
- clayst, med-gy, very silty
- clayst, med-gy, mod silty
- clayst, dk-gy, sli silty

Logging speed: 20 ft/min
Logged depth: 475 ft
Density range: 3 cps
Gamma range: 15 cps
SP sensitivity: 100 mv
Gamma TC: 3 sec
Resistance sensitivity: 5 ohms

clayst, dk-gy
clayst, dk-brn
clayst, med-gy, very silty
clayst, med-gy, mod silty
clayst, med-gy, very silty
clayst, med-gy, mod silty
clayst, dk-gy, sli silty
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 17**

**SHEET 1 OF 2**

**AREA** Three River  
**QUAD NAME** Grassy Butte SE

**DATE STARTED** 8-4-79  
**DATE COMP** 8-4-79  
**COUNTY** Dunn  
**STATE** North Dakota

**LOCATION-SEC.** 14 T145 N., R. 97 W., FOOTAGE LOC.  105 ft  
**FOOTAGE** 440 ft  
**TOTAL DEPTH** 440 ft

**SIZE AND BIT-TYPE:** 4-3/4 inch drag  
**FOOTAGE LOC.** IPS ft

**GROUND ELEV** 2520 ft

**DRILLING AGENCY** Gregory Drilling Company  
**DRILL TYPE** Rotary  
**DEPTH TO FLUID LEVEL** 9 ft

**REMARKS:**

**LITHOLOGY RECORDED BY** L. Tomac  
**GEOPHYSICAL LOGS RECORDED BY** J. Waid

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>soil, med-brn, sand, unconsol</td>
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<td>sandst, med-brn, fine-grained</td>
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<td>clayst, med-gy, mod silty</td>
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<tr>
<td>sandst, med-gy, calc, fine-grained</td>
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<td>lignite (336-337.5)</td>
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### Remarks:

#### Lithology

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<th>Depth</th>
<th>Description</th>
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<td>440 ft</td>
<td>Silt, med-gy</td>
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<tr>
<td>436-437 ft</td>
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<tr>
<td>414.5-420 ft</td>
<td>Clay, dk-gy, very silty</td>
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<tr>
<td>436-437 ft</td>
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<tr>
<td>414.5-420 ft</td>
<td>Lignite</td>
</tr>
</tbody>
</table>

| Logging Speed | 20 ft/min |
| Density Range | 3 cps |
| Logged Depth | 439 ft |
| Density TC | 1 sec |
| Gamma Range | 15 cps |
| SP Sensitivity | 100 mv |
| Gamma TC | 3 sec |
| Resistance Sensitivity | 5 ohms |

**Diagram**

[Insert diagram showing logging data and depth measurements]
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 18
UNITED STATES GEOLOGICAL SURVEY

AREA
Three River

QUAD NAME
Grassy Butte SE

DATE STARTED
8-4-79

DATE COMP.
8-4-79

COUNTY
Dunn

STATE
North Dakota

LOCATION: SEC. 34 T 145 N., R. 97 W., FOOTAGE LOC.

2633 ft

240 ft

GROUND

ELEV

2448 ft

FOOTAGE

TOTAL

DEPTH

300 ft

SIZE AND BIT TYPE:
4-3/4 inch drag

DRILLING AGENCY:
Gregory Drilling Company

DRILL TYPE:
Rotary

DEPTH TO

FLUID LEVEL

2 ft

LITHOLOGY RECORDED BY
S. Christensen

GEOPHYSICAL LOGS RECORDED BY
J. Wald

REMARKS:

LITHOLOGY

soil, med-brn, sand, silt, clay, unconsol
clayst, lt-gy
siltst, med-gy; high clay content
clayst, med-gy, mod silty
sandst, med-gy, fine-grained
clayst, med-gy, very silty
sandst, lt-gy, calc, well-consol, med grained
clayst, med-gy, very silty
clayst, med-gy, sil silty
lignite (53-55)

clayst, med-gy, very silty
lignite (86-89)

clayst, med-gy, very silty
lignite (103-105)

clayst, lt-gy, mod silty
siltst, med-gy
lignite (179-181.5)
clayst, med-gy, very silty
lignite (212.5-221.5)
clayst, med-brn, cbnscs
lignite (230-231.5)
clayst, med-gy, mod silty
lignite (265-267.5)
clayst, med-gy, very silty
siltst, med-gy

Logging speed
20 ft/min

Density range
3 cps

Logged depth
300 ft

Density TC
1 sec

Gamma range
15 cps
SP sensitivity
100 mv

Gamma TC
3 sec
Resistance sensitivity
5 ohms

DEPTH

FEET

0

10

20

30

40

50

60

70

80

90

100

150

200

250

300

350

TD

300
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 19A**

**SHEET 1 OF 1**

**AREA:** Three River  **QUAD NAME:** Killdeer Mountains

**DATE STARTED:** 8-9-79  **DATE COMP:** 8-9-79  **COUNTY:** Dunn  **STATE:** North Dakota

**LOCATION:** SEC. 2 T.14 S., R. 96 W., FOOTAGE LOC. 1056 ft

**FOOTAGE LOG:** 1056 ft  **TOTAL FOOTAGE:** 2630 ft  **GROUND ELEV:** 2518 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag  **DRILL TYPE:** Rotary

**DRILLING AGENCY:** Gregory Drilling Company  **DRILL TYPE:** Rotary

**LITHOLOGY RECORDED BY:** M. Hudson  **GEOPHYSICAL LOGS RECORDED BY:** ---

**REMARKS:**
- Hole abandoned at 150 ft owing to complete loss of circulation
- No geophysical log run on this hole

**LITHOLOGY**

- soil, lt-brn, sand, silt, unconsol
- sandst, med-brn, fine-grained
- no return, probably sandst

**LOG**

- Logging speed --- ft/min  Density range --- cps
- Logged depth --- Density TC --- sec
- Gamma range --- cps  SP sensitivity --- mV
- Gamma TC --- sec  Resistance sensitivity --- ohms

**DEPTH**

- TD 150
**LITHOLOGY**

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<tr>
<td>Siltst, med-gy; high clay content</td>
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<tr>
<td>Clayst, med-gy, mod silty</td>
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<td>Lignite (180.5-183)</td>
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<tr>
<td>Lignite (215-217)</td>
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<tr>
<td>Siltst, med-gy</td>
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<td>Lignite (264-265)</td>
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<td>Lignite (266.5-269.5)</td>
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<td>Lignite (270.5-271.5)</td>
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<td>Sandst, lt-gy, calc, fine-grained; well-consol</td>
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<td>Clayst, med-gy, very silty</td>
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<tr>
<td>Siltst, med-gy</td>
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<tr>
<td>Lignite (333-335)</td>
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<tr>
<td>Lignite (336.5-337.5)</td>
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<tr>
<td>Lignite (341-348)</td>
</tr>
<tr>
<td>Clayst, dk-brn, cbns</td>
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</table>

**LITHOLOGY**

- **Logging speed**: 20 ft/min
- **Density range**: 3 cps
- **Logged depth**: 440 ft
- **Density TC**: 1 sec
- **Gamma range**: 15 cps
- **SP sensitivity**: 100 mV
- **Gamma TC**: 3 sec
- **Resistance sensitivity**: 5 ohms

**DEPTH**

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**REMARKS:**

**LITHOLOGY**

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<td>750</td>
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- **clayst, dk-gy, very silty**
- **siltst, med-gy**
- **sandst, med-gy, fine-grained**
- **lignite (350-353.5)**
- **clayst, mod-gy, mod silty**

**Logging speed:** 20 ft/min  
**Logged depth:** 440 ft  
**Density range:** 3 cps  
**Density TC:** 1 sec  
**Gamma range:** 15 cps  
**SP sensitivity:** 100 mv  
**Gamma TC:** 3 sec  
**Resistance sensitivity:** 5 ohms
Area: Three River
Quad Name: Killdeer Mountains
Date Started: 8-20-79
Date Comp: 8-20-79
County: Dunn
State: North Dakota
Location: Sec. 6, T.145 N., R. 96 W., Footage Loc.

Size and Bit Type: 4-3/4 inch drag
Drilling Agency: Gregory Drilling Company
Drill Type: Rotary

Remarks: Hole was drilled to 520 ft. Because of poor hole condition geophysical log was run only from 447 ft to surface.

Lithology recorded by M. Hudson
Geophysical logs recorded by J. Walz

Lithology:
- soil, lt-brn, sand, silt, unconsol
- sandst, med-brn, fine-grained
- sandst, med-gy, fine-grained
- clayst, dk-gy, sli silty
- lignite (213.5-214.5)
- siltst, dk-gy
- lignite (229.5-235)
- clayst, dk-gy, sli silty
- lignite (237.5-239)
- clayst, med-gy, sli silty
- lignite (255.5-256.5)
- siltst, med-gy
- sandst, med-gy, med-grained
REMARKS:

LITHOLOGY

sandstone, medium-gray, medium-grained
claystone, dark-gray, silt silty
siltstone, medium-gray; high clay content

claystone, dark-gray
claystone, medium-gray, very silty
claystone, dark-gray, very silty
siltstone, medium-gray
sandstone, medium-gray, fine-grained

no return - probably sandstone
LITHOLOGY

channel deposit, gravel, sand, silt, unconsol

sand, med-gy, fine-grained

clay, med-gy, mod silty

lignite (103.5-105.5)

lignite (107.5-111)

clay, med-gy, very silty

clay, med-gy, silt silt, lt-gy

silt silt, med-gy, calc, fine-grained;

top 3 ft well-consol

lignite (160.5-162)

lignite (169.5-172)

clay, med-gy, silt silt

lignite (209-210)

lignite (212.5-216)

clay, med-gy, very silty

lignite (266.5-268)

silt, med-gy

clay, dk-gy to dk-brn, cbncs, mod silty

lignite (314-328)

clay, med-gy, mod silty
REMARKS:

LITHOLOGY

- clayst, med-gy, mod silty lignite (352-355)
- clayst, med-gy, very silty

Logging speed: 20 ft/min
Logged depth: 379 ft
Gamma range: 15 cps
Gamma TC: 3 sec
Density range: 3 cps
Density TC: 1 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

TD: 380

DEPTH

<table>
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<tr>
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<td>700</td>
<td>180</td>
</tr>
<tr>
<td>750</td>
<td>200</td>
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LOCATION: SEC. 20 T. 145 N, R. 96 W, FOOTAGE LOC. 1520 ft — 2620 ft — 2518 ft
SIZE AND BIT TYPE: 4 3/4 inch drag
DRILLING AGENCY: Gregory Drilling Company
LITHOLOGY RECORDED BY: S. Christensen
REMARKS:

LITHOLOGY

- soil, lt-brn, sand, silt, unconsol
- sandst, med-brn, fine-grained
- clayst, dk-gy, cbncs, very silty
- sandst, med-brn, fine-grained
- lignite (117.5-119)
- sandst, med-gy, fine-grained
- lignite (213-214)
- lignite (218.5-221.5)
- lignite (223-224.5)
- clayst, med-gy, very silty
- lignite (256-257)
- lignite (259-261.5)
- clayst, med-gy, mod silty
- lignite (285.5-288.5)
- lignite (291-293.5)
- lignite (295-296)
- siltst, med-gy; high clay content
- sandst, med-gy, fine-grained, calc, well-consol
- clayst, lt-gy, mod silty
### Lithology

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<th>TD (meters)</th>
<th>Depth (feet)</th>
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<tr>
<td>360</td>
<td>120</td>
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</table>

**Remarks:**
- Clayst, lt-gy, mod silty

**Log Data:**
- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 357 ft
- Density T.C.: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma T.C.: 3 sec
- Resistance sensitivity: 5 ohms
AREA: Three River
QUAD NAME: Oakdale

DATE STARTED: 8-8-79
DATE COMP: 8-8-79
COUNTY: Dunn
STATE: North Dakota

LOCATION: SEC. 8 T.145 N., R. 95 W., FOOTAGE LOC. 250 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: L. Tomac
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

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<thead>
<tr>
<th>Lithology</th>
<th>Strip Log</th>
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<td>soil, med-brn, sand, silt, unconsol</td>
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<tr>
<td>clayst, lt-brn, sili silty</td>
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<tr>
<td>clayst, med-gy, sili silty</td>
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<tr>
<td>clayst, med-gy, very silty</td>
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<tr>
<td>clayst, dk-brn, cbncs</td>
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<tr>
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<tr>
<td>lignite (104.5-106)</td>
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<tr>
<td>siltst, lt-grn</td>
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<td>lignite (125.5-126.5)</td>
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<td>siltst, med-gy</td>
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<td>sandst, med-gy, fine-grained, calc</td>
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<tr>
<td>clayst, med-gy, very silty</td>
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<tr>
<td>clayst, lt-gy, mod silty</td>
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<td>clayst, dk-brn, cbncs</td>
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<td>lignite (205.5-216.5)</td>
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<tr>
<td>clayst, med-gy, sili silty</td>
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<td>lignite (219-221)</td>
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<td>siltst, med-gy</td>
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<td>lignite (255-257)</td>
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<td>clayst, med-gy, very silty</td>
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<tr>
<td>siltst, lt-gy</td>
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</tr>
</tbody>
</table>

Logging speed: 20 ft/min
Density range: 3 cps
Logged depth: 319 ft
Density TC: 1 sec
Gamma range: 15 cps
SP sensitivity: 100 mV
Gamma TC: 3 sec
Resistivity sensitivity: 5 MΩ
**AREA** Three River  
**QUAD NAME** Killdeer  
**DATE STARTED** 8-8-79  
**DATE COMP.** 8-8-79  
**COUNTY** Dunn  
**STATE** North Dakota  
**LOCATION:** SEC. 34 T.145 N., R. 95 W., FOOTAGE LOC. 100 ft  
**FOOTAGE:** 45 ft  
**GROUND ELEV.** 2282 ft  
**TOTAL DEPTH** 360 ft  
**DEPTH TO FLUID LEVEL** 8 ft  
**SIZE AND BIT TYPE:** 4-3/4 inch drag  
**DRILLING AGENCY:** Gregory Drilling Company  
**DRILL TYPE:** Rotary  
**LITHOLOGY RECORDED BY:** L. Tomac  
**GEOPHYSICAL LOGS RECORDED BY:** J. Wald  

### LITHOLOGY

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<th>METERS</th>
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<td>Siltst, med-gy</td>
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<td>Sandst, lt-gy, fine-grained</td>
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<td>Clayst, dk-gy, very silty</td>
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### Remarks:

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

### Log Details:
- **Logging Speed:** 20 feet/minute
- **Logged Depth:** 360 feet
- **Gamma Range:** 15 cps
- **Gamma TC:** 3 seconds
- **Density TC:** 1 second
- **Density Range:** 3 cps
- **SP Sensitivity:** 100 mV
- **Resistance Sensitivity:** 5 ohms

### Depth Measurement:

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**Note:** The diagram illustrates the depth measurements with various indicators and annotations typical of geological logging data.
UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 25
SHEET 1 OF 2

UNITED STATES GEOLOGICAL SURVEY

AREA
Three River

DATE STARTED
8-14-79

DATE COMP.
8-14-79

QUAD NAME
Dunn Center NE

COUNTY
Dunn

STATE
North Dakota

LOCATION: SEC. 2 T 145 N., R. 94 W., FOOTAGE LOC.

GROUND ELEV
2254 ft

SIZE AND BIT TYPE:
4-3/4 inch drag

DRILLING AGENCY:
Gregory Drilling Company

DRILL TYPE:
Rotary

DEPTH TO FLUID LEVEL
5 ft

LITHOLOGY RECORDED BY
M. Hudson

GEOPHYSICAL LOGS RECORDED BY
J. Wald

REMARKS:

LITHOLOGY

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REMARKS:

LITHOLOGY

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Logging speed: 20 ft/min
Logged depth: 500 ft
Density range: 3 cps
Gamma range: 15 cps
Gamma TC.: 3 sec
SP sensitivity: 100 mv
Resistance sensitivity: 9 ohms
AREA: Three River  QUAD NAME: Lake Ilo

DATE STARTED: 8-8-79  DATE COMP: 8-8-79  COUNTY: Dunn  STATE: North Dakota

LOCATION: SEC. 20 T.145 N., R. 94 W., FOOTAGE LOC. 1190 ft FWL 15 ft XWL 2224 ft GROUND ELEV

SIZE AND BIT TYPE: 4-3/4 inch drag  FOOTAGE 397 ft CORING ----  TOTAL DEPTH 397 ft

DRILLING AGENCY: Gregory Drilling Company  DRILL TYPE: Rotary  DEPTH TO FLUID LEVEL 6 ft

LITHOLOGY RECORDED BY: M. Hudson  GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

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<th>Depth (ft)</th>
<th>Description</th>
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<td>250-260</td>
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<td>260-275</td>
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<tr>
<td>290-300</td>
<td>Siltst, med-gy</td>
</tr>
<tr>
<td>300-325</td>
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</tr>
<tr>
<td>325-340</td>
<td>Lignite (272-274)</td>
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<tr>
<td>340-350</td>
<td>Clayst, med-gy, sli silty</td>
</tr>
<tr>
<td>350-360</td>
<td>Siltst, med-gy</td>
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<tr>
<td>360-375</td>
<td>Lignite (331.5-333.5)</td>
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<tr>
<td>375-385</td>
<td>Clayst, med-gy, very silty</td>
</tr>
<tr>
<td>385-395</td>
<td>Lignite (335-343.5)</td>
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</table>
**REMARKS:**

**LITHOLOGY**

<table>
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<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>350</td>
<td>clayst, med-gy, very silty</td>
<td>lignite (358-359)</td>
</tr>
<tr>
<td>397</td>
<td>clayst, lt-gy, sli silty</td>
<td></td>
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</table>

**LOGGING DATA**

- **Logging Speed:** 20 ft/min
- **Logged Depth:** 396 ft
- **Density Range:** 3 cps
- **Density TC:** 1 sec
- **Gamma Range:** 15 cps
- **Gamma TC:** 3 sec
- **SP Sensitivity:** 100 mv
- **Resistance Sensitivity:** 5 ohms

**DIAGRAM**

- TD 397

**DEPTH**

<table>
<thead>
<tr>
<th>FEET</th>
<th>METERS</th>
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<tbody>
<tr>
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<tr>
<td>700</td>
<td>180</td>
</tr>
<tr>
<td>750</td>
<td>200</td>
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UNITED STATES GEOLOGICAL SURVEY
HOLE NO 27
SHEET 1 OF 2

AREA: Three River
QUAD NAME: Dunn Center NE

DATE STARTED: 8-14-79
DATE COMP: 8-14-79
COUNTY: Dunn
STATE: North Dakota

LOCATION: SEC. 10 T.145 N., R. 93 W., FOOTAGE LOC.
180 ft
20 ft
FOOTAGE
ROTOR 460 ft
TOTAL
DEPTH 460 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: M. Hudson
GEOPHYSICAL LOGS RECORDED BY: J. Waid

REMARKS:
Logging speed 20 ft/min
Density range: 3 cps
Logged depth 458 ft
Density TC: 1 sec
Gamma range 15 cps
SP sensitivity: 100 mV
Gamma T.C.: 3 sec
Resistance sensitivity: 5 ohms

LITHOLOGY

soil, lt-brn, silt, clay, unconsol
lignite (3.5-12)

clayst, med-gy, sli silty

siltst, med-gy

clayst, dk-gy, very silty
lignite (65.5-76.5)

siltst, med-gy

clayst, dk-gy, cbncs
lignite (106-107.5)
lignite (112-112.5)

clayst, dk-gy, mod silty
lignite (124-127)

clayst, dk-gy
lignite (130-131)

clayst, med-gy, mod silty
lignite (179.5-181)

clayst, dk-gy, sli silty
lignite (188.5-194)

clayst, dk-gy
lignite (199.5-200.5)
lignite (202-206)

clayst, dk-gy, very silty

sandst, med-gy, fine-grained

siltst, dk-gy; high clay content
lignite (291.5-293)

siltst, med-gy
lignite (327.5-335)

clayst, med-gy, very silty
### LITHOLOGY

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<thead>
<tr>
<th>Lithology</th>
<th>Gamma Range</th>
<th>Density Range</th>
<th>Density TC</th>
<th>SP Sensitivity</th>
<th>Resistance Sensitivity</th>
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<tbody>
<tr>
<td>clayst, med-gy, very silty</td>
<td>15 cps</td>
<td>3 cps</td>
<td>1 sec</td>
<td>100 mv</td>
<td>12.5 ohms</td>
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<td>lignite (371.5-373)</td>
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<td>lignite (377-382.5)</td>
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<td>clayst, med-gy, mod silty</td>
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<td>lignite (415.5-416.5)</td>
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<td>lignite (434.5-438)</td>
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<td>clayst, dk-gy, sil silty</td>
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<td>lignite (434.5-438)</td>
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</table>

**REMARKS:**

- Logging speed: 20 ft/min
- Logged depth: 458 ft
- Density range: 3 cps
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Resistance sensitivity: 12.5 ohms

**Diagram**

- TD: 460 ft

**Graphs**

- Graph 1
- Graph 2
- Graph 3
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<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
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<tr>
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<tr>
<td>sandst, med-brn, fine-grained</td>
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<td>siltst, med-gy</td>
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<tr>
<td>lignite (60-70.5)</td>
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<td>clayst, lt-gy, very silty</td>
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<tr>
<td>siltst, med-gy</td>
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<td></td>
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<tr>
<td>clayst, dk-gy, mod silty</td>
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<tr>
<td>lignite (138.5-146)</td>
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<td>clayst, med-gy, mod silty</td>
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<tr>
<td>lignite (200.5-211)</td>
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<td>siltst, dk-gy; high clay content</td>
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<tr>
<td>lignite (230-236)</td>
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<td>clayst, med-gy, mod silty</td>
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<td>lignite (267-268)</td>
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<td>clayst, lt-gy, sil silty</td>
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<tr>
<td>lignite (305.5-306.5)</td>
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<tr>
<td>clayst, med-gy, mod silty</td>
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<td></td>
</tr>
<tr>
<td>siltst, med-gy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>siltst, med-gy; high clay content</td>
<td></td>
<td></td>
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<tr>
<td>lignite (342-345.5)</td>
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</table>
REMARKS:

LITHOLOGY

- Siltst, med-gy; high clay content
- Clayst, dk-gy, cbnscs
  - Lignite (390-398.5)
  - Lignite (420-421)
- Clayst, lt-gy, sls silty
  - Lignite (454-455)
- Clayst, med-gy, very silty

Logging speed 20 fpm
Logged depth 475 ft
Density range 3 cps
Density TC 1 sec
Gamma range 15 cps
Gamma TC 3 sec
SP sensitivity 100 mV
Resistance sensitivity 5 ohms

DEPT

FEET

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

METERS

58
AREA: Three River
QUAD NAME: Halliday NW
DATE STARTED: 8-15-79
DATE COMP: 8-15-79
COUNTY: Dunn
STATE: North Dakota
LOCATION: SEC. 6 T. 145 N., R. 92 W., FOOTAGE LOC.
SIZE AND BIT TYPE: 4-3/4 inch drag
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
LITHOLOGY RECORDED BY: S. Christensen
GEOPHYSICAL LOGS RECORDED BY: J. Wald

LITHOLOGY

- soil, med-brn, sand, unconsol
- sandst, med-gy, fine-grained
- clayst, dk-gy, mod silty
- lignite (97-104)
- clayst, dk-gy, sli silty
- lignite (115-121)
- lignite (122-124)
- siltst, med-gy; high clay content
- lignite (144-145.5)
- lignite (146.5-148)
- clayst, med-gy, sli silty
- sandst, med-gy, fine-grained, calc, well-consol
- clayst, med-gy, mod silty
- clayst, dk-gy, cbncs-
- clayst, med-gy, mod silty
- lignite (251-252)
- clayst, dk-gy, very silty
- lignite (281.5-287)
- lignite (288-290.5)
- clayst, med-gy, mod silty
- sandst, med-gy, fine-grained, calc, well-consol
- clayst, med-gy, mod silty
### Remarks:

**Lithology**

<table>
<thead>
<tr>
<th>Depth (Meters)</th>
<th>Lithology Description</th>
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<tbody>
<tr>
<td>350–370</td>
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<tr>
<td>370–384</td>
<td>Lignite (372–373)</td>
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<tr>
<td>384–400</td>
<td>Clay, med-gy, very silty</td>
</tr>
<tr>
<td>400–421</td>
<td>Silt, lt-gy</td>
</tr>
<tr>
<td>421–750</td>
<td>Clay, med-gy, very silty</td>
</tr>
</tbody>
</table>

**Logging Details**

- **Logging Speed**: 20 ft/min
- **Logged Depth**: 420 ft
- **Density Range**: 3 cps
- **Density TC**: 1 sec
- **Gamma Range**: 15 cps
- **Gamma TC**: 3 sec
- **SP Sensitivity**: 100 mV
- **Resistance Sensitivity**: 5 ohms
LITHOLOGY

- Siltst, med-gy
- Clayst, dk-gy, very silty
- Siltst, med-gy
- Clayst, med-gy, very silty

**REMARKS:**

Logging speed: 20 ft/min  
Logged depth: 400 ft  
Density range: 3 cps  
Density TC: 1 sec  
Gamma range: 15 cps  
Gamma TC: 3 sec  
SP sensitivity: 100 mv  
Resistance sensitivity: 12.5 mV
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 31**

<table>
<thead>
<tr>
<th>AREA</th>
<th>Three River</th>
</tr>
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<td>QUAD NAME</td>
<td>Werner</td>
</tr>
<tr>
<td>DATE STARTED</td>
<td>8-15-79</td>
</tr>
<tr>
<td>DATE COMP</td>
<td>8-15-79</td>
</tr>
<tr>
<td>COUNTY</td>
<td>Dunn</td>
</tr>
<tr>
<td>STATE</td>
<td>North Dakota</td>
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</tbody>
</table>

**LOCATION:** Sec. 34 T. 145 N., R. 92 W., FOOTAGE LOC. 372 ft

**FOOTAGE:** 12 ft 12 ft

**GROUND ELEV:** 2190 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag

**ROTARY FOOTAGE:** 380 ft **CORING FOOTAGE:** --- **TOTAL DEPTH:** 380 ft

**DRILLING AGENCY:** Gregory Drilling Company

**DRILL TYPE:** Rotary

**DEPTH TO FLUID LEVEL:** 29 ft

**DRILLING AGENCY:** Gregory Drilling Company

**DATE STARTED:** 8-15-79 **DATE COMPLETED:** 8-15-79

**COUNTY:** Dunn **STATE:** North Dakota

**LOCATION:** Sec. 34 T. 145 N., R. 92 W., FOOTAGE LOC. 372 ft

**FOOTAGE:** 12 ft 12 ft

**GROUND ELEV:** 2190 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag

**ROTARY FOOTAGE:** 380 ft **CORING FOOTAGE:** --- **TOTAL DEPTH:** 380 ft

**DRILLING AGENCY:** Gregory Drilling Company

**DRILL TYPE:** Rotary

**DEPTH TO FLUID LEVEL:** 29 ft

**LOCATION:** Sec. 34 T. 145 N., R. 92 W., FOOTAGE LOC. 372 ft

**FOOTAGE:** 12 ft 12 ft

**GROUND ELEV:** 2190 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag

**ROTARY FOOTAGE:** 380 ft **CORING FOOTAGE:** --- **TOTAL DEPTH:** 380 ft

**DRILLING AGENCY:** Gregory Drilling Company

**DRILL TYPE:** Rotary

**DEPTH TO FLUID LEVEL:** 29 ft

**LITHOLOGY RECORDED BY:** M. Hudson

**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
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</thead>
<tbody>
<tr>
<td>soil, med-brn, silt, clay, unconsol</td>
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<td>clayst, med-brn, very silty</td>
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<td>lignite (17-20)</td>
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<td>lignite (95-98)</td>
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<td>siltst, med-gy, fine-grained</td>
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<tr>
<td>clayst, lt-gy, mod silty</td>
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<tr>
<td>siltst, med-gy</td>
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<td>lignite (217-220.5)</td>
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<td>lignite (225-227)</td>
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<td>clayst, med-gy, very silty</td>
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<td>lignite (277-279)</td>
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<td>siltst, dk-gy, high clay content</td>
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<tr>
<td>clayst, med-gy, ali silty</td>
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</tr>
<tr>
<td>siltst, med-gy; high clay content</td>
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</table>
## Remarks:

- Lithology:
  - Siltst, med-gy; high clay content

## Logging Parameters:
- Logging speed: 20 ft/min
- Logged depth: 380 ft
- Gamma range: 15 cps
- Gamma TC: 3 sec
- SP sensitivity: 100 mv
- Resistance sensitivity: 5 ohms

## Depth vs. Meters:

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Depth (Meters)</th>
</tr>
</thead>
<tbody>
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<td>100</td>
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</tr>
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<td>700</td>
<td>240</td>
</tr>
<tr>
<td>750</td>
<td>260</td>
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</tbody>
</table>

**TD:** 380
**LITHOLOGY**

soil, lt-brn, silt, clay, unconsol

clayst, med-brn, very silty

siltst, med-gy; high clay content

clayst, dk-gy, silt silty

lignite (66.5-68)

clayst, med-gy, very silty

lignite (84-85)

clayst, med-gy

siltst, med-gy

clayst, med-gy, mod silty

lignite (139-141.5)

clayst, med-gy, mod silty

siltst, dk-gy; high clay content

clayst, dk-gy, very silty

lignite (180.5-183)

clayst, dk-gy, very silty

lignite (191.5-192.5)

siltst, med-gy

clayst, dk-gy, mod silty

siltst, med-gy

clayst, med-gy, mod silty

clayst, med-gy, very silty

clayst, dk-gy, silt silty

siltst, med-gy

clayst, dk-brn

lignite (291.5-293.5)

siltst, med-gy

sandst, med-gy, fine-grained

clayst, dk-gy, silt silty

siltst, med-gy
REMARKS:

**LITHOLOGY**

<table>
<thead>
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<th>STRIP LOG</th>
<th>DEPTH</th>
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</thead>
<tbody>
<tr>
<td>TD 505</td>
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</tbody>
</table>

- siltst, med-gy; high clay content
- clayst, dk-gy, sli silty
- clayst, dk-gy
- clayst, dk-gy, mod silty
- clayst, med-gy, very silty
- clayst, dk-gy
- clayst, dk-gy, sli silty
- sandst, med-gy, fine-grained

Logging speed: 20 ft/min
Logged depth: 505 ft
Density range: 3 cps
Gamma range: 15 cps
Gamma TC.: 3 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

**DEPTHS**

- 350 - lignite (364.5-375)
- 400 - lignite (385-386)
- 450 - lignite (424.5-429)
- 500 - lignite (364.5-375)
- 550 - lignite (385-386)
- 600 - lignite (424.5-429)
- 650 - lignite (364.5-375)
- 700 - lignite (385-386)
- 750 - lignite (424.5-429)
LOCATION: SEC. 23 T.144 N., R. 101 W., FOOTAGE LOC. 1640 ft, 2270 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company

DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: S. Christensen

REMARKS:

LITHOLOGY

- soil, med-brn, silt, clay, unconsol
- clayst, med-brn, very silty
- clayst, med-gy, sli silty
- lignite (54-55)
- lignite (56.5-58)
- clayst, lt-gy, mod silty
- lignite (99-100)
- clayst, med-gy, mod silty
- siltst, dk-gy; high clay content
- lignite (165.5-168.5)
- lignite (171.5-172.5)
- clayst, med-gy, mod silty
- siltst, med-gy
- clayst, med-gy, sli silty
- siltst, med-gy; high clay content
<table>
<thead>
<tr>
<th>Lithology</th>
<th>Depth (feet)</th>
</tr>
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<tbody>
<tr>
<td>silt, med-gy; high clay content</td>
<td>350-110</td>
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<tr>
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<td>400-120</td>
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<td>450-130</td>
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<td>clay, med-gy, mod silty</td>
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<td>lignite (500.5-505)</td>
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<td>650-170</td>
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<td>clay, med-gy, very silty</td>
<td>700-180</td>
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<td>lignite (564.5-571)</td>
<td>750-190</td>
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<td>clay, dk-gy, mod silty</td>
<td>750-210</td>
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Logging speed: 20 ft/min  
Logged depth: 599 ft  
Density range: 3 cps  
Gamma range: 15 cps  
Gamma TC: 3 sec  
Density TC: 1 sec  
SP sensitivity: 100 mv  
Resistance sensitivity: 5 ohms
### LITHOLOGY

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</tr>
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<td>40-60</td>
<td>Clayst, med-gy, mod silty lignite (16.5-18)</td>
</tr>
<tr>
<td>60-80</td>
<td>Clayst, med-gy, very silty</td>
</tr>
<tr>
<td>80-100</td>
<td>Clayst, dk-gy to dk-brn, cbncs</td>
</tr>
<tr>
<td>100-120</td>
<td>Clayst, med-gy, very silty</td>
</tr>
<tr>
<td>120-140</td>
<td>Lignite (135-137)</td>
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<tr>
<td>140-160</td>
<td>Clayst, lt-gy, mod silty</td>
</tr>
<tr>
<td>160-180</td>
<td>Siltst, med-gy</td>
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<tr>
<td>180-200</td>
<td>Clayst, med-gy, very silty</td>
</tr>
<tr>
<td>200-220</td>
<td>Lignite (180-181)</td>
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<tr>
<td>220-240</td>
<td>Siltst, dk-gy</td>
</tr>
<tr>
<td>240-260</td>
<td>Lignite (215-219)</td>
</tr>
<tr>
<td>260-280</td>
<td>Siltst, dk-gy</td>
</tr>
<tr>
<td>280-300</td>
<td>Lignite (255.5-257)</td>
</tr>
<tr>
<td>300-320</td>
<td>Lignite (258-259)</td>
</tr>
<tr>
<td>320-340</td>
<td>Siltst, med-gy; high clay content</td>
</tr>
<tr>
<td>340-360</td>
<td>Clayst, med-gy, very silty</td>
</tr>
<tr>
<td>360-380</td>
<td>Lignite (305-306)</td>
</tr>
<tr>
<td>380-400</td>
<td>Siltst, med-gy</td>
</tr>
<tr>
<td>400-401</td>
<td>Clayst, med-gy, mod silty</td>
</tr>
</tbody>
</table>

---

**Remarks:**

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 400 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SF sensitivity: 100 in
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms
REMARKS:

LITHOLOGY

clay, med-gy, mod silty

lignite (382.5-384)

clay, med-gy, very silty

Logging speed: 20 ft/min
Density range: 3 cps
Logged depth: 400 ft
Density TC: 1 sec
Gamma range: 15 cps
SP sensitivity: 100 mv
Gamma TC: 3 sec
Resistance sensitivity: 5 ohms

DEPTH

FEET

METERS

350
110
400
120
450
130
500
140
550
150
600
160
650
170
700
180
750
190
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 35**

**SHEET 1 OF 2**

<table>
<thead>
<tr>
<th>AREA</th>
<th>Three River</th>
<th>QUAD NAME</th>
<th>Squaretop Butte</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE STARTED</td>
<td>8-1-79</td>
<td>DATE COMP.</td>
<td>8-1-79</td>
</tr>
<tr>
<td>COUNTY</td>
<td>Billings</td>
<td>STATE</td>
<td>North Dakota</td>
</tr>
<tr>
<td>LOCATION: SEC. 8 T.144 N., R. 100 W., FOOTAGE LOC.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOOTAGE</td>
<td></td>
<td>TOTAL DEPTH</td>
<td>401 ft</td>
</tr>
<tr>
<td>SIZE AND BIT TYPE:</td>
<td>4-3/4 inch drag</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRILLING AGENCY:</td>
<td>Gregory Drilling Company</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRILL TYPE:</td>
<td>Rotary</td>
<td>DEPTH TO FLUID LEVEL</td>
<td>6 ft</td>
</tr>
<tr>
<td>LITHOLOGY RECORDED BY</td>
<td>M. Hudson</td>
<td>GEOPHYSICAL LOGS RECORDED BY</td>
<td>J. Wald</td>
</tr>
<tr>
<td>REMARKS:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LITHOLOGY**

- soil, med-brn, silt, unconsol
- clayst, lt-brn, mod silty
- siltst, lt-brn
- clayst, med-gy, sli silty
- siltst, med-gy; high clay content
- sandst, lt-gy, fine-grained
- clayst, med-gy, very silty
- lignite (215.5-219)
- clayst, med-gy, mod silty
- lignite (287-289)
- siltst, dk-gy; high clay content
- clayst, med-gy, mod silty
- sandst, lt-gy, calc, med-grained, well-consol
- siltst, med-gy; high clay content
**LITHOLOGY**

<table>
<thead>
<tr>
<th>Depth (Meters)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>350-400</td>
<td>Lignite (351-353.5), clayst, med-gy, very silty</td>
</tr>
<tr>
<td>400-450</td>
<td>Siltst, med-gy</td>
</tr>
<tr>
<td>450-500</td>
<td>Lignite (391-392)</td>
</tr>
</tbody>
</table>

**Log Data**

- **Logging speed**: 20 ft/min
- **Logged depth**: 400 ft
- **Density range**: 3 cps
- **Density TC**: 1 sec
- **Gamma range**: 15 cps
- **SP sensitivity**: 100 mv
- **Gamma TC**: 3 sec
- **Resistance sensitivity**: 5 ohms

**Diagram**

The diagram shows the tool responses at different depths, indicating variations in lithology and physical properties.
UNITED STATES GEOLOGICAL SURVEY
HOLE NO 36
SHEET 1 OF 2

AREA
Three River

QUAD NAME
Scairt Woman Draw

DATE STARTED
8-2-79

DATE COMP
8-2-79

COUNTY
Billings

STATE
North Dakota

LOCATION: SEC. 19 T.144 N., R. 99 W., FOOTAGE LOC.

FOOTAGE
120 ft

TOTAL DEPTH
401 ft

ELEV
2662 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

FOOTAGE LOG. 120 ft

DEPTH TO FLUID LEVEL 11 ft

REMARKS:

LITHOLOGY

Soil, med-brn, silt, clay, unconsol

Clayst, med-gy, very silty

Lignite (16.5-21)

Clayst, med-gy, mod silty

Siltst, med-gy

Sandst, lt-gy, fine-grained

Clayst, med-gy, very silty

Lignite (156-157)

Clayst, dk-gy, mod silty

Lignite (180-184)

Clayst, dk-gy, sil silty

Lignite (205.5-207.5)

Siltst, med-gy; high clay content

Lignite (244.5-246)

Clayst, med-gy, sil silty

Siltst, med-gy

Clayst, dk-gy, sil silty

Lignite (286-288)

Clayst, med-gy, mod silty

Lignite (312-313)

Clayst, lt-gy, very silty

Logging speed 20 ft/min

Density range 3 cps

Logged depth 400 ft

Gamma range 15 cps

Gamma TC 3 sec

SP sensitivity 100 mv

Resistance sensitivity 5 ohms

Depth to fluid level 11 ft

Drilling agency: Gregory Drilling Company

Drill type: Rotary
REMARKS:

LITHOLOGY

- clayst, lt-gy, very silty
- clayst, dk-brn, chnsc
- siltst, med-gy

Logging speed 20 ft/min
Logged depth 400 ft
Gamma range 15 cps
Gamma TC 1 sec
Density range 1 cps
Density TC 1 sec
SP sensitivity 100 mv
Resistivity sensitivity 5 ohms

DEPTH

FEET

METERS

350—
300—
250—
200—
150—
100—
50—
0—

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
360
370
380
390
400
410
420
430
440
450
460
470
480
490
500
510
520
530
540
550
560
570
580
590
600
610
620
630
640
650
660
670
680
690
700
710
720
730
740
750

TD 401
### Lithology

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STIP LOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>soil, med-brn, silt, clay, unconsol</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>clayst, med-brn, very silty</td>
<td>lignite (15-18)</td>
</tr>
<tr>
<td>clayst, med-gy, mod silty</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>siltst, med-gy; high clay content</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>clayst, dk-gy, sli silty</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>siltst, med-gy; high clay content</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>lignite (114.5-119.5)</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>lignite (123-126)</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>lignite (130-131.5)</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>clayst, med-gy, mod silty</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>sandst, med-gy, fine-grained</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>clayst, dk-gy, very silty</td>
<td>lignite (172-176.5)</td>
</tr>
<tr>
<td>clayst, med-gy, mod silty</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>lignite (224-225)</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>clayst, med-gy, sli silty</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>lignite (284.5-286)</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>siltst, mod-gy</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>sandst, med-gy, fine-grained</td>
<td>lignite (324-326)</td>
</tr>
<tr>
<td>clayst, med-gy, very silty</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
<tr>
<td>clayst, med-gy, sli silty</td>
<td>lignite (345-346)</td>
</tr>
<tr>
<td>lignite (354-356)</td>
<td><img src="image" alt="Lithology Diagram" /></td>
</tr>
</tbody>
</table>
REMARKS:

LITHOLOGY

clayst, med-gy, sli silty
clayst, dk-gy
sandst, med-gy, fine-grained

lignite (374-378)

Logging speed 20 ft/min
Logged depth 399 ft
Gamma range 15 cps
Gamma TC 3 sec

Density range 3 cps
Density TC 1 sec
SP sensitivity 100 mv
Resistance sensitivity 5 ohms

TD 400
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 38
SHEET 1 OF 2

UNITED STATES GEOLOGICAL SURVEY

HOLE NO 38
SHEET 1 OF 2

AREA Three River
QUAD NAME Grassy Butte SW
DATE STARTED 8-2-79
DATE COMP 8-2-79
COUNTY Billings
STATE North Dakota
LOCATION: SEC. 34 T. 144 N., R. 99 W., FOOTAGE LOC. 715 ft
FOOTAGE 160 ft
GROUND ELEV 2695 ft
SIZE AND BIT TYPE: 4-3/4 inch drag
DRILLING AGENCY: Gregory Drilling Company
LITHOLOGY RECORDED BY M. Hudson
REMARKS:

LITHOLOGY

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
</tr>
</thead>
</table>
| Soil, med-brn, silt, clay, unconsol
| Clayst, med-brn, very silty        |
| Siltst, med-gy                     |
| Clayst, dk-gy, sli silty           |
| Clayst, med-gy, mod silty          |
| Siltst, med-gy                     |
| Clayst, med-gy, very silty         |
| Siltst, med-gy                     |
| Clayst, dk-gy, mod silty           |
| Siltst, lt-gy; high clay content   |
| Clayst, dk-gy, sli silty           |
| Clayst, med-gy, sli silty          |
| Clayst, dk-brn                     |
| Siltst, med-gy                     |
| Siltst, med-gy; high clay content  |
| Clayst, med-gy, sli silty          |

1. Logging speed 20 ft/min
2. Density range 3 cps
3. Logged depth 400 ft
4. Density TC 1 sec
5. Gamma range 15 cps
6. SP sensitivity 100 mu
7. Gamma TC 3 sec
8. Resistance sensitivity 3 ohms

DEPT METERS

0 10 20 30 40 50
100 200 300 400 500

Depth

30 40 50 60 70
80 90 100 110 120

250 260 270 280 290
300 310 320 330 340

77
REMARKS:

LITHOLOGY

clayst, med-gy, sli silty

lignite (366,5-370)

clayst, med-gy, very silty

 Logging speed: 20 ft/min  Density range: 3 cps
 Lagged depth: 400 ft  Density TC: 1 sec
 Gamma range: 15 cps  SP sensitivity: 100 mv
 Gamma TC: 3 sec  Resistance sensitivity: 5 ohms
UNITED STATES GEOLOGICAL SURVEY

AREA: Three River  
QUAD NAME: Grassy Butte SE

DATE STARTED: 8-3-79  
DATE COMP: 8-3-79  
COUNTY: Billings  
STATE: North Dakota

LOCATION: SEC. 8 T.144 N., R. 98 W., FOOTAGE LOC.

FOOTAGE: 84 ft  
ROTARY: 361 ft  
CORING: ---

SIZE AND BIT TYPE: 4-3/4 inch drag  
DRILL TYPE: Rotary

DRILLING AGENCY: Gregory Drilling Company

LITHOLOGY RECORDED BY M. Hudson

REMARKS:

LITHOLOGY

- soil, med-brn, silt, clay, unconsol
- clayst, med-brn, very silty
- siltst, med-brn
- clayst, med-gy, mod silty
- lignite (50.3-53)
- clayst, med-gy, very silty
- lignite (72.5-73.5)
- clayst, dk-gy, mod silty
- lignite (91-97.5)
- clayst, med-gy, very silty
- siltst, med-gy; high clay content
- lignite (145.5-148.5)
- clayst, med-gy, sli silty
- siltst, med-gy
- clayst, dk-gy, mod silty
- lignite (237-241.5)
- clayst, lt-gy, sli silty
- lignite (274.5-275.5)
- clayst, lt-gy, sli silty
- sandst, med-gy, calc, fine-grained, well-consol
- clayst, lt-gy, sli silty
- sandst, lt-gy, calc, fine-grained, well-consol
- clayst, med-gy, mod silty
### Remarks:

- **Lithology:**
  - Clay, med-gy, mod silty

- **Logging speed:** 20 ft/min
- **Logged depth:** 360 ft
- **Density range:** 3 cps
- **Density TC:** 1 sec
- **Gamma range:** 15 cps
- **Gamma TC:** 3 sec
- **SP sensitivity:** 100 mv
- **Resistance sensitivity:** 5 ohms

<table>
<thead>
<tr>
<th>Strip Log</th>
<th>Depth</th>
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<tbody>
<tr>
<td>TD 361</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth (Meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
</tr>
<tr>
<td>400</td>
</tr>
<tr>
<td>450</td>
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<tr>
<td>500</td>
</tr>
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<td>550</td>
</tr>
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<td>600</td>
</tr>
<tr>
<td>650</td>
</tr>
<tr>
<td>700</td>
</tr>
<tr>
<td>750</td>
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DEPT
**LITHOLOGY**

<table>
<thead>
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<th>LITHOLOGY</th>
<th>DEPTH</th>
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<td>soil, med-brn, silt, clay, unconsol</td>
<td>0.00</td>
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<tr>
<td>clayst, med-gy, slt sily</td>
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<td>clayst, dk-brn, cbncs</td>
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<td>clayst, med-gy, mod sily</td>
<td>421.50</td>
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<tr>
<td>siltst, med-gy</td>
<td>421.60</td>
</tr>
<tr>
<td>clayst, med-gy, very sily</td>
<td>421.70</td>
</tr>
<tr>
<td>clayst, lt-gy, mod sily</td>
<td>421.80</td>
</tr>
<tr>
<td>siltst, med-gy</td>
<td>421.90</td>
</tr>
<tr>
<td>clayst, dk-gy, sli sily</td>
<td>422.00</td>
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<tr>
<td>clayst, lt-brn</td>
<td>422.10</td>
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<tr>
<td>clayst, med-gy, mod silty</td>
<td>422.20</td>
</tr>
<tr>
<td>clayst, med-gy, very silty</td>
<td>422.30</td>
</tr>
<tr>
<td>siltst, med-gy: high clay content</td>
<td>422.40</td>
</tr>
<tr>
<td>siltst, med-gy</td>
<td>422.50</td>
</tr>
<tr>
<td>lignite (201.5-202.5)</td>
<td>422.60</td>
</tr>
<tr>
<td>sandst, lt-gy, fine-grained</td>
<td>422.70</td>
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<tr>
<td>siltst, med-gy</td>
<td>422.80</td>
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<tr>
<td>lignite (291.5-294.5)</td>
<td>422.90</td>
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<tr>
<td>clayst, med-gy, very sily</td>
<td>423.00</td>
</tr>
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<td>siltst, med-gy</td>
<td>423.10</td>
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</tbody>
</table>

**LOGS**

- **Logging speed**: 20 ft/min
- **Density range**: 3 cps
- **Gamma range**: 15 cps
- **Resistivity sensitivity**: 100 ms
- **Gamma TC**: 3 sec
- **Resistivity sensitivity**: 5 ohms
**REMARKS:**

### LITHOLOGY

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Logged Depth (ft)</th>
<th>Density Range (cps)</th>
<th>Density TC (sec)</th>
<th>Gamma Range (cpm)</th>
<th>SP Sensitivity (mv)</th>
<th>Gamma TC (sec)</th>
<th>Resistance Sensitivity (ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay, dk-brown, cbncs</td>
<td>350</td>
<td>20</td>
<td>3</td>
<td>1</td>
<td>100</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Lignite (350.5-352)</td>
<td>420</td>
<td>15</td>
<td>3</td>
<td>3</td>
<td>100</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Silt, dk-gy</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lignite (380.5-382)</td>
<td>450</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clay, dk-gy, very silty</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silt, med-gy</td>
<td>550</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lignite (405-406)</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silt, lt-gy; high clay content</td>
<td>650</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Logging speed: 20 ft/min
Logged depth: 420 ft
Density range: 3 cps
Density TC: 1 sec
Gamma range: 15 cpm
SP sensitivity: 100 mv
Gamma TC: 3 sec
Resistance sensitivity: 5 ohms

**Diagram:**

- TD
- 421

**Graph:**

- Depth in feet from 0 to 750
- Depth in meters from 0 to 220
- Graph showing variations in density and gamma readings.
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 41**

**AREA** Three River  
**QUAD NAME** Fayette

**DATE STARTED** 8-5-79  
**DATE COMP** 8-5-79  
**COUNTY** Dunn  
**STATE** North Dakota

**LOCATION:** SEC. 12 T.144 N., R. 97 W., FOOTAGE Loc.  
**FOOTAGE:** 2218 ft  
**R.F.L.** 810 ft  
**FNL** 2218 ft  
**GROUND ELEV** 2422 ft

<table>
<thead>
<tr>
<th>SIZE AND BIT TYPE</th>
<th>DRILLING AGENCY</th>
<th>DRILL TYPE</th>
<th>DEPTH TO FLUID LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-3/4 inch drag</td>
<td>Gregory Drilling Company</td>
<td>Rotary</td>
<td>---</td>
</tr>
</tbody>
</table>

**LOCATION RECORDED BY:** L. Tomac  
**GEOPHYSICAL LOGS RECORDED BY:** J. Wald

**REMARKS:** Due to hole caving, geophysical log was run through the casing. Gamma and density were the only logs run on this hole.

**LITHOLOGY**

<table>
<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>surface</td>
<td>0</td>
</tr>
</tbody>
</table>

run number 1, density only

<table>
<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>surface</td>
<td>110 ft</td>
</tr>
</tbody>
</table>

run number 2, gamma & density

<table>
<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>silts, med-gy</td>
<td>110 ft</td>
</tr>
</tbody>
</table>

clayst, med-gy, very silty

<table>
<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>lignite (?)(96.5-98.5)</td>
<td>110 ft</td>
</tr>
</tbody>
</table>

lignite (?)(107-?)

**Gamma range:** 15 cps  
**SP sensitivity:** 333 mv  
**Gamma TC:** 3 sec  
**Resistance sensitivity:** --- ohms

**Logging speed:** 20 ft/min  
**Density range:** 3 cps  
**Logged depth:** 110 ft  
**Density TC:** 1 sec  
**Gamma range:** 15 cps  
**Resistance sensitivity:** --- ohms

**Circulation was probably lost in a fractured coal bed**
UNITED STATES GEOLOGICAL SURVEY

AREA Three River
QUAD NAME Grassy Butte SE
DATE STARTED 8-3-79 DATE COMP. 8-3-79 COUNTY Dunn STATE North Dakota
LOCATION: SEC. 18 T.144 N., R. 97 W., FOOTAGE LOC. 40 ft FSL 2610 ft FWL GROUND ELEV 2424 ft
SIZE AND BIT TYPE: 4-3/4 inch drag FOOTAGE ROTARY 380 ft CORING --- TOTAL DEPTH 380 ft
DRILLING AGENCY: Gregory Drilling Company DRILL TYPE: Rotary DEPTH TO FLUID LEVEL 4 ft
LITHOLOGY RECORDED BY S. Christensen GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

soil, med-brn, sand, silt, unconsol
siltst, med-gy
clayst, med-gy, sl* siltst
siltst, lt-gy
sandst, med-gy, fine-grained
lignite (29.5-31.5)

lignite (138-139)
siltst, med-gy
lignite (181.5-188.5)
clayst, dk-brn, cbnca, sl* siltst
clayst, med-gy, mod siltst
lignite (201.5-203)
clayst, med-gy, very siltst
lignite (210.5-212.5)
sandst, med-gy, calc, fine-grained
clayst, dk-gy, mod siltst
lignite (257-259.5)
siltst, med-gy, high clay content
lignite (275-277)
siltst, med-gy
sandst, med-gy, fine-grained
clayst, med-gy, mod siltst
LITHOLOGY

clayst, med-gy, mod silty
sandst, med-gy, fine-grained
claysi, lt-gy, very silty

Logging speed: 20 ft/min
Logged depth: 380 ft
Gamma range: 15 cps
Gamma T.C.: 3 sec

Density range: 3 cps
Density T.C.: 1 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

DEPTH

FEET

METERS

350—
380—
400—
450—
500—
550—
600—
650—
700—
750—
850—

### Remarks:

- **Lithology**
  - Clayst, med-gy, very silty
  - Lignite (364.5-365.5)
  - Clayst, med-gy, sli silty

### Lithology Log

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Density (cps)</th>
<th>Gamma TC (sec)</th>
<th>Resistance Sensitivity (ohm-m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>380</td>
<td>3</td>
<td>100</td>
<td>5</td>
</tr>
</tbody>
</table>

Logging speed: 20 ft/min
Logged depth: 380 ft
Gamma range: 15 cps

---

### Diagram

- TD 381
- Depth scale: 350-750 feet/meters
- Depth markers: 350, 400, 450, 500, 550, 600, 650, 700, 750 feet/meters

---

- **Density Range**: 3 cps
- **Gamma TC**: 3 sec
- **SP Sensitivity**: 100 mV
- **Resistance Sensitivity**: 5 ohm-m
**LOCATION**: SEC. 12 T.144 N., R. 96 W., FOOTAGE LOC.

**SIZE AND BIT TYPE**: 4-3/4 inch drag

**DRILLING AGENCY**: Gregory Drilling Company

**LITHOLOGY RECORDED BY**: S. Christensen

**LITHOLOGY**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>(20 \text{ ft/min})</th>
<th>(3 \text{ cps})</th>
</tr>
</thead>
</table>

|DEPTH| \(360 \text{ ft}\) | \(1 \text{ sec}\) |

|DEPTH| \(15 \text{ cps}\) | \(100 \text{ mV}\) |

|DEPTH| \(3 \text{ sec}\) | \(5 \text{ ohms}\) |

---

**REMARKS**

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 360 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mV
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms
<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>siltst, med-gy</td>
<td>TD 360</td>
<td></td>
</tr>
</tbody>
</table>

| Logging speed | 20 ft/min |
| Density range | 3 cps |
| Logged depth | 360 ft |
| Density TC | 1 sec |
| Gamma range | 15 cps |
| SP sensitivity | 100 mv |
| Gamma TC | 3 sec |
| Resistance sensitivity | 5 ohms |

<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>
</tr>
<tr>
<td>450</td>
<td>130</td>
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<td>500</td>
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<td>550</td>
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<td>600</td>
<td>160</td>
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<tr>
<td>650</td>
<td>170</td>
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<tr>
<td>700</td>
<td>180</td>
</tr>
<tr>
<td>750</td>
<td>200</td>
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**UNITED STATES GEOLOGICAL SURVEY**

**AREA**
Three River

**DATE STARTED**
8-7-79

**DATE COMP.**
8-7-79

**QUAD NAME**
Killdeer

**COUNTY**
Dunn

**STATE**
North Dakota

**LOCATION:** SEC. 22 T.144 N., R. 96 W., FOOTAGE LOC. 10 ft

**FOOTAGE:**
FNL 132 ft XXX

**GROUND ELEV.**
2350 ft

**TOTAL DEPTH:**
631 ft

**SIZE AND BIT TYPE:**
4-3/4 inch drag

**DRILLING AGENCY:**
Gregory Drilling Company

**DRILL TYPE:**
Rotary

**DEPTH TO FLUID LEVEL:**
19 ft

**LITHOLOGY RECORDED BY:**
M. Hudson

**GEOPHYSICAL LOGS RECORDED BY:**
J. Wald

**REMARKS:**

---

**LITHOLOGY**

<table>
<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
<th>FEET</th>
<th>METERS</th>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>siltst, med-brn; high clay content</td>
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<tr>
<td>sandst, lt-brn, fine-grained</td>
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<tr>
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<td>lignite (218.5-220)</td>
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<td>lignite (272-273.5)</td>
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<td>100</td>
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## REMARKS:

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<td>siltst, dk-gy; high clay content</td>
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<td>lignite (457-458)</td>
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<td>sandst, med-gy, fine-grained</td>
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<td>lignite (524.5-528.5)</td>
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<tr>
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<td>clayst, med-gy, sili silty</td>
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</tr>
<tr>
<td>lignite (607-614)</td>
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</tbody>
</table>

**LOGGING:**
- **Logging speed:** 20 ft/min
- **Density range:** 3 cps
- **Gamma range:** 15 cps
- **Gamma TC:** 3 sec
- **SP sensitivity:** 100 mV
- **Resistivity sensitivity:** 5 ohms

**DEPT**

<table>
<thead>
<tr>
<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
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<tr>
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<tr>
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<td>600</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>
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</tbody>
</table>

**TD 631**
**UNITED STATES GEOLOGICAL SURVEY**

**AREA** Three River  
**DATE STARTED** 8-7-79  
**DATE COMP** 8-7-79  
**QUAD NAME** Killdeer  
**COUNTY** Dunn  
**STATE** North Dakota  

**LOCATION**  
- **SEC.** 30  
- **T.** 144 N, **R.** 95 W, **FOOTAGE LOC.**  

**FOOTAGE**  
- **FNL** 1660 ft  
- **FEL** 820 ft  
- **GROUND ELEV** 2286 ft  
- **TOTAL DEPTH** 340 ft  
- **DEPTH TO FLUID LEVEL** 1 ft  

**SIZE AND BIT TYPE** 4-3/4 inch drag  

**DRILLING AGENCY** Gregory Drilling Company  
**DRILL TYPE** Rotary  

**LITHOLOGY RECORDED BY** S. Christensen  
**GEOPHYSICAL LOGS RECORDED BY** J. Wald  

**REMARKS**  
- Logging speed: 20 ft/min  
- Density range: 3 cps  
- Density TC: 1 sec  
- Gamma range: 15 cps  
- SP sensitivity: 100 mv  
- Gamma TC: 3 sec  
- Resistance sensitivity: 5 ohms  

**LITHOLOGY**  

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<tbody>
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<td>340</td>
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</table>

<table>
<thead>
<tr>
<th>Soil, med-brn, silt, clay, unconsol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Logging speed</strong> 20 ft/min</td>
</tr>
<tr>
<td><strong>Density range</strong> 3 cps</td>
</tr>
<tr>
<td><strong>Density TC</strong> 1 sec</td>
</tr>
<tr>
<td><strong>Gamma range</strong> 15 cps</td>
</tr>
<tr>
<td><strong>SP sensitivity</strong> 100 mv</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Siltst, med-brn, high clay content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lignite (23-26)</strong></td>
</tr>
<tr>
<td><strong>Logging speed</strong> 20 ft/min</td>
</tr>
<tr>
<td><strong>Density range</strong> 3 cps</td>
</tr>
<tr>
<td><strong>Density TC</strong> 1 sec</td>
</tr>
<tr>
<td><strong>Gamma range</strong> 15 cps</td>
</tr>
<tr>
<td><strong>SP sensitivity</strong> 100 mv</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clayst, med-gy, very silty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lignite (111-113)</strong></td>
</tr>
<tr>
<td><strong>Lignite (114-117)</strong></td>
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<tr>
<td><strong>Logging speed</strong> 20 ft/min</td>
</tr>
<tr>
<td><strong>Density range</strong> 3 cps</td>
</tr>
<tr>
<td><strong>Density TC</strong> 1 sec</td>
</tr>
<tr>
<td><strong>Gamma range</strong> 15 cps</td>
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<tr>
<td><strong>SP sensitivity</strong> 100 mv</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Clayst, med-gy, siltst, med-gy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lignite (138-142.5)</strong></td>
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<tr>
<td><strong>Lignite (151.5-152.5)</strong></td>
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<td><strong>Lignite (157-158)</strong></td>
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<tr>
<td><strong>Lignite (165-166)</strong></td>
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<td><strong>Lignite (168-173)</strong></td>
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<tr>
<td><strong>Lignite (175-179)</strong></td>
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<tr>
<td><strong>Logging speed</strong> 20 ft/min</td>
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<tr>
<td><strong>Density range</strong> 3 cps</td>
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<td><strong>Density TC</strong> 1 sec</td>
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<td><strong>Gamma range</strong> 15 cps</td>
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<tr>
<td><strong>SP sensitivity</strong> 100 mv</td>
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<table>
<thead>
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<th>Siltst, med-gy</th>
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<tbody>
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<td><strong>Lignite (204-205)</strong></td>
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<tr>
<td><strong>Logging speed</strong> 20 ft/min</td>
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<tr>
<td><strong>Density range</strong> 3 cps</td>
</tr>
<tr>
<td><strong>Density TC</strong> 1 sec</td>
</tr>
<tr>
<td><strong>Gamma range</strong> 15 cps</td>
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<tr>
<td><strong>SP sensitivity</strong> 100 mv</td>
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<table>
<thead>
<tr>
<th>Clayst, med-gy, siltst, med-gy</th>
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<tbody>
<tr>
<td><strong>Lignite (242.5-243.5)</strong></td>
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<tr>
<td><strong>Logging speed</strong> 20 ft/min</td>
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<tr>
<td><strong>Density range</strong> 3 cps</td>
</tr>
<tr>
<td><strong>Density TC</strong> 1 sec</td>
</tr>
<tr>
<td><strong>Gamma range</strong> 15 cps</td>
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<td><strong>SP sensitivity</strong> 100 mv</td>
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<table>
<thead>
<tr>
<th>Clayst, med-gy, mod silty</th>
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<tbody>
<tr>
<td><strong>Lignite (286-287)</strong></td>
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<tr>
<td><strong>Logging speed</strong> 20 ft/min</td>
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<tr>
<td><strong>Density range</strong> 3 cps</td>
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<tr>
<td><strong>Density TC</strong> 1 sec</td>
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<td><strong>Gamma range</strong> 15 cps</td>
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<tr>
<td><strong>SP sensitivity</strong> 100 mv</td>
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<table>
<thead>
<tr>
<th>Clayst, med-gy, mod silty</th>
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<tbody>
<tr>
<td><strong>Lignite (314-315)</strong></td>
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<tr>
<td><strong>Density TC</strong> 1 sec</td>
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<td><strong>Gamma range</strong> 15 cps</td>
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<tr>
<td><strong>SP sensitivity</strong> 100 mv</td>
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</table>
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 47
SHEET 1 OF 2

AREA Three River
QUAD NAME Werner

DATE STARTED 8-17-79
DATE COMP 8-17-79
COUNTY Dunn
STATE North Dakota

LOCATION: SEC. 28 T. 144 N, R. 93 W., FOOTAGE LOC. 25 ft

FOOTAGE

TOTAL DEPTH 401 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY L. Tomac
GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Logging speed</th>
<th>Density range</th>
<th>Density TC</th>
<th>Gamma range</th>
<th>Gamma TC</th>
<th>SP sensitivity</th>
<th>Resistance sensitivity</th>
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<td>3 cps</td>
<td>1 sec</td>
<td>15 cps</td>
<td>3 sec</td>
<td>100 mv</td>
<td>5 ohms</td>
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**LITHOLOGY**

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** Logging Speed:** 20 ft/min  
**Logged depth:** 400 ft  
**Density range:** 3 cps  
**Density TC:** 1 sec  
**Gamma range:** 15 cps  
**Gamma TC:** 3 sec  
**SP sensitivity:** 100 mv  
**Resistance sensitivity:** 5 ohms  

**DEPTH**

- 350 ft (110 m)
- 400 ft (120 m)
- 450 ft (130 m)
- 500 ft (150 m)
- 550 ft (160 m)
- 600 ft (180 m)
- 650 ft (190 m)
- 700 ft (200 m)
- 750 ft (220 m)
# United States Geological Survey

**Area:** Three River  
**Quad Name:** Marshall  
**Date Started:** 8-15-79  
**Date Comp:** 8-15-79  
**County:** Dunn  
**State:** North Dakota

**Location:** Sec. 32, T.144 N., R. 91 W., Footage Loc. 1580 ft

**Size and Bit Type:** 4-3/4 inch drag  
**Drilling Agency:** Gregory Drilling Company  
**Drill Type:** Rotary  
**Logging Agency:** S. Christensen  
**Geophysical Logs Recorded By:** J. Wald

**Remarks:**

## Lithology

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<tr>
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<th>Density Range (cps)</th>
<th>SP Sensitivity (mV)</th>
<th>Resistance Sensitivity (ohms)</th>
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**Footage Log:**

- Total Depth: 460 ft
- Depth to Fluid Level: 6 ft
**REMARKS:**

**LITHOLOGY**

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- Clayst, med-gy, mod silty
- Siltst, med gy
- Lignite (395-398)
- Clayst, lt-gy, very silty
- Siltst, med-gy; high clay content

Logging speed: 20 ft/min
Logged depth: 460 ft
Density range: 3 cps
Density TC: 1 sec
Gamma range: 15 cps
SP sensitivity: 100 mv
Gamma TC: 3 sec
Resistance sensitivity: 12.5 ohms

TD: 460
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 49
SHEET 1 OF 2

AREA
Three River

DATE STARTED
7-25-79

DATE COMP.
7-25-79

QUAD NAME
Roosevelt Creek East

LOCATION: SEC. 7 T.143 N., R. 101 W., FOOTAGE LOC.
30 ft

FOOTAGE
FSL
1120 ft

TOTAL
XX

ELEV
2415 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

FOOTAGE
ROTARY 500 ft
CORING ---

TOTAL DEPTH
500 ft

COUNTY
Billings

STATE
North Dakota

DRILLING AGENCY: Gregory Drilling Company

DRILL TYPE: Rotary

DEPTH TO FLUID LEVEL
12 ft

LITHOLOGY RECORDED BY M. Hudson

GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

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- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 499 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO: 50**

**SHEET 1 OF 2**

**AREA:** Three River  
**QUAD NAME:** Gorham NW

**DATE STARTED:** 7-25-79  
**DATE COMP:** 7-25-79  
**COUNTY:** Billings  
**STATE:** North Dakota

**LOCATION-SEC:** 15 T, 143 N., R. 101 W., FOOTAGE LOC.  
**FNL:** 630 ft  
**FEL:** 1170 ft  
**GROUND ELEV:** 2425 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag  
**FOOTAGE:** 1170 ft  
**TOTAL DEPTH:** 505 ft

**DRILLING AGENCY:** Gregory Drilling Company  
**DRILL TYPE:** Rotary  
**DEPTH TO FLUID LEVEL:** 5 ft

**LITHOLOGY RECORDED BY:** M. Hudson  
**GEOPHYSICAL LOGS RECORDED BY:** J. Wald

**REMARKS:**

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**Logging speed:** 20 ft/min  
**Density range:** 3 cps  
**Gamma range:** 15 cps  
**Gamma TC:** 3 sec  
**Resistivity sensitivity:** 5 ohms
REMERS:

LITHOLOGY

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clay, med-gy, very silty
lignite (357.5-364.5)
clay, med-gy, mod silty
clay, med-gy, sli silty
sandst, med-gy, fine-grained
= calc, well-consol
clay, med-brn
lignite (397.5-400.5)
clay, med-gy, very silty
lignite (402-403.5)
clay, med-gy, mod silty
siltst, lt-gy
clay, dk-gy, mod silty
lignite (455.5-459)
clay, lt-gy, mod silty
siltsc, med-gy
LITHOLOGY

soil, med-brn, sand, silt, clay, unconsol

siltst, med-gy

clayst, lt-gy, very silt

sandst, lt-gy, fine-grained, calc

clayst, med-gy, sili silt

clayst, dk-gy, sili silt

clayst, dk-gy, sili silt

siltst, med-gy; high clay content

clayst, med-gy, mod silt

siltst, med-gy

clayst, dk-gy, very silt

siltst, med-gy

sandst, med-gy, fine-grained
LITHOLOGY

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- sandst, med-gy, fine-grained
- clayst, med-gy, very silty
- siltst, med-gy
- sandst, lt-gy, fine-grained

Logging speed 20 ft/min  
Logged depth 339 ft  
Density range 3 cps  
Density T.C. 1 sec  
Gamma range 15 cps  
Gamma T.C. 3 sec  
SP sensitivity 100 mV  
Resistance sensitivity 5 ohms
**UNITED STATES GEOLOGICAL SURVEY**

**AREA** Three River  | **DATE STARTED** 7-26-79  | **QUAD NAME** Gorham  | **DATE COMP** 7-26-79  | **COUNTY** Billings  | **STATE** North Dakota

**LOCATION** SEC. 34 T. 144 N., R. 100 W., FOOTAGE LOC. 528 ft | **FOOTAGE** LOC. 70 ft | **GROUND ELEV** 2665 ft

**SIZE AND BIT TYPE** 4-3/4 inch drag

**DRILLING AGENCY** Gregory Drilling Company

**LITHOLOGY RECORDED BY** S. Christensen

**REMARKS**

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<th>STRIP LOG</th>
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<td>lignite (347-351)</td>
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**LOGGING SPEED** 20 ft/min  | **Density range** 3 cps  | **Gamma range** 15 cps  | **Density TC** 3 sec  | **Gamma TC** 3 sec  | **SP sensitivity** 100 mv  | **Resistance sensitivity** 5 ohms

**DRILL TYPE** Rotary

**GEOPHYSICAL LOGS RECORDED BY** J. Wald

**FOOTAGE TOTAL** ROTARY 420 ft | DEPTH TO FLUID LEVEL 84 ft

**Lithology Diagram**

- Soil, median brown, silt, clay, unconsolidated
- Claystone, light brown, silt, silty
- Siltstone, median brown
- Claystone, median gray, very silty
- Sandstone, median gray, medium-grained, calcareous, well-consolidated
- Claystone, median gray, moderately silty
- Lignite (169-170.5)
- Claystone, median gray, very silty
- Siltstone, median gray
- Lignite (272-274.5)
- Claystone, light gray, very silty
- Siltstone, median gray
- Lignite (347-351)
**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>SHMT LOG</th>
<th>DEPTH</th>
</tr>
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<tbody>
<tr>
<td>clayst, med-brn</td>
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<tr>
<td>lignite (347-351)</td>
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<tr>
<td>lignite (356-357.5)</td>
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<td>lignite (381.5-385)</td>
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<tr>
<td>sandst, lt-gy, fine-grained, calc</td>
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</table>

- **Logging speed:** 20 ft/min
- **Density range:** 3 cps
- **Logged depth:** 419 ft
- **Density TC:** 1 sec
- **Gamma range:** 15 cps
- **SP sensitivity:** 100 mv
- **Gamma TC:** 3 sec
- **Resistance sensitivity:** 5 ohms

**TD:** 420
UNITED STATES GEOLOGICAL SURVEY

AREA  Three River
QUAD NAME  Gorham NW

DATE STARTED  7-26-79
DATE COMP.  7-26-79
COUNTY  Billings
STATE  North Dakota

LOCATION: SEC. 18 T.143 N., R.100 W., FOOTAGE LOC. 2530 ft
FOOTAGE 2305 ft
GROUND ELEV. 2735 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY M. Hudson
GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

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<tr>
<th>STRIP</th>
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<tbody>
<tr>
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<tr>
<td>sandst, lt-brn, fine-grained</td>
<td></td>
</tr>
<tr>
<td>siltst, med-brn</td>
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<tr>
<td>sandst, med-gy, fine-grained</td>
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<tr>
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<td>siltst, med-gy</td>
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<tr>
<td>clayst, med-gy, very silty</td>
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<td>lignite (158-159.5)</td>
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<td>clayst, med-gy, mod silty</td>
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<td>clayst, med-gy, very silty</td>
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<td>lignite (288-292)</td>
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<td>clayst, med-gy, sli silty</td>
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LOGGING SPEED: 20 ft/min
CERSTY RANGE: 3 cps
GAMMA RANGE: 15 cps
SP SENSITIVITY: 100 mv
GAMMA TC: 1 sec
RESISTANCE SENSITIVITY: 5 ohms

DEPTH TO TD: 301 ft
FLUID LEVEL: 11 ft

SIGNIFICANT DEPTHS:
- 500 ft
- 1000 ft
- 1500 ft
- 2000 ft
- 2500 ft
- 3000 ft
- 3500 ft

FOOTAGE TOTAL: 301 ft

TOTAL DEPTH: 301 ft
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO. 54A**

**SHEET 1 OF 1**

---

**AREA:** Three River  
**QUAD NAME:** Gorham

---

**DATE STARTED:** 7-26-79  
**DATE COMP:** 7-26-79  
**COUNTY:** Billings  
**STATE:** North Dakota

---

**LOCATION:** Sec. 25 T.143 N., R. 100 W., Footage Loc.  
**FOOTAGE:** 405 ft  
**GROUND ELEV:** 140 ft  
**TOTAL ELEV:** 2695 ft

---

**SIZE AND BIT TYPE:** 4-3/4 inch drag  
**DRILLING AGENCY:** Gregory Drilling Company  
**DRILL TYPE:** Rotary

---

**LITHOLOGY:**
- Soil, lt-brn, clay, silt, unconsol
- Siltst, med-gy; high clay content
- Clayst, med-gy, mod silty
- Sandst, lt-gy, fine-grained
- No return, probably sandst

---

**REMARKS:** Hole abandoned at 100 ft due to complete loss of circulation.  
No geophysical log run on this hole.

---

**LITHOLOGY**

<table>
<thead>
<tr>
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<th>STRIP LOG</th>
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<tbody>
<tr>
<td>Soil, lt-brn, clay, silt, unconsol</td>
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<td>Clayst, med-gy, mod silty</td>
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<td>Sandst, lt-gy, fine-grained</td>
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<td>No return, probably sandst</td>
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**DEPTH**

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---

**LOGGING SPEED:** --- ft/min  
**DENSITY RANGE:** --- cps  
**LOGGED DEPTH:** ---  
**DENSITY TC:** --- sec  
**GAMMA RANGE:** --- cps  
**SP SENSITIVITY:** --- mv  
**GAMMA TC:** --- sec  
**RESISTANCE SENSITIVITY:** --- ohms
**United States Geological Survey**

**Area:** Three River  
**Quad Name:** Gorham  
**Date Started:** 7-26-79  
**Date Comp.:** 7-26-79  
**County:** Billings  
**State:** North Dakota

**Location:** Sec. 25, T.143 N., R.100 W., Footage Loc. 1000 ft  
**Footage:** 85 ft  
**Total Depth:** 380 ft  
**Ground Elevation:** 3672 ft

**Size and Bit Type:** 4-3/4 inch drag  
**Rotary:** 380 ft  
**Coring:** ---  
**Drilling Agency:** Gregory Drilling Company  
**Drill Type:** Rotary  
**Depth to Fluid Level:** 3 ft

**Lithology Recorded By:** M. Hudson  
**Geophysical Logs Recorded By:** J. Wald

**Remarks:**

<table>
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<tr>
<th>Lithology</th>
<th>Strip Log</th>
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<td>Clayst, med-brn, very silty</td>
<td><img src="image" alt="strip log" /></td>
</tr>
<tr>
<td>Sandst, lt-brn, fine-grained</td>
<td><img src="image" alt="strip log" /></td>
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<tr>
<td>Clayst, med-gy, very silty</td>
<td><img src="image" alt="strip log" /></td>
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<tr>
<td>Siltst, med-gy</td>
<td><img src="image" alt="strip log" /></td>
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<tr>
<td>Clayst, lt-gy, very silty</td>
<td><img src="image" alt="strip log" /></td>
</tr>
<tr>
<td>Siltst, med-gy; high clay content</td>
<td><img src="image" alt="strip log" /></td>
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<tr>
<td>Clayst, med-gy, very silty</td>
<td><img src="image" alt="strip log" /></td>
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<td>Lignite (226.5-227.5)</td>
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<td>Lignite (236-237.5)</td>
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<td>Lignite (240.5-241.5)</td>
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<td>Clayst, med-gy, very silty</td>
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<tr>
<td>Siltst, med-gy</td>
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<td>Lignite (287-290)</td>
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<td>Lignite (313-314.5)</td>
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<td>Clayst, med-gy, very sily</td>
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<tr>
<td>Lignite (332-333.5)</td>
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<tr>
<td>Siltst, lt-gy</td>
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</table>

**Logging Speed:** 20 ft/min  
**Density range:** 1200-1250 kg/m³  
**Density TC:** 1 sec  
**Gamma range:** 15 cps  
**SP sensitivity:** 100 mV  
**Gamma TC:** 3 sec  
**Resistance sensitivity:** 5 ohms
**LITHOLOGY**

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<th>DEPTH</th>
<th>LITHOLOGY</th>
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<tbody>
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<td>450</td>
<td>lignite (362.5-367.5)</td>
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<tr>
<td>500</td>
<td>clayst, med-gy, mod silty</td>
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** REMARKS:**

- **Logging speed:** 20 ft/min
- **Density range:** 3 cps
- **Logged depth:** 380 ft
- **Density TC:** 1 sec
- **Gamma range:** 15 cps
- **SP sensitivity:** 100 mv
- **Gamma TC:** 3 sec
- **SP sensitivity:** 5 ohms

**DEPTH**

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<th>METERS</th>
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<td>750</td>
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**TD:** 380
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 55
SHEET 1 OF 2

AREA Three River
QUAD NAME Gorham
DATE STARTED 7-26-79
DATE COMP. 7-26-79
COUNTY Billings
STATE North Dakota

LOCATION: SEC. 8 T.143 N., R. 99 W., FOOTAGE LOC.

FOOTAGE TOTAL
108 ft FSL 6 ft FWL GROUND
102 ft ELEV 2778 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company

DEPTH TO FLUID LEVEL 24 ft

LITHOLOGY RECORDED BY M. Hudson

GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

Logging speed 20 ft/min
Logged depth 400 ft
Density range 3 cps
Gamma range 15 cps
Gamma TC 3 sec
SP sensitivity 100 nV
Density TC:
Resistance sensitivity 5 ohms

soil, med-brn, sand, silt, unconsol
sandst, med-brn, fine-grained
siltst, med-gY; high clay content
clayst, dk-gY, mod sily
siltst, med-gY
clayst, med-gY, very sily
siltst, med-gY
lignite (18.5-22)
siltst, med-gY
clayst, dk-gY, sli sily
lignite (78.5-79.5)
clayst, med-gY
lignite (109.5-112)
clayst, med-gY
siltst, med-gY
lignite (335.5-336.5)
siltst, med-gY
lignite (337.5-341)
sandst, lt-gY, fine-grained
clayst, med-gY, very sily
siltst, med-gY
siltst, med-gY
**REMARKS:**

### LITHOLOGY

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<thead>
<tr>
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<th>Depth (ft/meters)</th>
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<td>lignite (376.5-379.5)</td>
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<td>lignite (383.5-384.5)</td>
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</table>

**Logging speed:** 20 ft/min  
**Logged depth:** 400 ft  
**Gamma range:** 15 cps  
**Gamma TC:** 3 sec  
**SP sensitivity:** 100 mV  
**Resistance sensitivity:** 5 ohms  

**Logging speed:** 20 ft/min  
**Density range:** 3 cps  
**Density TC:** 1 sec  
**Logged depth:** 400 ft  
**SP sensitivity:** 100 mV  
**Gamma TC:** 3 sec  
**Resistance sensitivity:** 5 ohms  

**TD:** 401
**LOCATION: SEC. 27 T.143 N., R. 99 W., FOOTAGE LOC.**

- **FOOTAGE**: 50 ft FNL, 2580 ft MAX
- **GROUND ELEV**: 2798 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag

**DRILLING AGENCY:** Gregory Drilling Company

**LITHOLOGY RECORDED BY:** L. Tomac

**REMARKS:**

- **LITHOLOGY:**
  - Soil, med-brn, sand, silt, unconsol
  - Sandst, lt-gy, med-grained, calc, well-consol
  - Siltst, med-gy; high clay content
  - Sandst, med-brn, fine-grained
  - Lignite (135-137)
  - Siltst, med-gy
  - Clayst, med-gy, mod silty
  - Lignite (196.5-201.5)
  - Clayst, dk-gy, very silty
  - Lignite (229.5-231.5)
  - Clayst, med-gy, mod silty
  - Siltst, lt-gy
  - Clayst, lt-gy, sli silty
  - Sandst, med-gy, fine-grained, calc, well-consol
  - Clayst, med-gy, sli silty
REMARKS:

LITHOLOGY

clayst, med-gy, sli silty
clayst, med-gy, mod silty
siltst, med-gy
clayst, dk-gy, mod silty
clayst, med-gy, sli silty
clayst, mod-gy, sli silty
sandst, med-gy, fine-grained
clayst, dk-gy, sli silty
clayst, med-gy, sli silty

Logged depth: 499 ft
Gamma range: 15 cps
Log: Dens.TC: 1 sec
Gamma T.C.: 3 sec

Log speed: 20 ft/min
Density range: 3 cps
SP sensitivity: 100 mv

Resistance sensitivity: 5 ohms

Logged depth: 499 ft Density T.C. 1 sec
Gamma range: 15 cps SP sensitivity: 100 mv
Gamma T.C.: 3 sec Resistance sensitivity: 5 ohms

Log speed: 20 ft/min Density range: 3 cps
Logged depth: 499 ft Density T.C.: 1 sec
Gamma range: 15 cps SP sensitivity: 100 mv
Gamma T.C.: 3 sec Resistance sensitivity: 5 ohms
**UNITED STATES GEOLOGICAL SURVEY**

**AREA** Three River  
**DATE STARTED** 8-2-79  
**DATE COMP.** 8-2-79  
**QUAD NAME** Fairfield  
**LOCATION-SEC.** 6 T.143 N., R. 98 W., FOOTAGE LOC.  
**FOOTAGE** 90 ft  
**TOTAL ELEV.** 2528 ft  
**GROUND ELEV.**  
**SIZE AND BIT TYPE:** 4-3/4 inch drag  
**DEPTH TO FLUID LEVEL** 5 ft  
**DRILLING AGENCY:** Gregory Drilling Company  
**DRILL TYPE:** Rotary  
**COUNTY** Billings  
**STATE** North Dakota  
**REMARKS:**

### LITHOLOGY

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<thead>
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<th>DEPTH</th>
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<td>sandst, med-gy, fine-grained</td>
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<td>clayst, med-gy, very silty</td>
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<td>lignite (108.5-109.5)</td>
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**Logging speed:** 20 ft/min  
**Density range:** 3 cps  
**Logged depth:** 550 ft  
**Density TC:** 1 sec  
**Gamma range:** 15 cps  
**SP sensitivity:** 100 mV  
**Gamma TC:** 3 sec  
**Resistance sensitivity:** 5 kN/s
## REMARKS:

### LITHOLOGY

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- **Logging speed**: 20 ft/min
- **Density range**: 3 cps
- **Logged depth**: 550 ft
- **Density TC**: 1 sec
- **Gamma range**: 15 cps
- **SP sensitivity**: 100 mV
- **Gamma TC**: 3 sec
- **Resistance sensitivity**: 5 ohms

<table>
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<tr>
<th>Lithology</th>
<th>Range</th>
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<tr>
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<td>(355.5-356.5)</td>
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<tr>
<td>Clay, dk-&lt;i&gt;gy&lt;/i&gt;, very silty</td>
<td>(372-373.5)</td>
</tr>
<tr>
<td>Clay, dk-&lt;i&gt;gy&lt;/i&gt;, mod silty</td>
<td>(380.5-384.5)</td>
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<tr>
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<td>(392-395.5)</td>
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<tr>
<td>Sand, med-&lt;i&gt;gy&lt;/i&gt;, fine-grained</td>
<td></td>
</tr>
<tr>
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<td>(438-440.5)</td>
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<tr>
<td>Silt, med-&lt;i&gt;gy&lt;/i&gt;</td>
<td>(447-448)</td>
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<td>(474-479)</td>
</tr>
<tr>
<td>Clay, med-&lt;i&gt;gy&lt;/i&gt;, mod silty</td>
<td>(503-504)</td>
</tr>
<tr>
<td>Clay, dk-&lt;i&gt;gy&lt;/i&gt;, silty</td>
<td>(512.5-516)</td>
</tr>
<tr>
<td>Clay, med-&lt;i&gt;gy&lt;/i&gt;, silty</td>
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**TD**: Total Depth
### LITHOLOGY

<table>
<thead>
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<th>Depth</th>
<th>Lithology Description</th>
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<tbody>
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<td>75-100</td>
<td>Lignite (22-23)</td>
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<tr>
<td>100-150</td>
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<tr>
<td>150-200</td>
<td>Sandst, med-gy, fine-grained, calc, well-consol</td>
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<td>200-250</td>
<td>Siltst, med-gy</td>
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<tr>
<td>250-300</td>
<td>Clayst, med-gy, sili sily</td>
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<tr>
<td>300-350</td>
<td>Lignite (89-90.5)</td>
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<td>400-450</td>
<td>Siltst, med-gy</td>
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<tr>
<td>450-500</td>
<td>Clayst, med-gy, mod sily</td>
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<td>500-550</td>
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<td>650-700</td>
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<td>700-750</td>
<td>Lignite (212.5-214.5)</td>
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<td>750-800</td>
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<td>Lignite (261-265)</td>
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<td>Lignite (280-281)</td>
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<td>Lignite (294-295.5)</td>
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<td>Clayst, med-gy, sili sily</td>
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<tr>
<td>1150-1200</td>
<td>Lignite (345-346)</td>
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REMARKS:

LITHOLOGY

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<tr>
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<td>clayst, lt-gy, silt silty</td>
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Logging speed: 20 ft/min
Logged depth: 420 ft
Density range: 3 cps
Logged density: 420 ft
Density TC: 1 sec
Gamma range: 15 cps
SP sensitivity: 100 mv
Gamma TC: 3 sec
Resistance sensitivity: 5 ohms

Depth

FEET METERS
350 110
400 120
450 130
500 140
550 150
600 160
650 170
700 180
750 190

TD 420
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 59
SHEET 1 OF 2

<table>
<thead>
<tr>
<th>AREA</th>
<th>Three River</th>
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<tbody>
<tr>
<td>QUAD NAME</td>
<td>Hungry Man Butte</td>
</tr>
<tr>
<td>DATE STARTED</td>
<td>8-2-79</td>
</tr>
<tr>
<td>DATE COMP</td>
<td>8-2-79</td>
</tr>
<tr>
<td>COUNTY</td>
<td>Billings</td>
</tr>
<tr>
<td>STATE</td>
<td>North Dakota</td>
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<td>LOCATION:SEC.</td>
<td>T.143 N., R. 98 W., FOOTAGE LOC.</td>
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<tr>
<td>FOOTAGE</td>
<td>70 ft</td>
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<td>FSL</td>
<td>2550 ft</td>
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<td>FEL</td>
<td>2681 ft</td>
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<tr>
<td>GROUND ELEV</td>
<td>2681 ft</td>
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<tr>
<td>SIZE AND BIT TYPE</td>
<td>4-3/4 inch drag</td>
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<tr>
<td>DRILLING AGENCY</td>
<td>Gregory Drilling Company</td>
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<tr>
<td>DRILL TYPE</td>
<td>Rotary</td>
</tr>
<tr>
<td>LITHOLOGY RECORDED BY</td>
<td>M. Hudson</td>
</tr>
<tr>
<td>GEOPHYSICAL LOGS RECORDED BY</td>
<td>J. Wald</td>
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<tr>
<td>REMARKS:</td>
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LITHOLOGY

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<th>Description</th>
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<td>400-1000</td>
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<tr>
<td>1000-1500</td>
<td>sandst, med-gy, fine-grained</td>
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<tr>
<td>2500-3000</td>
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<td>3000-3500</td>
<td>lignite (156-157)</td>
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<td>3500-4000</td>
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<td>siltst, med-gy</td>
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<td>5500-6000</td>
<td>sandst, med-gy, med-grained, calc, well-consol</td>
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<td>siltst, med-gy</td>
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<tr>
<td>6500-7000</td>
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<td>7000-7500</td>
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<td>7500-8000</td>
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<td>8000-8500</td>
<td>lignite (318-328)</td>
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Graph showing logging speed, density range, gamma range, and SP sensitivity.
REMARKS:

**LITHOLOGY**

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<th>DEPTH</th>
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<td>450</td>
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<td>800</td>
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<tr>
<td>850</td>
<td>220</td>
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**Logging speed**: 20 ft/min  
**Logged depth**: 400 ft  
**Density range**: 3 cps  
**Density TC**: 1 sec  
**Gamma range**: 15 cps  
**Gamma TC**: 3 sec  
**SP sensitivity**: 100 mv  
**Resistance sensitivity**: 5 ohms

- *siltst, med-gy*  
- *clayst, dk-gy, very silty*  
- *lignite (360-361)*  
- *lignite (368.5-371.5)*  
- *lignite (374-375.5)*  
- *lignite (377-380)*

- *clayst, lt-gy, very silty*
AREA: Three River

QUAD NAME: Fairfield

DATE STARTED: 8-3-79

DATE COMP: 8-3-79

COUNTRY: Billings

STATE: North Dakota

LOCATION: SEC. 30 T.143 N., R. 98 W., FOOTAGE LOC. 1585 ft

FOOTAGE: 15 ft

LEVEL: 2762 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company

DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: M. Hudson

GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY:

- soil, med-brn, silt, clay, unconsol
- siltst, med-brn
- siltst, med-gy; high clay content
- sandst, med-gy, fine-grained
- clayst, med-gy, mod silty
- lignite (200-206)
- siltst, dk-gy; high clay content
- clayst, med-gy, very silty
- siltst, lt-gy
- clayst, med-gy, mod silty
### Lithology

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<tr>
<th>Layer Description</th>
<th>Depth Range</th>
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<tr>
<td>Clay, med-gy, mod silty</td>
<td>359.5 - 361.5 ft</td>
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<tr>
<td>Silt, dk-gy</td>
<td>371.5 - 375 ft</td>
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<tr>
<td>Lignite</td>
<td>379.5 - 385.5 ft</td>
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<td>Clay, med-gy, very silty</td>
<td>404 - 410.5 ft</td>
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<td>Sand, med-gy, med-grained, calc, well-consol</td>
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<tr>
<td>Silt, dk-gy</td>
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<tr>
<td>Clay, med-gy, silt silty</td>
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### Log Information

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 420 ft
- Gamma range: 15 cps
- Density TC: 1 sec
- SP sensitivity: 100 mV
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms

### Depth

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<th>Feet</th>
<th>Meters</th>
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<td>700</td>
<td>180</td>
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<tr>
<td>750</td>
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### Diagram

A diagram showing log data with various measurements and features is present. The diagram includes graph lines and annotations relevant to the log data.
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<th>Stripe Log</th>
<th>Depth</th>
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<td>sand, med-brn, fine-grained</td>
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<td>clay, dk-gy, very silty</td>
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<tr>
<td>clay, med-gy, very silty</td>
<td></td>
<td></td>
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<tr>
<td>clay, med-gy, very silty</td>
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<td></td>
</tr>
<tr>
<td>sand, med-gy, very silty</td>
<td></td>
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</tr>
<tr>
<td>sand, lt-gy, fine-grained</td>
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<td></td>
</tr>
<tr>
<td>clay, dk-gy, very silty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>clay, dk-gy, mod silty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>silt, med-gy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>clay, med-gy, very silty</td>
<td></td>
<td></td>
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<tr>
<td>sand, med-gy, fine-grained</td>
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</tr>
<tr>
<td>lignite (349-350)</td>
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<td>lignite (241.5-242.5)</td>
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<td>lignite (218-219.5)</td>
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<td>lignite (204-207.5)</td>
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<td>lignite (40-42)</td>
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<td>lignite (77.5-85.5)</td>
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</table>

Logging speed: 20 ft/min
Density range: 3 cps
Logged depth: 480 ft
Gamma range: 15 cps
Gamma TC: 3 sec
SP sensitivity: 100 mV
Resistance sensitivity: 5 ohms
REMARKS:

LITHOLOGY

Logging speed: 20 ft/min  Density range: 3 cps
Logged depth: 480 ft  Density TC: 1 sec
Gamma range: 15 cps  SP sensitivity: 100 mv
Gamma TC: 3 sec  Resistance sensitivity: 5 ohms

clayst, med-gy, silt silyy
sandst, med-gy, calc, fine-grained  lignite (419-423)
siltst, med-gy  lignite (441-442)
clayst, med-gy, very silty
siltst, med-gy
siltst, med-gy  lignite (473-475.5)

TD 481
### United States Geological Survey

#### Hole No. 62

**Sheet 1 of 2**

<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
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<tr>
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<td><strong>Quad Name</strong></td>
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<tr>
<td><strong>Date Started</strong></td>
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<td><strong>Date Comp</strong></td>
<td>8-17-79</td>
</tr>
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<td><strong>County</strong></td>
<td>Dunn</td>
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<tr>
<td><strong>State</strong></td>
<td>North Dakota</td>
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<tr>
<td><strong>Location Sec.</strong></td>
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<td><strong>Drilling Agency</strong></td>
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<td><strong>Drill Type</strong></td>
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<tr>
<td><strong>Lithology Recorded By</strong></td>
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</tr>
<tr>
<td><strong>Geophysical Logs Recorded By</strong></td>
<td>J. Wald</td>
</tr>
</tbody>
</table>

#### Remarks
- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 460 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms

#### Lithology

<table>
<thead>
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<th>Depth (ft)</th>
<th>Lithology Description</th>
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<td>Silt, lt-gy</td>
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<td>Clay, med-gy, silty</td>
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<td>461-461</td>
<td>Clay, dk-brn to blk, cbncs</td>
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<td>Lignite (239.5-241.5)</td>
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REMARKS:

LITHOLOGY

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Logging speed: 20 ft/min  Density range: 3 cps
Logged depth: 460 ft  Density TC: 1 sec
Gamma range: 15 cps  SP sensitivity: 100 mv
Gamma TC: 3 sec  Resistance sensitivity: 5 ohms

TD 461
LOCATION: SEC. 2 T.143 N., R. 93 W., FOOTAGE LOC. 20 ft
GROUND ELEV. 2235 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY M. Hudson
GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

<table>
<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>380 ft</td>
<td>380 ft</td>
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</tbody>
</table>

- soil, med-brn, silt, clay, unconsol
- siltst, lt-brn; high clay content
- clayst, med-gy, very silty
- lignite (26-33)
- lignite (50.5-52)
- clayst, med-gy, very silty
- clayst, med-gy, sli silty
- lignite (100-117)
- clayst, dk-gy
- lignite (126-127)
- siltst, med-gy
- clayst, dk-gy, sli silty
- lignite (168.5-170)
- lignite (172.5-173.5)
- clayst, dk-gy, very silty
- lignite (182.5-183.5)
- siltst, dk-gy
- lignite (188-191)
- siltst, med-gy
- clayst, lt-gy, mod silty
- siltst, med-gy
- lignite (242.5-244)
- siltst, med-gy
- lignite (247.5-248.5)
- siltst, med-gy
- lignite (255-256.5)
- clayst, med-gy, sli silty
- siltst, med-gy
- lignite (303.5-305)
- siltst, lt-gy
- sandst, lt-gy, fine-grained
REMARKS:

LITHOLOGY

<table>
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<tr>
<th>Lithology Description</th>
<th>FEET</th>
<th>METERS</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>lignite (362-365)</td>
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<tr>
<td>siltst, med-gy</td>
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Logging speed: 20 ft/min
Logged depth: 380 ft
Gamma range: 15 cps
Gamma TC: 3 sec
Density range: 3 cps
Density TC: 1 sec
SP sensitivity: 100 mu
Resistance sensitivity: 5 ohms
**LITHOLOGY**

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<tr>
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<th>Depth (feet)</th>
<th>Remarks</th>
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<td>Clayst, med-gy, mod silty</td>
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<td>Sandst, lt-gy, med-grained, calc,</td>
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<td>Well-consol</td>
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<td>Clayst, dk-gy, mod silty</td>
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<td>Clayst, med-gy, very silty</td>
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<td>Sandst, lt-gy, fine-grained, calc,</td>
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<td>Well-consol</td>
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<td>Siltst, dk-gy</td>
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<tr>
<td>Clayst, med-gy, mod silty</td>
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<tr>
<td>Clayst, dk-gy, silty</td>
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**Logging speed:** 20 ft/min  
**Density range:** 3 cp  
**Logged depth:** 420 ft  
**Gamma range:** 15 cp  
**SP sensitivity:** 100 mv  
**Gamma TC:** 3 sec  
**Resistance sensitivity:** 5 ohms

**REMARKS:**

- Logging speed: 20 ft/min
- Density range: 3 cp
- Logged depth: 420 ft
- Gamma range: 15 cp
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms
## Remarks:

### Lithology

<table>
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<td>Sandst, lt-gy, med-grained, calc, well-consol</td>
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### Geophysical Log

- **Logging speed**: 20 ft/min
- **Density range**: 3 cps
- **Logged depth**: 420 ft
- **Density TC**: 1 sec
- **Gamma range**: 15 cps
- **SP sensitivity**: 100 mv
- **Gamma TC**: 3 sec
- **Resistance sensitivity**: 5 ohms

**TD**: 421

---

### Depth

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<th>Depth (meters)</th>
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<tr>
<td>700</td>
<td>200</td>
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<tr>
<td>750</td>
<td>220</td>
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128
LOCATION: SEC. 20 T. 142 N., R. 101 W., FOOTAGE LOC.

DATE STARTED: 7-24-79
DATE COMP: 7-24-79
COUNTY: Billings
STATE: North Dakota

LOCATION=SEC. 20 j.142 N., R. 101 w., FOOTAGE LOC. 2035 ft FNL XXX 940 ft XXX FWL GROUND ELEV 2562 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: L. Tomac
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

- soil, med-brn, sand, silt, unconsol
- sandst, med-brn, fine-grained
- clayst, med-gy, mod silty
- clayst, dk-gy
- clayst, dk-gy, very silty
- clayst, med-gy, mod silty
- sandst, lt-gy, fine-grained
- clayst, med-gy, very silty
- clayst, dk-gy
- clayst, dk-gy, very silty
- siltst, dk-gy
- siltst, dk-gy, very silty
- siltst, med-gy, mod silty
- sandst, med-gy, fine-grained
- clayst, med-gy, mod silty
- siltst, med-gy
- clayst, dk-gy, mod silty
- siltst, lt-gy
- clayst, med-gy, mod silty
- sandst, med-gy, fine-grained
- siltst, dk-gy
- siltst, dk-gy; high clay content
REMARKS:

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<td>sandst, lt-gy, fine-grained</td>
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<td>lignite (434.5-456)</td>
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<td>clayst, med-gy, sli silty</td>
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<td>siltst, med-gy</td>
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<td>clayst, med-gy, mod silty</td>
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<tr>
<td>lignite (512-513)</td>
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<td>sandst, med-gy, fine-grained</td>
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<td>lignite (643.5-660.5)</td>
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Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 679 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mv  
Gamma TC: 3 sec  
Resistance sensitivity: 5 ohms
UNITED STATES GEOLOGICAL SURVEY
HOLE NO 66
SHEET 1 OF 2

AREA Three River
QUAD NAME Gorham NW

DATE STARTED 7-25-79
DATE COMP 7-25-79
COUNTY Billings
STATE North Dakota

LOCATION: SEC. 6 T142 N., R100 W., FOOTAGE LOC. 2478 ft
FOOTAGE 300 ft
TOTAL FOOTAGE 2778 ft
GROUND ELEV 2778 ft

SIZE AND BIT TYPE: 4-3/4 inch drag
ROTARY 461 ft CORING ----

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

DEPTH TO FLUID LEVEL 6 ft

LITHOLOGY RECORDED BY M. Hudson
GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

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<th>DEPTH</th>
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<td>000- 0</td>
<td>siltst, med-gy, calc</td>
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REMARKS:

LITHOLOGY

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<tr>
<td></td>
<td>700</td>
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<tr>
<td></td>
<td>750</td>
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</tbody>
</table>

Logging speed: 20 ft/min  Density range: 3 cps
Logged depth: 460 ft  Density TC: 1 sec
Gamma range: 15 cps  SP sensitivity: 100 µV
Gamma TC: 3 sec  Resistance sensitivity: 5 ohms

siltst, med-gy, calc

lignite (388.5-389.5)
lignite (391-392)
lignite (398-399.5)

clayst, med-gy, very silty

sandst, med-gy, fine-grained
clayst, lt-gy, very silty

TD 461

132
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 67
SHEET 1 OF 2

AREA
Three River

DATE STARTED
7-25-79

DATE COMP.
7-25-79

COUNTY
Billings

STATE
North Dakota

LOCATION-SEC. 27 T.142 N., R. 100 W., FOOTAGE LOC.

FOOTAGE

TOTAL DEPTH
380 ft

DEPTH TO FLUID LEVEL
4 ft

FOOTAGE

GROUND ELEV
2690 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

RC"ARY
380 ft

Coring
---

DRILL TYPE: Rotary

DRILLING AGENCY: Gregory Drilling Company

LITHOLOGY RECORDED BY L. Tomac

GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

Logging speed 20 ft/min
Density range: 3 cps
Logged depth, 379 ft
Density TC. 1 sec
Gamma range 15 cps
Log SP sensitivity 100 mv
Gamma TC 3 sec
Resistance sensitivity 5 ohms

DEPT

FEET METERS

soil, med-brn, sand, silt, unconsol

clayst, med-brn, very silty

clayst, dk-brn

clayst, med-gy, very silty

siltst, lt-grn

clayst, med-gy, very silty

clayst, dk-brn, silt, silt, cbns

siltst, med-gy

lignite (26.5-28)

lignite (95.5-97.5)

lignite (120-121)

siltst, med-gy; high clay content

clayst, med-gy, silt

siltst, med-gy; high clay content

lignite (189.5-192)

clayst, med-gy, very silty

lignite (336-341)

clayst, lt-gy, mod silt

lignite (347.5-348.5)

sandst, lt-gy, fine-grained, calc

lignite (300-302)

clayst, lt-gy, mod silt

lignite (236.5-238.5)

clayst, med-gy, very silty

lignite (232.5-233.5)

clayst, dk-gy, silt, silt, cbns

siltst, med-gy

lignite (255.5-261)

clayst, dk-gy, silt, silt, cbns

siltst, med-gy

lignite (236.5-238.5)

clayst, med-gy, very silty

lignite (232.5-233.5)

clayst, dk-gy, silt, silt, cbns

siltst, med-gy

lignite (255.5-261)

clayst, dk-gy, silt, silt, cbns

siltst, med-gy

lignite (236.5-238.5)

clayst, med-gy, very silty

lignite (232.5-233.5)

clayst, dk-gy, silt, silt, cbns

siltst, med-gy

lignite (255.5-261)

clayst, dk-gy, silt, silt, cbns

siltst, med-gy

lignite (236.5-238.5)

clayst, med-gy, very silty

lignite (232.5-233.5)

clayst, dk-gy, silt, silt, cbns

siltst, med-gy

lignite (255.5-261)
### Remarks:

#### Lithology

<table>
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<th>DEPTH</th>
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<tbody>
<tr>
<td>TD 380</td>
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</table>

**Lithology:**
- clayst, med-gy, mod silty

**Logging Details:**
- Logging speed: 20 ft/min
- Logged depth: 379 ft
- Density range: 3000 cps
- Density TC: 1 sec
- Gamma range: 1500 cps
- Gamma TC: 3 sec
- SP sensitivity: 1000 mv
- Resistance sensitivity: 5 ohms

**Logged Depth:**
- 379 ft

**Graph Details:**
- Graph shows variations in density, gamma, and other logging parameters with depth.
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<th>Fairfield</th>
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<tr>
<td>SEC.</td>
<td>2</td>
<td>STATE</td>
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<tr>
<td>FOOTAGE LOC.</td>
<td>142 N., R.</td>
<td>GROUND ELEV.</td>
<td>2755 ft</td>
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<td>SIZE AND BIT TYPE:</td>
<td>4-3/4 inch drag</td>
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**LITHOLOGY**

<table>
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<th>Description</th>
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<td></td>
<td></td>
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<tr>
<td>Clay</td>
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**DEPTH**

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<td>60 10</td>
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**REMARKS:**

135
LITHOLOGY

lignite (350-351.5)

clayst, lt-gy, very silty

Logged speed: 20 ft/min
Logged depth: 380 ft
Density range: 3 cps
Density TC: 1 sec
Gamma range: 15 cps
Gamma TC: 3 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

TD 381
LITHOLOGY

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Lithology Description</th>
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<tbody>
<tr>
<td>0-360</td>
<td>soil, med-brn, silt, clay, unconsol</td>
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<td>0-198</td>
<td>clayst, med-gy, very silty</td>
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<tr>
<td>0-360</td>
<td>siltst, lt-gy</td>
</tr>
<tr>
<td>0-360</td>
<td>sandst, med-gy, fine-grained</td>
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<td>0-360</td>
<td>siltst, med-gy</td>
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<tr>
<td>0-360</td>
<td>clayst, dk-gy, sli silty</td>
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<td>0-360</td>
<td>lignite (167-170.5)</td>
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<td>clayst, med-gy, very silty</td>
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<td>siltst, med-gy</td>
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<tr>
<td>0-360</td>
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<td>siltst, med-gy, calc</td>
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Logging speed: 20 ft/min
Density range: 3 cps
Logged depth: 360 ft
Density TC: 1 sec
Gamma range: 15 cps
Gamma TC: 3 sec
SP sensitivity: 100 mV
Resistance sensitivity: 5 ohms
REMARKS:

LITHOLOGY

clayst, lt-gy, very silty

Logging speed 20 ft/min
Logged depth 360 ft
Gamma range 15 cps
Gamma TC 3 sec
Log range 3 cps
Density range 3 cps
Density TC 1 sec
SP sensitivity 100 mv
Resistance sensitivity 5 ohms

DEPTH

F E E T  M E T E R S

clayst, lt-gy, very silty
## United States Geological Survey

### Hole No. 70

#### Sheet 1 of 1

**Area:** Three River  
**Quad Name:** Rattlesnake Butte

<table>
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<th>Date Started</th>
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<th>County</th>
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<td>Billings</td>
<td>North Dakota</td>
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**Location:** SEC. 34 T.142 N., R.99 W., FOOTAGE LOC.

<table>
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<th>Size and Bit Type</th>
<th>Drilling Agency</th>
<th>Drill Type</th>
<th>Footage</th>
<th>Total Depth</th>
<th>Depth to Fluid Level</th>
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<tr>
<td>4-3/4 inch drag</td>
<td>Gregory Drilling Company</td>
<td>Rotary</td>
<td>340 ft</td>
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**Ground Elev:** 2630 ft

**Lithology Recorded By:** S. Christensen  
**Geophysical Logs Recorded By:** J. Wald

**Remarks:**

### Lithology

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<tr>
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<th>Description</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>
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<tbody>
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<td>3 cps</td>
<td>1 sec</td>
<td>15 cps</td>
<td>100 mv</td>
<td>5 ohms</td>
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**Stratigraphic Log:**

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<td>Silt</td>
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<tr>
<td>Sand</td>
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**Gamma: 15 cps**

**Lignite (24-29.5):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (51-52):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (55-56):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (60.5-61.5):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (70.5-73):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (74-76):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (113.5-115):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (191-192):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (252.5-254):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (280.5-282):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Lignite (312-315):**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms

**Sand, lit-gy, fine-grained:**

- **Depth:** 339 ft  
- **Density:** 3 cps  
- **Density TC:** 1 sec  
- **Gamma:** 15 cps  
- **SP Sensitivity:** 100 mv  
- **Resistance Sensitivity:** 5 ohms
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 71
SHEET 1 OF 2

AREA: Three River
QUAD NAME: Hungry Man Butte

DATE STARTED: 8-3-79
DATE COMP: 8-3-79
COUNTY: Billings
STATE: North Dakota

LOCATION: SEC. 4 T.142 N., R. 98 W., FOOTAGE LOC.

FOOTAGE: 210 ft
GROUND ELEV: 2645 ft
COUNTY: Billings
STATE: North Dakota

SIZE AND BIT TYPE: 4-3/4 inch drag
DRILL TYPE: Rotary

DRILLING AGENCY: Gregory Drilling Company
GEOPHYSICAL LOGS RECORDED BY: J. Wald

LOCATION'SEC. 4 T.142 N., R. 98 W., FOOTAGE LOC.

FOOTAGE: 405 ft
GROUND ELEV: 2645 ft
COUNTY: Billings
STATE: North Dakota

SIZE AND BIT TYPE: 4-3/4 inch drag
DRILL TYPE: Rotary

DRILLING AGENCY: Gregory Drilling Company
GEOPHYSICAL LOGS RECORDED BY: J. Wald

LITHOLOGY RECORDED BY: M. Hudson

REMARKS:

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LITHOLOGY:

- soil, med-brn, silt, clay, unconsol
- siltst, med-gy
- clayst, lt-gy, very silty
- siltst, lt-gy; high clay content
- clayst, med-gy, very silty
- lignite (93.5-101)
- clayst, med-gy, silt silty
- clayst, dk-brn to blk, cbncs
- siltst, med-gy
- clayst, med-gy, mod silty
- lignite (150-152.5)
- lignite (153.5-155)
- clayst, dk-gy
- lignite (160-161)
- lignite (167.5-169)
- clayst, dk-gy
- lignite (175-179)
- clayst, med-gy, mod silty
- lignite (221.5-236)
- clayst, dk-gy, ali silty
- lignite (243-247)
- siltst, med-gy; high clay content
- clayst, med-gy, very silty
- lignite (299.5-300.5)
- clayst, med-gy, mod silty
- lignite (317.5-318.5)
- siltst, med-gy

Logging speed 20 ft/min
Density range 3 cps
Logged depth 360 ft
Density TC 1 sec
Gamma range 15 cps
SI sensitivity 100 ma
Gamma TC 3 sec
Resistance sensitivity 3 ohms
REMARKS:

LITHOLOGY

clayst, med-gy, sli silty lignite (351-352)

Logging speed: 20 ft/min
Logged depth: 360 ft
Gamma range: 15 cps
Gamma TC: 3 sec
Density range: 3 cps
Density TC: 1 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

DEPTH
350
400
450
500
550
600
650
700
750

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

TD 361
United States Geological Survey

Area: Three River
Quad Name: Fairfield SE
Date Started: 8-3-79
Date Comp: 8-3-79
County: Billings
State: North Dakota
Location: Sec. 28 T. 142 N., R. 98 W., Footage Loc. 30 ft FNL, 105 ft FEL
Size and Bit Type: 4-3/4 inch drag
Drilling Agency: Gregory Drilling Company
Drill Type: Rotary
Depth to Fluid Level: 2 ft
Ground Elev: 2642 ft

Lithology Recorded By: S. Christensen
Geophysical Logs Recorded By: J. Wald

Remarks:

Logging Speed: 20 ft/min
Density Range: 3 cps
Gamma Range: 15 cps
Gamma TC: 3 sec
SP Sensitivity: 100 mV
Resistance Sensitivity: 5 ohm

Lithology:

- Soil, med-brn, sand, silty, unconsol
- Sandst, med-brn, fine-grained
- Lignite (66.5-73)
- Clayst, med-gy, mod silty
- Siltst, lt-gy
- Clayst, med-gy, silty silty
  - Lignite (145-147)
  - Lignite (149-154.5)
- Clayst, med-gy, silty silty
  - Sandst, lt-gy, med-grained, calc, well-consol
  - Clayst, med-gy, silty silty
    - Lignite (189-209)
- Clayst, med-gy, silty silty
  - Lignite (223-243.5)
- Clayst, med-gy, silty silty
  - Lignite (267.5-270.5)
  - Lignite (281.5-283.5)
  - Lignite (285-286)
- Siltst, dk-gy
  - Lignite (309.5-310.5)
- Clayst, med-gy, very silty
**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
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</table>

Logging speed: 20 ft/min  
Logged depth: 360 ft  
Density range: 3 cps  
Density T.C.: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mv  
Gamma T.C.: 3 sec  
Resistance sensitivity: 5 ohms  

Logged depth: 360 ft  
Density T.C.: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mv  
Gamma T.C.: 3 sec  
Resistance sensitivity: 5 ohms
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 73
SHEET 1 OF 2

AREA: Three River
QUAD NAME: Gorham SE

DATE STARTED: 7-24-79
DATE COMP: 7-24-79
COUNTY: Billings
STATE: North Dakota

LOCATION: SECTION 4 T.141 N., R. 100 W., FOOTAGE LOC.

FOOTAGE:
- FSL: 63 ft
- PAL: 23 ft

GROUND ELEV: 2521 ft

SIZE AND BIT TYPE:
- 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

SIZE AND BIT TYPE:
- ROTARY: 460 ft
- CORING: ----

TOTA1 DEPTH: 460 ft

DEPTH TO FLUID LEVEL: 15 ft

LITHOLOGY RECORDED BY: M. Hudson
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY:

- soil, med-brn, silt, clay, unconsol
- clayst, med-brn, very silty
- lignite (18.5-20)

- siltst, med-gy

- sandst, med-gy, fine-grained

- clayst, lt-gy, ali silty
- lignite (86-99)
- siltst, dk-gy
- lignite (103.5-104.5)

- clayst, med-gy, mod silty

- siltst, med-gy, high clay content
- lignite (168-170.5)

- siltst, med-gy
- lignite (199-200)

- clayst, lt-gy, very silty
- lignite (252-253)
- lignite (254-255.5)

- siltst, med-gy

- clayst, med-gy, s11 silty

- siltst, med-gy

- siltst, med-gy
- lignite (341-342)
## Remarks:

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<td>Clayst, lt-gy, mod silty</td>
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### Logging Information
- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 460 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mV
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 74
SHEET 1 OF 2

AREA: Three River
QUAD NAME: Fryburg NW

DATE STARTED: 7-23-79
DATE COMP: 7-23-79
COUNTY: Billings
STATE: North Dakota

LOCATION: SEC. 1 T140 N., R 101 W., FOOTAGE LOC.

FOOTAGE: 2360 ft T140 N., R 101 W., 710 ft S.
FOOTAGE LOC.: 2495 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: L. Tomac
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

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### LOGGING DATA
- Logging speed: 20 ft/min
- Logged depth: 439 ft
- Gamma range: 15 cps
- Gamma TC: 3 sec
- Density range: 3 cps
- Density TC: 1 sec
- SP sensitivity: 100 mv
- Resistance sensitivity: 5 ohms
- TD: 440 ft
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 75
SHEET 1 OF 2

AREA          Three River
QUAD NAME     Gorham SE
DATE STARTED  7-23-79
DATE COMP.    7-23-79
COUNTRY       Billings
STATE         North Dakota

LOCATION: SEC. 8 T.141 N., R.99 W., FOOTAGE LOC. 27 ft
            72 ft 27 ft
            FSL  FWL
GROUND ELEV.  2678 ft

SIZE AND BIT TYPE: 4-3/4 inch drag
FOOTAGE
ROTARY 360 ft CORING ---
TOTAL DEPTH 360 ft
DEPTH TO FLUID LEVEL 5 ft

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY  M. Hudson
GEOPHYSICAL LOGS RECORDED BY  J. Wald

REMARKS:

LITHOLOGY

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Logging speed 20 ft/min
Gamma range 15 cps
Density range 3 cps
 gamma TC 3 sec
SP sensitivity 100 mV
Resistivity sensitivity 5 ohms

Lithology:

- soil, med-brn, silt, clay, unconsol
- clayst, med-gy, very silty
- clayst, dk-brn, cbncs
- lignite (47-56.5)
- lignite (60-62)
- lignite (63-68)
- siltst, dk-gy; high clay content
- sandst, med-gy, fine-grained
- lignite (98.5-100)
- siltst, med-gy
- clayst, med-gy, silty
- lignite (143.5-144.5)
- lignite (145.5-147)
- lignite (150-151.5)
- lignite (153.5-154.5)
- clayst, lt-gy, very silty
- sandst, lt-gy
- clayst, dk-gy, very silty
- lignite (271-272)
- clayst, med-gy, very silty
- lignite (296-298.5)
- lignite (305.5-308)
- clayst, dk-gy, very silty
- sandst, med-gy, fine-grained
REMARKS:

LITHOLOGY

sandst, med-gy, fine-grained

Logging speed: 20 ft/min
Logged depth: 360 ft
Density range: 3 cps
Density TC: 1 sec
Gamma range: 15 cps
Gamma TC: 3 sec
SP sensitivity: 100 mV
Resistance sensitivity: 5 ohms

TD: 360
Lithology:

- Soil, med-brn, sand, silt, unconsol
- Sandst, med-gy, fine-grained
- Clayst, dk-gy, very silty
- Lignite (82.5-89.5)
- Clayst, med-gy, mod silty
- Lignite (116-117.5)
- Clayst, med-gy, mod silty
- Lignite (141.5-143.5)
- Siltst, lt-brn
- Lignite (150.5-153)
- Lignite (154.5-156)
- Clayst, med-gy, very silty
- Lignite (196.5-198.5)
- Clayst, med-gy, sli silty
- Sandst, lt-gy, med-grained, calc, well-consol
- Clayst, lt-gy, sli silty
- Lignite (309-310)
- Lignite (312-317)
- Clayst, med-gy, mod silty
**LITHOLOGY**

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<tr>
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<th>Trim Log</th>
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<td>Sand, med-gy, fine-grained</td>
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<td>Silt, med-gy; high clay content</td>
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<td>Clay, med-gy, mod silty</td>
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<td>Clay, med-gy, silty</td>
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<tr>
<td>Clay, med-gy, very silty</td>
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<td>Clay, med-gy, sily silty</td>
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<td>Clay, med-gy, mod silty</td>
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**Logging speed**: 20 ft/min
**Density range**: 3 cps
**Logged depth**: 610 ft
**Density TC**: 1 sec
**Gamma range**: 15 cps
**Gamma TC**: 3 sec
**SP sensitivity**: 100 mv
**Resistance sensitivity**: 5 ohms

**DEPTH**

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**Remarks**:

- Clay, med-gy, mod silty: lignite (355-356.5)
- Sand, med-gy, fine-grained
- Silt, med-gy; high clay content
- Clay, med-gy, mod silty
- Clay, med-gy, sily silty: lignite (494.5-497)
- Clay, med-gy, very silty
- Clay, med-gy, sily silty
- Silt, med-gy
- Clay, med-gy, mod silty
- Clay, med-gy, mod silty: lignite (591-595.5)
UNITED STATES GEOLOGICAL SURVEY
HOLE NO 77
SHEET 1 OF 2

AREA Three River
QUAD NAME Rattlesnake Butte
DATE STARTED 7-22-79 DATE COMP 7-22-79 COUNTY Billings STATE North Dakota
LOCATION:SEC. 6 T.141 N., R. 98 W., FOOTAGE LOC. 550 ft
FOOTAGE 20 ft TOTAL ELEV 2632 ft
SIZE AND BIT TYPE: 4-3/4 inch drag
FOOTAGE LOG 550 ft 
CORING
TOTAL DEPTH 400 ft
DRILLING AGENCY: Gregory Drilling Company DRILL TYPE: Rotary
DEPTH TO FLUID LEVEL 5 ft
LITHOLOGY RECORDED BY S. Christensen GEOPHYSICAL LOGS RECORDED BY J. Wald
REMARKS:

LITHOLOGY

| Soil | Ark brn | Sand | Silt | Unconsol
|------|--------|------|------|--------
| Sandst, med-brn, fine-grained
| Clayst, med-gy, very silty
| Clayst, dk-gy, mod silty
| Siltst, dk-gy
| Clayst, dk-gy, ali silty
| Sandst, med-gy, fine-grained

Logging speed 20 ft/min Density range: 3 cps
Logge depth 400 ft Density TC 1 sec
Gamma range 15 cps SP sensitivity 100 mv
Gamma TC 3 sec Resistance sensitivity 5 ohms

DEPTH

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

152
**REMARKS:**

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<td>1ignite (386.5-390)</td>
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Logging speed: 20 ft/min  Density range: 3 cps
Logged depth: 400 ft  Density TC: 1 sec
Gamma range: 15 cps  SP sensitivity: 100 mv
Gamma TC: 3 sec  Resistance sensitivity: 5 ohms

**DEPTH**

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TD: 400
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 78
SHEET 1 OF 2

AREA
Three River

QUAD NAME
Fairfield SE

DATE STARTED
7-22-79

DATE COMP
7-22-79

COUNTRY
Dunn

STATE
North Dakota

LOCATION: SEC. 8 T.141 N., R. 97 W., FOOTAGE LOC.

FOOTAGE

GROUND ELEV
2625 ft

TOTAL DEPTH
361 ft

DEPTH TO FLUID LEVEL
8 ft

SIZE AND BIT TYPE:
4-3/4 inch drag

DRILLING AGENCY:
Gregory Drilling Company

DRILL TYPE:
Rotary

LITHOLOGY RECORDED BY:
M. Hudson

GEOPHYSICAL LOGS RECORDED BY:
J. Wald

REMARKS:

LITHOLOGY

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Logging speed: 20 ft/min
Density range: 3 cps
Gamma range: 15 cps
Gamma TC: 3 sec
SP sensitivity: 100 mV
Residual sensitivity: 5 mV

soil, lt-brn, sand, silt, unconsol
sandst, lt-grn, fine-grained
clayst, med-gy, very silty
siltst, med-gy
clayst, med-gy, sli silty
lignite (91-93)
siltst, lt-gy
clayst, dk-gy, very silty
lignite (164-165)
clayst, med-gy, very silty
lignite (195.5-197)
clayst, dk-gy
lignite (198.5-203)
clayst, dk-gy
lignite (207.5-228)
clayst, med-gy, very silty
lignite (259-269)
clayst, med-gy, mod silty
lignite (293-301)
clayst, med-gy, mod silty
lignite (314.5-316)
siltst, lt-gy
clayst, med-gy, sli silty

154
**REMARKS:**

**LITHOLOGY**

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- **clayst, med-gy, silty**

**Logging parameters:**
- Logging speed: 20 ft/min
- Density range: 3 cps
- Density T.C.: 1 sec
- Gamma range: 15 cps
- Gamma T.C.: 3 sec
- SP sensitivity: 100 mv
- Resistance sensitivity: 5 ohms
UNITED STATES GEOLOGICAL SURVEY

DATE STARTED 8-17-79
DATE COMP 8-17-79
COUNTY Dunn
STATE North Dakota
LOCATION: SEC. 8 T.141 N., R. 97 W., FOOTAGE LOC 270 ft
FOOTAGE Location: 18 ft
GROUND ELEV 2625 ft
SIZE AND BIT TYPE: 4-3/4 inch drag
FOOTAGE Location: 18 ft
TOTAL DEPTH 257 ft
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
DEPTH TO FLUID LEVEL 4 ft
LITHOLOGY RECORDED BY M. Menge
GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS: continuous core taken from 193 ft to 233 ft.

LITHOLOGY

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Logging speed: 20 ft/min
Density range: 100 cp
Gamma range: 15 cps
Sensitivity: 100 mV
Gamma TC: 3 sec
Resistance sensitivity: 5 ohms

DEPTH

soil, lt-brn
sandst, lt-grn, fine-grained
clayst, med-gy, very silty
siltst, med-gy
clayst, med-gy, sili sily
lignite (91-93)
siltst, lt-gy
clayst, dk-gy, very silty
lignite (164-165)
clayst, med-gy, very silty
lignite (195.5-197)
lignite (198.5-203)
clayst, dk-gy
lignite (207.5-228)
clayst, med-gy, very silty
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 79
SHEET 1 OF 2

AREA: Three River
QUAD NAME: New Hradec South

DATE STARTED: 8-17-79
DATE COMP: 8-17-79
COUNTY: Dunn
STATE: North Dakota

LOCATION: SEC. 28, T. 141 N, R. 97 W, FOOTAGE LOC: 200 ft
FOOTAGE: 25 ft
GROUND ELEV: 2352 ft
TOTAL DEPTH: 561 ft
DEPTH TO FLUID LEVEL: 4 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: S. Christensen
GEOPHYSICAL LOGS RECORDED BY: J. Waid

REMARKS:

LITHOLOGY

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<tr>
<td></td>
<td>350</td>
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<td></td>
<td>400</td>
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</table>

Soil, med-brn, silt, clay, unconsol

Clay, lt-brn, mod silty

Sandst, med-brn, fine-grained

Clay, dk-brn, sili silty

Lignite (60-72)

Clays, med-gy, mod silty

Lignite (126-127)

Siltst, med-gy

Clay, dk-gy

Lignite (156.5-160)

Clay, dk-gy, mod silty

Lignite (172.5-182)

Clay, dk-brn, sili silty

Sandst, med-gy, fine-grained

Clay, dk-brn, sili silty

Lignite (216.5-218)

Siltst, med-gy, high clay content

Lignite (296.5-298)

Siltst, med-gy, high clay content

Lignite (312-313.5)

Siltst, med-gy, high clay content

Clay, dk-gy

Clay, dk-gy, very silty

Lignite (349.5-350.5)
**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>clayst, dk-gy, mod silty</td>
<td>lignite (349.5-350.5)</td>
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<tr>
<td>clayst, med-gy, very silty</td>
<td>lignite (355-359.5)</td>
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<td>siltst, med-gy</td>
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<tr>
<td>clayst, dk-gy, very silty</td>
<td>lignite (411-414)</td>
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<tr>
<td>clayst, med-gy, mod silty</td>
<td>lignite (415-418)</td>
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<td>lignite (423.5-424.5)</td>
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<td>lignite (446.5-448.5)</td>
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<td>lignite (503.5-505.5)</td>
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<td>clayst, dk-gy</td>
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<tr>
<td>clayst, med-gy, very silty</td>
<td>lignite (521.5-522.5)</td>
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</tbody>
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Logged depth: 560 ft

Density range: 3 cps

Logged depth: 561 ft

Density range: 1 sec

Gamma range: 15 cps

SP sensitivity: 100 mv

Gamma TC: 3 sec

Resistance sensitivity: 5 ohms

Temperature: 255°

Logged depth: 561 ft

Density TC: 1 sec

Gamma TC: 3 sec

Temperature: 255°
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 80
SHEET 10

AREA: Three River
QUAD NAME: Dickinson North
DATE STARTED: 7-12-79
DATE COMP: 7-12-79
COUNTY: Dunn
STATE: North Dakota
LOCATION: SEC. 26 T.141 N., R. 96 W., FOOTAGE LOC. 270 ft
SIZE AND BIT TYPE: 4-3/4 inch drag
GROUND ELEV: 2548 ft
TOTAL DEPTH: 340 ft
DEPT TO FLUID LEVEL: 3 ft
DATE STARTED: 7-12-79
DATE COMP: 7-12-79
COUNTY: Dunn
STATE: North Dakota
LOCATION: SEC. 26 T.141 N., R. 96 W., FOOTAGE LOC. 270 ft
SIZE AND BIT TYPE: 4-3/4 inch drag
GROUND ELEV: 2548 ft
TOTAL DEPTH: 340 ft
DEPT TO FLUID LEVEL: 3 ft
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
LITHOLOGY RECORDED BY: L. Tomac
GEOPHYSICAL LOGS RECORDED BY: J. Wald
REMARKS:

LITHOLOGY

<table>
<thead>
<tr>
<th>Layer Description</th>
<th>Depth (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil, med-brn, silt, clay, unconsol</td>
<td>0-3</td>
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<tr>
<td>Siltst, med-brn; high clay content</td>
<td>3-6</td>
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<tr>
<td>Clayst, med-gy, sli silty</td>
<td>6-9</td>
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<tr>
<td>Lignite (40.5-42)</td>
<td>9-12</td>
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<tr>
<td>Siltst, med-gy</td>
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<tr>
<td>Clayst, dk-gy, very silty</td>
<td>15-18</td>
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<td>Lignite (101.5-102.5)</td>
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<td>Lignite (103.5-108.5)</td>
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<td>Clayst, med-gy, very silty</td>
<td>24-27</td>
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<td>Lignite (141-144.5)</td>
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<td>Lignite (146.5-148.5)</td>
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<td>Lignite (149.5-151)</td>
<td>33-36</td>
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<td>Lignite (153-159)</td>
<td>36-39</td>
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<td>Lignite (160-163)</td>
<td>39-42</td>
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<td>Lignite (164-165)</td>
<td>42-45</td>
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<tr>
<td>Clayst, med-gy, very silty</td>
<td>45-48</td>
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<tr>
<td>Sandst, med-gy, fine-grained</td>
<td>48-51</td>
</tr>
<tr>
<td>Siltst, med-gy; high clay content</td>
<td>51-54</td>
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<tr>
<td>Siltst, med-gy</td>
<td>54-57</td>
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<tr>
<td>Sandst, lt-gy, fine-grained</td>
<td>57-60</td>
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<td>Siltst, dk-gy</td>
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<td>Lignite (298.5-299.5)</td>
<td>63-66</td>
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<tr>
<td>Lignite (303-304)</td>
<td>66-69</td>
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<tr>
<td>Clayst, med-gy, sli silty</td>
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LOG DATA

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<tr>
<th>Property</th>
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<td>Logging speed</td>
<td>20 ft/min</td>
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<tr>
<td>Logged depth</td>
<td>339 ft</td>
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<tr>
<td>Density range</td>
<td>3 cps</td>
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<tr>
<td>Gamma range</td>
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</tr>
<tr>
<td>SP sensitivity</td>
<td>100 mV</td>
</tr>
<tr>
<td>Gamma TC</td>
<td>3 sec</td>
</tr>
<tr>
<td>Resistance sensitivity</td>
<td>5 x 10^5 mV</td>
</tr>
<tr>
<td>TD</td>
<td>340 ft</td>
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159
**LITHOLOGY**

- **soil, med-brn, silt, clay, unconsol**
- **clayst, med-gy, mod silty**
- **clayst, dk-gy, very silty**
- **clayst, med-gy, very silty**
- **siltst, med-gy**
- **clayst, dk-gy, sli silty**
- **clayst, med-gy, sli silty**
- **siltst, med-gy**
- **sandst, lt-gy, fine-grained**
- **sandst, lt-gy, med-grained, calc, well-consol**
- **sandst, med-gy, fine-grained**
- **clayst, med-gy, mod silty**
- **lignite (138-139.5)**
- **lignite (141-143)**
- **siltst, lt-gy**
- **lignite (165.5-168)**
- **clayst, med-gy, sli silty**
- **lignite (191.5-193)**
- **clayst, med-gy, mod silty**
- **lignite (210.5-213)**
- **clayst, lt-gy, very silty**
- **sandst, med-gy, fine-grained**
- **lignite (282-283.5)**
- **siltst, med-gy**
- **lignite (314.5-315.5)**
- **clayst, med-gy, sli silty**

- **Density**
- **Gamma ray**
- **SP sensitivity**
- **Resistivity sensitivity**
**Remarks:**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
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<tbody>
<tr>
<td>350-400</td>
<td>Clays, med-gy, silt, siltst, med-gy, siltst, lt-gy, clayst, med-gy, silty</td>
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<td>450-500</td>
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<td>Lignite (443-444)</td>
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<td>550-600</td>
<td>Lignite (467.5-469.5)</td>
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<td>600-650</td>
<td>Lignite (508.5-512.5), lignite (515-516.5)</td>
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<td>650-700</td>
<td>Lignite (570-574), lignite (577-579)</td>
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<td>700-750</td>
<td>Lignite (608.5-609.5)</td>
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<td>750</td>
<td>Sandst, lt-gy, fine-grained</td>
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**Logging:**
- **Speed:** 20 ft/min
- **Logged Depth:** 659 ft
- **Density Range:** 3 cps
- **Density TC:** 1 sec
- **Gamma Range:** 15 cps
- **Gamma TC:** 3 sec
- **SP Sensitivity:** 100 mv
- **Resistance Sensitivity:** 5 ohms

**Logging depiction:**
- TD 660
- 161
LITHOLOGY

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<td>lignite (19-20.5)</td>
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<td>lignite (44-46)</td>
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<td>70-80</td>
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<td>lignite (71-72)</td>
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</table>

REMARKS:

Logging speed 20 ft/min  Density range 3 cps
Logged depth 399 ft  Density TC 1 sec
Gamma range 15 cps  SP sensitivity 100 mv
Gamma TC 3 sec  Resistance sensitivity 5 ohms
REMEXKS:

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Depth</th>
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<tbody>
<tr>
<td>Silt, med-gy, high clay content, lignite (357-358.5)</td>
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<tr>
<td>Clay, med-gy, silt, silty</td>
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<tr>
<td>Clay, med-gy, silt, silty, lignite (389.5-391)</td>
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Logging speed: 20 ft/min
Logged depth: 399 ft
Density range: 3 cps
Density T.C.: 3 sec
Gamma range: 15 cps
Gamma T.C.: 3 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

TD 400
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 83
SHEET 1 OF 2

AREA: Three River
QUAD NAME: Indian Butte

DATE STARTED: 7-7-79
DATE COMP: 7-7-79
COUNTY: Stark
STATE: North Dakota

LOCATION: SEC. 32 T.141 N., R. 91 W., FOOTAGE LOC.

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: A. Banet
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

- soil, med-brn, sand, silt, unconsol
- siltst, med-brn
- sandst, med-gy, fine-grained
- siltst, med-gy
- sandst, med-gy, fine-grained
- clayst, med-gy, sli silty
- lignite (184-185)
- clayst, dk-gy, sli silty
- lignite (203-207.5)
- clayst, med-gy, sli silty
- siltst, med-gy; high clay content
- clayst, med-gy, mod silty
- lignite (263-264)
- siltst, med-gy
- clayst, dk-gy, sli silty
- lignite (311-312)
- siltst, dk-gy; high clay content
- clayst, dk-gy, very silty
- lignite (335.5-339)
- clayst, med-gy, mod silty

Logging speed: 20 ft/min
Density range: 3 cps
Logged depth: 399 ft
Density TC: 1 sec
Gamma range: 15 cps
SP sensitivity: 100 ma
Gamma TC: 3 sec
Resistance sensitivity: 0.5 ohms

DEPTH

FEET

METERS
**REMARKS:**

- **LITHOLOGY**
- **clayst, med-gy, mod silty**
- **siltst, med-gy**
- **sandst, lt-gy, fine-grained**
- **clayst, med-gy, very silty**

**Strip Log**

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<th>Logging speed</th>
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<tr>
<td>Logged depth</td>
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<td>Gamma range</td>
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<td>3 sec</td>
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<tr>
<td>SP sensitivity</td>
<td>Resistance sensitivity</td>
<td>100 mv</td>
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**DEPTH**

<table>
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<th>FEET</th>
<th>METERS</th>
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<td>700</td>
<td>-180</td>
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<tr>
<td>750</td>
<td>-190</td>
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</table>

**TD**

400
LITHOLOGY

soil, med-brn, silt, clay, unconsol

clayst, med-brn, very silty

clayst, med-gy, very silty

siltst, med-gy

clayst, dk-gy, all silty

lignite (22-23.5)

lignite (82-88)

clayst, dk-gy, mod silty

lignite (103.5-106)

clayst, med-gy, very silty

lignite (149-151.5)

clayst, dk-brn to blk, cbncs

siltst, med-gy

sandst, lt-gy, fine-grained

clayst, dk-gy, very silty

siltst, med-gy

sandst, med-gy, fine-grained

clayst, med-gy, mod silty
**REMARKS:**

**LITHOLOGY**

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<td>siltst, med-gy</td>
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<tr>
<td>clayst, med-gy, mod silty</td>
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<td>lignite (353.5-358.5)</td>
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<tr>
<td>lignite (413.5-417)</td>
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<td>clayst, lt-gy, very silty</td>
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</tr>
<tr>
<td>siltst, lt-gy</td>
<td></td>
</tr>
</tbody>
</table>

**STRIP LOG**

- **Logging speed**: 20 ft/min
- **Logged depth**: 490 ft
- **Density range**: 3 cps
- **Gamma range**: 15 cps
- **Gamma TC**: 3 sec
- **SP sensitivity**: 100 mV
- ** Resistance sensitivity**: 5 ohms
AREA: Three River

QUAD NAME: Belfield

DATE STARTED: 7-23-79

DATE COMP.: 7-23-79

COUNTY: Stark

STATE: North Dakota

LOCATION: SEC. 10 T. 140 N., R. 99 W., FOOTAGE LOC.

LOCATION: SEC. 10 T. 140 N., R. 99 W., FOOTAGE LOC.

FOOTAGE: 270 ft

GROUND ELEV: 2722 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

FOOTAGE: 600 ft

TOTAL DEPTH: 600 ft

DRILLING AGENCY: Gregory Drilling Company

DRILL TYPE: Rotary

DEPTH TO FLUID LEVEL: 34 ft

LITHOLOGY RECORDED BY: S. Christensen

GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY:

- soil, med-brn, silt, clay, unconsol
- clayst, med-gy, mod silty
- lignite (52-54)
- siltst, med-gy
- lignite (113.5-121)
- clayst, dk-gy, very silty
- lignite (141-143)
- siltst, med-gy; high clay content
- lignite (180.5-182)
- sandst, lt-gy, fine-grained
- lignite (262-263.5)
- clayst, med-gy, very fine
- siltst, med-gy
- sandst, med-gy, fine-grained
- clayst, med-gy, mod silty
REMARKS:

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Depth</th>
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<tbody>
<tr>
<td>clayst, med-gy, mod silty</td>
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<tr>
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<td>360-380</td>
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<tr>
<td>sandst, med-gy, med-grained, calc, well-consol</td>
<td>380-395</td>
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<tr>
<td>siltst, med-gy; high clay content</td>
<td>395-400</td>
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<td>lignite (414-421)</td>
<td>400-415</td>
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<tr>
<td>clayst, med-gy, very silty</td>
<td>415-420</td>
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<td>lignite (448.5-449.5)</td>
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<tr>
<td>clayst, med-gy, very silty</td>
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<td>siltst, med-gy</td>
<td>440-450</td>
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<tr>
<td>sandst, lt-gy, fine-grained</td>
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<td>lignite (522-524)</td>
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<td>clayst, dk-gy, mod silty</td>
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<td>lignite (544.5-545.5)</td>
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<td>lignite (549-550)</td>
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<tr>
<td>siltst, dk-gy; high clay content</td>
<td>500-510</td>
</tr>
<tr>
<td>lignite (566.5-570.5)</td>
<td>510-520</td>
</tr>
<tr>
<td>siltst, med-gy</td>
<td>520-530</td>
</tr>
<tr>
<td>lignite (587-589)</td>
<td>530-540</td>
</tr>
<tr>
<td>siltst, med-gy</td>
<td>540-550</td>
</tr>
<tr>
<td>lignite (599-600)</td>
<td>600-610</td>
</tr>
</tbody>
</table>

Logging speed: 20 ft/min
Logged depth: 599 ft
Gamma range: 15 cps
Gamma TC: 3 sec
Density range: 3 cps
Density TC: 1 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

TD: 600
REMARKS:

LITHOLOGY

- siltst, med-gy
- clayst, dk-gy, sli silty
- siltst, lt-gy
- clayst, dk-gy, very silty
- clayst, dk-gy, sli silty
- clayst, lt-gy, mod silty

Logging speed: 20 ft/min
Logged depth: 499 ft
Gamma range: 15 cps
Gamma T.C.: 3 sec
Density range: 3 cos
Density T.C.: 1 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

DEPTHE

FEET METERS

500 171

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
1000
LITHOLOGY

soil, med-brn, silt, clay, unconsol

clayst, med-brn, very silty

lignite (32.5-43)

clayst, med-gy, very silty

siltst, med-gy

sandst, med-gy, fine-grained

siltst, med-gy

siltst, med-gy

siltst, med-gy

siltst, med-gy

lignite (135.5-137)

clayst, med-gy

lignite (141-142)

siltst, lt-gy

sandst, lt-gy, fine-grained

clayst, lt-gy, mod silty

siltst, med-gy

clayst, dk-gy, very silty

clayst, dk-brn

lignite (320-327.5)

lignite (343-345.5)
REMARKS:

LITHOLOGY

clay, med-gy, very silty
clay, med-gy, very silty  lignite (379-380.5)
clay, med-gy, very silty  lignite (392-395)
clay, med-gy, very silty
sand, lt-grn, fine-grained

Logging speed 20 ft/min  Density range 3 cps
Logged depth 459 ft  Density TC 1 sec
Gamma range 15 cps  SP sensitivity 100 mv
Gamma TC 3 sec  Resistance sensitivity 5 ohms

DEPTH

clay, med-gy, very silty
clay, med-gy, very silty  lignite (379-380.5)
clay, med-gy, very silty  lignite (392-395)
clay, med-gy, very silty
sand, lt-grn, fine-grained
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 88**

**SHEET 1 OF 2**

<table>
<thead>
<tr>
<th>AREA</th>
<th>Three River</th>
<th>QUAD NAME</th>
<th>New Hradec South</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE STARTED</td>
<td>7-22-79</td>
<td>DATE COMP.</td>
<td>7-22-79</td>
</tr>
<tr>
<td>COUNTY</td>
<td>Stark</td>
<td>STATE</td>
<td>North Dakota</td>
</tr>
<tr>
<td>LOCATION:SEC.</td>
<td>30 T. 140 N, R. 97 W., FOOTAGE LOC.</td>
<td>30 ft макс. FSL 201 ft макс. FWL</td>
<td>GROUND ELEV 2578 ft</td>
</tr>
<tr>
<td>SIZE AND BIT TYPE:</td>
<td>4-3/4 inch drag</td>
<td>FOOTAGE</td>
<td>TOTAL DEPTH 600 ft</td>
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<td>DRILLING AGENCY:</td>
<td>Gregory Drilling Company</td>
<td>DRILL TYPE:</td>
<td>ROTARY</td>
</tr>
<tr>
<td>LITHOLOGY RECORDED BY:</td>
<td>S. Christensen</td>
<td>GEOPHYSICAL LOGS RECORDED BY:</td>
<td>J. Wald</td>
</tr>
<tr>
<td>REMARKS:</td>
<td></td>
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<td></td>
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**LITHOLOGY**

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<tr>
<th>Depth (ft)</th>
<th>Lithology</th>
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<tbody>
<tr>
<td>0</td>
<td>soil, med-brn, silt, clay, unconsol</td>
</tr>
<tr>
<td></td>
<td>clayst, med-brn, mod silty</td>
</tr>
<tr>
<td></td>
<td>clayst, med-gy, very silty</td>
</tr>
<tr>
<td></td>
<td>clayst, dk-gy</td>
</tr>
<tr>
<td></td>
<td>siltst, med-gy</td>
</tr>
<tr>
<td></td>
<td>clayst, med-gy, silt sily</td>
</tr>
<tr>
<td></td>
<td>siltst, med-gy</td>
</tr>
<tr>
<td></td>
<td>clayst, med-gy</td>
</tr>
<tr>
<td></td>
<td>clayst, med-gy</td>
</tr>
<tr>
<td></td>
<td>clayst, dk-brn, silt sily</td>
</tr>
<tr>
<td></td>
<td>sandst, med-gy, fine-grained</td>
</tr>
<tr>
<td></td>
<td>lignite (296.5-304)</td>
</tr>
<tr>
<td></td>
<td>siltst, lt-gy</td>
</tr>
<tr>
<td></td>
<td>lignite (329-332.5)</td>
</tr>
<tr>
<td></td>
<td>clayst, med-gy, mod sily</td>
</tr>
</tbody>
</table>

**Logging speed:** 20 ft/min  
**Density range:** 3 cps  
**Logged depth:** 599 ft  
**Density T.C.:** 1 sec  
**Gamma range:** 15 cps  
**SP sensitivity:** 100 mv  
**Gamma T.C.:** 3 sec  
**Resistance sensitivity:** 5 ohms  

**Graph**

- **DEPTH**
  - FEET
  - METERS

- **LOG**
  - Graph of lithological data with depth and measurements.
REMARKS:

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Depth (ft)</th>
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</thead>
<tbody>
<tr>
<td>Clay, med-gy, mod silty</td>
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<tr>
<td>Clay, med-gy, very silty</td>
<td>360</td>
</tr>
<tr>
<td>Clay, light-gy, fine-grained</td>
<td>365</td>
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<tr>
<td>Clay, med-gy, very silty</td>
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<tr>
<td>Sand, med-gy, fine-grained</td>
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<td>Clay, light-gy, mod silty</td>
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<td>Sand, med-gy, fine-grained</td>
<td>385</td>
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<tr>
<td>Clay, med-gy, very silty</td>
<td>390</td>
</tr>
<tr>
<td>Sand, light-gy</td>
<td>395</td>
</tr>
<tr>
<td>Clay, med-gy, mod silty</td>
<td>400</td>
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<tr>
<td>Sand, med-gy, fine-grained</td>
<td>405</td>
</tr>
<tr>
<td>Clay, med-gy, very silty</td>
<td>410</td>
</tr>
</tbody>
</table>

Logging speed: 20 ft/min  
Logged depth: 599 ft  
Gamma range: 15 cps  
Gamma TC: 3 sec  
Density range: 3 cps  
Density TC: 1 sec  
SP sensitivity: 100 mv  
Resistance sensitivity: 5 ohms

Depth (m):
- 350
- 360
- 365
- 370
- 375
- 380
- 385
- 390
- 395
- 400
- 405
- 410

TD: 600
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 89
SHEET i OF 2

AREA
Three River

QUAD NAME
Dickinson North

DATE STARTED
7-12-79

DATE COMP
7-12-79

LOCATION: SEC. 22 T. 140 N., R. 96 W., FOOTAGE LOC.

COUNTY
Stark

STATE
North Dakota

FOOTAGE
110 ft FNL

775 ft FWL

GROUND
ELEV
2545 ft

GROUND
ELEV

FOOTAGE

TOTAL

DEPT

360 ft

DRILLING AGENCY:
Gregory Drilling Company

DRILL TYPE:
Rotary

LITHOLOGY RECORDED BY
A. Banet

GEOPHYSICAL LOGS RECORDED BY
J. Wald

REMARKS:

LITHOLOGY

Logging speed
20 ft/min

Density range
3 cps

Logged depth
359 ft

Density TO
1 sec

Gamma range
15 cps

SP sensitivity
100 mv

Gamma TO
3 sec

Resistance sensitivity
5 ohms

soil, med-brn, silt, clay, unconsol

clayst, med-brn, very silty

sandst, med-gy, fine-grained

clayst, dk-gy, sli silty

clayst, med-gy, mod silty

siltst, med-gy

siltst, dk-gy

lignite (194-195)

clayst, med-gy, very silty

siltst, med-gy

lignite (239-253)

clayst, dk-gy

siltst, lt-gy

sandst, lt-gy, fine-grained
REMARKS:

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
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<td>400</td>
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</tr>
<tr>
<td>1050</td>
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</table>

LITHOLOGY

sandst, lt-gy, fine-grained

Logging speed 20 ft/min
Logged depth 359 ft
Gamma range 15 cps
Gamma TC 3 sec
Sp sensitivity 100 mv
Resistance sensitivity 5 ohms

TD 360
soil, med-brn, silt, clay, unconsoil

siltst, lt-brn

clayst, med-gy, mod silty

lignite (58.5-60)
lignite (62-63)
lignite (65.5-66.5)

clayst, lt-gy, mod silty

siltst, dk-gy

clayst, med-gy, mod silty

siltst, med-gy

lignite (210-217)
lignite (219-220.5)

clayst, dk-brn, cbcns

lignite (227-230)

sandst, lt-gy, fine-grained

clayst, med-gy, mod silty
REMARKS:

LITHOLOGY

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>609 ft</td>
<td>clayst, med-gy, mod silty, lignite (365-366)</td>
</tr>
<tr>
<td>610 ft</td>
<td>siltst, med-gy</td>
</tr>
<tr>
<td>610 ft</td>
<td>clayst, med-gy, mod silty</td>
</tr>
<tr>
<td>610 ft</td>
<td>lignite (454-455)</td>
</tr>
<tr>
<td>610 ft</td>
<td>clayst, med-gy, very silty, lignite (475-477)</td>
</tr>
<tr>
<td>610 ft</td>
<td>clayst, dk-gy, lignite (484-490)</td>
</tr>
<tr>
<td>610 ft</td>
<td>siltst, med-gy</td>
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<tr>
<td>610 ft</td>
<td>clayst, dk-gy, sil silty</td>
</tr>
<tr>
<td>610 ft</td>
<td>lignite (524.5-530)</td>
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<tr>
<td>610 ft</td>
<td>clayst, med-gy, very silty</td>
</tr>
<tr>
<td>610 ft</td>
<td>siltst, lt-gy</td>
</tr>
</tbody>
</table>

Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 609 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mv  
Gamma TC: 3 sec  
Resistance sensitivity: 5 ohms  

TD 610
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 91
SHEET 1 OF 2

AREA       Three River
QUAD NAME  Davis Buttes

DATE STARTED  7-11-79  DATE COMP.  7-11-79
COUNTY      Stark  STATE       North Dakota

LOCATION: SEC. 32  T.140 N., R. 95 W., FOOTAGE LOC.  282 ft
GROUND ELEV  2510 ft

SIZE AND BIT TYPE:  4-3/4 inch drag
FOOTAGE  ROTARY  700 ft  CORING  ---
TOTAL DEPTH  700 ft

DRILLING AGENCY:  Gregory Drilling Company
DRILL TYPE:  Rotary

LITHOLOGY RECORDED BY  M. Hudson
GEOPHYSICAL LOGS RECORDED BY  J. Wald

REMARKS:

LITHOLOGY

- soil, med-brn, sand, silt, unconsol
- sandst, med-brn, fine-grained
- clayst, dk-gy, silt silty  lignite (67.5-69.5)
- siltst, med-gy; high clay content
- clayst, med-gy, mod silty  lignite (125.5-127)
- clayst, med-gy, mod silty  lignite (157.5-158.5)
- clayst, dk-gy  lignite (166-170.5)
- clayst, med-gy, mod silty  lignite (181-182)
- clayst, lt-gy, very silty  lignite (220-230.5)
- clayst, dk-gy, very silty
- sandst, lt-gy, fine-grained

Logging speed  20 ft/min  Density range  3 cps
Logged depth  699 ft  Density TC  1 sec
Gamma range  15 cps  SF sensitivity  100 mV
Gamma TC  3 sec  Resistance sensitivity  5 ohms

DEPTH

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
# Remarks

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 699 ft
- Gamma range: 15 cps
- Gamma TC: 3 sec
- SP sensitivity: 100 μV
- Resistance sensitivity: 5 ohms

## Lithology

<table>
<thead>
<tr>
<th>Depth Range</th>
<th>Description</th>
<th>TD</th>
</tr>
</thead>
<tbody>
<tr>
<td>350-110</td>
<td>Sand, lt-gy, fine-grained</td>
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<tr>
<td>110-120</td>
<td>Lignite (376-377)</td>
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<tr>
<td>120-210</td>
<td>Clay, med-gy, very silty</td>
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<tr>
<td>210-220</td>
<td>Lignite (415.5-417.5)</td>
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</tr>
<tr>
<td>220-310</td>
<td>Silt, med-gy</td>
<td></td>
</tr>
<tr>
<td>310-320</td>
<td>Lignite (443-444)</td>
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</tr>
<tr>
<td>320-410</td>
<td>Clay, med-gy, mod silty</td>
<td></td>
</tr>
<tr>
<td>410-420</td>
<td>Lignite (499-506.5)</td>
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</tr>
<tr>
<td>420-510</td>
<td>Clay, med-gy, silty</td>
<td></td>
</tr>
<tr>
<td>510-520</td>
<td>Lignite (535-536.5)</td>
<td></td>
</tr>
<tr>
<td>520-530</td>
<td>Clay, med-gy, silty</td>
<td></td>
</tr>
<tr>
<td>530-540</td>
<td>Lignite (552.5-555)</td>
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<td>540-550</td>
<td>Clay, med-gy, mod silty</td>
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<td>550-560</td>
<td>Lignite (573-576)</td>
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<td>560-570</td>
<td>Silt, med-gy; high clay content</td>
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<td>Lignite (588-589)</td>
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<td>580-590</td>
<td>Clay, lt-gy, very silty</td>
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<td>590-600</td>
<td>Lignite (625.5-627)</td>
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<td>600-610</td>
<td>Clay, dk-gy, silty</td>
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<td>610-620</td>
<td>Lignite (636.5-639.5)</td>
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<td>620-630</td>
<td>Clay, med-gy, mod silty</td>
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<td>630-640</td>
<td>Lignite (683-684.5)</td>
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<tr>
<td>640-650</td>
<td>Lignite (686.5-691.5)</td>
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<tr>
<td>650-700</td>
<td>Clay, med-gy, mod silty</td>
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TD: 700
UNITED STATES GEOLOGICAL SURVEY

AREA: Three River
QUAD NAME: Boyle

DATE STARTED: 7-11-79
DATE COMP: 7-11-79
COUNTY: Stark
STATE: North Dakota

LOCATION: SEC. 4 T.140 N., R. 94 W., FOOTAGE LOC. 1490 ft
GROUND ELEV: 2228 ft

FOOTAGE: FSL 12 ft
TOTAL DEPTH: 700 ft
DEPTH TO FLUID LEVEL: 29 ft

SIZE AND BIT TYPE: 4-3/4 inch drag
DRILL TYPE: Rotary

DRILLING AGENCY: Gregory Drilling Company

LITHOLOGY RECORDED BY: A. Banet
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

**LITHOLOGY**

- soil, lt-brn, sand, silt, unconsol
- sandst, lt-brn, fine-grained
- siltst, lt-grn
- clayst, lt-gy, very silty
- siltst, med-gy
- clayst, dk-gy
- clayst, dk-gy, sli silty
- siltst, lt-gy
- clayst, med-gy, mod silty
- siltst, med-gy
- clayst, med-gy, mod silty
- siltst, med-gy
- clayst, med-gy, mod silty
- siltst, med-gy
- lignite (70-77)
- lignite (173.5-175.5)
- lignite (229.5-230.5)
- lignite (232-234)
- lignite (269-271)

Logging speed: 20 ft/min
Density range: 3 cps
Logged depth: 699 ft
Density T.C.: 1 sec
Gamma range: 15 cps
SP sensitivity: 100 mv
Gamma T.C.: 3 sec
Resistance sensitivity: 5 ohms
## Remarks:

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Logging Speed</th>
<th>Density range</th>
<th>Density TC</th>
<th>Gamma range</th>
<th>SP sensitivity</th>
<th>Gamma TC</th>
<th>Resistance sensitivity</th>
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<tbody>
<tr>
<td></td>
<td>20 ft/min</td>
<td>3 cps</td>
<td>1 sec</td>
<td>15 cps</td>
<td>100 mv</td>
<td>3 sec</td>
<td>5 ohms</td>
</tr>
<tr>
<td></td>
<td>699 ft</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Lithology Details:

- **Siltst, med-gy**
  - Lignite (367.5-371.5)
  - Siltst, dk-gy; high clay content

- **Clayst, med-gy, very silty**
  - Lignite (434.5-440)
  - Lignite (444-445)

- **Clayst, med-gy, very silty**

- **Clayst, lt-gy, silt sily**
  - Siltst, lt-gy
  - Lignite (504-505)
  - Lignite (514-515)

- **Clayst, med-gy, very silty**
  - Lignite (530.5-531.5)

- **Clayst, med-gy, very silty**

- **Clayst, dk-brn**
  - Lignite (568-571)

- **Clayst, dk-gy, very silty**
  - Siltst, dk-gy
  - Lignite (598.5-603.5)

- **Clayst, med-gy, very silty**

- **Siltst, med-gy**

- **Clayst, dk-gy, all silty**

- **Siltst, med-gy**

<table>
<thead>
<tr>
<th>Depth</th>
<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
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</table>
UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 93
SHEET 1 OF 2

AREA Three River
QUAD NAME Boyle
DATE STARTED 7-12-79
DATE COMP 7-12-79
COUNTY Stark
STATE North Dakota

LOCATION: SEC. 28 T.140 N., R. 94 W., FOOTAGE LOC.

DATE STARTED 7-12-79
DATE COMP 7-12-79
COUNTY Stark
STATE North Dakota

LOCATION: SEC. 28 T.140 N., R. 94 W., FOOTAGE LOC.

GROUND ELEV 2355 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY S. Christensen
GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

soil, lt-brn, sand, silt, unconsol
clayst, med-brn, mod silty
clayst, med-gy, mod silty
clayst, med-gy, sli silty

lignite (101-104)
clayst, med-gy, mod silty
clayst, med-gy, very silty
sandst, med-gy, fine-grained
clayst, dk-gy, sli silty
lignite (236.5-239)
clayst, dk-gy, sli silty
clayst, med-gy, mod silty
lignite (265.5-268)
clayst, med-gy, mod silty
lignite (301.5-303)
clayst, lt-gy, very silty
clayst, med-gy, very silty
lignite (343.5-345)
REMARKS:

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<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRM LOG</th>
<th>DEPTH</th>
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<td>sandst, lt-gy, med-grained, calc, well-consol</td>
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<td>lignite (547-551)</td>
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<td>lignite (641.5-645)</td>
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<tr>
<td>clayst, lt-gy, very silty</td>
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</tbody>
</table>

Logging speed: 20 ft/min
Logged depth: 699 ft
Density range: 1 cps
Density T.C.: 1 sec
Gamma range: 15 cps
SP sensitivity: 100 mv
Gamma T.C.: 3 sec
Resistivity sensitivity: 5 ohms

DEPT
700 TTD

185
AREA: Three River
QUAD NAME: Richardton

DATE STARTED: 7-7-79  DATE COMP: 7-7-79
COUNTY: Stark  STATE: North Dakota

LOCATION: SEC. 12 T.140 N., R. 93 W., FOOTAGE LOC.

FOOTAGE: 11 ft 60 ft 2210 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

DEPTH TO FLUID LEVEL: 62 ft

LITHOLOGY RECORDED BY: S. Christensen

ELEV: 2210 ft

LOGGING SPEED: 20 ft/min
DENSITY RANGES:
- Density TC: 3 cps
- Density SP: 1 sec
- Gamma TC: 15 cps
- Gamma SP: 3 sec
- Resistance: 100 ohms

LITHOLOGY:
- Soil, med-brn, sand, silt, unconsol
- Sandst, lt-brn, fine-grained
- Clayst, med-gy, mod silty
- Lignite (64.5-67.5)
- Clayst, med-gy, mod silty
- Lignite (94.5-95.5)
- Clayst, dk-gy, sli silty
- Lignite (110-112)
- Clayst, dk-gy, sli silty
- Lignite (124-128.5)
- Clayst, med-gy, mod silty
- Lignite (149.5-151)
- Clayst, med-gy, very silty
- Lignite (182-183)
- Clayst, lt-gy, very silty
- Siltst, med-gy
- Sandst, med-gy, fine-grained, calc
- Lignite (236-241.5)
- Sandst, med-gy, fine-grained
- Clayst, med-gy, very silty
- Sandst, lt-gy, fine-grained
LITHOLOGY

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
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<tbody>
<tr>
<td>300-350</td>
<td>Sand, lt-gy, fine-grained</td>
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<td>350-400</td>
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<td>400-450</td>
<td>Lignite (401-403)</td>
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<tr>
<td>450-500</td>
<td>Clay, med-gy, mod silty</td>
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<tr>
<td>500-550</td>
<td>Lignite (431-435.5)</td>
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<tr>
<td>550-600</td>
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<tr>
<td>600-650</td>
<td>Lignite (482.5-484)</td>
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<tr>
<td>650-700</td>
<td>Clay, med-gy, silty</td>
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<tr>
<td>700-750</td>
<td>Lignite (512.5-513.5)</td>
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<tr>
<td>TD 642</td>
<td>Silt, dk-gy, high clay content</td>
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<td></td>
<td>Lignite (527.5-529)</td>
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<td></td>
<td>Lignite (531-537.5)</td>
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<td>Lignite (548.5-550)</td>
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<td>Lignite (598-599.5)</td>
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<td></td>
<td>Lignite (612.5-613.5)</td>
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<td></td>
<td>Lignite (619.5-621)</td>
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<td></td>
<td>Clay, med-gy, mod silty</td>
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</table>
**AREA**: Three River  
**QUAD NAME**: Taylor

**DATE STARTED**: 7-8-79  
**DATE COMP**: 7-8-79  
**COUNTY**: Stark  
**STATE**: North Dakota

**LOCATION**: SEC. 20 T 140 N, R. 93 W., FOOTAGE LOC. 1218 ft  
**FOOTAGE**: 60 ft  
**TOTAL**: FTP, 60 ft  
**GROUND ELEV**: 2518 ft

**SIZE AND BIT TYPE**: 4-3/4 inch drag  
**FOOTAGE**: ROTARY 600 ft  
**TOTAL DEPTH**: 600 ft

**DRILLING AGENCY**: Gregory Drilling Company  
**DRILL TYPE**: Rotary  
**DEPTH TO FLUID LEVEL**: 40 ft

**LITHOLOGY RECORDED BY**: S. Christensen  
**GEOPHYSICAL LOGS RECORDED BY**: J. Wald

**REMARKS**:

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
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</thead>
<tbody>
<tr>
<td>soil, lt-brn, sand, silt, unconsol</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>sandst, med-brn, fine-grained</td>
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<td>clayst, med-gy, very silty</td>
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<td>lignite (107-109.5)</td>
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<td>clayst, med-gy, very silty</td>
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<td>lignite (141.5-143.5)</td>
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<td>lignite (156.5-157.5)</td>
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<td>lignite (313.5-314.5)</td>
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<td>clayst, med-gy, ali silty</td>
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<tr>
<td>lignite (332-337.5)</td>
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</table>

Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 599 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mV  
Gamma TC: 3 sec  
Resistance sensitivity: 5 ohms
**REMARKS:**

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<th>Strip Log</th>
<th>Depth (Feet)</th>
<th>Depth (Meters)</th>
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<tbody>
<tr>
<td>Clay, med-brn, very silty</td>
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<tr>
<td>Sand, med-gy, fine-grained</td>
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<tr>
<td>Clay, med-gy, very silty</td>
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<td>Silt, med-gy</td>
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<td>Lignite (426-428)</td>
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<td>Clay, dk-gy, sli silty</td>
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<td>Lignite (468.5-470)</td>
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<tr>
<td>Clay, dk-gy</td>
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Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 599 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 μv  
Gamma TC: 3 sec  
Resistance sensitivity: 5 ohms
LOCATION: SEC. 10 T.140 N., R. 91 W., FOOTAGE LOC.

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company

LITHOLOGY RECORDED BY A. Banet

REMARKS:

LITHOLOGY

| STRIP LOC | DEPTH
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<td>sandst, lt-gy, med-grained, calc, well-consol</td>
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<td>lignite (305-307)</td>
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REMARKS:

LITHOLOGY

siltst, lt-gy

clayst, dk-brn to blk, cbncs, slt silty

clayst, med-gy, very silty

siltst, med-gy

Logging speed 20 ft/min  Density range 3 cps
Logged depth 504 ft  Density T.C. 1 sec
Gamma range 15 cps  SP sensitivity 100 mv
Gamma T.C. 3 sec  Resistance sensitivity 5 ohms

DEPTH

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

METERS

-120
-130
-140
-150
-160
-170
-180
-190
-200

logging speed 20 ft/min
Logged depth 504 ft
Gamma range 15 cps
Gamma T.C. 3 sec

TD 505
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<td>clayst, dk-brn to blk, cbncs</td>
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REMARKS:

LITHOLOGY

siltst, med-gy
clayst, lt-gy, sli silty

siltst, lt-gy
clayst, med-gy, mod silty
siltst, dk-gy; high clay content
clayst, dk-gy, mod silty  lignite (445.5-446.5)
clayst, dk-gy, mod silty  lignite (452.5-454.5)
clayst, dk-gy, mod silty  lignite (466.5-468.5)
clayst, med-gy, mod silty
siltst, lt-gy
clayst, med-gy, sli silty
clayst, lt-gy, sli silty  lignite (524.5-526.5)
clayst, lt-gy, sli silty
siltst, lt-gy
sandst, med-gy, fine-grained
clayst, med-gy, sli silty  lignite (603-605.5)
siltst, med-gy
clayst, med-gy  lignite (627-628)
siltst, med-gy, mod silty
siltst, lt-gy
clayst, lt-gy, sli silty
siltst, med-gy
REMARKS:

LITHOLOGY

- Clayst, med-gy, mod silty
- Clayst, dk-gy, sli silty
- Siltst, med-gy; high clay content
- Clayst, dk-brn to blk, cbncs
- Siltst, lt-gy
- Clayst, dk-gy, mod silty
- Siltst, lt-gy

Lignite (369-370)
Lignite (380.5-394)
Lignite (395-396.5)
Lignite (399-400)
Lignite (531-532)
soil, lt-brn, sand, silt, unconsol

sandst, med-gy, fine-grained

lignite (32-47)

clayst, med-gy, very silty

clayst, med-gy, mod silty

clayst, med-gy, sli silty

clayst, med-gy, mod silty

siltst, dk-gy

lignite (163-164)

clayst, med-gy, mod silty

siltst, lt-gy

clayst, dk-brn

lignite (234.5-240)

lignite (245.5-246.5)

lignite (248-249.5)

lignite (254-257.5)

clayst, med-gy, very silty

siltst, med-gy

sandst, med-gy, fine-grained

lignite (307.5-312)

clayst, med-gy, very silty

sandst, lt-gy, fine-grained
**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STIP LOG</th>
<th>DEPTH</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>sandst, lt-gy, fine-grained</td>
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<tr>
<td>siltst, dk-gy; high clay content</td>
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<td>sandst, med-gy, fine-grained</td>
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</tbody>
</table>

- Logging speed: 20 ft/min
- Logged depth: 459 ft
- Density range: 3 cps
- Density TC: 1 sec
- Gamma range: 15 cps
- Gamma TC: 3 sec
- SP sensitivity: 100 mV
- Resistance sensitivity: 5 ohms

TD 460
UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 100
SHEET 1 OF 2

AREA Three River
QUAD NAME Fryburg
DATE STARTED 7-21-79
DATE COMP. 7-21-79
COUNTY Billings
STATE North Dakota

LOCATION: SEC. 14 T.139 N., R.100 W., FOOTAGE LOC. 650 ft
FNL 400 ft
FEL 2688 ft
GROUND ELEV. 2688 ft

SIZE AND BIT TYPE: 4-3/4 inch drag
ROTARY 421 ft
CORING ---
TOTAL DEPTH 421 ft

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY A. Banet
GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

<table>
<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEET</td>
<td>METERS</td>
</tr>
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</table>

- soil, med-brn, silt, clay, unconsol
- siltst, lt-brn; high clay content
- lignite (36-43)
- clayst, med-gy, mod silty
- siltst, dk-gy
- lignite (78.5-81.5)
- clayst, dk-brn
- lignite (134-149)
- clayst, dk-brn
- siltst, med-gy; high clay content
- siltst, med-gy
- lignite (205.5-206.5)
- sandst, med-gy, fine-grained
- clayst, lt-gy, very silty
- lignite (261-266)
- clayst, dk-gy, sli silty
- lignite (277-278)
- clayst, dk-gy, sli silty
- lignite (293-297)
- clayst, med-gy, mod silty

Logging speed: 20 ft/min
Density range: 3 cps
Logged depth: 420 ft
Density TC: 3 sec
Gamma range: 15 cps
SP sensitivity: 100 mV
Gamma TC: 3 sec
Resistance sensitivity: 57 ms
**REMARKS:**

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<tr>
<th>LITHOLOGY</th>
<th>STRAT LOG</th>
<th>DEPTH</th>
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<tbody>
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<td>clayst, med-gy, mod silty</td>
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<td>siltst, med-gy</td>
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Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 420 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mv  
Gamma TC: 3 sec  
Resistance sensitivity: 5 ohms

TD: 421

**DEPTH**

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

**ELECTRICLOG**

- 100 mV
- 200 mV
- 300 mV
- 400 mV
- 500 mV
- 600 mV
- 700 mV
- 800 mV
- 900 mV
- 1000 mV

**ELECTRIC LOG**

- 1000 mV
- 2000 mV
- 3000 mV
- 4000 mV
- 5000 mV
- 6000 mV
- 7000 mV
- 8000 mV
- 9000 mV
- 10000 mV
UNITED STATES GEOLOGICAL SURVEY SHEET OF AREA Three River QUAD NAME Belfield SW

DATE STARTED 7-21-79 DATE COMP 7-21-79 COUNTY Stark STATE North Dakota

LOCATION: SEC. 10 T. 139 N., R. 99 W., FOOTAGE LOC. 108 ft

SIZE AND BIT TYPE: 4-3/4 inch drag FOOTAGE ROTARY 380 ft CORING TOTAL DEPTH 380 ft

COUNTY Stark STATE North Dakota

LOCATION: SEC. 10 T. 139 N., R. 99 W., FOOTAGE LOC. 108 ft

SIZE AND BIT TYPE: 4-3/4 inch drag FOOTAGE ROTARY 380 ft CORING TOTAL DEPTH 380 ft

DRILLING AGENCY: Gregory Drilling Company DRILL TYPE: Rotary DEPTH TO FLUID LEVEL 12 ft

LITHOLOGY RECORDED BY S. Christensen GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

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- soil, lt-brn, silt, clay, unconsol
- clayst, med-brn, mod silty
- lignite (28-33)
- clayst, med-gy, silt silty
- clayst, med-gy, very silty
- lignite (70.5-72.5)
- clayst, dk-gy, silt silty
- lignite (87.5-89.5)
- clayst, med-gy, mod silty
- lignite (117-131)
- siltst, med-gy
- clayst, dk-brn to blk, cbncs
- clayst, med-gy, mod silty
- lignite (200.5-201.5)
- clayst, med-gy, mod silty
- lignite (231-236.5)
- clayst, dk-gy, silt silty
- siltst, med-gy
- sandst, lt-gy, med-grained, calc, well-consol
- siltst, med-gy
- clayst, dk-brn to blk, cbncs
- sandst, med-gy, fine-grained

Logging speed 20 ft/min Density range 3 cps
Logged depth 380 ft Density TC 1 sec
Gamma range 15 cps SP sensitivity 100 mv
Gamma TC 3 sec Resistance sensitivity 5 ohms
LITHOLOGY

sandst, med-gy, fine-grained
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 102

SHEET 1 OF 2

AREA: Three River
QUAD NAME: Belfield SW

DATE STARTED: 7-21-79
DATE COMP: 7-21-79
COUNTY: Stark
STATE: North Dakota

LOCATION: SEC. 30 T.139 N., R.99 W., FOOTAGE LOC.:
253 ft
GROUND ELEV: 2624 ft

SIZE AND BIT TYPE: 4-3/4 inch drag
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

FOOTAGE: 380 ft
DEPTH TO FLUID LEVEL: 3 ft

TOTAL DEPTH: 380 ft

LITHOLOGY RECORDED BY: S. Christensen
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY:

- soil, med-brn, silt, clay, unconsol
- clayst, lt-brn, mod silty
  lignite (29-30)
- clayst, med-gy, mod silty
- clayst, dk-gy
  lignite (67-82)
- clayst, lt-gy, sli silty
- clayst, med-gy, mod silty
- clayst, dk-brn
  lignite (149-150.5)
- clayst, med-gy, mod silty
  lignite (203.5-210.5)
- clayst, med-gy, mod silty
  lignite (228.5-229.5)
- clayst, med-gy, mod silty
  lignite (240-244.5)
- clayst, dk-brn
- clayst, med-gy, mod silty
  lignite (307-310)
  lignite (314.5-315.5)
- clayst, med-gy, mod silty
REMARKS:

LITHOLOGY

clayst, med-gy, mod silty
sandst, med-gy, fine-grained
clayst, lt-gy, ali silty

Logging speed: 20 ft/min
Logged depth: 379 ft
Gamma range: 15 cps
Gamma TC: 3 sec
Density range: 3 cps
Density TC: 1 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

TD: 380
AREA: Three River
QUAD NAME: Belfield SE
DATE STARTED: 7-21-79
DATE COMP.: 7-21-79
COUNTY: Stark
STATE: North Dakota
LOCATION-SEC.: 30 T139 N., R. 98 W., FOOTAGE LOC.: 355 ft
FOOTAGE: 18 ft
GROUND ELEV: 2555 ft
TOTAL DEPTH: 360 ft
SIZE AND BIT TYPE: 4-3/4 inch drag
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
DEPTH TO FLUID LEVEL: 1 ft
LITHOLOGY RECORDED BY: M. Hudson
GEOPHYSICAL LOGS RECORDED BY: J. Wald

LITHOLOGY

- soil, med-brn, silt, clay, unconsol
- siltst, lt-brn
- sandst, med-brn, fine-grained
- lignite (83.5-97.5)
- clayst, med-gy, sli-sily
- clayst, med-gy, mod sily
- lignite (174.5-175.5)
- clayst, med-gy, very sily
- sandst, lt-gy, fine-grained, calc, well-consol
- clayst, dk-gy, sli sily
- lignite (224.5-235.5)
- clayst, dk-gy, sli sily
- lignite (254-258)
- clayst, med-gy, very sily
- sandst, med-gy, fine-grained
- clayst, lt-gy, sli sily
LITHOLOGY

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<tr>
<th>Depth</th>
<th>Description</th>
<th>Depths</th>
<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
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<td>350</td>
<td>110</td>
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</tbody>
</table>

Log: Logging speed 20 ft/min, Density range 3 cps, Logged depth 359 ft, Density TC 1 sec, Gamma range 15 cps, SP sensitivity 100 mv, Gamma TC 3 sec, Resistance sensitivity 5 ohms.
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO. 104**

**SHEET 1 OF 1**

**AREA** Three River  
**QUAD NAME** South Heart

**DATE STARTED** 7-22-79  
**DATE COMPLETED** 7-22-79  
**COUNTY** Stark  
**STATE** North Dakota

**LOCATION: SEC. 18 T139 N., R.97 W., FOOTAGE LOC.** 1315 ft 50 ft 2530 ft  
**FOOTAGE** 340 ft  
**GROUND ELEV** 50 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag  
**DRILL TYPE:** Rotary  
**DEPART TO FLUID LEVEL** 5 ft

**DRILLING AGENCY:** Gregory Drilling Company  
**REMARKS:**

**LITHOLOGY**

<table>
<thead>
<tr>
<th>Strata Type</th>
<th>Density Range</th>
<th>Gamma Range</th>
<th>Resistance Sensitivity</th>
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<tbody>
<tr>
<td>Soil, lt-brn, sand, silt, unconsol</td>
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<td>15 cps</td>
<td>100 mV</td>
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<td>Clayst, med-gy, silty</td>
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<tr>
<td>Clayst, med-gy, very silty</td>
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<td>Lignite (63-73.5)</td>
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<td>Lignite (75.5-77)</td>
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<td>Lignite (224.5-231)</td>
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<tr>
<td>Sandst, lt-gy, fine-grained</td>
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</table>
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 105**  
**SHEET 1 OF 2**

**AREA**  
Three River

**QUAD NAME**  
Dickinson South

**DATE STARTED**  
7-12-79

**DATE COMP.**  
7-12-79

**COUNTY**  
Stark

**STATE**  
North Dakota

**LOCATION-SEC.**  
30

**T.139 N, R. 96 W., FOOTAGE LOC.**  
25 ft

**FOOTAGE**  
25 ft

**KEY**  
1

**FSL**  
85 ft

**GND**  
2500 ft

**ELEV**  
2500 ft

**SIZE AND BIT TYPE:**  4-3/4 inch drag

**DRILLING AGENCY:**  Gregory Drilling Company

**DATE STARTED**  
7-12-79

**DATE COMP.**  
7-12-79

**COUNTY**  
Stark

**STATE**  
North Dakota

**LOCATION-SEC.**  
30

**T.139 N, R. 96 W., FOOTAGE LOC.**  
25 ft

**FOOTAGE**  
25 ft

**TOTAL DEPTH**  
360 ft

**DEPTH TO**  
49 ft

**DRILL TYPE:**  Rotary

**REMARKS:**

**LITHOLOGY**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>359</td>
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<td>207</td>
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<td>181</td>
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<td>178</td>
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**LOGGING SPEED:** 20 ft/min  
**Density range:** 3 cps  
**Gamma range:** 15 cps  
**Gamma TC:** 3 sec  
**SP sensitivity:** 100 mv  
**Resistance sensitivity:** 125 ohms
**REMARKS:**

**LITHOLOGY**

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<tr>
<td>siltst, lt-gy</td>
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- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 359 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 12.5 ohms

<table>
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<tr>
<td>750</td>
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## United States Geological Survey

**Hole No. 106**

**Area:** Three River

**Date Started:** 7-11-79

**Date Comp:** 7-11-79

**County:** Stark

**State:** North Dakota

### Location

- **Sec.:** 12
- **T.:** 139 N
- **R.:** 95 W
- **Footage Loc.:** 690 ft

### Size and Bit Type
- **Type:** 4-3/4 inch drag

### Drilling Agency
- **Agency:** Gregory Drilling Company

### Drilling Type
- **Type:** Rotary

### Lithology Recorded by
- **Recorded by:** A. Rane

### Geophysical Logs Recorded by
- **Recorded by:** J. Wald

### Remarks

#### Lithology

<table>
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<th>Strip Log</th>
<th>Depth</th>
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<th>Meters</th>
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<td>siltst, med-gy</td>
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<td>Clayst, dk-gy, silt</td>
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<td>Lignite (129.5-133.5)</td>
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REMARKS:

LITHOLOGY

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<tr>
<th>Depth (ft)</th>
<th>Lithology</th>
</tr>
</thead>
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<tr>
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Logging speed: 20 ft/min  
Logged depth: 379 ft  
Density range: 3 cps  
Density TC: 1 sec  
Gamma range: 15 cps  
Gamma TC: 3 sec  
SP sensitivity: 100 mV  
Resistance sensitivity: 5 ohms  

DEPTH

<table>
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<tr>
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<th>METERS</th>
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<tr>
<td>350</td>
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<td>750</td>
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Logged depth: 379 ft  
Density range: 3 cps  
Density TC: 1 sec  
Gamma range: 15 cps  
Gamma TC: 3 sec  
SP sensitivity: 100 mV  
Resistance sensitivity: 5 ohms  

TD: 380
**LITHOLOGY**

<table>
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<tr>
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<td>sandst, lt-brn, med-grained</td>
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<td>clayst, lt-gy, silt, silty</td>
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<td>ignite (193.5-196.5)</td>
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<td>ignite (289-296)</td>
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<td>ignite (338-339)</td>
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**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
<th>DEPTH</th>
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<tbody>
<tr>
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<tr>
<td>siltst, med-gy</td>
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<tr>
<td>clayst, dk-gy, very silty</td>
<td></td>
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<td>lignite (354-356)</td>
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<td>lignite (396-397)</td>
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<td>lignite (398-400)</td>
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<tr>
<td>clayst, med-gy, mod silty</td>
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Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 439 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 ma  
Gamma TC: 3 sec  
Resistance sensitivity: 5 ohms  

Logged depth: 439 ft  
Gammr rarfje: 15 sp  
SP sensitivity: 100 m«  
Gammr TT • 3 «pr Resistance sensitivity: 5 ohms  

<table>
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<tr>
<th>FEET</th>
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</tr>
<tr>
<td>700</td>
<td>180</td>
</tr>
<tr>
<td>750</td>
<td>190</td>
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UNITED STATES GEOLOGICAL SURVEY
HOLE NO 108
SHEET 1 OF 2

AREA Three River QUAD NAME Taylor
DATE STARTED 7-8-79 DATE COMP. 7-8-79 COUNTY Stark STATE North Dakota
LOCATION SEC. 6 T.139 N., R.93 W., FOOTAGE LOC. 1410 ft FNL 2590 ft FNL GROUND ELEV 2480 ft
SIZE AND BIT TYPE: 4-3/4 inch drag FOOTAGE ROTARY 620 ft CORING --- TOTAL DEPTH 620 ft
DRILLING AGENCY: Gregory Drilling Company DRILL TYPE: Rotary DEPTH TO FLUID LEVEL 18 ft.
LITHOLOGY RECORDED BY M. Hudson GEOPHYSICAL LOGS RECORDED BY J. Wald
REMARKS:

LITHOLOGY

<table>
<thead>
<tr>
<th>STRIP LOG</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logging speed: 20 ft/min</td>
<td>Density range: 3 cps</td>
</tr>
<tr>
<td>Logged depth: 619 ft</td>
<td>Density 1C: 1 sec</td>
</tr>
<tr>
<td>Gamma range: 15 cps</td>
<td>SP sensitivity: 100 mV</td>
</tr>
<tr>
<td>Gamma TC: 3 sec</td>
<td>Resistance sensitivity: 5 ohms</td>
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</table>

soil, med-brn, sand, silt, unconsol

sandst, med-brn, fine-grained

clayst, med-gy, silt silty
clayst, dk-gy, silt silty
clayst, dk-gy, silt silty
clayst, med-gy, mod silty
clayst, med-gy, very silty

siltst, dk-gy; high clay content
lignite (104.5-105.5)

clayst, med-gy, very silty

siltst, med-gy

clayst, med-gy, fine-grained
clayst, dk-gy, silt silty
lignite (273.5-274.5)
clayst, med-gy, very silty
clayst, dk-gy, mod silty
lignite (309.5-310.5)
clayst, med-gy, silt silty
lignite (319-322.5)
siltst, med-gy
## Remarks:

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Description</th>
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<tbody>
<tr>
<td>silt, med-gy</td>
<td>lignite (380-381)</td>
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<tr>
<td>clay, med-gy, mod silty</td>
<td>lignite (387.5-389)</td>
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<tr>
<td>silt, dk-gy</td>
<td>lignite (411-412)</td>
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<td>lignite (441-443)</td>
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<td>silt, dk-gy</td>
<td>lignite (447.5-448.5)</td>
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<td>lignite (466-467.5)</td>
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<td>lignite (484-485)</td>
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<td>lignite (539.5-548)</td>
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<td>silt, lt-gy</td>
<td>lignite (587-588)</td>
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<td>clay, med-gy, mod silty</td>
<td>lignite (596-599)</td>
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<tr>
<td>silt, dk-gy</td>
<td>lignite (605-607)</td>
</tr>
<tr>
<td>clay, med-gy, very silty</td>
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</table>

Logging speed: 20 ft/min  
Density range: 1 cps  
Logged depth: 619 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
Gamma TC: 3 sec  
SP sensitivity: 100 mv  
Resistance sensitivity: 5 ohms
# Lithology

<table>
<thead>
<tr>
<th>Depth Range</th>
<th>Lithology Description</th>
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</thead>
<tbody>
<tr>
<td>0-10 ft</td>
<td>Soil, med-brn, silt, clay, unconsol</td>
</tr>
<tr>
<td>10-20 ft</td>
<td>Clay, med-brn, very silty</td>
</tr>
<tr>
<td></td>
<td>Lignite (34.5-37)</td>
</tr>
<tr>
<td>20-30 ft</td>
<td>Clay, med-gy, mod silty</td>
</tr>
<tr>
<td>30-40 ft</td>
<td>Clay, dk-brn</td>
</tr>
<tr>
<td>40-50 ft</td>
<td>Clay, med-gy, mod silty</td>
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<tr>
<td>50-60 ft</td>
<td>Lignite (118-120.5)</td>
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<tr>
<td>60-70 ft</td>
<td>Clay, med-gy, very silty</td>
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<tr>
<td>70-80 ft</td>
<td>Lignite (139.5-141)</td>
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<tr>
<td>80-90 ft</td>
<td>Lignite (143-144)</td>
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<tr>
<td>90-100 ft</td>
<td>Lignite (146.5-147.5)</td>
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<tr>
<td>100-110 ft</td>
<td>Clay, dk-gy, silt silty</td>
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<tr>
<td>110-120 ft</td>
<td>Clay, med-gy, med-grained, calc, well-consol</td>
</tr>
<tr>
<td>120-130 ft</td>
<td>Clay, med-gy, ali silty</td>
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<tr>
<td>130-140 ft</td>
<td>Lignite (312.5-313.5)</td>
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<tr>
<td>140-150 ft</td>
<td>Clay, lt-gy, very silty</td>
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<tr>
<td>150-160 ft</td>
<td>Clay, med-gy, mod silty</td>
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<tr>
<td>160-170 ft</td>
<td>Lignite (164-166.5)</td>
</tr>
<tr>
<td>170-180 ft</td>
<td>Clay, lt-gy, mod silty</td>
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# Geophysical Logs

- **Logging speed**: 20 ft/min
- **Logged depth**: 439 ft
- **Density range**: 3 cps
- **Gamma range**: 15 cps
- **Resistivity range**: 100 mΩ
- **Densitas TC**: 1 sec
- **Resistivity sensitivity**: 50 mΩ/cps

---

# Diagram

The diagram includes a graphical representation of the lithology and geophysical logs, with depth on the y-axis and feet/meters on the x-axis.
### Remarks:

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Depth (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay, med-gy, mod silty</td>
<td>350</td>
</tr>
<tr>
<td>Clay, dk-brn</td>
<td>400</td>
</tr>
<tr>
<td>Clay, med-gy, mod silty</td>
<td>450</td>
</tr>
<tr>
<td>Clay, med-gy, mod silty</td>
<td>500</td>
</tr>
<tr>
<td>Clay, med-gy, sili silty</td>
<td>550</td>
</tr>
<tr>
<td>Lignite (367-372)</td>
<td>600</td>
</tr>
<tr>
<td>Lignite (401-403.5)</td>
<td>650</td>
</tr>
<tr>
<td>Lignite (430-431.5)</td>
<td>700</td>
</tr>
</tbody>
</table>

**Logging Parameters:**
- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 439 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 110**

**SHEET 1 OF 2**

**AREA** Three River

**QUAD NAME** Richardton

**DATE STARTED** 7-7-79  
**DATE COMP.** 7-7-79  
**COUNTY** Stark  
**STATE** North Dakota

**LOCATION-SEC.** 4 T139 N., R.92 W., FOOTAGE LOC. 60 ft KXX 60 ft KXX

**FOOTAGE** 656 ft 656 ft  
**GROUND ELEV.** 2464 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag

**DRILLING AGENCY:** Gregory Drilling Company

**DRILL TYPE:** Rotary

**DEPTH TO FLUID LEVEL:** 42 ft

**LITHOLOGY RECORDED BY** A. Banet

**GEOPHYSICAL LOGS RECORDED BY** J. Wald

**REMARKS:**

### LITHOLOGY

| Logging speed | 20 ft/min |
| Dens. range | 3 cps |
| Logged depth | 656 ft |
| Dens. TC | 1 sec |
| Gamma range | 15 cps |
| SF sensitivity | 100 mv |
| Gamma TC | 3 sec |
| Resistance sensitivity | 5 ohms |

- soil, med-brn, silt, clay, unconsol
- siltst, med-brn
- clayst, med-gy, sli silty
- clayst, dk-gy
- clayst, dk-brn
- clayst, med-gy, mod silty
- lignite (74-79)
- lignite (86.5-88)
- lignite (92-93)
- lignite (121.5-125)
- siltst, med-gy; high clay content
- sandst, lt-gy, fine-grained
- clayst, med-gy, mod silty
- lignite (173.5-174.5)
- clayst, med-gy, mod silty
- clayst, dk-gy
- clayst, dk-gy, very silty
- lignite (221.5-222.5)
- lignite (227.5-229.5)
- siltst, med-gy
- clayst, med-gy, very silty
- siltst, dk-gy
- clayst, dk-brn
- lignite (281-286.5)
- sandst, med-gy, fine-grained
- clayst, dk-brn
- siltst, med-gy
- clayst, med-gy, mod silty
**REMARKS:**

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<thead>
<tr>
<th>LITHOLOGY</th>
<th>LOG</th>
<th>DEPTH</th>
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<tr>
<td>clayst, med-gy, mod silty</td>
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<tr>
<td>siltst, med-gy; high clay content</td>
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</tr>
<tr>
<td>siltst, dk-gy</td>
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<td>siltst, dk-gy</td>
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<td>siltst, lt-gy</td>
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<tr>
<td>clayst, med-gy, very silty</td>
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<tr>
<td>clayst, med-gy, sli silty</td>
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<tr>
<td>clayst, dk-gy, mod silty</td>
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<td>siltst, dk-gy</td>
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<tr>
<td>sandst, med-gy, fine-grained</td>
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</table>

- **Logging speed:** 20 ft/min
- **Density range:** 3 cps
- **Logged depth:** 656 ft
- **Density TC:** 1 sec
- **Gamma range:** 15 cps
- **SP sensitivity:** 100 mV
- **Gamma TC:** 3 sec
- **Resistivity sensitivity:** 5 ohms
LITHOLOGY

- soil, med-brown, silt, clay, unconsolidated
- clays, medium-gray, moderate silt content
  lignite (41.5-43)
- silt, medium-gray; high clay content
- clays, medium-gray, very silt content
- silt, medium-gray; high clay content
- clay, dark-brown to black, coal bed
- clay, medium-gray, very silt content
  lignite (179-181.5)
  lignite (183-186)
- silt, medium-gray
- clay, medium-gray, very silt content
- silt, medium-gray
- clay, dark-gray
  lignite (220-221.5)
  lignite (230-231.5)
- clay, medium-gray, very silt content
- sand, light-gray, fine-grained, calcareous, well-consolidated
- clay, medium-gray, very silt content
  lignite (277-278)
- clay, dark-brown
- silt, medium-gray
- clay, dark-gray, very silt content
- silt, medium-gray
- clay, medium-gray, silty silt
- silt, medium-gray

DEPTH

FEET METERS

0 0 10 20 30 40 50 60 70 80 90 100
0 10 20 30 40 50 60 70 80 90 100

Logging speed 20 ft/min Density range 3 cps
Loggers depth 506 ft Density TC 1 %
Gamma range 15 cps SP sensitivity 100 μV
Gamma TC 3 sec Resistance sensitivity 5 ohms

GEOPHYSICAL LOGS RECORDED BY J. Waid

REMARKS:

- Lithology recorded by A. Banet
### Lithology

<table>
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<tr>
<th>Depth (FT)</th>
<th>Lithology</th>
<th>Gamma Range</th>
<th>Density Range</th>
<th>Log Speed</th>
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<tr>
<td>350-400</td>
<td>Siltstone, med-gy</td>
<td>15 cps</td>
<td>3 cps</td>
<td>20 ft/min</td>
<td>507</td>
</tr>
<tr>
<td>450-500</td>
<td>Claystone, med-gy, very silty</td>
<td>15 cps</td>
<td>3 cps</td>
<td>20 ft/min</td>
<td>507</td>
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<tr>
<td>550-600</td>
<td>Claystone, dk-brown</td>
<td>15 cps</td>
<td>3 cps</td>
<td>20 ft/min</td>
<td>507</td>
</tr>
<tr>
<td>650-700</td>
<td>Claystone, med-gy, very silty</td>
<td>15 cps</td>
<td>3 cps</td>
<td>20 ft/min</td>
<td>507</td>
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<tr>
<td>750-800</td>
<td>Claystone, med-gy, mod-silty</td>
<td>15 cps</td>
<td>3 cps</td>
<td>20 ft/min</td>
<td>507</td>
</tr>
</tbody>
</table>

**Remarks:**

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 506 ft
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms

---

**Diagram:**

A seismic profile showing the depth and lithology with corresponding gamma and density values.
<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>soil, med-brn, silt, clay, unconsol</td>
<td>![Strip Log 1]</td>
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<tr>
<td>clayst, med-gy, sl sl silty</td>
<td>![Strip Log 2]</td>
</tr>
<tr>
<td>clayst, med-gy, mod silty</td>
<td>![Strip Log 3]</td>
</tr>
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<td>siltst, med-gy</td>
<td>![Strip Log 4]</td>
</tr>
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<td>siltst, dk-gy; high clay content</td>
<td>![Strip Log 5]</td>
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<td>siltst, med-gy</td>
<td>![Strip Log 7]</td>
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<tr>
<td>siltst, med-gy</td>
<td>![Strip Log 8]</td>
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<td>clayst, dk-gy, very silty</td>
<td>![Strip Log 9]</td>
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<td>![Strip Log 10]</td>
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<tr>
<td>clayst, dk-brn</td>
<td>![Strip Log 11]</td>
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<td>![Strip Log 12]</td>
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<td>clayst, med-gy, mod silty</td>
<td>![Strip Log 13]</td>
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<tr>
<td>clayst, lt-gy, very silty</td>
<td>![Strip Log 14]</td>
</tr>
<tr>
<td>siltst, lt-gy</td>
<td>![Strip Log 15]</td>
</tr>
<tr>
<td>sandst, lt-gy, fine-grained, well-consol</td>
<td>![Strip Log 16]</td>
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</table>
**LITHOLOGY**

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Depth</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>clayst, med-gy, very silty</td>
<td>350-400</td>
<td>lignite (372.5-374)</td>
</tr>
<tr>
<td>clayst, dk-gy, mod silty</td>
<td>400-450</td>
<td>lignite (397-404.5)</td>
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<tr>
<td>clayst, dk-gy, sli silty</td>
<td>450-500</td>
<td>lignite (407.5-408.5)</td>
</tr>
<tr>
<td>sandst, lt-gy, fine-grained</td>
<td>500-750</td>
<td></td>
</tr>
</tbody>
</table>

**TECHNICAL DATA**

- **Logging speed**: 20 ft/min
- **Logged depth**: 476 ft
- **Density range**: 3 cps
- **Gamma range**: 15 cps
- **Gamma TC**: 1 sec
- **SP sensitivity**: 100 mv
- **Resistance sensitivity**: 5 ohms
- **TD**: 476 ft

**DEPTH**

<table>
<thead>
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<th>Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
</tr>
<tr>
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</tr>
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<tr>
<td>600</td>
</tr>
<tr>
<td>650</td>
</tr>
<tr>
<td>700</td>
</tr>
<tr>
<td>750</td>
</tr>
</tbody>
</table>
AREA: Three River
QUAD NAME: Belfield 3 NE (Preliminary)
DATE STARTED: 7-20-79
DATE COMP: 7-20-79
COUNTY: Billings
STATE: North Dakota
LOCATION: SEC. 33 T. 138 N, R. 100 W, FOOTAGE LOC.
FOOTAGE: 298 ft FSL, 240 ft FWL
GROUND ELEV: 2958 ft
TOTAL DEPTH: 560 ft
SIZE AND BIT TYPE: 4-3/4 inch drag
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
LITHOLOGY RECORDED BY: S. Christensen
GEOPHYSICAL LOGS RECORDED BY: J. Wald
REMARKS:

**LITHOLOGY**

- soil, lt-brn, sand, silt, unconsol
- sandst, med-brn, fine-grained
- clayst, dk-gy, very silty
  lignite (100.5-102)
  lignite (114-115.5)
- siltst, med-gy
- clayst, med-gy, mod-silty
  lignite (160.5-170)
- clayst, dk-gy, sli silty
  lignite (186.5-188)
  lignite (189-190)
- clayst, dk-brn
  lignite (198-207)
- clasts, dk-brn
  lignite (212-213)
  lignite (214-215)
- clayst, dk-gy
  lignite (220-221)
- clayst, dk-gy
  lignite (224-225)
  lignite (229.5-230.5)
- clayst, med-gy, mod silty
  lignite (277-278.5)
- clayst, med-gy, mod silty
  lignite (331-336)
REMARKS:

LITHOLOGY

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<th>FEET</th>
<th>METERS</th>
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Logging speed: 20 ft/min
Logged depth: 560 ft
Gamma range: 15 cps
Gamma TC: 3 sec
Density range: 3 cps
Density TC: 1 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

- lignite (350-351)
- clayst, med-gy, silt silty
- lignite (410-417)
- clayst, dk-gy, mod silty
- lignite (426-427.5)
- clayst, lt-gy, very silty
- sandst, lt-gy, fine-grained
- lignite (539-540)
- sandst, dk-brn
- lignite (548.5-550.5)
- siltst, med-gy
- lignite (552-553)

 rerun of uraniumiferous zone at top of hole

surfaced
**LITHOLOGY**

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<tr>
<td>clayst, dk-gy, mod silty</td>
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**Remarks:**

- **Logging speed:** 20 ft/min
- **Density range:** 3 cps
- **Logged depth:** 439 ft
- **Density TC:** 1 sec
- **Gamma range:** 15 cps
- **SP sensitivity:** 100 mv
- **Gamma TC:** 3 sec
- **Resistance sensitivity:** 5 ohms
**REMARKS:**

**LITHOLOGY**

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<th>Strip Log</th>
<th>DEPTH</th>
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<td>siltst, med-gy</td>
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Logged depth: 439 ft
Density range: 3 cps
Gamma range: 15 cps
Gamma TC: 3 sec
SP sensitivity: 100 mv
Resistivity sensitivity: 5 ohms

Logged speed: 20 ft/min
Density TCS: 1 sec
Gamma TC: 3 sec
Resistivity: 5 ohms

TD: 440

**DEPTH**

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226
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 115
SHEET 1 OF 2

AREA
Three River

QUAD NAME
Belfield 4 NE (Preliminary)

DATE STARTED
7-18-79

DATE COMP.
7-18-79

COUNTY
Stark

STATE
North Dakota

LOCATION: SEC. 28 T.138 N., R. 98 W., FOOTAGE LOC.
1130 ft

FOOTAGE
ROTARY 361 ft

TOTAL DEPTH
361 ft

GROUND ELEV.
2472 ft

SIZE AND BIT TYPE:
4-3/4 inch drag

DRILLING AGENCY:
Gregory Drilling Company

DRILL TYPE:
Rotary

DEPTH TO FLUID LEVEL
17 ft

COUNTY
Stark

STATE
North Dakota

LITHOLOGY RECORDED BY
A. Benet

GEOPHYSICAL LOGS RECORDED BY
J. Wald

REMARKS:

LITHOLOGY

soil, lt-brn, silt, clay, unconsol
silts, lt-brn

sandst, med-brn, fine-grained
silts, med-gy

clayst, dk-gy, very silty
silts, dk-gy; high clay content
clayst, med-gy, very silty

sandst, med-grn, fine-grained
clayst, med-gy, very silty
sandst, med-gy, fine-grained
clayst, med-gy, very silty

sandst, lt-gy, fine-grained

silts, med-gy

lignite (339.5-344)
lignite (345-346.5)
**REMARKS:**

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

Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 361 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mv  
Gamma TC: 3 sec  
Resistance sensitivity: 5 ohms
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO**: 116  
**SHEET**: 1/2

**AREA**: Three River  
**QUAD NAME**: Dickinson South

**DATE STARTED**: 7-13-79  
**DATE COMP**: 7-13-79  
**COUNTY**: Stark  
**STATE**: North Dakota

**LOCATION**: SEC. 12 T.138 N., R. 97 W., FOOTAGE LOC.

**FOOTAGE**: 18 ft FSL  
**TOTAL DEPTH**: 420 ft

**SIZE AND BIT TYPE**: 4-3/4 inch drag  
**DRILL TYPE**: Rotary

**DRILLING AGENCY**: Gregory Drilling Company  
**DRILL TYPE**: Rotary

**GROUND ELEV**: 2678 ft  
**DEPTH TO FLUID LEVEL**: 14 ft

**LITHOLOGY RECORDED BY**: A. Banet  
**GEOPHYSICAL LOGS RECORDED BY**: J. Wald

**REMARKS:**

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<td>alluvium, gravel, sand, med-brn, unconsol</td>
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<td>sandst, lt-grn, fine-grained</td>
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</table>

**Lithology Details**

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 420 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mV
- Gamma TC: 3 sec
- Resistance sensitivity: 20 ohms

**Graphical Log**

- Soil, med-brn, gravel, sand, silt, unconsol
- Alluvium, gravel, sand, med-brn, unconsol
- Siltst, med-brn
- Clayst, med-gy, silt, silty
- Clayst, med-gy, very silty
- Siltst, lt-gy
- Clayst, med-gy, mod silty
- Siltst, med-gy
- Clayst, dk-gy
- Clayst, dk-brn
- Siltst, dk-gy
- Clayst, dk-gy, silt, silty
- Siltst, lt-gy
- Clayst, lt-gy, very silty
- Sandst, lt-grn, fine-grained
sandst, lt-grn, fine-grained

Rerun of uraniferous zone 85-120 ft
UNITED STATES GEOLOGICAL SURVEY

AREA: Three River
QUAD NAME: New England NW
DATE STARTED: 7-18-79
DATE COMPLETED: 7-18-79
COUNTY: Stark
STATE: North Dakota
LOCATION: SEC. 20 T. 138 N., R. 97 W., FOOTAGE LOC: 1160 ft FSL 36 ft FWL
GROUND ELEV: 2671 ft
SIZE AND BIT TYPE: 4-3/4 inch drag
FOOTAGE: ROTARY 480 ft CORING ----
TOTAL DEPTH: 480 ft
DEPTH TO FLUID LEVEL: 15 ft
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
LITHOLOGY RECORDED BY: M. Hudson
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

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# Remarks:

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<td>350-400</td>
<td>![Sandstone Diagram]</td>
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<td>![Claystone Diagram]</td>
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<td>Lignite (405-408)</td>
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<td>![Lignite Diagram]</td>
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<td>Lignite (448.5-457.5)</td>
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<td>![Lignite Diagram]</td>
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<td>650-700</td>
<td>![Claystone Diagram]</td>
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**Logging Details:**
- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 480 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- Gamma TC: 3 sec
- SP sensitivity: 100 mV
- Resistance sensitivity: 5 ohms

**Diagnosis:**
- TD: 480 ft
- FEET: 350-750
- METERS: 100-220
## Lithology

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<td>380-390</td>
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<tr>
<td>390-400</td>
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</table>

**Logging speed:** 20 ft/min  
**Density range:** 3 cps  
**Gamma range:** 15 cps  
**Resistivity range:** 100 ohm 
**Gamma TC:** 3 sec  
**Resistivity TC:** 5 ohm 

**Ground Elevation:** 2558 ft  
**Total Depth:** 400 ft  
**Drill Type:** Rotary  
**Drilling Agency:** Gregory Drilling Company  
**Geophysical Logs Recorded By:** J. Wald  
**Remarks:**
REMARKS:

LITHOLOGY

clayst, dk-gy, sli silty
sandst, med-pv, fine-grained, calc, well-consol
clayst, med-gy, mod silty
clayst, med-gy, very silty
lignite (388-389)

rerun of uraniferous zone

Logging speed 20 ft/min  Density range 3 cps
Logged depth 399 ft  Density TC 1 sec
Gamma range 15 cps  SP sensitivity 100 mv
Gamma TC 3 sec  Resistance sensitivity 5 ohms

DEPTH

FEET

METERS

350
110
400
120
200
100
190
80
70
60
50
40
30
20
15
10
5
3
2
1
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 119
SHEET 1 OF 2

AREA Three River
QUAD NAME Lefor NW
DATE STARTED 7-10-79
DATE COMP. 7-10-79
COUNTY Stark
STATE North Dakota

LOCATION: SEC. 34 T. 138 N., R. 95 W., FOOTAGE LOC. 12 ft FNL 48 ft FNL

FOOTAGE TOTAL

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY M. Hudson
GEOPHYSICAL LOGS RECORDED BY J. Wald

Remarks:

LITHOLOGY

soil, lt-brn, sand, silt, unconsol

sandst, med-brn, fine-grained

clayst, dk-gy, silty siltst, med-gy

clayst, med-gy, mod silty

clayst, med-gy, mod silty

clayst, lt-gy, mod silty

clayst, lt-gy, very silty

clayst, med-gy, mod silty

clayst, med-gy, very silty

clayst, dk-gy, very silty

clayst, dk-brn, mod silty

clayst, dk-brn

Logging speed 20 ft/min
Logged depth, 640 ft
Density range 3 cps
Density TC 1 sec
Gamma range 15 cps
Gamma TC 3 sec
SP sensitivity 100 mV
Resistance sensitivity 12.5 ohms

SAND LOG

FOOTAGE TOTAL

DEPTH TO DRILL TYPE: Rotary

FLUID LEVEL 51 ft

640 ft

DEPTH TO 60 ft

GEOPHYSICAL LOGS RECORDED BY J. Wald
### LITHOLOGY

<table>
<thead>
<tr>
<th>Depth (FT)</th>
<th>Lithology Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>236-237</td>
<td>Claystone, dark-brown</td>
</tr>
<tr>
<td>237-238</td>
<td>Sandstone, medium-grey, fine-grained</td>
</tr>
<tr>
<td>238-239</td>
<td>Claystone, dark-grey</td>
</tr>
<tr>
<td>239-240</td>
<td>Claystone, medium-grey, medium-silty</td>
</tr>
<tr>
<td>240-241</td>
<td>Claystone, dark-brown, silt-silty</td>
</tr>
<tr>
<td>241-242</td>
<td>Siltstone, medium-grey</td>
</tr>
<tr>
<td>242-243</td>
<td>Claystone, medium-grey, very-silty</td>
</tr>
<tr>
<td>243-244</td>
<td>Sandstone, medium-grey, fine-grained</td>
</tr>
<tr>
<td>244-245</td>
<td>Siltstone, dark-grey</td>
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<tr>
<td>245-246</td>
<td>Claystone, medium-grey, silt-silty</td>
</tr>
<tr>
<td>246-247</td>
<td>Sandstone, medium-grey, fine-grained</td>
</tr>
<tr>
<td>247-248</td>
<td>Siltstone, dark-grey</td>
</tr>
<tr>
<td>248-249</td>
<td>Claystone, medium-grey, silt-silty</td>
</tr>
<tr>
<td>249-250</td>
<td>Lignite (376-381)</td>
</tr>
<tr>
<td>250-251</td>
<td>Lignite (395-397)</td>
</tr>
<tr>
<td>251-252</td>
<td>Sandstone, medium-grey, fine-grained</td>
</tr>
<tr>
<td>252-253</td>
<td>Lignite (488-495)</td>
</tr>
<tr>
<td>253-254</td>
<td>Claystone, dark-grey, very-silty</td>
</tr>
<tr>
<td>254-255</td>
<td>Lignite (517.5-518.5)</td>
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<tr>
<td>255-256</td>
<td>Siltstone, medium-grey</td>
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<td>256-257</td>
<td>Lignite (542-543)</td>
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<tr>
<td>257-258</td>
<td>Claystone, medium-grey, very-silty</td>
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<tr>
<td>258-259</td>
<td>Lignite (574-575.5)</td>
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<tr>
<td>259-260</td>
<td>Claystone, medium-grey, silt-silty</td>
</tr>
<tr>
<td>260-261</td>
<td>Sandstone, medium-grey, fine-grained</td>
</tr>
<tr>
<td>261-262</td>
<td>Lignite (607-608)</td>
</tr>
<tr>
<td>262-263</td>
<td>Siltstone, dark-grey</td>
</tr>
<tr>
<td>263-264</td>
<td>Lignite (617.5-618.5)</td>
</tr>
<tr>
<td>264-265</td>
<td>Claystone, light-grey, silt-silty</td>
</tr>
</tbody>
</table>

**Diagram**: The diagram includes a log with various lithological and physical properties such as density, gamma rays, and electrical resistance, corresponding to the depth measurements provided.
UNITED STATES GEOLOGICAL SURVEY

AREA: Three River
QUAD NAME: Gladstone

DATE STARTED: 7-9-79
DATE COMPLETION: 7-9-79
COUNTY: Stark
STATE: North Dakota

LOCATION: SEC. 8 T.138 N., R. 94 W., FOOTAGE LOC.

FOOTAGE: 30 ft PNL, 825 ft PXK, 825 ft PWL
GROUND ELEV: 2402 ft

SIZE AND BIT TYPE: 4-3/4 inch drag
DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

DEPTH TO FLUID LEVEL: 23 ft

LITHOLOGY RECORDED BY: M. Hudson
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

- Soil, lt-brn, silt, clay, unconsol
- Siltst, med-brn
- Lignite (12.5-14)
- Clayst, med-gy, mod silt
- Siltst, med-gy
- Clayst, med-gy, mod silt
- Lignite (71.5-73)
- Clayst, med-gy, very sily
- Siltst, med-gy
- Clayst, dk-gy, mod silt
- Lignite (116.5-117.5)
- Clayst, med-gy, very sily
- Siltst, med-gy
- Clayst, med-gy, mod silt
- Lignite (168.5-170)
- Siltst, dk-gy; high clay content
- Clayst, med-gy, mod silt
- Lignite (221-222.5)
- Clayst, dk-gy, mod silt
- Lignite (245-250.5)
- Clayst, dk-brn
- Lignite (254-255)
- Siltst, dk-gy
- Lignite (261.5-264.5)
- Siltst, lt-gy
- Lignite (270.5-271.5)
- Clayst, dk-brn to blk, cbncs
- Sandst, lt-gy, fine-grained, calc, well-consol
- Clayst, med-gy, very sily
- Lignite (334-337)
- Clayst, dk-gy, very sily
- Lignite (345-350)
## Remarks:

### Lithology

<table>
<thead>
<tr>
<th>Depth (meters)</th>
<th>Lithology Details</th>
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</thead>
<tbody>
<tr>
<td>350-361</td>
<td>Clay, dark brown, lignite (360-361)</td>
</tr>
<tr>
<td>361-380.5</td>
<td>Clay, dark gray, very silty lignite (379.5-380.5)</td>
</tr>
<tr>
<td>380.5-383</td>
<td>Clay, dark brown lignite (382-383)</td>
</tr>
<tr>
<td>383-396</td>
<td>Clay, dark gray, very silty lignite (395-396)</td>
</tr>
<tr>
<td>396-399</td>
<td>Clay, dark brown lignite (398-399)</td>
</tr>
<tr>
<td>400</td>
<td>Silt, medium gray</td>
</tr>
</tbody>
</table>

### Logging Log

- **Logging speed**: 20 ft/min
- **Logged depth**: 420 ft
- **Density range**: 3 cps
- **Gamma range**: 15 cps
- **Gamma TC**: 3 sec
- **SP sensitivity**: 100 mv
- **Resistance sensitivity**: 5 ohms

### Diagram

[Diagram of borehole data with depth and lithology details.]

- **TD**: 420
UNITED STATES GEOLOGICAL SURVEY

AREA | Three River
QUAD NAME | Lefor
DATE STARTED | 7-9-79
DATE COMP | 7-9-79
COUNTY | Stark
STATE | North Dakota
LOCATION: SEC. 34 T.138 N., R. 94 W., FOOTAGE LOC. | 35 ft FSL 15 ft FWL
FOOTAGE | 35 ft
TOTAL ELEV | 2512 ft
SIZE AND BIT TYPE | 4-3/4 inch drag
DRILLING AGENCY | Gregory Drilling Company
DRILL TYPE | Rotary
LITHOLOGY RECORDED BY | S. Christensen
GEOPHYSICAL LOGS RECORDED BY | J. Walz

REMARKS:

LITHOLOGY

soil, lt-brn, sand, silt, unconsol
sandst, med-brn, fine-grained
clayst, dk-brn
lignite (54-57.5)
clayst, med-gy, mod silt
clayst, dk-brn
lignite (98-99.5)
clayst, med-gy, very silt
clayst, dk-brn
clayst, lt-gy, mod silt
clayst, dk-gy, sli silt
lignite (149-151)
siltst, med-gy; high clay content
clayst, dk-gy, mod silt
lignite (206.5-207.5)
clayst, dk-gy, mod silt
lignite (225-226)
clayst, med-gy, mod silt
lignite (230-231.5)
clayst, med-gy, very silt
clayst, med-gy, mod silt
lignite (249-250)
clayst, med-gy, mod silt
lignite (281-282)
clayst, med-gy, mod silt
lignite (290-291)
clayst, med-gy, mod silt
lignite (296-297)
siltst, lt-gy, calc, well-consol
clayst, lt-gy, sli silt
lignite (325.5-326.5)
clayst, med-gy, mod silt
**REMARKS:**

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Depth (ft or m)</th>
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<tr>
<td>Clayst, dk-gy</td>
<td>350 ft (106.7 m)</td>
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<td>Siltst, dk-gy</td>
<td>355 ft (108.2 m)</td>
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<td>Clayst, dk-gy, sli silty</td>
<td>360 ft (109.7 m)</td>
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<tr>
<td>Clayst, med-gy, mod silty</td>
<td>365 ft (110.7 m)</td>
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<td>Siltst, med-gy</td>
<td>370 ft (112.7 m)</td>
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<td>Clayst, lt-gy, very silty</td>
<td>375 ft (114.3 m)</td>
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<td>Sandst, lt-gy, fine-grained</td>
<td>380 ft (115.8 m)</td>
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<td>Clayst, dk-brn, mod silty</td>
<td>385 ft (117.3 m)</td>
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<td>Siltst, med-gy</td>
<td>390 ft (118.8 m)</td>
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<td>Clayst, dk-gy, sli silty</td>
<td>395 ft (119.8 m)</td>
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<td>Clayst, med-gy, mod silty</td>
<td>400 ft (121.9 m)</td>
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<td>Sandst, lt-gy, fine-grained</td>
<td>405 ft (123.4 m)</td>
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**Logging speed:** 20 ft/min  
**Density range:** 3 cps  
**Logged depth:** 500 ft  
**Gamma range:** 15 cps  
**Gamma TC:** 3 sec  
**SP sensitivity:** 100 μV  
**Resistance sensitivity:** 5 ohms

**DEPTH**  
500 ft (152.4 m)
### Lithology

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<tr>
<td>60</td>
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<tr>
<td>80</td>
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<tr>
<td>90</td>
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<tr>
<td>100</td>
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<tr>
<td>300</td>
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<tr>
<td>350</td>
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</tbody>
</table>

**Description:**
- Soil, med-brn, silt, clay, unconsol
- Siltst, lt-brn
- Lignite (17-18.5)
- Siltst, med-gy
- Lignite (39-41)
- Siltst, med-gy
- Lignite (80-82.5)
- Siltst, med-gy
- Clayst, dk-gy, very silty
- Siltst, med-gy; high clay content
- Clayst, dk-gy, silt silty
- Lignite (146-148.5)
- Clayst, dk-gy, mod silty
- Sandst, med-gy, fine-grained
- Siltst, med-gy
- Lignite (187-188)
- Clayst, med-gy, mod silty
- Sandst, lt-gy, fine-grained
- Clayst, dk-gy, silt silty
- Lignite (249-250.5)
- Clayst, dk-gy, silt silty
- Lignite (265-266)
- Siltst, dk-gy
- Lignite (277.5-278.5)
- Clayst, med-gy, mod silty
- Lignite (291.5-293.5)
- Clayst, med-gy, very silty
- Clayst, dk-gy, mod silty
- Lignite (326-327)
- Siltst, med-gy
- Lignite (333.5-335.5)
- Clayst, dk-brn to blk, cbncs
**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>SP LOG</th>
<th>DEPTH</th>
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<tr>
<td>clayst, dk-gy, sli silty</td>
<td></td>
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</tr>
<tr>
<td>siltst, med-gy</td>
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<tr>
<td>clayst, dk-gy</td>
<td>lignite (382-383)</td>
<td>350-400</td>
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<td>siltst, dk-gy</td>
<td>lignite (389.5-390.5)</td>
<td>400-450</td>
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<td>siltst, med-gy</td>
<td>lignite (404.5-405.5)</td>
<td>450-500</td>
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<td>lignite (410.5-411.5)</td>
<td>500-550</td>
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<td>clayst, dk-brn</td>
<td>lignite (426-427)</td>
<td>550-600</td>
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<td>siltst, dk-brn</td>
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<td>600-650</td>
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<td>siltst, lt-gy</td>
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<td>650-700</td>
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<tr>
<td>siltst, lt-gy</td>
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<td>700-750</td>
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</table>

Logging speed 20 ft/min  Density range 3 cps
Logged depth 459 ft  Density TC 1 sec
Gamma range 15 cps  SP sensitivity 100 mv
Gamma TC 3 sec  Resistance sensitivity 5 ohms

TD 460
**LITHOLOGY**

<table>
<thead>
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<th>Lithology Description</th>
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<tbody>
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<td>soil, lt-brn, silt, clay, unconsol</td>
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<tr>
<td>5-10</td>
<td>siltst, med-brn</td>
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<tr>
<td>10-20</td>
<td>clayst, med-gy, very silty</td>
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<tr>
<td>20-50</td>
<td>siltst, dk-gy</td>
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<td>50-100</td>
<td>lignite (53-55)</td>
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<td>100-150</td>
<td>lignite (59.5-62)</td>
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<td>150-200</td>
<td>clayst, med-gy, mod silty</td>
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<tr>
<td>200-300</td>
<td>clayst, dk-gy, silt silty</td>
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<tr>
<td>300-400</td>
<td>lignite (82-83.5)</td>
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<tr>
<td>400-500</td>
<td>sandst, med-gy, fine-grained</td>
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<td>500-700</td>
<td>clayst, dk-gy, silt silty</td>
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<tr>
<td>700-800</td>
<td>lignite (116.5-120)</td>
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<td>lignite (142-143.5)</td>
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<td>1000-1200</td>
<td>lignite (174.5-175.5)</td>
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<td>1200-1300</td>
<td>clayst, med-gy, mod silty</td>
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<td>lignite (295.5-296.5)</td>
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<tr>
<td>1400-1500</td>
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<td>1500-1600</td>
<td>lignite (284-285.5)</td>
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<tr>
<td>1600-1700</td>
<td>lignite (286.5-288)</td>
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<td>siltst, med-gy</td>
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<td>lignite (328-329)</td>
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<tr>
<td>2600-2800</td>
<td>siltst, med-gy; high clay content</td>
</tr>
</tbody>
</table>

**REMARKS:**

- Logging speed: 20 ft/min
- Density range: 3 cgs
- Logged depth: 519 ft
- Density TC: 1 sec
- Gamma range: 15 cgs
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 5 mhos
### REMARKS:

**LITHOLOGY**

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>363-364</td>
<td>Clayst, med-gy, very silty, lignite</td>
</tr>
<tr>
<td>384.5-387</td>
<td>Clayst, dk-gy, sili silty, lignite</td>
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<tr>
<td>396.5-398.5</td>
<td>Siltst, dk-gy; high clay content</td>
</tr>
<tr>
<td>474-475.5</td>
<td>Clayst, mod-sil, very silty, lignite</td>
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<tr>
<td>482.5-483.5</td>
<td>Clayst, mod-sil, high clay content</td>
</tr>
<tr>
<td>502-503.5</td>
<td>Clayst, mod-sil, very silty, lignite</td>
</tr>
<tr>
<td>513-515.5</td>
<td>Clayst, mod-sil, very silty, lignite</td>
</tr>
</tbody>
</table>

**Logging Speed**: 20 ft/min  
**Logged Depth**: 519 ft  
**Density Range**: 3 cps  
**Density TC**: 1 sec  
**Gamma Range**: 15 cps  
**Gamma TC**: 3 sec  
**SP Sensitivity**: 100 mv  
**Resistance Sensitivity**: 5 ohms

**Graph**:

![Graph showing logging data with depth in feet and meters and various lithological details](image)
UNITED STATES GEOLOGICAL SURVEY

AREA: Three River
QUAD NAME: Richardton SE
DATE STARTED: 7-5-79
DATE COMP: 7-5-79
LOCATION: SEC. 8 T. 138 N, R. 92 W, FOOTAGE LOC.
SIZE AND BIT TYPE: 4-3/4 inch drag
DRILLING AGENCY: Gregory Drilling Company
LITHOLOGY RECORDED BY: A. Banet
DRILL TYPE: Rotary
LITHOLOGY:

- soil, med-brn, silt, clay, unconsol
- clayst, med-brn, very silty
- siltst, med-brn
- clayst, dk-brn
- siltst, med-gy
- clayst, dk-gy
- siltst, lt-gy
- sandst, lt-gy, fine-grained, calc
- clayst, med-gy, sli silty
- siltst, med-gy
- clayst, med-gy, mod silty
- clayst, dk-brn to blk, cncs
- siltst, med-gy
- sandst, med-gy, fine-grained
- clayst, dk-gy, sli silty
- siltst, med-gy
- clayst, med-gy, very silty

GEOLOGICAL LOGS RECORDED BY: J. Wald

REMARKS:
**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>STRIP LOG</th>
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<tr>
<td>clayst, dk-gy</td>
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Logged depth: 504 ft  Density TC: 3 sec  Gamma TC: 3 sec  Resistance sensitivity: 5 ohms
## Lithology

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### Remarks:

- **Geophysical Logs Recorded by:** J. Wald

### Lithology Details:

- Logging speed: 20 ft/min
- Density range: 3 cps
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms

### Diagram Details:

- **Total Footage:** 332 ft
- **Rotary Depth:** 332 ft
- **Coring Depth:** ---
- **Fluid Level:** 89 ft
**LITHOLOGY**

- **soil**, **lt-brn**, **silt**, **clay**, **unconsol**
- **clayst**, **lt-brn**, **very silty**  
  lignite (12-13)
- **siltst**, **med-brn**
  lignite (42.5-45)
- **clayst**, **med-gy**, **mod silty**
- **siltst**, **med-gy**, **high clay content**
  lignite (94.5-96.5)
- **clayst**, **dk-gy**, **mod silty**
- **siltst**, **med-gy**, **clay content**
- **sandst**, **lt-gy**, **fine-grained**
- **clayst**, **dk-gy**, **all silty**
- **clayst**, **dk-brn**  
  lignite (201-205.5)
- **clayst**, **dk-gy**, **all silty**  
  lignite (209-210)
- **siltst**, **med-gy**
- **sandst**, **med-gy**, **fine-grained**  
  lignite (273-274)
- **clayst**, **med-gy**, **very silty**  
  lignite (276-277)
- **clayst**, **med-gy**, **mod silty**  
  lignite (307.5-309.5)
- **clayst**, **dk-brn**, **sli silty**
### Remarks:

**Lithology**

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<th>Depth (ft)</th>
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**Logging Specifications:**
- Logging speed: 20 ft/min
- Logged depth: 460 ft
- Density range: 3 cps
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms

**Depth:**
- TD: 460 ft
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 127**

**SHEET 10F 2**

**AREA** Three River  
**QUAD NAME** Clark Butte NW  
**COUNTY** Stark  
**STATE** North Dakota

**DATE STARTED** 7-5-79  
**DATE COMP** 7-5-79  
**FOOTAGE LOC.** 18 ft  
**GROUND ELEV** 2296 ft

**LOCATION:** SEC. 32 T. 138 N, R. 91 W, FOOTAGE LOC.  
**FOOTAGE** 30 ft  
**TOTAL DEPTH** 440 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag

**DRILLING AGENCY:** Gregory Drilling Company

**DRILL TYPE:** Rotary

**LITHOLOGY RECORDED BY** S. Christensen

**GEOPHYSICAL LOGS RECORDED BY** J. Wald

**REMARKS:**

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**FOOTAGE TOTAL**

**DRILL TYPE:** Rotary

**FLUID LEVEL** 4 ft

**DEPTH TO** 11 ft
clayst, dk-gy, sli silty
lignite (361-364)

clayst, dk-gy, mod silty
lignite (365.5-367)

clayst, med-gy, mod silty
lignite (382-383)

sandst, med-gy, fine-grained
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 128**

**SHEET 10F 2**

**AREA** Three River  
**QUAD NAME** Belfield 3 NE (Preliminary)

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<th>DATE COMP.</th>
<th>COUNTY</th>
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<td>7-20-79</td>
<td>Billings</td>
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**LOCATION:** SEC. 14 T. 137 N, R. 101 W, FOOTAGE LOC.  
910 ft FLN XXX 205 ft FEL XXX  
GROUND ELEV. 2862 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag  
**FOOTAGE** ROTARY 440 ft CORING ---  
**TOTAL DEPTH** 440 ft

**DRILLING AGENCY:** Gregory Drilling Company  
**DRILL TYPE:** Rotary  
**DEPTH TO FLUID LEVEL** 51 ft

**LITHOLOGY RECORDED BY** L. Tomac  
**GEOPHYSICAL LOGS RECORDED BY** J. Wald

**REMARKS:**

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**LITHOLOGY**

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Logging speed 20 ft/min  
Density range 3cps  
Logged depth 439 ft  
Density TO—97.5  
Gamma range 15 cps  
SP sensitivity 100 mV  
Gamma TO; 2 sec  
Resistance sensitivity 5 ohms
REMARKS:

**LITHOLOGY**

- clayst, dk-gy  
  lignite (356.5-358.5)
- clayst, med-gy, mod silty
- clayst, dk-gy, sili silty  
  lignite (403.5-407)
- siltst, lt-gy

**DEPTH**

Logging speed 20 ft/min  
Density range 3 cps  
Logged depth 439 ft  
Density TC 1 sec  
Gamma range 15 cps  
Gamma TC 3 sec  
SP sensitivity 100 mv  
Resistance sensitivity 5 ohms

**METERS**

TD 440
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<td>sandst, med-gy, fine-grained</td>
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Logging speed: 20 ft/min
Logged depth: 476 ft
Gamma range: 15 cps
Gamma TC: 3 sec
Density range: 1 cps
Density TC: 1 sec
SP sensitivity: 1000 mv
Resistance sensitivity: 5 ohms

TD: 476
LOCATION: SEC. 10 T. 137 N, R. 99 W, FOOTAGE LOC.

DATE STARTED 7-19-79
DATE COMP 7-19-79
COUNTY Stark
STATE North Dakota

FOOTAGE LOG.

SIZE AND BIT TYPE: 4-3/4 inch drag

GROUND ELEV 2684 ft

TOTAL DEPTH 460 ft

DEPTH TO FLUID LEVEL 14 ft

LITHOLOGY

- soil, lt-brn, silt, clay, unconsol
- clayst, med-brn, very silty
- clayst, dk-gy, mod silty
- lignite (40-47)
- clayst, dk-brn
- silst, dk-gy
- lignite (62.5-64)
- clayst, med-gy, silty
- lignite (83.5-89.5)
- clayst, dk-gy, silt silty
- lignite (182-187)
- clayst, dk-brn
- lignite (191-196)
- clayst, med-gy, very silty
- sandst, med-gy, fine-grained
- lignite (342.5-350)

REMARKS:

- Logging speed 20 ft/min
- Density range 3 cps
- Logged depth 459 ft
- Density TO 1 sec
- Gamma range 15 cps
- SP sensitivity 100 mv
- Gamma TO 3 sec
- Resistance sensitivity 5 ohms

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY A. Banet
GEOPHYSICAL LOGS RECORDED BY J. Wald
REMARKS:

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<th>Description</th>
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<tr>
<td>lignite (394-398.5)</td>
<td>clay, dk-gy, silt, silty</td>
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<tr>
<td>silt, med-gy</td>
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</table>

Logging speed: 20 ft/min  
Density range: 3 cps  
Logged depth: 459 ft  
Density TC: 1 sec  
Gamma range: 15 cps  
SP sensitivity: 100 mv  
Gamma TC: 3 sec  
Resistance sensitivity: 5 ohms
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 131
SHEET 1 OF 2

AREA Three River

DATE STARTED 7-18-79

DATE COMP 7-18-79

QUAD NAME Belfield 4 NW (Preliminary)

COUNTY Stark

STATE North Dakota

LOCATION: SEC. 6 T137 N., R.99 W., FOOTAGE LOC. 1580 ft FSL 236 ft FWL

GROUND ELEV 2724 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

FOOTAGE ROTARY 511 ft CORING --- TOTAL DEPTH 511 ft

DRILLING AGENCY: Gregory Drilling Company

DRILL TYPE: Rotary

DEPTH TO FLUID LEVEL 9 ft

LITHOLOGY RECORDED BY S. Christensen

GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Logging speed</th>
<th>Density range</th>
<th>Density TC range</th>
<th>Gamma TC range</th>
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<tr>
<td>0-500</td>
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<td>20 ft/min</td>
<td>3 cps</td>
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<tr>
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<td>100-150</td>
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<tr>
<td>150-200</td>
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<td>550-600</td>
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<tr>
<td>600-650</td>
<td>sandst, med-gy, fine-grained</td>
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<tr>
<td>650-700</td>
<td>clayst, dk-brn, sili silty</td>
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<td>750-800</td>
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<td>800-850</td>
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<td>1050-1100</td>
<td>sandst, lt-grn, fine-grained</td>
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<td>lignite (339-348.5)</td>
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258
**LITHOLOGY**

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<th>Depth (m)</th>
<th>Lithology</th>
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<tr>
<td>350-352</td>
<td>Clay, dk-gy, silty, lignite</td>
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<td>357.5-358.5</td>
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<td>367.5-368.5</td>
<td>Clay, med-gy, mod silty, lignite</td>
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<td>360-368.5</td>
<td>Silt, med-gy, very silty, lignite</td>
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<tr>
<td>370-372</td>
<td>Clay, dk-brn, to blk, cbncs, lignite</td>
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<tr>
<td>393-404.5</td>
<td>Clay, med-gy, mod silty, lignite</td>
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<tr>
<td>472-474.5</td>
<td>Clay, med-gy, mod silty, lignite</td>
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<tr>
<td>493-495.5</td>
<td>Clay, med-gy, mod silty, lignite</td>
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</tbody>
</table>

**Logging Details**

- **Logging speed**: 20 ft/min
- **Logged depth**: 510 ft
- **Density range**: 3 cps
- **Gamma range**: 15 cps
- **Gamma TC**: 3 sec
- **SP sensitivity**: 100 mv
- **Resistivity sensitivity**: 5 ohms
## Lithology

<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>Lithology Description</th>
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</thead>
<tbody>
<tr>
<td>0-50</td>
<td>Soil, lt-brn, silt, clay, unconsol</td>
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<tr>
<td>50-60</td>
<td>Clayst, med-brn, very silty</td>
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<tr>
<td>60-70</td>
<td>Clayst, med-gy, very silty</td>
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<tr>
<td>70-80</td>
<td>Clayst, dk-brn</td>
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<td>80-90</td>
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<td>110-120</td>
<td>Clayst, dk-gy</td>
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<td>120-130</td>
<td>Clayst, dk-gy, silt-silky</td>
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<td>130-140</td>
<td>Siltst, med-gy</td>
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<tr>
<td>140-150</td>
<td>Sandst, med-gy, fine-grained, calc, well-consol</td>
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<tr>
<td>150-160</td>
<td>Sandst, lt-gy, fine-grained</td>
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<td>160-170</td>
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<td>170-180</td>
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<td>190-200</td>
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<td>200-210</td>
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<td>210-220</td>
<td>Clayst, med-gy, mod silty</td>
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</table>

**Remarks:**

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 489 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mV
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms
**REMARKS:**

<table>
<thead>
<tr>
<th>LITHOLOGY</th>
<th>LOG TYPE</th>
<th>DEPTH</th>
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<tr>
<td>clayst, med-gy, mod silty</td>
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<tr>
<td>clayst, dk-brn</td>
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<tr>
<td>clayst, dk-gy</td>
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<tr>
<td>siltst, med-gy</td>
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<tr>
<td>clayst, dk-gy, ali silty</td>
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<tr>
<td>clayst, med-gy, very silty</td>
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<tr>
<td>clayst, dk-gy, ali silty</td>
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<tr>
<td>clayst, med-gy, mod silty</td>
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<tr>
<td>siltst, med-gy</td>
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<td>clayst, dk-gy, ali silty</td>
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<td>siltst, med-gy</td>
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<td>clayst, dk-gy, ali silty</td>
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<tr>
<td>siltst, med-gy</td>
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<tr>
<td>clayst, dk-gy, ali silty</td>
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<tr>
<td>sandst, lt-gy, fine-grained</td>
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Logging speed 20 ft/min
Logged depth 489 ft
Density range 3 cps
Gamma range 15 cps
Gamma TC 3 sec
SP sensitivity 100 mv
Resistance sensitivity 5 ohm

Lignite (357.5-368.5)
Lignite (374.5-375.5)
Lignite (425-430.5)

TD 490
### LITHOLOGY

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Lithology Description</th>
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<td>520-530</td>
<td>Clayst, dk-gy, silt, silty</td>
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<tr>
<td>530-540</td>
<td>Clayst, med-gy, very silty</td>
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<td>540-550</td>
<td>Lignite (71-72)</td>
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<td>550-560</td>
<td>Lignite (81-82.5)</td>
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<tr>
<td>560-570</td>
<td>Clayst, dk-gy, silt, silty</td>
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<td>570-580</td>
<td>Clayst, med-gy, very silty</td>
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<tr>
<td>580-590</td>
<td>Lignite (127.5-133)</td>
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<tr>
<td>590-600</td>
<td>Clayst, dk-gy, very silty</td>
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<td>600-610</td>
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<td>610-620</td>
<td>Lignite (152-153.5)</td>
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<td>630-640</td>
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<td>Lignite (182-183)</td>
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<td>650-660</td>
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<td>660-670</td>
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<td>670-680</td>
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<td>Sandst, med-gy, fine-grained</td>
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<td>730-740</td>
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**Remarks:**
- Depths and lithologies as recorded by L. Tomac.
- Geochemical logs recorded by J. Wald.
REMARKS:

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<tr>
<th>LITHOLOGY</th>
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<tbody>
<tr>
<td>clayst, med-gy, mod silty</td>
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<td>clayst, med-gy, very silty</td>
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<td>clayst, dk-brn</td>
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<tr>
<td>clayst, med-gy, mod silty</td>
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<tr>
<td>siltst, lt-gy</td>
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<tr>
<td>sandst, lt-gy, fine-grained</td>
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**LITHOLOGY**

Logging speed: 20 ft/min  
Density range: 3  
Density T.C.: 1 sec  
Gamma range: 15  
Gamma T.C.: 3 sec  
Resistance sensitivity: 5 ohms  

**DEPTH**

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<td>700</td>
<td>180</td>
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<tr>
<td>750</td>
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**STRIP LOG**

TD 520

263
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 134
SHEET 1 OF 2

AREA Three River QUAD NAME New England NW

DATE STARTED 7-18-79 DATE COMP. 7-18-79 COUNTY Stark STATE North Dakota

LOCATION-SEC. 12 T. 137 N, R. 98 W., FOOTAGE LOC. 18 ft XXX

COUNTY Stark STATE North Dakota

FOOTAGE 35 ft XXX GROUND ELEV 2785 ft

SIZE AND BIT TYPE: 4-3/4 inch drag FOOTAGE ROTARY 506 ft CORING --- TOTAL DEPTH 506 ft

DRILLING AGENCY: Gregory Drilling Company DRILL TYPE: Rotary DEPTH TO FLUID LEVEL 13 ft

LITHOLOGY RECORDED BY A. Banet GEOPHYSICAL LOGS RECORDED BY J. Wald

REMARKS:

LITHOLOGY

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<td>202</td>
<td>Density range</td>
<td>100 mv</td>
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<tr>
<td>203</td>
<td>Density range</td>
<td>5 ohms</td>
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soil, lt-brn, silt, clay, unconsol
clayst, med-brn, mod silty

sandst, lt-gy, fine-grained
clayst, med-gy, mod silty

clayst, med-gy, mod silty

clayst, med-gy, very silty

clayst, med-gy, mod silty

clayst, dk-brn

clayst, med-gy, mod silty

siltst, med-gy
clayst, dk-gy, mod silty

lignite (299.5-300.5)
lignite (306-307)

lignite (342-351.5)
**REMARKS:**

### LITHOLOGY

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<tr>
<td>silt, med-gy</td>
<td>lignite (645-646)</td>
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**login speed:** 20 ft/min  
**Density range:** 3 cps  
**Logged depth:** 505 ft  
**Density T.C.:** 1 sec  
**Gamma range:** 15 cps  
**SP sensitivity:** 100 mv  
**Gamma T.C.:** 3 sec  
**Resistance sensitivity:** 5 ohms  

**Graph:**

**TD:** 506
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 135**

**SHEET 1 OF 2**

**AREA** Three River

**DATE STARTED** 7-19-79

**DATE COMP** 7-19-79

**QUAD NAME** Belfield 4 NE (Preliminary)

**COUNTY** Stark

**STATE** North Dakota

**LOCATION-SEC.** 30 T. 137 N, R. 98 W, FOOTAGE LOC. 6 ft

**FOOTAGE**

- FSL
- 100 ft

**ROLE**

- KNX
- HSL
- FEL

**GROUND ELEV** 2705 ft

**TOTAL DEPTH** 460 ft

**DEPTH TO FLUID LEVEL** 19 ft

**SIZE AND BIT TYPE** 4-3/4 inch drag

**DRILLING AGENCY** Gregory Drilling Company

**DRILL TYPE** Rotary

**LITHOLOGY RECORDED BY** M. Hudson

**REMARKS**

**LITHOLOGY**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Lithology</th>
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<tbody>
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<td>0-266</td>
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<td>333-359</td>
<td>clayst, dk-brn, silt silty, cbmcs</td>
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<tr>
<td>360-375</td>
<td>clayst, dk-gy, mod silty</td>
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<td>lignite (58.5-59.5)</td>
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<td>576-675</td>
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<td>siltst, med-gy, fine-grained</td>
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<td>776-800</td>
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<td>801-980</td>
<td>clayst, dk-brn, lignite (230.5-236)</td>
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<td>981-1000</td>
<td>siltst, dk-gy</td>
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<td>1001-1025</td>
<td>lignite (346.5-348)</td>
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**LOGGING SPEED** 20 ft/min

**DENSITY RANGE** 13 cps

**LOGGED DEPTH** 659 ft

**DENSITY TC** 1 sec

**GAMMA RANGE** 15 cps

**GAMMA TC** 3 sec

**RESISTANCE SENSITIVITY** 5 ohms
REMARKS:

LITHOLOGY

clayst, dk-brown
sandst, lt-gy, med-grained, calc, well-consol
clayst, dk-gy, silt silty
sandst, med-gy, fine-grained
clayst, dk-gy, very silty
clayst, dk-gy, mod silty
siltst, med-gy
clayst, dk-gy, silt silty
clayst, med-gy, mod silty

Logging speed: 20 ft/min  Density range: 15 cos
Logged depth: 459 ft  Density TC: 1 sec
Gamma range: 15 cos  SP sensitivity: 100 mv
Gamma TC: 3 sec  Resistance sensitivity: 5 ohms

TD 460
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 136 SHEET 1 OF 2**

**AREA** Three River

**DATE STARTED** 7-18-79

**DATE COMP.** 7-18-79

**LOCATION** Sec. 10 T. 137 N., R. 97 W., FOOTAGE LOC.

**FOOTAGE**
- Footage Log: 20 ft
- Footage Log: 65 ft

**TOTAL ELEV**

**GROUND ELEV**

**FOOTAGE**
- Total feet: 520 ft
- Rotary: 520 ft
- Core: ---

**DEPTH**
- Total depth: 520 ft

**DRILL TYPE**

**DRILLING AGENCY** Gregory Drilling Company

**LITHOLOGY RECORDED BY** A. Banet

**GEOPHYSICAL Logs RECORDED BY** J. Wald

**REMARKS**

**LITHOLOGY**
- Soil, lt-brn, silt, clay, unconsol
- Siltst, med-brn
- Clayst, med-gy, mod silty
- Siltst, med-gy
- Sandst, med-gy, fine-grained
- Clayst, dk-gy, mod silty
- Lignite (173-176.5)
- Lignite (179.5-180.5)
- Clayst, med-gy, very silty
- Siltst, med-gy
- Clayst, dk-gy, very silty
- Lignite (233-240)
- Clayst, med-gy, mod silty
- Siltst, med-gy; high clay content
- Clayst, dk-gy, very silty
- Siltst, dk-gy
- Lignite (296.5-297.5)
- Sandst, med-gy, fine-grained
REMARKS:

LITHOLOGY

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Logging speed: 20 ft/min
Logged depth: 519 ft
Gamma range: 15 cps
Gamma TC: 3 sec
SP sensitivity: 100 mv
Resistance sensitivity: 5 ohms

TD 520

DEPTH

FEET  METERS

350  110
400  120
450  130
500  140
550  150
600  160
650  170
700  180
750  190
LITHOLOGY

soil, lt-brn, silt, clay, unconsol

clayst, lt-brn, very silty

siltst, med-gy; high clay content

clayst, med-gy, mod silty

siltst, med-gy

lignite (90.5-95)

clayst, med-gy, mod silty

siltst, med-gy

lignite (138.5-140.5)

clayst, dk-brn

lignite (149-151.5)

clayst, med-gy, mod silty

siltst, lt-gy, calc, well-consol

siltst, med-gy

clayst, dk-gy

lignite (210.5-212)
lignite (214-217)

clayst, med-gy, very silty

lignite (233.5-236.5)
lignite (238-239)
lignite (242-243)

clayst, med-gy, mod silty

clayst, dk-gy, sli silty

lignite (266.5-267.5)

clayst, med-gy, mod silty

clayst, dk-gy

lignite (312-320)

clayst, med-gy

lignite (326-327.5)

siltst, med-gy; high clay content

clayst, med-gy, mod silty
### Lithology

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### Logging Parameters

- **Logging speed**: 20 ft/min
- **Logged depth**: 519 ft
- **Density range**: 3 cps
- **Density TC**: 1 sec
- **Gamma range**: 15 cps
- **Gamma TC**: 3 sec
- **SP sensitivity**: 100 mv
- **Resistance sensitivity**: 5 ohms
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 138
SHEET 1 OF 2

AREA: Three River
QUAD NAME: Schefield

DATE STARTED: 7-18-79
DATE COMP: 7-18-79
COUNTY: Stark
STATE: North Dakota

LOCATION: SEC. 30 T.137 N., R. 96 W., FOOTAGE LOC.

FOOTAGE: 520 ft
FOOTAGE: 60 ft
GROUND ELEV: 2728 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: S. Christensen
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

Logging speed: 20 ft/min
Density range: 3 cps
Gamma range: 15 cps
Gamma TC: 3 sec

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soil, lt-brn, sand, silt, unconsol
sandst, med-brn, fine-grained
siltst, med-gy; high clay content
lignite (40-41)
clayst, med-gy, sli silty
siltst, lt-gy
clayst, dk-gy, sli silty
lignite (82.5-87.5)
clayst, med-gy, mod silty
clayst, dk-brn
clayst, med-gy, very silty
clayst, dk-gy, sli silty
lignite (159.5-161)
lignite (162.5-164)
clayst, dk-gy, sli silty
lignite (171-172.5)
lignite (178-179.5)
siltst, med-gy
clayst, lt-gy, sli silty
sandst, med-gy, fine-grained
clayst, dk-gy
lignite (130-137)
clayst, dk-brn
clayst, med-gy, very silty
clayst, dk-gy, sli silty
lignite (159.5-161)
lignite (162.5-164)
clayst, dk-gy, sli silty
lignite (171-172.5)
lignite (178-179.5)
siltst, med-gy
clayst, dk-brn
clayst, med-gy, mod silty
siltst, med-gy; high clay content
clayst, dk-gy, sli silty
sandst, med-gy
clayst, dk-gy
lignite (270.5-280)
lignite (270.5-280)
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- **clayst, dk-gy, very silty**
- **lignite (350-352)**
- **sandst, med-gy, fine-grained**
- **lignite (377-378, 5)**
- **clayst, dk-brn**
- **lignite (446-454)**
- **clayst, med-gy, very silty**
- **siltst, med-gy**
- **clayst, med-gy, mod silty**
- **clayst, dk-brn**
- **lignite (485.5-486.5)**
- **lignite (488-490)**
- **clayst, dk-gy, very silty**
- **lignite (502-503)**
- **clayst, dk-brn**
- **lignite (510-514)**
- **sandst, med-gy, fine-grained**
- **clayst, dk-gy, silty**
- **clayst, med-gy, mod silty**
- **clayst, dk-gy, silty**
- **sandst, med-gy, med-grained**
- **siltst, med-gy**
- **clayst, dk-gy, mod silty**
- **clayst, dk-brn**
- **lignite (592-596)**
- **TD 600**

**REMARKS:**

- Clayst, dk-gy, very silty
- Sandst, med-gy, fine-grained
- Clayst, dk-brn
- Clayst, med-gy, very silty
- Sandst, lt-gy, fine-grained
- Clayst, med-gy, mod silty
- Clayst, dk-brn
- Sandst, med-gy, fine-grained
- Clayst, dk-gy
- Siltst, dk-gy
- Clayst, dk-gy, very silty
- Clayst, dk-brn
- Sandst, med-gy, fine-grained
- Clayst, dk-gy, silty
- Clayst, med-gy, mod silty
- Clayst, dk-gy, silty
- Sandst, med-gy, med-grained
- Siltst, med-gy
- Clayst, dk-gy, mod silty
- Clayst, dk-brn
- Lignite (350-525)
- Lignite (377-378, 5)
- Lignite (510-514)
- Lignite (592-596)
soil, lt-brn, silt, clay, unconsol
clayst, med-brn, mod silty
siltst, med-gy; high clay content
clayst, med-gy, mod silty
clayst, dk-gy
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clayst, dk-gy, mod silty
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lignite (127.5-129)
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siltst, med-gy
lignite (167.5-169.5)
clayst, dk-brn
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clayst, med-gy, mod silty
lignite (225.5-226.5)
siltst, med-gy
clayst, dk-gy, sli silty
siltst, med-gy
lignite (346.5-347.5)
### LITHOLOGY

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### REMARKS:

- Logging speed: 20 ft/min
- Density range: 1 cps
- Logged depth: 579 ft
- Density TO: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TO: 3 sec
- Resistance sensitivity: 5 ohms
UNITED STATES GEOLOGICAL SURVEY

AREA: Three River
QUAD NAME: Lefor

DATE STARTED: 7-9-79
DATE COMP: 7-9-79
COUNTY: Stark
STATE: North Dakota

LOCATION: SEC. 12 T.137 N., R. 95 W., FOOTAGE LOC.

FOOTAGE: 84 ft FNL X 24 ft NYX X 2640 ft FWL
GROUND ELEV: 2640 ft

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary
FLUID LEVEL: 30 ft

DEPTH TO FLUID LEVEL: 30 ft

DEPTH: 520 ft
TOTAL DEPTH: 520 ft

REMARKS:

LITHOLOGY RECORDED BY: M. Hudson
GEOPHYSICAL LOGS RECORDED BY: J. Wald

LITHOLOGY:

- Soil, lt-brn, silt, clay, unconsol
- Clayst, med-brn, mod silty
  - Lignite (39.5-40.5)
- Clayst, med-gy, mod silty
- Clayst, lt-gy, very silty
- Siltst, med-gy
- Clayst, dk-gy, very silty
  - Lignite (224.5-225.5)
- Clayst, med-gy, very silty
- Siltst, med-gy, high clay content
- Clayst, dk-gy, very silty
  - Lignite (323-324.5)
- Clayst, med-gy, very silty
  - Lignite (337.5-338.5)
### Lithology

<table>
<thead>
<tr>
<th>Lithology Details</th>
<th>SI Diagram Log</th>
<th>TD 520</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clayst, med-gy, very silty</td>
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<tr>
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<td>Clayst, dk-gy</td>
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<td>Lignite (406-407)</td>
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<td>Siltst, med-gy</td>
<td>Lignite (471-472)</td>
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<td>Siltst, dk-gy</td>
<td>Lignite (480.5-497)</td>
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<td>Clayst, dk-br, sli silt</td>
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<td>Sandst, med-gy, fine-grained</td>
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<tr>
<td>Clayst, med-gy, sli silt</td>
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</table>

### Remarks

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 519 ft
- Density TC: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistance sensitivity: 5 ohms

- TD: 520 feet
### Lithology

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<tr>
<th>Depth</th>
<th>Lithology Description</th>
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</thead>
<tbody>
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<td>0-10</td>
<td>Soil, lt-brn, sand, silt, unconsol</td>
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<tr>
<td>10-20</td>
<td>Sand, med-brn, fine-grained</td>
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<tr>
<td>20-30</td>
<td>Clay, med-gy, mod silty</td>
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<td>30-40</td>
<td>Clay, dk-gy, silt silty</td>
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<tr>
<td>40-50</td>
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<tr>
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<td>90-100</td>
<td>Lignite (229-231)</td>
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<td>100-110</td>
<td>Clay, dk-gy, mod silty</td>
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<tr>
<td>110-120</td>
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<td>120-130</td>
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<td>130-140</td>
<td>Sand, med-gy, fine-grained</td>
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<td>140-150</td>
<td>Lignite (333.5-339.5)</td>
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<td>150-160</td>
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<td>170-180</td>
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<td>180-190</td>
<td>Sand, lt-gy, fine-grained, calc, well-consol</td>
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<td>190-200</td>
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<tr>
<td>200-210</td>
<td>Lignite (333.5-339.5)</td>
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</table>

### Logging Logs

- **Logging speed:** 20 ft/min
- **Density range:** 3 cps
- **Logged depth:** 599 ft
- **Density TC:** 1 sec
- **Gamma range:** 15 cps
- **SP sensitivity:** 100 mv
- **Gamma TC:** 3 sec
- **Resistance sensitivity:** 5 mms
REMARKS:

LITHOLOGY

- clayst, dk-gy, mod silty
- clayst, med-gy, very silty
- clayst, dk-gy, mod silty
- clayst, med-gy, very silty
- clayst, med-gy, mod silty
- clayst, dk-gy, silty
- clayst, med-gy, very silty
- clayst, dk-gy, mod silty
- siltst, med-gy
- siltst, med-gy
- clayst, med-gy, mod silty
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 142
SHEET 1 OF 2

AREA: Three River
QUAD NAME: White Butte NW

DATE STARTED: 7-9-79
DATE COMP: 7-9-79
COUNTY: Stark
STATE: North Dakota

LOCATION: SEC. 24 T. 137 N., R. 94 W., FOOTAGE LOC.
1725 ft FN
15 ft FN
GROUND ELEV 2540 ft

SIZE AND BIT TYPE: 4-3/4 inch drag
FOOTAGE ROTARY 405 ft CORING --- TOTAL DEPTH 405 ft

DRILLING AGENCY: Gregory Drilling Company
DRILL TYPE: Rotary

LITHOLOGY RECORDED BY: A. Banet
GEOPHYSICAL LOGS RECORDED BY: J. Wald

REMARKS:

LITHOLOGY

- soil, lt-brn, silt, clay, unconsol
- siltst, med-brn
- clayst, med-gy, very silty
- clayst, lt-gy, mod silty, calc
- siltst, med-gy
- clayst, dk-gy, mod silty
  lignite (105.5-107)
  lignite (108-109)
- clayst, med-gy, mod silty
- clayst, dk-gy, sli silty
  lignite (184.5-185.5)
- sandst, med-gy, fine-grained
- clayst, med-gy, mod silty
- clayst, med-gy, sli silty
- clayst, dk-gy, sli silty
  lignite (342-343)
REMARKS:

<table>
<thead>
<tr>
<th>STRIP-LOG</th>
<th>DEPTH</th>
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<tbody>
<tr>
<td>Logging speed: 20 ft/min</td>
<td>Depth range: 3 cps</td>
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<tr>
<td>Logged depth: 403 ft</td>
<td>Density T.C.: 1 sec</td>
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<tr>
<td>Gamma range: 15 cps</td>
<td>SP sensitivity: 100 mv</td>
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<tr>
<td>Gamma T.C.: 3 sec</td>
<td>Resistance sensitivity: 5 ohms</td>
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</tbody>
</table>

LITHOLOGY

- Clayst, dk-gy, sli silty
- Clayst, med-gy, mod silty
- Siltst, med-gy

TD 405
UNITED STATES GEOLOGICAL SURVEY

HOLE NO 143
SHEET 1 OF 2

AREA Three River

DATE STARTED 7-10-79

DATE COMP. 7-10-79

LOCATION=SEC. 30 T.137 N., R94 W., FOOTAGE LOC. 20 ft FNL XXX 2610 ft FEL XXX GROUND ELEV 2520 ft

COUNTY Stark

STATE North Dakota

SIZE AND BIT TYPE: 4-3/4 inch drag

DRILLING AGENCY: Gregory Drilling Company

DRILL TYPE: Rotary

TOTAL DEPTH 440 ft

DEPTH TO FLUID LEVEL 56 ft

FOOTAGE LOG. 260 ft

REMARKS:

LITHOLOGY

soil, lt-brn, sand, silt, unconsol
sandst, lt-brn, fine-grained
clayst, med-gy, mod silty
siltst, med-gy
sandst, med-gy, mod-grained, calc
clayst, med-gy, very silty
clayst, dk-gy, ali silty
clayst, med-gy, very silty
siltst, med-brn
clayst, med-gy, mod silty
clayst, dk-gy, ali silty
siltst, med-gy
clayst, dk-gy, ali silty
lignite (242.5-243.5)
clayst, med-gy, very silty
siltst, lt-gy
sandst, med-gy, fine-grained
siltst, med-gy; high clay content
### Remarks:

**Lithology**

- Siltst, med-gy; high clay content
- Lignite (379.5-381)
- Clayst, med-gy, mod silty
- Clayst, lt-gy, very silty
- Clayst, dk-brn to blk, cbncs
- Clayst, med-gy, very silty

### Logging Parameters

- Logging speed: 20 ft/min
- Density range: 3 cps
- Density TO: 1 sec
- Gamma range: 15 cps
- SP sensitivity: 100 mv
- Gamma TC: 3 sec
- Resistivity sensitivity: 5 ohms

### Depth

**Meters**

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<th>400</th>
<th>450</th>
<th>500</th>
<th>550</th>
<th>600</th>
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**TD**

440
**LITHOLOGY**

<table>
<thead>
<tr>
<th>Soil, lt-brn, silt, clay, unconsol</th>
<th>Lignite (12.5-13.5)</th>
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</thead>
<tbody>
<tr>
<td>Silts, med-brn; high clay content</td>
<td>Lignite (59-60)</td>
</tr>
<tr>
<td>Clay, dk-brn</td>
<td>Lignite (107.5-109.5)</td>
</tr>
<tr>
<td>Clay, med-gy, mod silt</td>
<td>Lignite (129-130.5)</td>
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<tr>
<td>Clay, dk-gy, very silt</td>
<td>Lignite (181-182)</td>
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<td>Clay, dk-gy, mod silt</td>
<td>Lignite (184-185)</td>
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<tr>
<td>Clay, med-gy, very silt</td>
<td>Lignite (225.5-226.5)</td>
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<td>Lignite (237-238)</td>
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<td>Lignite (276.5-277.5)</td>
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<td>Clay, med-gy, very silt</td>
<td>Lignite (286-287)</td>
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<tr>
<td>Clay, dk-gy, mod silt</td>
<td>Lignite (335.5-337)</td>
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**REMARKS:**

**LITHOLOGY**

<table>
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<th>DEPTH</th>
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</tr>
<tr>
<td>clayst, med-gy, very silty</td>
<td>350</td>
</tr>
<tr>
<td>clayst, med-gy, mod silty</td>
<td>380</td>
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<tr>
<td>lignite (365-366)</td>
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</table>

Logging speed 20 ft/min  
Logged depth 379 ft  
Gamma range 15 cps  
Gamma TC 3 sec

Density range 3 cps  
Density TC 1 sec  
SP sensitivity 100 mv  
Resistance sensitivity 5 ohms

**DEPTH**

<table>
<thead>
<tr>
<th>FEET</th>
<th>METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
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<td>700</td>
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## Lithology

### Log Record

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<td>0-286 ft</td>
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<td>340-399 ft</td>
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<td>lignite (74-75)</td>
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<td>399-458 ft</td>
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<td>576-616 ft</td>
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<td>siltst, med-gy</td>
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<td>856-916 ft</td>
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</table>

### Geophysical Logs

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logge depth: 139 ft
- Gamma range: 15 cps
- Gamma TC: 3 sec
- SP sensitivity: 100 mv
- Resistance sensitivity: 5 ohms

### Depth Measurements

- TD: 340 ft
**UNITED STATES GEOLOGICAL SURVEY**

**HOLE NO 146**

**SHEET 1 OF 2**

**AREA** Three River

**QUAD NAME** Fayette

**DATE STARTED** 8-17-79

**DATE COMP.** 8-17-79

**COUNTY** Dunn

**STATE** North Dakota

**LOCATION:** SEC. 2 T.144 N., R. 97 W., FOOTAGE LOC. 380 ft

**FOOTAGE:** 1080 ft

**GROUND ELEV.** 2365 ft

**TOTAL DEPTH** 506 ft

**DEPTH TO FLUID LEVEL** 3 ft

**SIZE AND BIT TYPE:** 4-3/4 inch drag

**DRILLING AGENCY:** Gregory Drilling Company

**DRILL TYPE:** Rotary

**LITHOLOGY RECORDED BY** M. Hudson

**GEOPHYSICAL LOGS RECORDED BY** J. Wald

**REMARKS:**

**LITHOLOGY**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Lithology</th>
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<tbody>
<tr>
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<td>soil, lt-brn, silt, clay, unconsol</td>
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<td>100-110</td>
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<td>110-120</td>
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<td>120-130</td>
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<td>260-270</td>
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</table>

**Geophysical Logs**

- **Logging speed:** 20 ft/min
- **Density range:** 3 cps
- **Density TC:** 1 sec
- **Gamma range:** 13 cps
- **SP sensitivity:** 100 mV
- **Gamma TC:** 3 sec
- **Resistance sensitivity:** 5 ohms

**Depth to Fluid Level:** 3 ft
**REMARKS:**

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<table>
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<tbody>
<tr>
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<td>clayst, med-gy, very silty</td>
<td>lignite (460-462.5)</td>
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<td>sandst, lt-gy, fine-grained</td>
<td>lignite (481.5-483)</td>
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**DEPTH**

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

**LOGGING PARAMETERS:**

- Logging speed: 20 ft/min
- Density range: 3 cps
- Logged depth: 505 ft
- Density T.C.: 1 sec
- Gamma range: 15 cps
- Gamma T.C.: 3 sec
- SP sensitivity: 100 mv
- Resistance sensitivity: 5 ohms

**TD:** 506